D7.5
Standardisation Activities Report – Issue 2

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List of Acronyms

C&C	Command & Control Centre
CAP	Common Alerting Protocol
CCC	Common Capability Challenge
CEN	European Committee on Standardisation
CENELEC	European Committee on Electrotechnical Standardisation
CM	Crisis Management
CMINE	Crisis Management Innovation Network Europe
CoU	Community of Users
CWA	CEN Workshop Agreement
DE	Distribution Element
DIN	Deutsches Institut für Normung (German Institute for Standardization)
DLR	Deutsches Zentrum für Luft- und Raumfahrt e.V. (German Aerospace Center)
DLR-DFD	Deutsches Zentrum für Luft- und Raumfahrt e.V.; German Remote Sensing Data Center
DLR-KN	Deutsches Zentrum für Luft- und Raumfahrt e.V.; Institute of Communications and Navigation
DRR	Disaster Risk Reduction
DS	Danish Standards Foundation
EC	European Commission
EDXL	Emergency Data Exchange Language
EFFIS	European Forest Fire Information System
ELSI	Ethical, Legal and Social Issues
EM-TC	OASIS Emergency Management TC
EMS	Copernicus Emergency Management Services
EMTEL	Emergency Telecommunications
ETSI	European Telecommunications Standards Institute
EUM	End User Meeting
EUW	End User Workshop
FBBR	Frederiksborg Brand og Redning (Frederiskborg Fire and Rescue Service)
FIRE-IN	Fire and Rescue Innovation Network
FP6	6th Framework Programme of the EC

FP7	7th Framework Programme of the EC
FR	First Responder
GRAF	Support Group for Forest Interventions of INT-FRS
H2020	Horizon 2020 Framework Programme of the EC
IC	Incident Commander
ICS	Incident Command System
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IFRC	International Federation and the International Committee of the Red Cross
IG	Information Gateway
INSARAG	International Search and Rescue Advisory Group
INSPIRE	INfrastructure for SPatial InfoRmation in Europe
INT	Departament d'Interior – Generalitat de Catalunya (Catalan Government – Department of Interior)
INT-FRS	Ministry of Home Affairs – Fire and Rescue Service
INT-PD	Ministry of Home Affairs – Police Department
ISO	International Organization for Standardisation
ITU	International Telecommunication Union
LLF	Lessons Learned Framework
OASIS	Organization for the Advancement of Structured Information Standards
OGC	Open Geospatial Consortium
OSOCC	On-Site Operations Coordination Centre
PCF	Fundació d'Ecologia del Foc i Gestió d'Incendis Pau Costa Alcubierre (Pau Costa Foundation)
SC	Subcommittee
SFRS	Scottish Fire and Rescue Services
SITREP	Situation Report Generation Service
SPH	Space Hellas S.A.
TC	Technical Committee
TGM	Trial Guidance Methodology
TOC	Table of Contents
USAR	Urban Search and Rescue
WG	Working Group

WM	Web Map Service
WP	Work Package

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Executive Summary

The current report documents the series of activities performed in the second half of the HEIMDALL project in the different work packages in order to foster the standardisation of project results. The content of the deliverable is the outcome of the activities carried out within the context of Task 7.2 (Standardisation) since M21 of the project.

The main objectives of the task are:

- Identification and analysis of relevant standardisation bodies and frameworks.
- Analysis of needs for standardization in the different stakeholder, ELSI and implementation work packages
- Application of existing standards which have the potential to serve the identified needs and identification of gaps
- Participation in relevant standardisation activities with the aim of contributing to existing standards and developing recommendations on standardization and standardization procurement.
- The HEIMDALL platform makes use of existing standards and those developed or extended in HEIMDALL, while the platform itself is not subject to standardisation efforts.

Apart from Task 7.2, the outcome of discussions and studies performed in WP3 and the technical progress of the works carried out in WP 4, 5 and 6 have been used as basis to identify the relevant standards to be applied for devising an interoperable system.

The activities carried out within this task have been focused on two main areas: (i) the identification of relevant standards to be used in order to ensure system interoperability and flexibility; (ii) the identification of relevant standards, which could be updated/extended according to the HEIMDALL outcome as well as the integration of new developments of harmonized methodologies, concepts and data models. For the first area, the objective has been to identify and analyse the standards in order to include them in the HEIMDALL design and implementation activities, while in the second case, the consortium has been active in proposing new updates or standards in the corresponding standardisation bodies and committees.

1 Introduction

Increasingly complex crisis situations require the development and uptake of innovative solutions that are addressing the operational needs of practitioners dealing with monitoring, anticipating, preparing for and learning from disasters. Experiences and best practices need to be manifested in these solutions and in recommendations and standards to facilitate a shared understanding of Crisis Management (CM) across Europe.

Where applicable HEIMDALL workflows, terminology and products are based on and where needed are designed to improve standards. In D7.4 [1] we have described how we have leveraged, besides the thorough standardization work conducted in the EC-funded PHAROS project (FP7) [2][3], the elaborate report of existing standards and standardization activities in crisis management generated in the EC-funded FP7 DRIVER+ project [4]. Hereinafter, the report will be referred to as 'D955.11'.

The rest of the document is structured as follows:

- Section 2 presents an overview of further standardization bodies, standards and standardization documents identified as relevant for the work in HEIMDALL.
- Section 3 presents the results of work conducted so far in detail and highlights gaps with the aim of contributing to existing standards and developing recommendations on standardization. As such, this section is elaborating on the second major objective of Task 7.2, i.e. the application of relevant standards, which have potential to serve needs for standardization identified in the different stakeholder, ELSI and implementation work packages.
- Section 4 gives a summary of standardisation events attended and activities conducted during the second standardization reporting period.
- Finally, section 5 summarizes and concludes the document.

2 Overview of Standardization Bodies, Standards and Documents

A comprehensive overview of relevant standardization bodies, standards and documents has been given in D7.4. Since then, we have put attention to the European Committee on Standardisation (CEN) and the International Search and Rescue Advisory Group (INSARAG) which both are investigated in the following sub-sections.

At service and product level, the most relevant standards are developed by the Open Geospatial Consortium (OGC) [5] as well as by the Organization for the Advancement of Structured Information Standards (OASIS) [6].

The task of OGC is to provide standards and standardized interfaces which enable users and developers in the field of geoinformatics to use such services in an interoperable way. This means every piece of software which implements these standards can interact without any problems with all service providers which are also using the same OGC standards. The OGC has a worldwide scope. OGC, relevant OGC committees, standards and their application in PHAROS have been described in detail in the PHAROS standardisation activity reports. As findings apply to HEIMDALL as well this deliverable does not provide any further details.

In comparison to OGC INSPIRE is a directive of the European Commission [7] and the geographical scope is the area of the European Union. Also, the field of the INSPIRE directive is much narrower, the target is to establish “an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment”. In fact, all INSPIRE standards are based on corresponding OGC standards. INSPIRE defines specifications for data products that fall into one of the categories defined in the INSPIRE Directive’s annexes [8]. Section 3.2.2 elaborates the approach to INSPIRE-conformance of HEIMDALL products.

Relevant OASIS standards and committees have been described in D7.4. This document provides updates on the extension to the EDXL standards in section 3.3.5. The final implementation of the EDXL-SitRep standard for the representation and sharing of HEIMDALL scenarios has been documented in the technical specification of the Situation Report Generation Service (SITREP) in D6.8 [9].

2.1 European Committee for Standardization (CEN) and European Committee on Electrotechnical Standardisation (CENELEC)

On the European level, the European Committee on Standardisation (CEN), European Committee on Electrotechnical Standardisation (CENELEC) and the European Telecommunication Standards Institute (ETSI) are in charge of developing European standards and other technical specifications to respond to the needs of European industry while meeting consumer, environmental and other societal expectations [10].

The close collaboration between CEN and CENELEC was consolidated at the start of 2010 by the creation of a common CEN-CENELEC Management Centre (CCMC) in Brussels. CEN and CENELEC bring together the national standards agencies of 34 countries. The CEN-CENELEC network involves business federations, commercial and consumer organizations, environmental groups and other societal stakeholders.

Together, CEN and CENELEC provide a platform for the development of European Standards and other technical specifications across a wide range of sectors. They work closely with the European Commission to ensure that standards correspond with any relevant EU legislation.

CEN and CENELEC also cooperate with respectively the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) to reach agreements on common standards that can be applied throughout the whole world, thereby facilitating international trade.

2.1.1 Relevant Committees

CEN, CENELEC and their members are fully committed towards building partnerships with European organizations, associations and other recognized stakeholders who have an interest in European standardization and are willing and able to provide added-value knowledge and to actively contribute with inputs and proposals to CEN and/or CENELEC governing and technical bodies [11].

2.1.1.1 CEN/TC 391 – Social and Citizen Security

As identified by DRIVER+ in D955.11, the Technical committee CEN/TC 391 – Social and Citizen Security is the most relevant one at European level to be considered in context of crisis and disaster management. Its scope is "to elaborate a family of European standards, standard-like documents (e.g. procedures, guidelines, best practices, minimal codes of practice and similar recommendations) in the Societal and Citizen Security sector including aspects of prevention, response, mitigation, continuity and recovery before, during and after a destabilizing or disruptive event".

DRIVER+ has built a Liaison with CEN/TC to be updated and give input into standardization activities in the field of crisis and disaster management. The CEN/TC members are experts from national standardization bodies, which enable DRIVER+ to extend its network via the Liaison. Special CEN-CENELEC specifications, which are developed with the rapid consensus of expert stakeholders (no full consensus needed), can be found in CEN Workshop Agreements (CWA). The multi-step process described by CEN to develop and produce a CWA has been summarized in D955.11. In the framework of the Liaison to CEN/TC 391 the DRIVER+ project has developed four CWAs related to the projects´ main results [12]:

- CWA 17513:2020 Crisis and disaster management — Semantic and syntactic interoperability.
- CWA 17514:2020 Systematic assessment of innovative solutions for Crisis Management — Trial guidance methodology (TGM).
- CWA 17515:2020 Building a common simulation space.
- CWA 17335:2018 Terminologies in crisis and disaster management.

2.1.2 HEIMDALL activities and contributions

Upon invitation from the DRIVER+ standardization group, DLR as a HEIMDALL representative has participated in the CWA on the Trial Guidance Methodology (TGM) which was published in April 2020. See section 3.5.1 of this document for details on the CWA and HEIMDALL contributions made herein.

Furthermore, HEIMDALL has been participating in other DRIVER+ standardization activities such as in the formalization of the DRIVER+ terminology and the Crisis Management Innovation Network Europe (CMINE) put into place by DRIVER+. Specifics are described in section 3.5.2.

2.2 International Search and Rescue Advisory Group (INSARAG)

The International Search and Rescue Advisory Group (INSARAG) is a global network of more than 90 countries and organisations under the United Nations umbrella [13]. INSARAG deals with urban search and rescue (USAR) related issues, aiming to establish minimum international standards for USAR teams and methodology for international coordination in earthquake response based on the INSARAG Guidelines endorsed by the United Nations General Assembly Resolution 57/150 of 2002, on "Strengthening the Effectiveness and Coordination of International Urban Search and Rescue Assistance".

The INSARAG methodology of the On-Site Operations Coordination Centre (OSOCC) is both a methodology and physical location for onsite emergency response and coordination particularly at the field level [14]. The OSOCC is mainly used for early setup and deployment of international first response, compliant with the Local Emergency Management Agency, or

the National Disaster Management Authority, and (as such, including also) operational resource allocation and monitoring. It currently considers earthquakes as the main hazard but is not limited here. The INSARAG methodology includes management guidelines, ICT, tools, symbols, etc. [15] and consists of several phases from getting high-level information, impact assessment etc. to sector-level response and information retrieval. Furthermore, organizations need to have a certification to participate in these international search and rescue events. Although the methodology deals not on strategical level and therefore does not affect current developments, it could be interesting for HEIMDALL in terms of:

- Sectorization/Division of areas into sectors for triage could be considered for scenario area design
- Information exchange to the user in the field and backwards
- Standards-based interagency/team coordination
- Debriefing process could be considered for the lessons learnt

It is therefore recommended to consider INSARAG for future developments in the long term.

3 Standards Application and Contributions, Standardisation Needs and Gaps Analysis

3.1 HEIMDALL Case Studies

3.1.1 Data Collection Methodology for Case Studies

WP3 has developed a **methodology for collecting and analysing case studies** of relevant past incidents with the aim to homogenise the gathering of information on different hazards by different actors. As described in the HEIMDALL Deliverable D3.1 Case studies - Issue 1 [16] and HEIMDALL Deliverable D3.4 Demonstrations – Issue 1 [17], the methodology to collect information and data from different case studies is based on a 5-step process. The first ones are data collection (1) and data processing (2). Unless the emergency services are familiar with incident analyses, the exact data needed for the analyses may not be collected. The tactical analyst shall ensure that the data being collected and processed in steps 1 and 2 are sufficient to perform the analyses on incident behaviour (3) and on deployed means (4). The final step (5) is to analyse potential lessons learnt (Figure 3-1).

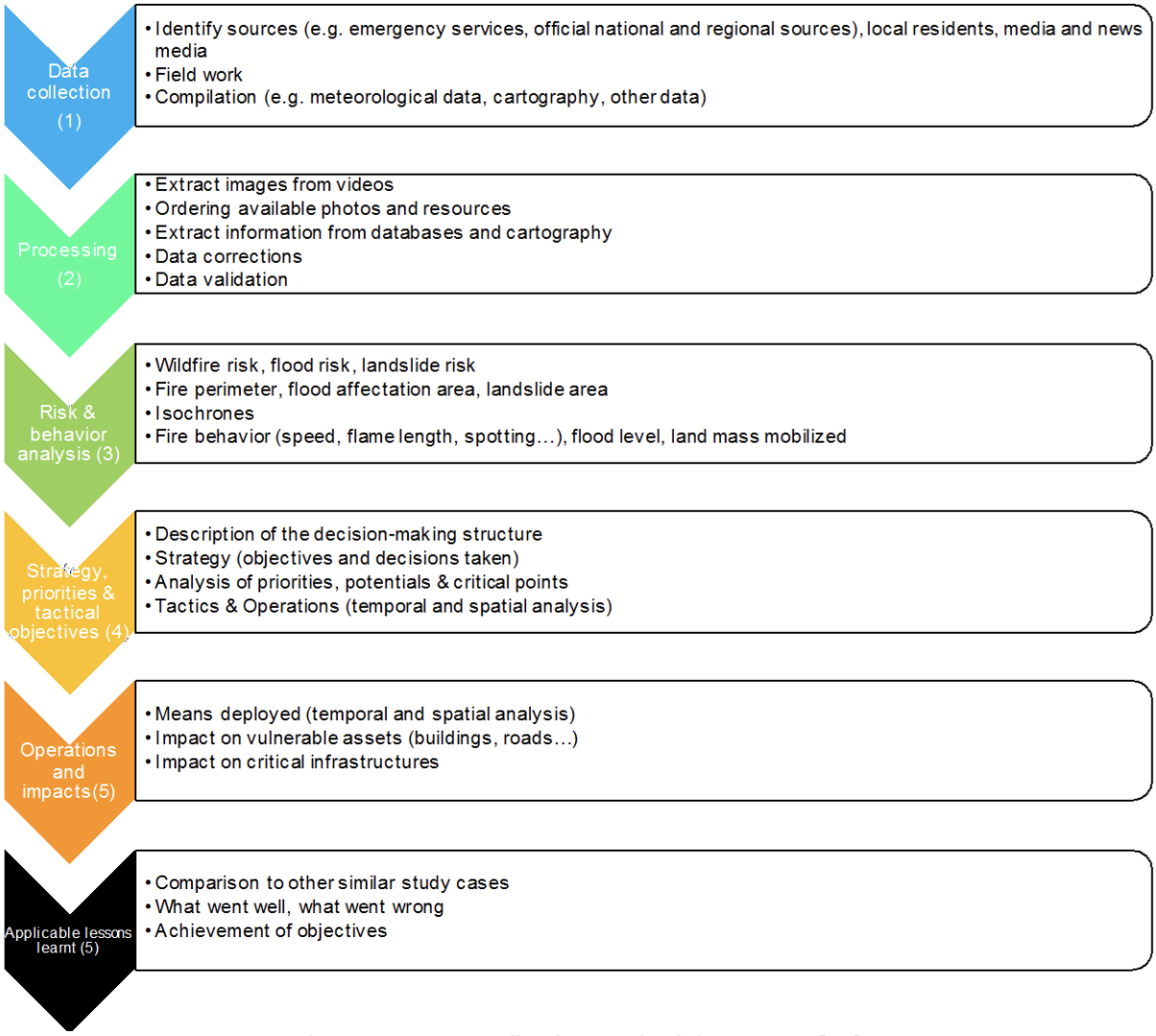

Figure 3-1 Data Collection Methodology steps [16]

Throughout the first part of the project lifetime, end-user partners have adapted their reports by following the methodology described above for the selected case studies. The information

and data gathered following the described methodology has been reported in D3.1-D3.3 [16][18][19].

3.2 HEIMDALL Data and Information Products

3.2.1 Data Integration from Official Sources

Data and information feeding the HEIMDALL systems stems from official and reliable channels such as the Copernicus Emergency Management Services (EMS) [20], particularly the European Forest Fire Information System (EFFIS) [21], which ensures a high quality and interoperability.

3.2.2 INSPIRE Conformance of HEIMDALL products

INSPIRE is a directive of the European Commission [7] and the geographical scope is the area of the European Union. The target is to establish “an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment”. In order to provide INSPIRE-compliant data a GeoNetwork server [22] was set up within the HEIMDALL network. A general template for metadata has been defined which was adapted to the certain products by the responsible partners. The following data has been identified to require INSPIRE metadata for compliance:

- Simulation results of all three simulators
- Earth observation
- Exposure data
- Impact assessment

The dedicated partners added the metadata for the corresponding use cases studied at the four demonstrations of the project: The La Jonquera fire, the Monesi landslide, the Ter river flood and the Entella river flood. Figure 3-2 shows the home page of the GeoNetwork server setup.

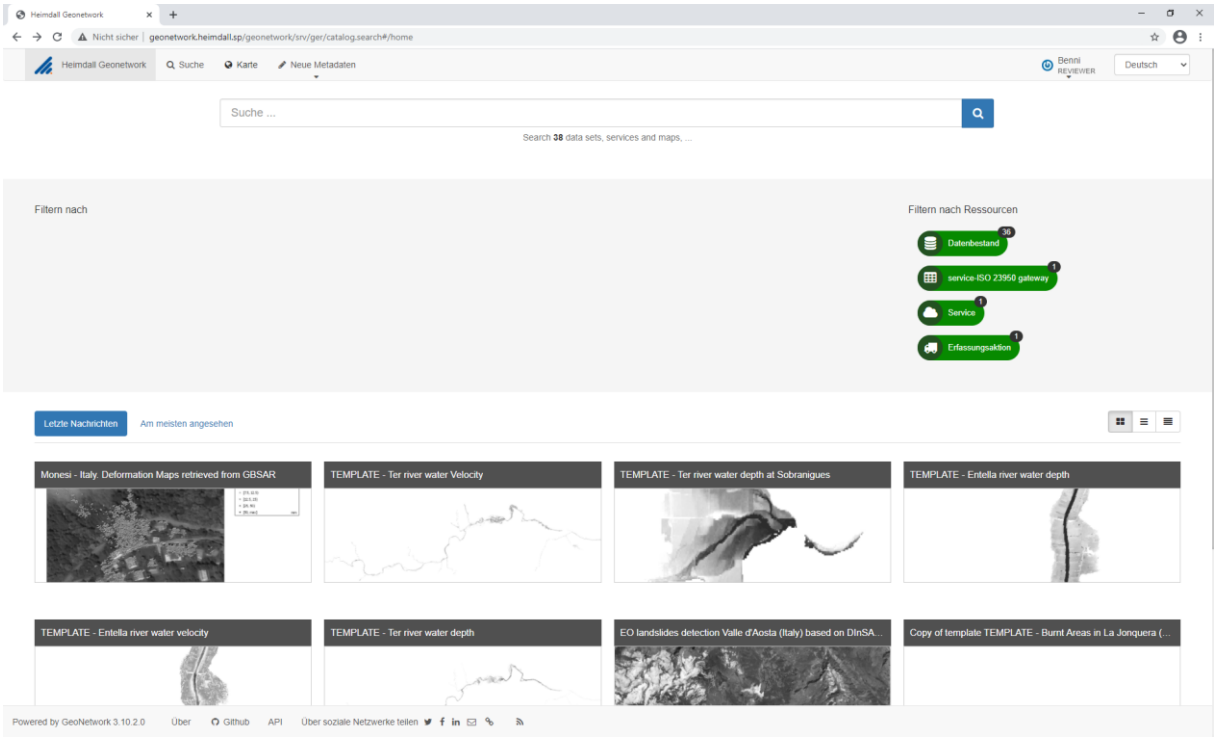

Figure 3-2: HEIMDALL GeoNetwork server

3.3 Standardisation of Scenarios

In D7.4 the need and concept for a common scenario data structure and a standards-based scenario exchange to foster interoperability have been introduced. In HEIMDALL, a scenario assembles all related information that has been collected, for instance incident information, simulation results, risk and impact assessment information, decisions made, measures taken, response plans and lessons learnt. The HEIMDALL scenario data model has been co-designed in multiple iterations by the technical and the end-user partners. It provides harmonized attributes and value lists common to all involved groups of end users under consideration of existing terminologies. For instance, terms and concepts specified by the ISO Guide 73, the European Commission (EC) Floods Directive on flood risk assessment and management (2007/60/EC) and the EDXL standards [23][24][25] have been collated and merged.

D6.15 [26] gives a comprehensive summary of scenario definitions, underlying concepts and standards, use cases, etc.

The HEIMDALL Situation Report Generation (SITREP) service provides an interface for system clients to transform all information available for a scenario at a given point of time (scenario snapshot) into an EDXL-based situation report. The goal is to create means for sharing a common operational picture in a standards-based way in order to foster interoperability between systems. D6.8 [9] provides details on the approach towards an EDXL-HEIMDALL message structure and the actual implementation.

The remainder of this section presents standardization activities related to specific parts of the scenario data model and management including response plans and lessons learnt.

3.3.1 **Adoption of Fire Types Concept**

When analysing historical fires, it becomes obvious that under the same topography and weather (synoptic situation) conditions, fire spreads following similar spread schemes. In the scope of the EC-funded FP6 project Fire Paradox [28] an analytical approach to classify, organise and typify wildfires that occur in a specific area has been developed under the lead of the Support Group for Forest Interventions (GRAF) of INT-FRS [29]. The methodology simplifies the study of wildfires by establishing a set of different Fire Types. Each of these Fire Types has been linked to specific synoptic weather conditions with a set of meteorological parameters that determine fire behaviour. For a region like Catalonia, nine Fire Types have been identified that are based on common spread patterns and classified by characteristic factors. Table 3-1 lists the three main types of fire spread patterns that can be distinguished.

Table 3-1: Classification of fires according to spread pattern and the dominant factors

Classification according to spread patterns	**Dominant factors**
Topographic fires	Local topographic winds, fuel heating and slope
Wind-driven fires	Wind speed and direction, as well as duration of the meteorological window that produces the fire conditions
Convection/Plume dominated fires	Accumulation of highly available fuel

The methodology of the Fire Types Concept has been integrated into forest planning and wildfire prevention in Catalonia. Moreover, GRAF strives to provide a European perspective on fire prevention considering the different fire regimes and vegetation structures as well as the heterogeneous socioeconomic conditions in Europe.

In HEIMDALL, the Fire Types classification has been integrated into recommended fire behaviour variables to be collected in forest fires cases studies [16] and specified in scenarios

using the HEIMDALL scenario management (see scenario specification in D6.15). Furthermore, INT-FRS has elaborated a forest fire behaviour classification table (named in the following “fire code table”) to be used in HEIMDALL for grading forest fires as there is a lack of a unified table in the fire services community. The fire code table which is shown in Table 3-2 combines the fire propagation type with thresholds for head and flank flame length, propagation velocity and distance to secondary focus. These thresholds form the base for hazard-behaviour-based scenario matching metrics (see scenario matching specification in D6.15). The table joins different experiences and knowledge collected by INT-FRS and other agencies such as Andalusia and Castilla forest services and also in Catalunya, among others expertise gained in Portugal fires.

Table 3-2: Registration number (build from digits) and thresholds for the different values of the fire behaviour

Code value	**Propagation**	**Head mean/average flame length (m):**	**Flank mean/average flame length (m):**	**Propagation velocity mean/average flame length (m/h):**	**Maximum distance to observed secondary focus (non-multiple; m):**
Digit 1		Digit 2	Digit 3	Digit 4	Digit 5
0	No description	No data	No data	No data	No data
1	**Low intensity surface**: It propagates along the surface death vegetation (fallen leaves) and grass, except in bushes although it can occasionally produce torching. It causes the partial consumption of the dead fine fuel. With trees or without them.	< 0,5	< 0,5	< 300	Non-observed
2	**Medium intensity surface**: It propagates through the dense grass mass or bushes. It causes the total consumption of the fine dead fuel and the partial consumption of the sprouts and of the green leaves of the bushes. With trees or without them.	0,5-1	0,5-1	300-600	<6
3	**High intensity surface**: It propagates through the dense grass mass, unharvested grain, or bushes. It causes the total consumption of fine dead fuel, sprouts and green leaves; and	1-3	1-3	600-2000	6-25

	the partial consumption of bushes' and trees' twigs. With trees.				
4	**Sustained torching**: It propagates through dense grassland, unharvested grain and bushes. It causes the total consumption of the fine dead fuel, sprouts and green leaves; and the partial consumption of bushes' and trees' twigs.	3-5	3-5	2000-4000	25-100
5	**Crown passive**: it propagates through the crowns if the below stratum is burned (bushes, grass…). It causes the total consumption of fine bushes' and trees' twigs. With trees (more than 40% of the surface burned by torching).	5-10	5-10	>4000	100-500
6	**Crown active**: Sustained propagation through the crowns. Total consumption of the fine tree twigs. With trees (more than 40% of the surface burned by torching).	>10	>10		>500

INT-FRS believes that at this stage of development of the HEIMDALL platform the opportunity is given to fill a table with these fire behaviour parameters, which will eventually foster the development of a common EU system to classify forest fires.

3.3.2 Common Capability Challenges (CCCs)

The EU-funded H2020 project FIRE-IN (Fire and Rescue Innovation Network) [30]has identified Common Capability Challenges (CCCs) based on the knowledge and experiences of more than 80 experts on emergency management [31]. The HEIMDALL partners INT-FRS and PCF have been strongly involved in the development of the CCCs as part of the FIRE-IN consortium. During a process organized with several workshops involving practitioners from 5 thematic fields (Search & Rescue Emergency Response, Structure Fires, Landscape Fires, Natural Hazards, CBRNE) needs for new technologies, methods and standards have been expressed. These needs have been gathered and consolidated, and finally reformulated into

capability challenges that are common for the 5 groups. The elaborated CCC matrix is shown in Figure 3-3.

The FIRE-IN Common Capability Challenges	High flow of effort in hostile environment	Low frequency, high impact	Multiagency / multileadership environment	High level of uncertainty
Incident Command Organization	Focus on sustainability of safe operations (TOP CHALLENGES)	Anticipate vulnerability, and communicate to the public (TOP CHALLENGE)	Distribute decision-making (TOP CHALLENGE)	Strategies choosing safe, resilient scenarios, and maintaining credibility
Pre-planning	Pre-plan a time-efficient, safe response, minimizing responder's engagement	Negotiate solutions with stakeholders for anticipated scenarios (TOP CHALLENGE)	Pre-plan interoperability and enhance synergies	Focus on governance and capacity building towards more resilient societies
Standardization	Establish specific procedures and guides facilitating operativity	Standardize capabilities in front of pre-established scenarios (TOP CHALLENGE)	Establish an interagency framework	Build doctrine for resilience in emergency services and societies
Knowledge cycle	Train specific roles and risks	Organizational learning focusing efforts in key risks and opportunities (TOP CHALLENGE)	Build a shared understanding of emergency and train interagency scenarios (TOP CHALLENGE)	Focus on capacity building towards more resilient societies
Information management	Information cycle	Manage key information focused on decision-making	Define common information management processes between agencies	Provide an efficient, flexible flow of information for a shared understanding
Community involvement	Develop public self-protection to minimize responders exposures (TOP CHALLENGE)	Involve communities in preparing population for the worst scenario before it happens (TOP CHALLENGE)	Not identified at this stage	Cultural changes in risk tolerance and resilience
Technology	Use technology to assess risks and minimize responder's engagement (TOP CHALLENGE)	Forecast and simulate complex scenarios	Technological tools to support data sharing	Get a clear picture of the risk evolution

Figure 3-3: FIRE-IN Common Capability Challenges (CCCs) [30]

CCCs have been adopted in HEIMDALL for a) the specification of the challenge of the scenario at hand (i.e. "High flow of effort in hostile environment", "Low frequency, high impact", "Multiagency / multi-leadership environment", and "High level of uncertainty"), b) the display of corresponding capability challenges to the decision maker and c) the classification of lessons learnt. More information on these features is given in D6.15 and in section 3.3.4 on the harmonization of lessons learnt.

3.3.3 **Harmonization of Response Plans**

In D7.4 the agreements and requirements on a common response plan structure based on used standards and terminologies (e.g. terminology of the Incident Command System, ICS) have been described. In the following the actual implementation is presented. The major challenge of response plans in HEIMDALL is how to integrate the different agencies and the civil protection into the whole. In general, all agencies define a similar set of minimum contents that are required in the plans. However, end users have identified information, particularly tactical information that is specific to every local authority.

Therefore, it has been agreed by all end-user partners that HEIMDALL shall provide a response plan for all authorities (i.e. agencies) composed by: (1) a **multi-agency common part**, which contains the overall strategy for the emergency management, (2) the **common objectives** (for all agencies) and (3) **specific tactical parts for each agency**, e.g. an FRS section, a police section, a medical service section and a civil protection section. Details on the design and implementation of the response plan structure proposed by HEIMDALL are specified in D6.15. Figure 3-4 shows the HEIMDALL response plan structure.

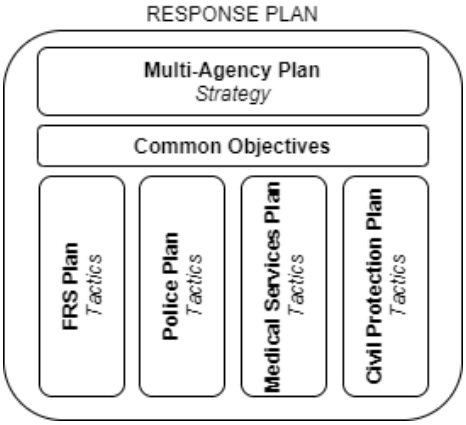

Figure 3-4: HEIMDALL response plan structure [26]

3.3.4 **Harmonization of Lessons Learnt**

Feedback collected at End User Workshops (EUWs) and End User Meetings (EUMs) and in-depth discussions with the end user partners underpin a gap and a need for solutions towards common structures to share lessons learnt from disaster situations among different organisations or even within the same organisation. For example, INT-FRS pointed out that collecting and sharing lessons learnt is one of the major requirements for them.

As described in the prior issue D7.4, the EC-funded FP7 project DRIVER project has designed a harmonised Lessons Learned Framework (LLF) with the aim to increase the efficiency of crisis management in Europe [32]. Furthermore, WP3 has had agreed upon a common lesson learnt structure for all involved HEIMDALL partners and stakeholders [24]. After performing a review of the LLF documentation, PCF has found out that here is no agreement on common structures to share lessons learnt among different organisations or even within the same organisation. Therefore, there is a need/gap for standardization and for technical solutions to facilitate the interoperable exchange. Thereupon, PCF and INT have proposed as an end-user-friendly solution to let users define a sort of "#tags" for lessons learnt that would also serve to search for scenarios through the tags applied to associated lessons learnt. In another iteration, INT have proposed to "tag" lessons learnt using the harmonised set of operational capabilities from the CCC matrix. The example below illustrates a possible application of HEIMDALL lesson learnt parameters:

- Scenario: *Òdena Forest Fire 2015/07/26*
- Challenge: *High flow of effort in hostile environment*
- Capability: *Pre-planning*
- CCC Result: *Pre-plan a time-efficient, safe response, minimizing responder's engagement*
- Evaluation: *Positive*
- Level of Command: *G00 (Strategical)*
- Lesson/Recommendation: *The prevention works previously carried out at the Can Maçana saddle improve the response (opportunity to do technical burn at the head of the fire).*

Based on these requirements, two approaches are combined to make lessons learnt from similar scenarios accessible to the end users: a) a lessons learnt data structure extension to the scenario data model which builds upon the capabilities listed in the CCC matrix and b) the scenario matching approach which allows users to find disaster situations with a similar context, environmental conditions, hazard behaviour and stressed capabilities, from local storage as well as shared by other organizations. End users and technical partners believe that both concepts combined allow for better continuous utilization of past experiences for strategic response planning.

3.3.5 Message Structures for extended Meteorological Information

As described in D7.4, WP6 has identified in the EDXL message formats a lack of data elements and concepts to save complex information on changing weather conditions in a scenario. For example, the use case of saving the evolution of weather conditions along an incident requires storing historic, current and future weather information for different points in time. In discussions with the EDXL EM-TC [33] it has been confirmed that an EDXL-SitRep message can contain only one weather data set. The main purpose is to report on a situation at a specific point in time. However, EDXL provides the possibility to a) enclose multiple SitRep messages in one EDXL container and b) define “Community Extensions” (short “extensions”). The EDXL extension mechanism allows for supplemental inclusion of community-defined sets of name/value pairs where needed. We use extensions in order to include simulation results data, weather forecasts (in addition to current weather conditions) and sub-hazard types defined in HEIMDALL. The extension concept improves information sharing between local authorities and developing standards for the emergency management community. What works well for communities can be incorporated formally into future standards.

This and other extensions to the EDXL standards developed for the HEIMDALL Situation Report Generation module have been documented in D6.8 [9].

3.4 HEIMDALL Terminology

The HEIMDALL consortium has consolidated a list of terms relevant to CM and in particular to response planning and scenario building. These terms have been documented on the project’s Microsoft SharePoint 2010 Teamsite in the form of a glossary. A part of the glossary is shown in Figure 3-5. The terms related to CM stem from relevant sources in the context of Disaster Risk Reduction (DRR) such as ISO Guide 73, ISO 22300 and ISO 31010 as well as the EDXL emergency messaging standards. An overview of relevant DRR terminologies and terms has been presented in the first standardization report D7.4. In the second reporting period, specific HEIMDALL terms have been contributed to the DRIVER+ terminology for CM and are summarized in section 3.5.2.

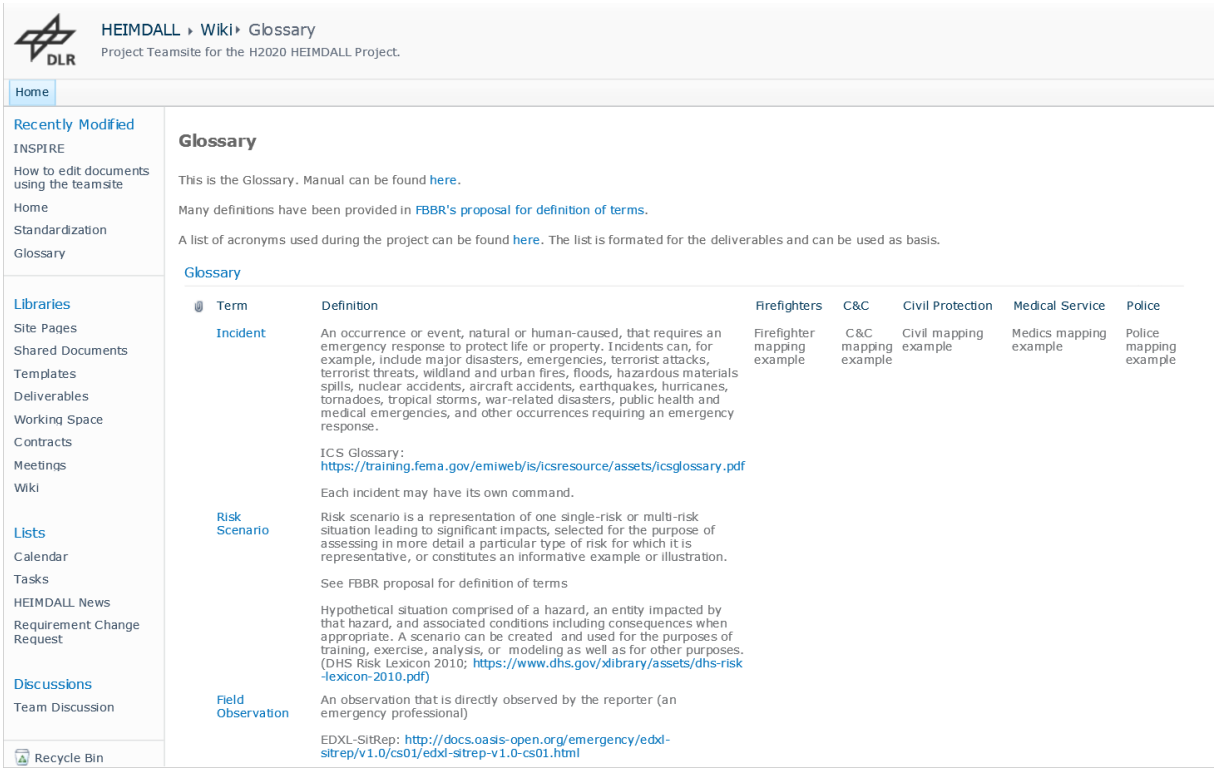

Figure 3-5: HEIMDALL Glossary on the project's Teamsite

3.5 Cooperation with DRIVER+

In D7.4 some standardization activities conducted by the DRIVER+ project have been described. The main aim of DRIVER+ (ended in 04/2020) has been to cope with current and future challenges due to increasingly severe consequences of natural disasters and terrorist threats by the development and uptake of innovative solutions that are addressing the operational needs of practitioners dealing with crisis management.

Since then, HEIMDALL has strived to promote its results and experience through contributions to DRIVER+ standardization activities, in particular:

- Joining of the Crisis Management Innovation Network Europe (CMINE) initiated by DRIVER+ [34]. The CMINE is a Community of Practice in the field of CM, an umbrella network made to foster exchanges between diverse stakeholders who have a role to play in crisis management innovation in various domains such as wildfires, volunteer management and floods. The CMINE platform is structured in various spotlight sections - Capability gaps, Innovative solutions, Terminology, Trials and Demonstrations and Standardization. Furthermore, chaired themes with task groups have been setup to discuss how to tackle current and future challenges and to develop approaches aimed at resolving pressing issues of practitioners involved in CM
- Participation in the CEN workshop agreement (CWA) on the Trial Guidance Methodology (TGM) initiated by DRIVER+ including review, contribution, finalization and approval of the CWA document (see section 3.5.1)
- Support in the cross-fertilization of terms between HEIMDALL and DRIVER+ for a harmonized DRIVER+ terminology (see section 3.5.2)
- Discussion and feedback on the market outlook and uptake of three main DRIVER+ outputs: the Test-bed, the TGM and the Portfolio of Solutions

3.5.1 **Contribution to CWA on the Trial Guidance Methodology**

In D7.4 the standardisation activity conducted by the DRIVER+ project related to the description of scenarios which provide the context for a crisis situation has been introduced.

Concepts elaborated in this and other DRIVER+ standardization activities have resulted in the forming of the CWA on the Trial Guidance Methodology (TGM) [35]. The purpose of the workshop has been to define a methodology that enables an objective and structured assessment of one or more socio-technical solutions (hardware, software, training, procedure, a mix of those) within a realistic CM scenario. The target group of the trial are CM practitioners concerned with innovation or procurement, Public authorities concerned with procurement (or writing tenders), Industry and Research as well as Research & Development. The proposer and secretariat holder of this workshop is DIN.

The TGM consists of phases (Preparation, Execution, Evaluation) and steps (six-step in the preparation phase) illustrated in Figure 3-1. In the HEIMDALL project, we have adopted the TGM for system release demonstrations and trainings at EUWs and virtually. Deliverables D3.5 [36] and D3.6 [37] reflect the TGM implementation for demonstrations in HEIMDALL.

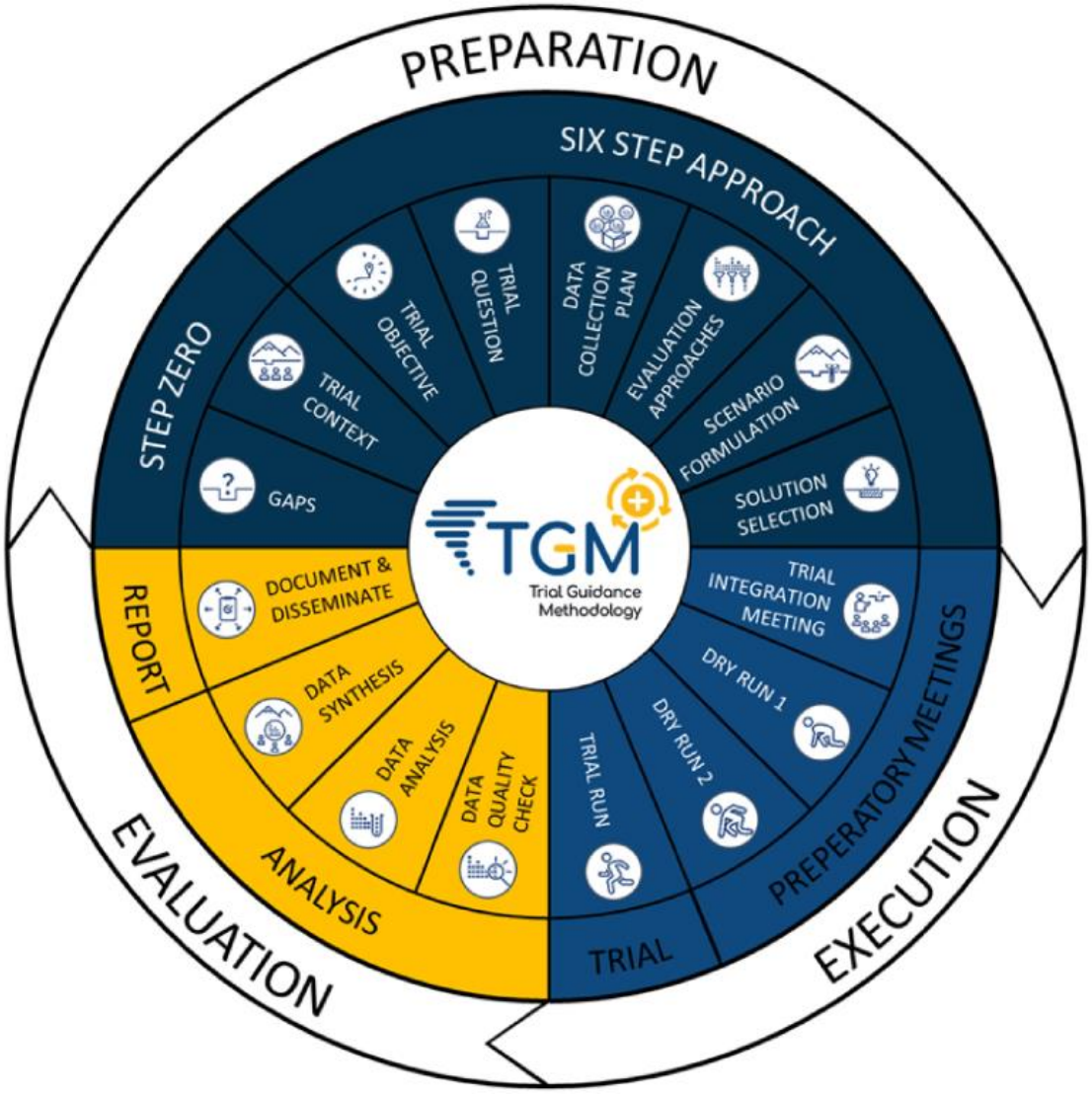

Figure 3-6: Overview of the Trial Guidance Methodology [35]

As a participant in the CWA on the TGM DLR has contributed its experience with the TGM and lessons learnt, in particular:

- Term definitions and references

- Reduction of complexity of the methodology with a focus on the definition of the crisis scenario, multiple scenes per scenario and detailed storyboards reflecting the steps in a scene performed by the trial participants using HEIMDALL system modules
- Challenges such as the lack of resources in the consortium to fill every defined role and domain required for trial planning, execution and evaluation

3.5.2 Contributions to CM Terminology on CMINE

DRIVER+ has established an English project terminology of key terms and associated definitions in order to enhance a common understanding in CM in Europe and within the project team [12]. Also, terms and definitions from the HEIMDALL project were discussed and included when possible in the DRIVER+ terminology. To be sustainable, the terminology is included in the DRIVER+ PoS and also translated in seven languages in this context. The DRIVER+ terminology furthermore will be provided to the Interactive Terminology for Europe (IATE) platform to expand it on the area of disaster management. Additionally, a CMINE group on terminology was developed and discussions started about definition of terms. Multiple HEIMDALL actors (i.e. DLR, FBBR, INT, CRI) have joined CMINE to contribute their expertise in group discussions.

The relevant terms from the HEIMDALL terminology have been integrated into the DRIVER+ terminology and can be looked up in Table 3-3.

Table 3-3: HEIMDALL terms adopted in DRIVER+ terminology [12]

Term	Definition	Source	DRIVER+ Comment
Cascading effects	Cascading effects are the dynamics present in disasters, in which the impact of a physical event generates other physical events or a sequence of events in human subsystems that result in physical, social or economic disruption.	https://planetrisk.org/index.php/pr/article/view/208/355	
Consequences	Consequences are the negative effects of a disaster expressed in terms of human impacts, economic and environmental impacts, and political/social impacts.	(ISO 31010) See FBBR proposal for definition of terms	
Data Harmonisation	Providing access to spatial data through network services in a representation that allows for combining it with other harmonised data in a coherent way by using a common set of data product specifications.	INSPIRE glossary: http://inspire.ec.europa.eu/glossary/DataHarmonisation	
Emergency Management Cycle	Sequence of four civil protection phases: preparedness, mitigation, response and, recovery.		DRIVER+ will provide an adapted definition. Maybe changed to: Crisis Management Cycle
Event	An event is “something that takes place; an occurrence at an arbitrary		DRIVER+ will provide an

	point in time; something that happens at a given place and time".		adapted definition.
Exposure	The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected.	http://www.ipcc.ch/pdf/special reports/srex/SREX Annex_FINAL.pdf	
Field Observation	An observation that is directly observed by the reporter (an emergency professional).	EDXL-SitRep: http://docs.oasis open.org/emergency/edxl sitrep/v1.0/cs01/edxl sitrep-v1.0-cs01.html	
First Responder	First responders include public and private safety professionals and trained volunteers who respond to and provide services at emergencies where additional skills and resources may be needed to bring the incident to a safe conclusion. First responders, often the first trained personnel to arrive on scene, usually arrive with standard issue protective and tactical equipment, which may not be adequate for intervention due to the level of complexity of the intervention (chemical accidents, etc.) that could require of especially trained units with specific protective equipment. First responders often provide first detailed scene information to managing authorities and other responding agencies. As the incident evolves, first responders may assist with establishment of structured incident command. They may continue to participate in incident stabilization and mitigation under the direction and supervision of highly trained specialists. Usually first responders are: police, firefighters, medical services, civil protection authorities, paramedics, etc.	Adapted from NIMS: http://www.esri.com/news/arcuser/1104/definitions.html	DRIVER+ provides a different definition (thesaurus)
Hazard	A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.	See FBBR proposal for definition of terms; See other hazard related terms in FBBR Terminology: Biological hazard; Environmental hazard, Geological hazard; Hydro meteorological hazard; Man-made hazard; Natural hazard; Socionatural hazard; Technological hazard.	
Impact Assessment	After Situation Assessment, the impact of the given situation must be assessed (Level 3 – Impact Assessment).	JDL model of Data Fusion	

	Regarding impact of actions, the impact estimate can include likelihood estimates and cost/utility measures associated with the potential outcomes of a player's planned actions.		
Incident	An occurrence or event, natural or human-caused, that requires an emergency response to protect life or property. Incidents can, for example, include major disasters, emergencies, terrorist attacks, terrorist threats, wildland and urban fires, floods, hazardous materials spills, nuclear accidents, aircraft accidents, earthquakes, hurricanes, tornadoes, tropical storms, war-related disasters, public health and medical emergencies, and other occurrences requiring an emergency response. Each incident may have its own command.	ICS Glossary: https://training.fema.gov/emiweb/is/icsresource/assets/icsglossary.pdf	DRIVER+ is talking more about crisis and disasters.
Interoperability	Ability of systems, personnel, and equipment to provide and receive functionality, data, information and/or services to and from other systems, personnel, and equipment, between both public and private agencies, departments, and other organizations, in a manner enabling them to operate effectively together. Allows emergency management/ response personnel and their affiliated organizations to communicate within and across agencies and jurisdictions via voice, data, or video on-demand, in real time, when needed, and when authorized.		Not for the DRIVER+ terminology. Can be kept for the thesaurus approach.
Response Planning	A disaster response plan should outline roles and responsibilities and prescribe a command structure as decentralized as necessary and as centralized as possible. A good disaster response strategy should also include what-if thinking. Some conditions pose frequent problems for disaster response plans, in particular the collapse of telecommunication infrastructure, a shortage of skilled personnel and an unanticipated magnitude of the disaster event. Disaster response plans should allow for these contingencies.	See Steigenberger, N. (2016). Organizing for the Big One: A Review of Case Studies and a Research Agenda for Multi-Agency Disaster Response. Journal of Contingencies and Crisis Management. Early Online, doi:10.1111/1468-5973.12106.	Not for the DRIVER+ terminology. Can be kept for the thesaurus approach.

Risk	"Risk is a combination of the consequences (impact) of an event (hazard) and the associated likelihood/ probability of its occurrence (ISO) Risk = f(probability, exposure, vulnerability) "	(ISO)	
Risk	The combination of the probability of a hazardous event and its consequences which result from interaction(s) between natural or man-made hazard(s), vulnerability, exposure and capacity.	See FBBR proposal for definition of terms.	Could be taken as a DRIVER+ Note to the DRIVER+ definition?
Risk Assessment	Risk assessment is the overall process of risk identification, risk analysis, and risk evaluation.	(ISO 31010) See FBBR proposal for definition of terms.	Not for the DRIVER+ terminology. Can be kept for the thesaurus approach.
Risk Scenario	Risk scenario is a representation of one single-risk or multi-risk situation leading to significant impacts, selected for the purpose of assessing in more detail a particular type of risk for which it is representative, or constitutes an informative example or illustration.	See FBBR proposal for definition of terms.	Not for the DRIVER+ terminology. Can be kept for the thesaurus approach.
Risk Scenario	Hypothetical situation comprised of a hazard, an entity impacted by that hazard, and associated conditions including consequences when appropriate. A scenario can be created and used for the purposes of training, exercise, analysis, or modelling as well as for other purposes.	(DHS Risk Lexicon 2010; https://www.dhs.gov/xlibrary/assets/dhs-risklexicon-2010.pdf).	Not for the DRIVER+ terminology. Can be kept for the thesaurus approach.

4 Summary of Standardisation Events and Outlook

This section summarizes the standardization events (meetings and teleconferences) carried out during the second reporting period since M22. Table 4-1 chronologically lists activities conducted or events attended in the second reporting period. The summary of the standardisation events attended up to M21 of the project has been provided in D7.4.

Table 4-1: Standardisation activities and events

Activity or Event	**Date and Location**	**Participating Partner(s)**
Participation in the 13th meeting of the Community of Users (CoU), in particular presentation of HEIMDALL standardisation activities in panel 3 – Standardisation Coordination	27-28/03/2019, Brussels, Belgium	DLR
Participation at a telephone conference with DRIVER+ standardization group on possible active engagement of HEIMDALL in the four planned CWAs on: • Requirements on Information Exchange across borders and organisations (interoperability) • Societal Impact Assessment Framework • Trial Guidance Methodology (TGM) • Building a Common Simulation Space	05/07/2019 (telephone conference)	DLR
Joining the Crisis Management Innovation Network Europe (CMINE) initiated by DRIVER+	September 2019 onwards	DLR, INT, FBBR, CRI
Participation in the 1st, 2nd and 3rd virtual meetings of the CWA on TGM	05/11/2019, 12/12/2019, 05/02/2020 (telephone conferences)	DLR
Participation in the Round Table DRIVER+ to discuss the analysis of the market for the DRIVER+ outcomes and to provide feedback	27/05/2020 (virtual)	DLR
Investigation of INSARAG procedures for search and rescue (int. standardized) to be considered in HEIMDALL	16/07/2020 (virtual)	DLR, PCF
Attendance at the CAP Implementation Workshop 2020 on developments, applications and implementations of EDXL-CAP and other standards	29-30/09/2020 (virtual)	DLR
Participation in the INTERGEO DIGITAL web conference, in particular in the INTERGEO 2020 INSPIRE Coverages Webinar	13-15/10/2020 (virtual); webinar on 26/10/2020 (catch-up date due to technical problems)	DLR

In the following, a summary of the performed standardisation activities in the second project reporting period is provided:

- Further cooperation and exchange with the DRIVER+ standardisation group
- Formal participation in the **CWA on the Trial Guidance Methodology (TGM)**
- Joining of the **CMINE** - Crisis Management Innovation Network Europe initiated by DRIVER+ and participation in the section on terminology
- Support in the cross-fertilization of terms between HEIMDALL and DRIVER+ for a harmonized **DRIVER+ terminology**
- Further contribution to and initiation of discussions raised by the **CAP Subcommittee of the OASIS EM-TC** and by DLR, mainly on possibilities for the representation of multiple weather condition datasets representing different forecast times in an EDXL message
- Integration of the **Fire Types concept** developed by GRAF of INT-FRS in HEIMDALL hazard behaviour attribution and matching
- Consideration of the **Common Capability Challenges (CCCs)** identified by the FIRE-IN project (e.g. PCF and INT-FRS being contributors) for additional decision support and lessons learnt classification
- Development of a harmonized **response plan data structure** in close interaction of DLR, PCF and the end user partners with an interagency common part and an agency-specific part
- Development of a harmonized **lessons learnt data structure** which allows stakeholders to capture experience of the emergency management in complex disasters:
    - Consolidation of existing data structures for pooling lessons learnt (e.g. LLF designed by the DRIVER project, the lessons learnt process and product format developed by HEIMDALL WP3)
    - Building upon the harmonised set of operational capabilities adopted from the CCC matrix
- INSPIRE task force to build **INSPIRE-conform HEIMDALL products**
- Investigation of opportunities to integrate **INSARAG procedures** for search and rescue into HEIMDALL
- Assessment of possible contributions to the revision of the technical specification TS 102 181 “Emergency Communications (EMTEL); Requirements for communication between authorities/organizations during emergencies” and overall monitoring of the activities carried out in the context of the ETSI EMTEL working group, although not specific action was eventually carried out as not completely fitting with the HEIMDALL framework.

5 Conclusion

This deliverable presented additional standardization bodies and standards as well as new developments of harmonized methodologies, concepts and data models that have been considered during the second standardization reporting period. The analysis of the already existing standards has driven HEIMDALL's design towards the use of standardised solutions and has allowed identifying areas where the project outcomes could be used to propose standard extensions or adaptations. The integration of new harmonized approaches into the HEIMDALL system development has provided the possibility to showcase and test them with the involved stakeholders in demonstrations and trainings. The deliverable has described the different activities associated with the project, which are generally: (i) the adoption of the standard within the system design; (ii) the triggering of actions for standardisation of the HEIMDALL outcomes.

6 References

[1] Friedemann, M. et al. (2019). HEIMDALL D7.4 – Standardisation Activities Report – Issue 1

[2] Mulero Chaves, J. et al. (2015). PHAROS D8.3 – Standardisation Activities Report - Intermediate

[3] Mulero Chaves, J. et al. (2016). PHAROS D8.4 – Standardisation Activities Report - Final

[4] Lindner, R. and Kähler, E. (2018). DRIVER+ D955.11 - Report on existing standards and standardization activities in crisis management

[5] Open Geospatial Consortium (OGC) website. Available at: https://www.ogc.org/about. [Verified 23 December 2020]

[6] Organization for the Advancement of Structured Information Standards (OASIS) website. Available at: https://www.oasis-open.org/org. [Verified 23 December 2020]

[7] INSPIRE Directive (2007). Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). Published in the official Journal on the 25th April, 2007. Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32007L0002 [Verified 23 December 2020].

[8] INSPIRE Data specifications, available at: https://inspire.ec.europa.eu/data-specifications/2892 [Verified 23 December 2020].

[9] Friedemann, M. et al. (2020). HEIMDALL D6.8: Situation Assessment, Impact Summary Generation and sCOP/SITREP Specification and Implementation Report – Final

[10] European Committee for Standardization (CEN) website. Available at: https://www.cencenelec.eu/aboutus/Pages/default.aspx [Verified 23 December 2020]

[11] CEN-CENELEC Guide 25 (2020). The concept of Partnership with European Organizations and other stakeholders. Available at: https://ftp.cencenelec.eu/EN/EuropeanStandardization/Guides/25_CENCLCGuide25.pdf [Verified 23 December 2020]

[12] Kähler, E. and Seeliger, A. (2020). DRIVER+ D955.31 - Summary of conducted standardisation activities

[13] International Search and Rescue Advisory Group (INSARAG) website. Available at: https://www.insarag.org/about/background [Verified 23 December 2020]

[14] OCHA Emergency Response Support Branch (ERSB) (2018). On-Site Operations Coordination Centre (OSOCC) Guidelines. Available at: https://www.insarag.org/guidance-notes/manuals/800-v-osocc [Verified 23 December 2020]

[15] ICMS UCC Guide v0.9 (2020). INSARAG Coordination & Management System (ICMS) UCC Based Field Operations Guide/Technical Manual. Available at: http://portal.undac.org/pssuportal/portalrest/filesharing/download/public/Abv9ptRPLvhdDvd [Verified 23 December 2020]

[16] Vendrell, J. et al. (2017). HEIMDALL D3.1: Case studies – Issue 1

[17] Vendrell, J. et al. (2017). HEIMDALL D3.4: HEIMDALL Demonstrations – Issue 1

[18] Vendrell, J. et al. (2018). HEIMDALL D3.2: Case studies – Issue 2

[19] Vendrell, J. et al. (2019). HEIMDALL D3.3: Case studies – Issue 3

[20] Copernicus Emergency Management Services (EMS) website. Available at: https://emergency.copernicus.eu/ [Verified 23 December 2020].

[21] European Forest Fire Information System (EFFIS) website. Available at: https://effis.jrc.ec.europa.eu/ [Verified 23 December 2020].

[22] OSGeo website. Available at: https://geonetwork-opensource.org/ [Verified 23 December 2020].

[23] Organization for the Advancement of Structured Information Standards (OASIS) Emergency Management TC (EM-TC) (2010). Common Alerting Protocol Version 1.2. Available at: http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.pdf [Verified 23 December 2020].

[24] Organization for the Advancement of Structured Information Standards (OASIS) Emergency Management TC (EM-TC) (2013). Emergency Data Exchange Language (EDXL) Distribution Element (EDXL-DE) Version 2.0. Available at: http://docs.oasis-open.org/emergency/edxl-de/v2.0/edxl-de-v2.0.pdf. [Verified 23 December 2020].

[25] Organization for the Advancement of Structured Information Standards (OASIS) Emergency Management TC (EM-TC) (2013). Emergency Data Exchange Language Situation Reporting (EDXL-SitRep) 1.0. Available at: http://docs.oasis-open.org/emergency/edxl-sitrep/v1.0/cs01/edxl-sitrep-v1.0-cs01.pdf [Verified 23 December 2020].

[26] Friedemann, M. et al. (2020), HEIMDALL D6.15: Scenario Specification, Scenario Management Specification and Scenario and Situation Metrics – Final

[27] Friedemann, M., Barth, B., Vendrell, J., Muehlbauer, M., Riedlinger, T. (2018). Conceptual scenario model for collaborative disaster response planning. In: Bungartz, H.-J., Kranzlmueller, D., Weinberg, V., Weismueller, J., Wohlgemuth, V. (Eds.): Environmental Informatics: Techniques and Trends. Adjunct Proceedings of the 32nd edition of the EnviroInfo, pp. 119-125

[28] Fire Paradox EU FP6 Project Website: http://www.fireparadox.org/ [Verified 23 December 2020].

[29] Costa, P., Castellnou, M., Larranaga, A., Miralles, M., Kraus, D. (2011). Prevention of large wildfires using the fire types concept. Generalitat de Catalunya, Fire Paradox European Project. (Barcelona, Spain)

[30] FIRE-IN EU H2020 Project Website: https://fire-in.eu/ [Verified 23 December 2020].

[31] Gallardo, C., Estivill Gonzales, L., Miralles, M., Pages, J. and Lahaye, S. (2019). FIRE-IN D1.3: Report on current and future common capability challenges (CCCs and FCCCs) #2. Available at: https://fire-in.eu/en/content/download/657/file/D1.3_Cycle2_CCCs_FinalVersion_compressed.pdf?inLanguage=eng-GB&version=2 [Verified 23 December 2020].

[32] Eriksson, P. and Andersson, D. (2017). DRIVER D530. 1 - Lessons Learned Framework Concept. Available at: https://www.driver-project.eu/wp-content/uploads/2017/11/Lessons-Learned-Framework-Concept.pdf. [Verified 23 December 2020].

[33] Organization for the Advancement of Structured Information Standards (OASIS) Emergency Management TC (EM-TC) website. Available at: https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=emergency [Verified 23 December 2020].

[34] CMINE website. Available at: https://www.cmine.eu/ [Verified 23 December 2020].

[35] CEN-TGM (2020). CWA 17514:2020 - Systematic assessment of innovative solutions for crisis management - Trial guidance methodology, Available at: https://www.cencenelec.eu/research/CWA/Pages/default.aspx [Verified 23 December 2020].

[36] Vendrell, J. et al. (2018). HEIMDALL D3.5 - HEIMDALL Demonstrations – Issue 2

[37] Martin, D. et al. (2020). HEIMDALL D3.6 - HEIMDALL Demonstrations – Issue 3

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