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Management of forest fire incidents - SITAC-based symbology

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European foreword

This CEN Workshop Agreement (CWA 18017:2023) has been developed in accordance with CEN-CENELEC Guide 29 "CEN/CENELEC Workshop Agreements – A rapid prototyping to standardization" and with the relevant provision of CEN/CENELEC Internal Regulations – Part 2. It was approved by a Workshop of representatives of interested parties on 2023-06-23, the constitution of which was supported by CEN following the public call for participation made on 2021-12-17. However, this CEN Workshop Agreement does not necessarily reflect the views of all stakeholders that might have an interest in its subject matter.

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Introduction

Crises and emergencies usually result from unpredictable events or unforeseeable consequences of various events, such as natural disasters, man-made threats and technological accidents. Considering those events can adversely affect human life, property and the environment, the swift response to them and their efficient handling is deemed instrumental. Therefore, the development and application of strategies that inform the sound response mechanisms to deal with sudden and adverse events are among the core challenges of crisis management.

Effective crisis management highly depends on accurate communication and information sharing among the different stakeholders involved in operations. Efficient collaboration requires a common situational understanding, especially in complex situations involving multiple actors, mandates and disciplines from various jurisdictions and nations. In that direction, cartography is essential in conveying reliable and readily interpreted operational information through digital or paper-based maps. Maps summarize and describe a situation visually, providing the involved actors with a common operating picture for supporting coordination during emergencies and crises. The cartographic symbols used on those maps depict, among others, information related to the event, the characteristics of the affected area and the preparedness and response actions that need to be taken. Unfortunately, although several cartographic symbols and symbol schemes for crisis management have been developed and published in different countries, few standardized sets exist worldwide. A typical example is the ANSI 415-2006 INCITS[1] Homeland Security Map Symbol Standard which the US Department of Homeland Security designed to standardize point symbols for emergency management mapping.

Wildfire incident management requires effective and coordinated management and multi-agent collaboration through common situational interpretation. Unfortunately, there are still no standardized approaches to forest fire management symbology. National organizations typically use informal cartographic symbols to share wildfire incident-related information in the field and operational centres. For example, in the US, the National Wildfire Coordinating Group (NWCG)[2] has developed a set of standard symbols for wildland fires to facilitate the fast and consistent interpretation of map-depicted information. Among the relevant symbol sets used in a non-systematic way in the EU, SITAC (abbreviation of "SITuation TACtique")[3], initially developed by the French Fire Service (Sapeur Pompiers), then revisited and enriched with new symbols and operationally adopted then by the "Corpo Nazionale dei Vigili del Fuoco (CNVVF)" in Italy, is currently under consideration by several fire services in other EU Member States. Representatives from these practitioners, relevant stakeholders from the R&D community and the industry have been engaged in developing the current document. The aim is to consider all aspects involved in the standardization process to evaluate the potential of using SITAC as a European operational standard in firefighting operations. The proposed symbology was initially made compatible with that already used in France, Portugal and Italy thanks to the kind cooperation of the ECASC in Valabre, and has been enriched with new symbols that further enhance the descriptive capabilities of the system. Within the CWA and in cooperation with its members, further enhancements have been achieved.

Formalizing information and establishing a standardized symbology set is a crucial challenge for supporting effective wildfire management practices and coordination requirements during the response. The lack of a standardized approach for visually communicating operational messages, using a commonly agreed and understood symbology among the actors involved in forest fire fighting, renders the effectiveness of coordinating the field operations even more troublesome. As previously mentioned, each

[1] ANSI INCITS 415-2006. Homeland Security Mapping Standard - Point Symbology for Emergency Management. https://webstore.ansi.org/standards/incits/ansiincits4152006
[2] National Wildfire Coordinating Group (NWCS). https://www.nwcg.gov/publications/pms936/symbology
[3] SITAC – Standardization of Firefighting Tactical Situation Management. https://www.in-prep.eu/wp-content/uploads/2018/05/Symbology-SITAC.pdf

EU member state has its processes, procedures and symbols for communicating situational information during large fire incidents and crisis management operations. In cross-border crises, such peculiarities and differences may confuse first responders and civil protection bodies or waste assistance between the Member States. More specifically, regarding large-scale forest fires in a cross-border context where multiple authorities and modules from foreign countries are usually involved, sharing operational information and a common understanding of the situation becomes even more crucial to an effective coordinated response. In this regard, establishing a standardized symbology that can be used by the forest fire management services and public safety agencies across the EU, is essential for combating/ mitigating the onset of wildfire-related disasters and facilitating cross-border collaboration in a coordinated manner.

This CEN Workshop Agreement (CWA) has been elaborated as part of the EU-funded research project STRATEGY (https://strategy-project.eu/), which received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement (GA) N° 883520. More specifically, upon investigation of the standardisation universe across its thematic streams of research and prioritisation of the identified gaps against the operational perspective of end-users, STRATEGY underlined the need and supported the drafting of this CWA.

1 Scope

This document proposes a set of standardized symbols to be agreed upon and adopted by the responsible public safety agencies and more specifically by the organizations involved in wildfire management in an optimally coordinated approach (particularly when considering a cross border context). Such symbology will enable the visual communication of the operational and field information that fire commanders exchange during firefighting operations, displayed on a geographical background, to effectively support the coordination and planning of the response activities. Hence, adopting such symbology will expectedly improve the understanding of the situation by the involved agencies, based on a common visualization approach concerning the information sharing among field actors from different countries, jointly operating in the theatre.

The set of symbols encompassed the characteristics of the area of operations, the propagation of the fire front, the intervention measures/available equipment and the actions that need to be taken.

The symbology proposed in this document is based on SITAC, a set of symbols developed by the French Fire Service (Sapeur Pompiers), which is currently operationally adopted by the "Corpo Nazionale dei Vigili del Fuoco (CNVVF)" in Italy and a number of other fire services in EU Member States.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp/

— IEC Electropedia: available at http://www.electropedia.org/

3.1
anchor point
an advantageous location, usually a barrier to fire spread, from which to start building a fire break or line

3.2
briefing map
map drawn and displayed in the briefing area and used during operational briefings. It is a simplified, large-format map of the incident area that is used to discuss work assignments and other details. The briefing map can be hand-drawn, printed or displayed digitally using a projector

Note 1 to entry: Sometimes in the US operational references, this map is referred to as a Briefing Area Map (BAM).

3.3
Command Post, CP
Incident Command Post, ICP
location at which the commander of a unit or an incident in the field receives orders, takes decisions and controls, and organizes the forces. The CP or ICP may be collocated with the incident base or other incident facilities

3.4
crown fire
type of fire that moves above the surface i.e. from top to top of trees or tall shrubs, its advancement being eventually independent of the propagation of the fire at the surface. Crown fires are sometimes classified as running or dependent to distinguish the degree of independence from the surface fire

3.5
EU Module
a combination of team and equipment of the EUCPM, which include forest Firefighting (ground or aerial) Modules, using concrete capacities defined by the EUCPM provisions

3.6
escape route
pre-planned and understood route firefighters take to move to a safety zone or other low-risk area. When escape routes deviate from a defined physical path, they should be marked (flagged)

3.7
evacuation
act of moving people or animals from a dangerous place to somewhere safe, reducing the possibility of injury or casualty

3.8
extreme fire
fire with unpredictable and erratic behaviour due to its potential associated with an unexpected rate of spread and/flame length/intensity

3.9
Fire (Incident) Commander
the highest-ranking member on the scene of a fire, rescue, incident, or emergency, responsible for the management of all incident operations at the incident site

3.10
fire flank
parts of a fire's perimeter that are roughly parallel to the main direction of the spread

3.11
fire front
part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, the fire front is assumed to be the leading edge of the fire perimeter

3.12
fire outline
boundaries of the current area burning

3.13
fire start
precise location where a competent ignition source came into contact with the material first ignited and sustained combustion occurred

3.14
fire team
Fire (Incident) Commander and appropriate Command and General Staff assigned to an incident

3.15
first responders
Emergency Services' professionals (from Fire/Wildfire, Police/Law-Enforcement, Emergency-Medical-Services, Rescue Agencies) and professionally trained-and certified volunteers (from local communities and/or citizen groups and/or civic society at large) who are immediately responding to scenes of emergency, disaster and/or crisis, with the pertinent and necessary culture/behaviour, training, skills, procedures and equipment to tackle the said emergency, disaster and/or crisis

3.16
ground fire
type of fire that spreads on the ground and consumes the organic material beneath the surface of litter, such as a peat fire

3.17
health care or healthcare
improvement of health via the prevention, diagnosis, treatment, amelioration or cure of disease, illness, injury, and other physical and mental impairments in people

3.18
helibase
main location for parking, fuelling, maintenance, and loading of helicopters operating in support of an incident, usually located at or near the incident base

3.19
helispot
natural or improved take-off and landing area intended for temporary or occasional helicopter use

3.20
hot spot
particularly active part of a fire

3.21
Law Enforcement Agency (LEA)
any government agency responsible for the enforcement of the law

3.22
line ignition
technique used in wildfire management to create a controlled burn along a predetermined line or boundary to create a barrier that will slow or stop the spread of a wildfire. This technique is known as "firing out" or "burning out”

3.23
recon
reconnaissance
examine a fire area to obtain information about current and probable fire behaviour and other related fire suppression information

3.24
rescue
help someone or something get out of a dangerous, harmful, or unpleasant situation

3.25
retardant
substance or chemical agent (e.g. foam, class A, gel) which reduces the flammability of combustibles

3.26
retardant drop
dropping of fire retardants from aerial means (air tankers or specially designed buckets slung below a helicopter)

3.27
retardant line
applying fire retardants from ground crews to slow down the fire, protecting infrastructures, preventing further ignitions, etc.

3.28
safety line
designated area around the perimeter of a wildfire where firefighters and other emergency personnel can work safely without being immediately threatened by the flames

3.29
safe zone
safety zone
area cleared of flammable material, used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. In firing operations, crews progress to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuel breaks; they are greatly enlarged areas that can be used with relative safety by firefighters and their equipment in the event of a blow-up in the vicinity

3.30
spot ignition
spot fire
fire ignition that occurs from sparks or embers carried by the wind and which start new fires (spot fires) beyond the zone of direct ignition by the main fire. A cascade of spot fires can cause a blow-up

3.31
surface fire
type of fire that moves near the surface, burning surface fuels comprising dead branches, leaves, and low vegetation

3.32
staging area
location set up at an incident where resources can be placed while awaiting a tactical assignment

Note 1 to entry: Staging areas are managed by the Operations Section.

3.33
transit point
temporary location established by fire managers and incident commanders as part of the overall firefighting strategy aims to support the operations by providing a central location for personnel, equipment, and supplies and a staging area for firefighting resources

3.34
volunteers' team
team of volunteers
fire fighter's department of volunteers who perform fire suppression and other related emergency services for a local jurisdiction

3.35
water point
indicate water supply points

4 Forest fire incidents and the use of symbology

4.1 General

First responders routinely use location-based information (maps) to dispatch resources, analyze spatial risk, coordinate field activity, be aware of dangerous spots and perform several other mission-critical tasks. In large fires, paper maps (hand drawn, printed or digital) are used in the form of wall maps, field drawings or digital maps in responders' vehicles. In the headquarters or operational centers, a growing number use high-quality computer-based maps utilizing Command and Control (C2) software, based on Geographic Information Systems (GIS) capabilities and technology.

There are multiple examples of map symbol standards, currently in use, designed to support emergency management. These include symbol standards for humanitarian demining efforts (GICHD 2005), military operations (NATO 2005), and emergency response and recovery (ANSI 2006; Martin and Black 2007). Most of these standards specify designs for point symbol markers, though some also suggest standards for symbolizing area features by defining styles for boundary lines (Kostelnick et al. 2008).

A primary challenge with any map is to create a consistent look so that information can be conveyed across all operational levels (tactical, operational and strategic) and different agencies, disciplines and jurisdictions. Information consistently presented in such maps is commonly referred to as Common Operating Picture (COP).

4.2 Types of maps used in managing forest fire incidents

In wildfire management, maps are used to plan and coordinate activities, and develop a common operational picture between responders and involved actors. Several maps may support communication and information sharing during firefighting operations related to a specific wildfire incident. This is the case in modern fire management operations applied by the leading countries in fire management technology.

Such maps, endorsed by the National Wildfire Coordination Group (NWCG), established in the USA in 1976, are presented here next regarding the exchanging information, which may be considered potential elements of the SITAC standardization process.

Incident Action Plan Map

The Incident Action Plan (IAP) map is the primary map used by field operations personnel and it is an essential tool for firefighter safety. The IAP map effectively communicates incident management objectives in addition to geographic and incident features.

Briefing map

The Briefing Map is displayed in the briefing area and used during operational briefings. It is a simplified, large-format map of the incident area that is used to discuss work assignments and other details. The briefing map can be printed or displayed digitally using a projector. Sometimes this map is referred to as a Briefing Area Map (BAM).

Situation Unit Map

The Situation Unit Map is a large-format map with an accurate, current, and detailed record of the incident information, displayed in or near the Situation Unit area. The Situation Unit Map should be limited to the

extent of the incident rather than showing the surrounding area. Its purpose is to show the current incident information and provide a place for marking map edits.

Transportation map

The Transportation Map shows the access routes to the incident and is included in the Incident Action Plan (IAP). It provides an overview of the transportation network in the incident vicinity to support safe transportation. This map is used to facilitate land-based delivery of equipment, supplies, and personnel to and from the incident location.

Progression map

The Progression Map shows the areas affected by the incident over time. A copy of the map is required to be included in the incident documentation package.

Air operations map

The Air Operations Map provides air operations with enough detail to aid in locating key features on an incident. A secondary Air Operations map, the Pilot Map, may be created for pilots.

Operations map

The Operations Map effectively displays geographic and incident features for use by operations personnel (Operations Section Chief, Operations Branch Directors, Division/Group Supervisors) either in the Incident Command Post or out in the field. Sample legends of Operation maps are shown next.

Other maps

Fire personnel frequently request special maps. These maps may refer to:

a) Areas of Special Concern (ASC), used to identify sensitive areas, such as endangered species habitats or locations, cultural resources, and other areas at risk;

b) Facilities Map showing the layout of the incident facilities at the Incident Command Post (ICP) or Incident Base/Camp;

c) Fuels Map showing the fuels in the fire perimeter;

d) Ownership–Land Status Map showing the ownership or land status for the areas impacted by the incident. It graphically depicts the land ownership or fire protection responsibility around the incident;

e) Structure Protection Map showing structures and resources that could be impacted by the incident etc.

4.3 Specific requirements for forest fires incidents symbology

Standardized symbols in mapping wildland fires facilitate fast and consistent interpretation of mapping products and help prevent ambiguous map interpretation, which can become a safety issue during an incident.

Moreover, the transmission of the field operations map across the chain of command, allows a more informed assessment to higher decision-making levels that need to take broader initiative. The use of operational mapping, updated regularly during the phases of the intervention, also allows for a kind of operations logbook, a concise logbook easily interpreted by all the present actors. It is important to keep the number of symbols small, and categorized by topic, so as to make sketching easy and the cartography not too redundant and therefore unreadable. Likewise, it is important to identify symbols in such a way that they are always clearly distinguishable (even in small size), even in the case of a black-and-white representation. Further, common map conventions (e.g., blue for hydrologic features) should be observed, if possible, to ensure clear communication.

For forest fires incidents symbology, the following requirements apply:

- In practice, symbols will need to be drawn on a map during an incident, but the user should choose such symbols and/or clues that are easy, simple and understandable to everyone who receives these notes/remarks. A necessary condition of understanding rather than confusion, which can easily be caused, especially during the management of large forest incidents (megafires), should take into consideration to inform and/or agree in advance on the imprinting of these symbols. If properly and timely communed, it can work in practice.
- Means/resources symbols contained on a map are quite generic, avoiding including for example basic information about a fire truck, such as the amount of water, installations, special tools for forestry operations (shovels, ferns, hoes, overseers, chainsaws, etc.), and even all the personnel on board. The only information it provides has to do for example with the operating point of the fire truck, information that should be updated very often, especially in the development of the forest incident. So, combinations of such symbols with containers (e.g., a specific text code or acronym that depicts all the above information) that each Agency and/or country further defines or standardizes is needed, so that all involved stakeholders understand the map in the same way.
- A wide range of symbols, covering every case and providing in depth details on the operations would be more confusing than helping. Introducing a number of standard symbols that can be further adapted or enhanced (if needed) nationally or within an agency (e.g., by using more containers in symbols) is the key point.
- The ambiguous interpretation of maps or misunderstanding should be avoided as it will raise safety issues for both personnel and equipment in the development of a forest incident.

5 SITAC-based methodological framework and symbol system definition, for forest fire incident management

5.1 SITAC-based methodological approach

The creation of a standardized methodology of graphical representation of the various concepts and elements describing the tactical situation on a fire incident, allows having a common communication language that can be used:

— at the national level, where Forest Fire Fighting systems have a complex organization with multiple actors involved, and/or

— at the European and international level, to facilitate missions and interventions linked to bilateral agreements or the EU Civil Protection Mechanism.

In this sense, SITAC, is the common "language" designed to facilitate the collection, processing, transmission, and understanding of operational information at different levels of command and execution.

SITAC is also a method of analysis that, combined with a specific graphical symbology, makes it possible to represent the picture of the ongoing situation of complex fires and to plan operations in a standardized and understandable way for all involved. Furthermore, with modern data transmission systems, sharing the plan with operations rooms and different decision-making levels becomes extremely easy.

SITAC also constitutes a kind of "campaign notebook" in which updates on the evolution of the fire and the actions taken to deal with it can be recorded, and shared. As the duration of operations continues, it also constitutes a handy tool for the handover of handovers in changes between Directors of Operations.

All graphic symbols adopted are designed to be unambiguously understandable even in the case of black-and-white representation and easily reproduced by hand on a field map.

The symbols of operational means and teams and the actions performed by them, are indicated differently if provided and/or implemented.

The symbols of actions and of teams and means must be congruent with each other: an action in place presupposes an operational team in place, but on the other hand, actions in progress with teams not yet arrived are not possible.

5.2 Classification structure

Four steps must be included in the creation of a complete operational mapping:

- Analysis of the area of operation (topography, fuel, sensitive points, roads, power lines, etc.);
- Assessment of the most likely fire behaviour depending on the area of origin, topography and weather conditions, distribution of fuels;
- Identification of actions to be taken: indirect attack, containment on flanks, localized attacks, etc.
- Operational organization at the scene of the event (actions and means).

All the above info must be represented, associating a symbol, having a precise meaning, with a geographical location on the map. The SITAC set of symbols includes fire management concepts and formalized relevant shapes as depicted in the next figure, presenting the following ten main categories:

1. Description of the intervention area

The perception and analysis of the characteristics of the area in which the firefighting system has to extinguish the fire (morphology, fuels, railroad network, water resources, flight obstacles, power lines, etc.) is the first step to preparing the action plan; this means to identify the more relevant elements that condition the fire spread, the endangered areas, the infrastructures available to fight the fire; the size of the area to be analysed are such as to allow for the forecast of negative evolutions of the fire as well.

2. Source of danger

Source of danger are places (points, lines, areas) where the existence of e.g. an asset, an infrastructure, an element, a substance, etc. can lead to causing the ignition of a fire or expanding the fire propagation For example assets, infrastructures, elements, substances, such as a pilar of power distribution network that could cause fire ignition.

3. Sensitive points

Sensitive points are places (points, lines, areas) where is possible a change of fire behaviour due to a change of morphology, fuels, exposure, or to the presence of a road and so on. These situations could represent a chance to stop easier the fire or places where a negative evolution of the incident is likely. WUI Sensitive points represent areas with houses, factories, railroads and main roads that could be endangered by the fire. Other sensitive points are for example assets or infrastructures that their service can be impacted/disrupted due to the fire propagation in the area.

4. Infrastructure for resources

The evaluation of infrastructures that are useful for the Forest Fire Fighting System present on site is one of the main elements to be considered; the characteristics of the road network, the presence of fuel-break and the availability of water points for ground and air means in the endangered area, are very important

to plan and to run the attack to the fire; they condition the possibility of approaching the fires with the engine crews and to fill them, the rotation time for the drops of Forest Fire Fighting aircrafts.

5. Fire evolution and weather situation

Fire evolution is strictly linked to fuels, morphology and weather conditions, particularly with wind and humidity.

6. Fire front

The fire front is one of the most important parameters to evaluate the difficulties to extinguish the fire; the length is important but also if the front is continuous or broken in different parts.

7. Type of fire

Crown fires, surface fires, and ground fires, request different approaches and techniques; ground fires in particular need good handover procedures for mop-up and surveillance

8. Wind direction and intensity

Wind direction and intensity shape the main spread direction and speed of the fire; firefighters use the relationship between the wind speed and rate of spread to plan the operations.

9. Means

The availability of ground and air means is important to make a realistic plan of operation; the Incident Commander must evaluate the number and the type of resources really usable according to the road network and availability of water, and the weather conditions for the air means.

10. Actions

Actions depend on the availability of means and crew, their skills and capability, the morphology, the road network, the weather condition and so on. The plan of actions must be realistic and flexible.

11. Evacuation

Evacuation requests to be planned in time; it is necessary to identify the safety zone and the safe way to reach it, and the evaluation of the needed time to run this operation.

5.3 Design of symbols

The following Tables 1, 2 and 3 provide the basic rules for designing the proposed symbols, with regards to their shape, colour, line and filling (with information/text) which, when followed by all organizations or countries involved in the fire incident management, will lead to easily understanding of the shared information.

Table 1 — Basic shapes

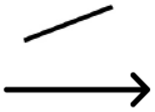
Shape type	Description	Shape image
	Means/resources	
Triangle top	Warning or danger	
Triangle bottom	Sensitive points	
Polygon	Area	
Circle	Place or point	
Star	Incident or part of incident	
Line (or arrow)	Limit, action, motion, direction	
Rectangular with a line on top	Infrastructure	
Flag	Command post	

Table 2 — Design colours

Black	Green	Blue	Red	Orange
Generic	Rescue	Water	Fire	CBRNe

Table 3 — Shape drawing line

Solid line	Dashed line
Running action (examples)	Planned action (examples)
	

5.4 Combined map symbols

The approach for drawing each shape/icon in a consistent and formalized way is described together with the main description of each symbol.

5.4.1 Description of the operating area

5.4.1.1 Sectors of operations

The delimitation of sectors is used to define the areas of operation, supporting the coordination of teams and the management of the incident. Graphically it is represented by a dashed-dot line.

5.4.1.2 Roads

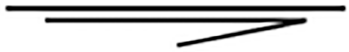
5.4.1.3 Road with normal access

A road with normal access is a rural/forest road with width that allows access to all types of vehicles. It is depicted with two bold parallel continuous lines. In case that the road is unpaved or its conditions indicates that only vehicles with off-rad capabilities are appropriate to access, then next to the symbol it should be indicated the text (4x4).

5.4.1.4 Road with limited access

A road with limited access is a road with limited width allowing access only to small/light vehicles. It is represented with a straight line on top and a parallel dashed line at the bottom. In case that the road is unpaved or its conditions indicates that only vehicles with off-rad capabilities are appropriate to access, then next to the symbol it should be indicated the text (4x4).

5.4.1.4.1 One-way route



One-way route symbol is depicted with a straight line (road) and a parallel line ending with an arrow showing the valid direction.

5.4.1.4.2 Road closed

A blocked or closed road (with no access to fire vehicles) is represented by an X sign, crossing the straight line of the road that is closed.

5.4.1.5 Trail

A trail is usually a forest narrow road which may be used by persons or crews. It is represented with a straight line on top and a parallel line of dots at the bottom.

5.4.1.6 Slope

5.4.1.6.1 Slight slope

An area with slight slope (0-10%) is marked with a downward arrow with 1 perpendicular dash at its tail

5.4.1.6.2 Moderate slope

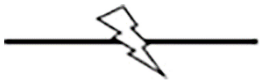
An area with moderate slope (11-30%) is marked with a downward arrow with 2 perpendicular dashes at its tail

5.4.1.6.3 Steep slope

An area with steep slope (>30%) is marked with a downward arrow with 3 perpendicular dashes at its tail.

5.4.1.7 Power lines

5.4.1.7.1 Active power line



An active (charged) power line is marked by placing a blitz sign on the drawn lines depicting the electricity network.

5.4.1.7.2 Power line off

A deactivated power line is depicted with a crossed blitz symbol placed on a mapped/drawn electricity line.

5.4.2 Water points

5.4.2.1 Water point for ground vehicles

The point where ground vehicles could pump water and use it for ground firefighting actions. It is depicted as a blue solid circle. Within the circle the capacity of water could be added in case it indicates a water tank, otherwise no text is included.

5.4.2.2 Water point for helicopters

A point where helicopters could pump water and use it for aerial firefighting actions. It is depicted as a circle divided into quarters, with the two verticals colored white and the two vertical colored blue.

5.4.2.3 Water point for airplanes

A point where airplanes could pump water and use it for aerial firefighting actions. It is depicted as a circle with blue color and a white rectangle in the middle (horizontal axis).

5.4.3 Helicopter pad

A natural or improved take-off and landing area intended for temporary or occasional helicopter use. It is depicted by a circle with black outline and white filling, containing letter H.

5.4.3.1 Obstacles

5.4.3.1.1 Cable car, overhead wires etc.

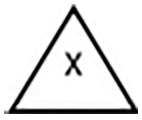
Cable car, overhead wires, and related hanging elements above the ground (horizontal or oblique flight obstacles in general) in the area of operations are depicted with a black rectangle from an oblique line.

5.4.3.1.2 Repeaters, antennas, wind turbines, etc.

Repeaters, antennas, wind generators and other point elements representing high linear structures (poles) are depicted by an open isosceles triangle with a bold dot at the bottom.

5.4.3.2 Source of danger

5.4.3.2.1 Generic source of danger



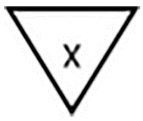
A source of danger, depicted as a black triangle with the apex down which can be combined with a container/filling (in the place indicated with an X in the graphic) in order to depict any generic information on the map. Indicative containers are: UXO (for unexploded ordnance – explosives), G (for Gas) and E (for Electric).

5.4.3.2.2 CBRN related source of danger

A source of danger, depicted as an orange triangle with the apex down which can be combined with a container/filling (in the place indicated with an X in the graphic) in order to depict any CBRN related information on the map. Indicative containers are: C (for Chemical), B (for Biological), R (for Radiological), N (for Nuclear).

5.4.3.3 Sensitive points

5.4.3.3.1 Generic sensitive point



A sensitive point, depicted as a black triangle with the apex down which can be combined with a container/filling (in the place indicated with an X in the graphic) in order to depict any generic information on the map. Indicative containers are: UXO (for unexploded ordnance – explosives), G (for Gas) and E (for Electric).

5.4.3.3.2 CBRN related sensitive point

A sensitive point, depicted as an orange triangle with the apex down which can be combined with a container/filling (in the place indicated with an X in the graphic) in order to depict any CBRN related information on the map. Indicative containers are: C (for Chemical), B (for Biological), R (for Radiological), N (for Nuclear).

5.4.3.3.3 Fire related sensitive point

A sensitive point related to fire is depicted as a red (solid fill) triangle with the apex down.

5.4.3.3.4 Human related sensitive point

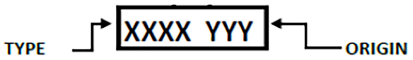
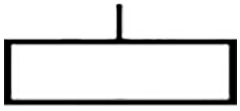
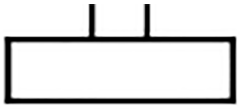
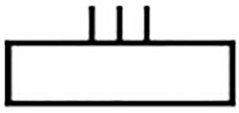
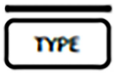
A sensitive point related to humans/lives, especially in a wildland-urban interface or rural-urban interface. It is depicted as a triangle with the apex down with a pattern fill with diagonal green and white stripes.

5.4.4 Resources and means

5.4.4.1 Additional design principles for resources and means symbols

Symbols related to resources and means that are operating in the area or planned to operate, use a rectangle as the basic shape (see Table 1), in different colours when needed to depict the organization/authority they belong. Moreover, further adjusted graphics are used in order to specify the type of resources, usually combined with text (container) in order to specify further the type or even the origin of the resources. The colour filling is also used to specify if the specific resource is planned to operate or if it is active. All these are presented as design principles in the following Table 4.

Table 4 — Design principles for resources

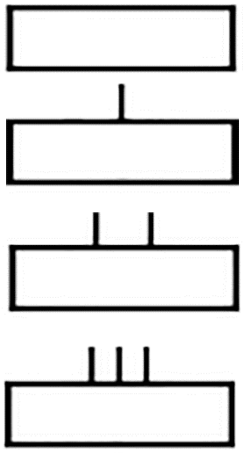
Textual	Graphic (examples)	Mixed (example)
	 Generic vehicle  Fire fighter vehicle (unit)  Group of vehicles  Columns (set of groups)  Aerial means  Infrastructures	 Example of ground forces  Example for Canadair 
Can specify type and origin of the means	Can specify type of the means	Can specify type, origin and status of the resources

5.4.4.2 Symbols related to resources and means

Based on the general principles presented in 5.3 and those presented in the Table 4, the combinations of symbols and containers for resources and means are presented below.

5.4.4.2.1 Ground forces

In order to depict the ground forces the following symbols are used: a rectangle with no or up to three vertical lines to the top side.



Generic Vehicle

Unit

Group

Columns

The approach followed by this CWA regarding the above symbols is the following:

- A Unit is typically the smallest organizational element, e.g. in fire management operations, consisting of firefighters working together on a specific task or objective. Units can vary in size depending on the specific operation, but they generally consist of three to seven firefighters.

- A Group is a larger organizational element (in fire management operations), typically consisting of two or more units. Squads are often responsible for a specific area or firefighting task, and may be assigned to work on different parts of the firefront (head, flanks, or rear).

- A Column is the largest organizational element in fire management operations, typically consisting of several squads. Columns are often used for more complex firefighting operations, such as large wildfires, and are responsible for coordinating and executing multiple tasks across a large area.

The above depends on each country/organizational structure and norms, and they may be followed as a pattern/methodology to depict the respective categories for resources.

In order to specify the status of each resource, a solid outline is used for ongoing activities or dashed for planned. Below is an example of a group of fire vehicles (red indicates fire related info).

The above symbols are used in combination with a container in order to specify the type and/or name of resources, as indicated in the example below depicting a unit of volunteers.

Indicative containers are:

- IC- Incident Commander
- FB - fire brigade
- FS - forest service
- VOL - volunteers
- DOZ – dozers
- EU – EU Module

Additional containers may be used upon adoption of the CWA by each country/organization.

5.4.4.2.2 Command post

The command post is depicted by a flag symbol (solid line for ongoing activities or dashed for planned) containing the letters CP within, in red colour as it is linked to fire (wildfire management).

5.4.4.2.3 Law Enforcement Authorities

Resources from Law Enforcement Agencies, such as police, are depicted by a black rectangle in two versions indicating the status (solid line for ongoing activities or dashed for planned) as described further above. The “Pol” is used as a container.

5.4.4.2.4 Emergency Management Services

Resources related to health care and rescue (e.g., ambulance service) are depicted by a green rectangle in two versions indicating the status (solid line for ongoing activities or dashed for planned) as described further above. The “HEALTH” is used as a container, also in green. This symbol may also be combined with vertical lines on top, following the approach described in 5.4.4.2.1.

5.4.4.2.5 Aerial means

Aerial forces are depicted by a rectangle containing two triangles horizontally connected with their apexes, combined with a text at the bottom to indicate the type of resources.

In order to specify the status of each resource, a solid outline for ongoing activities or dashed for planned, is used . Below is an example of a group of fire vehicles (red indicates fire related info).

The above symbols are used in combination with a container in order to specify the type and/or name of resources, as indicated in the example below depicting a Canadair airplane.

Indicative containers are:

Airplanes

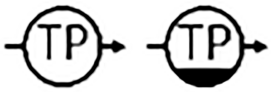
- Plane- airplanes in general
- CAN- Canadair
- BOSS- Fireboss
- PZL- PZL (Mielec) M-18B
- BE- Beriev

Helicopters

- HELI- Helicopters in general
- S64 - Erickson S-64
- COU - Cougar helicopter
- BELL - Bell 412
- CH - CHINOOK
- SP - SUPER PUMA
- KA - KAMOV

Additional containers may be used upon adoption of the CWA by each country/organization.

5.4.4.2.6 Transit Point



A transit point is depicted by a circle with a black outline, containing the letters "TP" within, and an arrow horizontally. Moreover, if the bottom part is coloured black, it indicates that it is active and running, otherwise, it is planned.

5.4.4.2.7 Infrastructure

In order to depict infrastructures in the field, a rectangle with a container (text) within it is used, combined with a solid line on the top side. Depending on the container and the type of information that is depicted, the symbol may be combined with colour (e.g. green for hospital).

Indicative containers are:

- MMP (means meeting point)
- VMP (Victims meeting point)
- MH (Mobile hospital)
- HSP (Hospital)
- MOR (Morgue)
- VET (Veterinary)
- REST (Restaurant)
- P (Parking)
- MEC (Mechanic support)
- OIL (OIL refueling point)
- ELEC (Electricity support point)
- FOAM (Foam reserve)
- RET (Retardant reserve)

Additional containers may be used upon adoption of the CWA by each country/organization.

5.4.5 Fire evolution and weather situation

The following symbols are used in order to depict on a map the current situation of the fire and the weather that prevails in the area. Sets of these symbols, which through their combination provide a more complete situational picture are presented in Annex B.

5.4.5.1 Fire outline

The fire outline depicts the outer boundaries of the current area burning. It is depicted by a red polygon which may also be filled with a light red colour.

5.4.5.2 Primary and secondary axes

5.4.5.2.1 Main development axis

The main development axis indicates the main direction of the fire propagation, which is placed where the head of the fire is drawn. It is depicted with a red big arrow.

5.4.5.2.2 Secondary flank (fast)

The secondary flank is part of the fire perimeter, which when evolving fast is depicted with an arrow with a red outline and a red/white pattern filling (lines in an angle of 45^{o}).

5.4.5.2.3 Secondary flank (slow)

The secondary flank is part of the fire perimeter, which when evolving slow it is depicted with an arrow with red outline and white filling.

5.4.5.3 Point of origin or ignition point

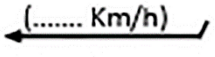
The point of origin indicates a point/area where the fire initially started and then evolved. It is depicted with a red (solid filling) star.

5.4.5.4 Fire front

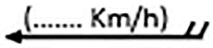
Fire front is any part of the fire perimeter that is located in the wind direction and displays continuous flaming combustion. It is depicted with red color as a polygon with a pattern of red parallel lines (or even solid red), drawn at the part of the fire outline where the above circumstances apply.

5.4.5.5 Wind direction and intensity

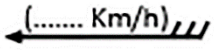
Wind direction and intensity are depicted by combining an arrow that indicates the direction of the wind, a number of short lines at its tail in order to indicate the wind intensity, and texture on top of the arrow indicating the wind speed (km/h) when known.



Wind direction with weak intensity (<19km/h)



Wind direction with moderate intensity (20-38km/h)



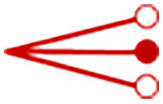
Wind direction with strong intensity (39-61km/h)

5.4.6 Type of fire

5.4.6.1 Ground fire

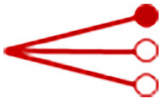
The ground fire symbol indicates a fire burning below the surface fuel layer. It is depicted with three lines starting from the same point, creating an angle of approximately 15º on top and beneath the middle one (which is parallel to the horizontal axis). At the end of each line a small circle with a red outline is placed and a white or red solid filling. For ground fire the only bottom circle is red.

5.4.6.2 Surface fire



The surface fire symbol indicates a fire that burns within the fuel layer above the ground (surface). It is drawn with the same principles as above, but with the middle circle coloured red.

5.4.6.3 Crown fire



The crown fire symbol indicates a fire that advances from top to top of trees or shrubs more or less independent of a surface fire. It is drawn with the same principles as above, but with the top circle coloured red.

5.4.7 Firefighting actions

5.4.7.1 Aerial means

5.4.7.1.1 Water drop of helicopter

The area where helicopters operate dropping water is indicated using a circle with a blue outline (solid line for ongoing activities or dashed for planned). If the area of droping is wide or linear, then several overlapping symbols may be used.

5.4.7.1.2 Retardant drop of helicopter

The area where helicopters operate dropping retardant is indicated using a circle with a red outline (solid line for ongoing activities or dashed for planned) and pattern filling of diagonal red parallel lines. If the area of droping is wide or linear, then several overlapping symbols may be used.

5.4.7.1.3 Water drop of airplane

The area where airplanes operate dropping water is indicated using an eclipse with a blue outline (solid line for ongoing activities or dashed for planned). If the area of droping is wide or linear, then several overlapping symbols may be used.

5.4.7.1.4 Retardant drop of airplane

The area where airplanes operate dropping retardant is indicated using an eclipse with a red outline (solid line for ongoing activities or dashed for planned) and pattern filling of diagonal red parallel lines. If the area of droping is wide or linear, then several overlapping symbols may be used.

5.4.7.2 Ground teams

5.4.7.2.1 Recon

A reconnaissance activity by the ground teams to obtain information is depected by a red double elbow arrow (solid line for ongoing activities or dashed for planned).

5.4.7.2.2 Line defence

Defencive actions that occur in a line by ground means in order to suppress fire or protect e.g. infrastructures, is depected by continious triangles in a row, with red outline, and no fill for planned actions or red solid fill for ongoing ones.

5.4.7.2.3 Perimeter defence

Defencive actions that occur around the fire (in the perimeter) by ground means in order to suppress fire or protect e.g. infrastructures, are depected by continious triangles creating a circle, with red outline, and no fill for planned actions or red solid fill for ongoing ones.

5.4.7.2.4 Containment attack

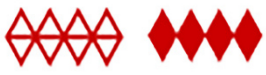
Offensive actions that usually occur at the fire flanks as mutual attacks by ground means in order to suppress fire, are depected by three elbow arrows beginning from the same point, in red colour(dashed line for planned action or solid line for ongoing).

5.4.7.2.5 Hot spot attack

Offensive action by ground forces specifically for hot spots, is depected by a red arrow (dashed line for planned action or solid line for ongoing).

5.4.7.3 Counter fire and tactical fire

5.4.7.3.1 Anchor point



Establishment of the safety line is depected continious double (united at their bottom sides, creating a diamond) triangles in a row, with a red outline, and no fill for planned actions or red solid fill for ongoing ones.

5.4.7.3.2 Spot ignitions

Spot ignitions that are used for controlled burn backfire, are depicted as red outlined circle with a red vertical arrow at the bottom, and no fill for planned actions or red solid fill for ongoing ones.

5.4.7.3.3 Line ignitions

Line ignitions that are used for controlled burn backfire, are depicted as red outlined block elbow arrow, and no fill for planned actions or red solid fill for ongoing ones.

5.4.7.4 Evacuation

5.4.7.4.1 Area to be evacuated

An area that needs to be/is evacuated is depicted by a circle with a green outline, containing the letters "EV". Moreover, if the bottom part is coloured green, it indicates that it is active and running, otherwise it is planned.

5.4.7.4.2 Escape route

The route that is used for the evacuation of people or animals (from EV to SZ) is depicted by a green arrow indicating the direction. With single arrowed head and tail, planned actions are depicted, while with double-arrowed edges active actions are depicted.

5.4.7.4.3 Safe zone

An area where the evacuated people or animals are escorted is depicted by a circle with a green outline, containing the letters "SZ" within. Moreover, if the bottom part is coloured green, it indicates that it is active and running, otherwise, it is planned.

5.5 Matching of map symbols with message structure for exchange of information

The use of formalized graphical symbols to depict the actual situation, in addition to allowing the planning of field activities, supports efficient information sharing at the advanced command post via hand-drawn maps between the personnel on the fire front. These maps can be scanned and transformed into a meaningful digital layer to be shared via smartphone and tablet, so that all the involved actors can be aware of the ongoing operations.

The proposed SITAC-based symbols are not meant to substitute other groups of symbols currently used by operational Control Centres (C2s) for the same purpose. Their role is to act as a reference to properly express concepts and meanings, so as to facilitate the implementation of sound interoperability services between C2s.

For example, as illustrated by Figure 1**– Example of implementation of symbol exchange between Control Centres**, whereas one C2 (say, C2_A) intend to communicate to a second C2 (say, C2_B) the location where a HELI WATER DROP is planned,

- the C2_A operator would still visualise such location through the correspondent symbol offered by his/her C2 system,
- the interoperability service of C2_A would automatically generate a properly formatted message containing the reference code (say, 1234) to the SITAC symbol "HELI WATER DROP", (previously selected as the best match to the C2_A symbol),
- the interoperability service of C2_B would receive such a message, and visualise for the operator either the corresponding C2_B symbol (previously selected as the best match to the SITAC symbol with reference code 1234) or the SITAC symbol "HELI WATER DROP" itself (depending from the settings).

As a result, C2_A and C2_B operators would be able to observe either on the same symbol proposed by this CWA or look to their respective symbol. Thus, each of them would see the symbol they are accustomed to, and they perfectly know the meaning of, so that avoiding unnecessary additional effort, while ensuring the inherent coherence and efficacy of the operational communication exchanged.

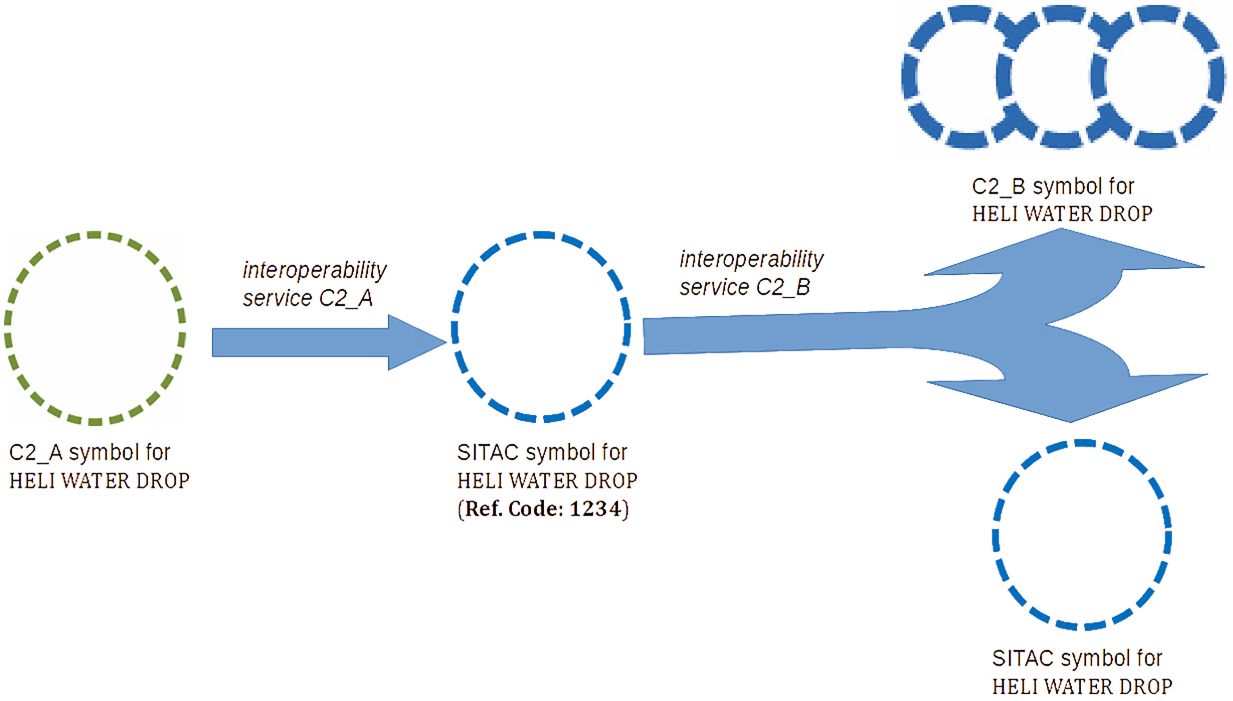


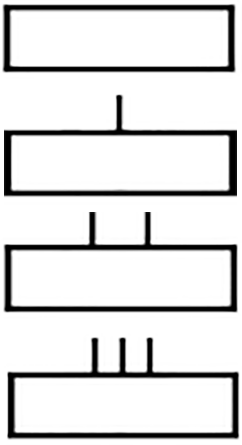
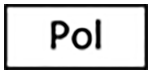
Figure 1– Example of implementation of symbol exchange between Control Centres

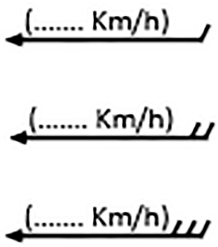
The above "translation" could be achieved either by agreeing on a specific reference code for each proposed symbol of this CWA, among the C2 operators or by using the following indicative matching of symbols with the elements and codes (see Table 5), included in other standards related to message structure for the exchange of information.

Table 5 — Matching of symbols with the elements and codes

SYMBOL[4]	Description	Message code (Definition)[4]
	Road with normal access for all types of vehicles	/ROAD (Road Infrastructure)
	Road with limited access for smaller/lighter vehicles	/ROAD/TRK (Trackway)
	One way road	/ROAD/1RD (One-way road)
	Water point for ground vehicles	/FAC/WATFIR (Water and foam Supplies) /FAC/OTH/ RES (Reservoir) /FAC/OTH/WATSPL (Water supply)

[4] For symbols that have both planned and ongoing version, the Emergency Management Shared Information (EMSI) code can be applied to both, but only one of the two symbols is included in the table.
[4] The message codes can be further enhanced, adapted, combined by adding a in the end a slash and an acronym (e.g. a /VEH/EMG/FIRFS would be a firefighting vehicle, or /VEH/AIR/CAN would be a Canadair)

SYMBOL[4]	Description	Message code (Definition)[4]
	Water point for helicopters	/FAC/WATFIR (Water and foam Supplies)
	Water point for airplanes	/FAC/WATFIR (Water and foam Supplies)
	Sensitive point for C – Chemical B – Biological R -Radiological N – Nuclear	/DGR/CHM (Chemically contaminated area) /DGR/RAD (Radioactive area) /DGR/BIO (Biologically contaminated area) /DGR/ NUKCNL (Nuclear dose rate contour line)
	Helispot	/GEN/LA (landing area)
	Horizontal or oblique flight obstacles (ropeway, cableway, etc.)	/DGR/ OBSGEN (Obstacle, general)
	Vertical flight obstacles (poles, towers, antennas, cranes wind turbines, etc.)	/DGR/ OBSGEN (Obstacle, general)
	Ground forces Generic Vehicle Unit Group Columns	<u>Generic categories</u> VEH (Vehicles) /VEH/EMG (Vehicle — Emergency) /HUM/UNIT (Unit) <u>Organizations</u> /ORG/FIRFS (Fire services) /ORG/ CIVP (Civil Protection) /ORG /POLICE (Police)
	Command post	/FAC/OPR/MOBLCP (Command post, Mobile)
	Law Enforcement Authorities	/HUM/UNIT/POL (Police Units) /HUM/UNIT LAWENF (Law Enforcement)
	Emergency Management Services	/VEH/EMG (Vehicle — Emergency) /HUM/UNIT/MEDCL (Medical) /ORG/AMBUL (Ambulances)
	Aerial forces (airplanes, helicopters)	/VEH/AIR (Aerial vehicle) /VEH/AIR/HEL (Helicopters)

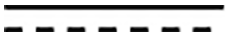
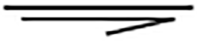
SYMBOL[4]	Description	Message code (Definition)[4]
	Transit Point	/GEN/TRSTRT (Transit route)
	Fire outline	/FLAME (Area in combustion)
	Wind direction and strength	Wddsss (Wind direction and speed)
	Recon	/INT/RECCE (Reconnaissance)
	Evacuation	/RSC/MEDEVC (Medical Evacuation) /POL/EVAC (Evacuation)
	Escape route	/GEN/SAFERT (Safe route)
	Safe zone	/GEN/SAFZ (Safety zone)

Annex A
(normative)

SITAC based proposed symbol set

The following tables summarize the symbol set to be used during the managing of forest fire incidents, categorized in symbol groups and functionalities, as described in clause 5.

Table A.1 — Symbol set for the operating area

SYMBOL	Description
	Delimitation of operational sectors
	Road with normal access for all types of vehicles [combined with a textual indication of (4x4) in case it is unpaved]
	Road with limited access for smaller/lighter vehicles [combined with a textual indication of (4x4) in case it is unpaved]
	One way road
	Road closed
	Trail
	Slight slope
	Moderate slope
	Steep slope
	Power line on
	Power line off
	Water point for ground vehicles
	Water point for helicopters
	water point for airplanes

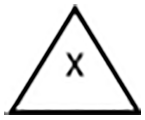
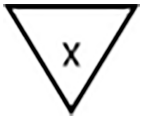
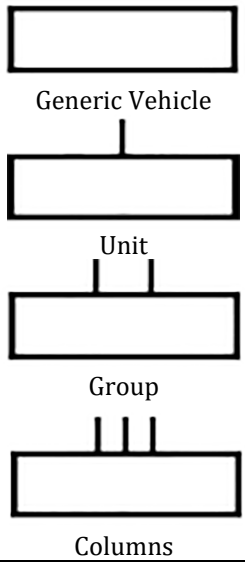
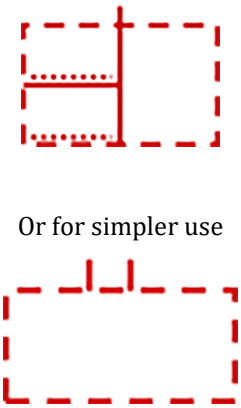
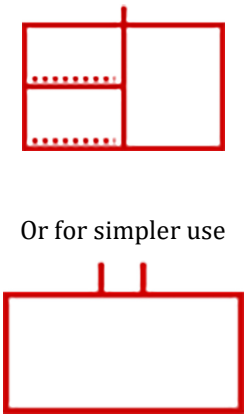
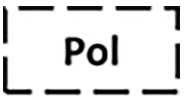
SYMBOL	Description
	Generic symbol for source of danger such as UXO- unexploded ordnance/explosives G- Gas E- Electric
	Source of danger from N – Nuclear R -Radiological B – Biological C – Chemical
	Sensitive point for UXO- unexploded ordnance/explosives G- Gas E- Electric
	Sensitive point for N – Nuclear R -Radiological B – Biological C – Chemical
	Sensitive target location related to fire
	Sensitive target location related to humans especially for WUI
	Helispot
	Horizontal or oblique flight obstacles (ropeway, cableway, etc.)
	Vertical flight obstacles (poles, towers, antennas, cranes wind turbines, etc.)

Table A.2 — Symbol set for resources and means

Means	Symbols to be combined with colours and containers	Planned	Active	Containers
Ground forces				IC- Incident Commander FB- fire brigade FS -forest service VOL- volunteers DOZ dozers EU EU-Module
Command post				
Law Enforcement Authorities				Police
Emergency Management Services				Health care/rescue
Aerial forces (airplanes)				**Plane- airplanes in general** CAN- Canadair BOSS- Fireboss PZL- PZL (Mielec) M-18B BE- Beriev
Aerial forces (helicopters)				**HELI- Helicopters in general** S64 - Erickson S-64 COU - Cougar helicopter BELL - Bell 412 CH - CHINOOK SP - SUPER PUMA KA - KAMOV

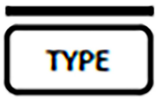
Means	Symbols to be combined with colours and containers	Planned	Active	Containers
Transit Point				
Infrastructure				MMP (means meeting point) VMP (Victims meeting point) MH (Mobile hospital) HSP (Hospital) MOR (Morgue) VET (Veterinary) REST (Restaurant) P (Parking) MEC (Mechanic support) OIL (OIL refuelling point) ELEC (Electricity support point) FOAM (Foam reserve) RET (Retardant reserve)

Table A.3 — Symbol set for fire evolution and weather situation

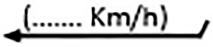
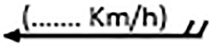
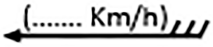
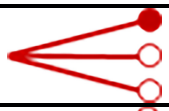
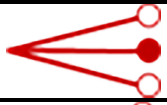
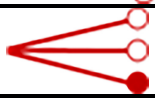
SYMBOL	Description
	Fire outline
	Main direction of fire propagation/ head of the fire
	Secondary fire flank (fast)
	Secondary fire flank (slow)
	Ignition point
	Fire front
	Wind direction weak
	Wind direction moderate strength
	Wind direction strong
	Crown fire
	Surface fire
	Ground fire

Table A.4 — Symbol set for firefighting actions

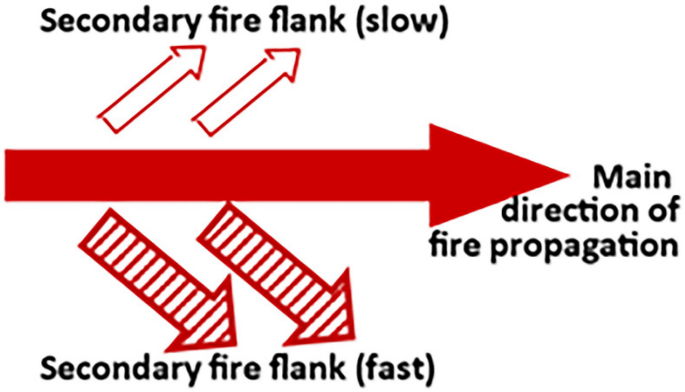
ACTION	PLANNED	ONGOING	ENGLISH TERM
AIREAL MEANS			Long Term Fire retardant drop (airplanes)
			Water drop (airplanes)
			Long Term Retardant drop (helicopters)
			Water drop (helicopters)
GROUND MEANS			Reconnaissance
			Fire defence in line
			Perimeter fire defence
			Containment-mutual attack/flank attack
			Hot spotting/offensive action
CONTROLLED BURN BACKFIRE			Establishment of safety line (Anchor point)
			Spot ignitions
			Line ignitions
EVACUATION			Evacuation
			Escape route
			Safe zone

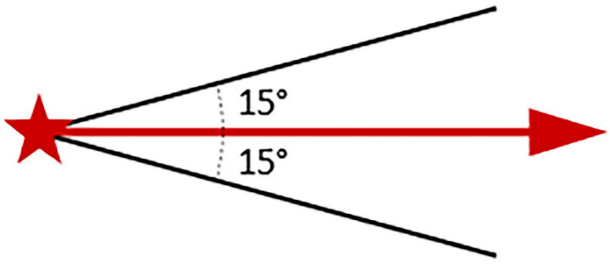
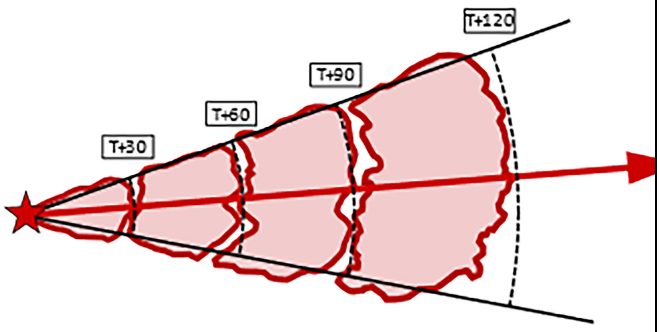
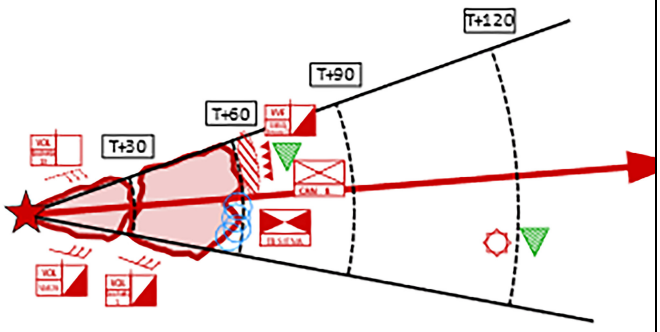
Annex B
(informative)

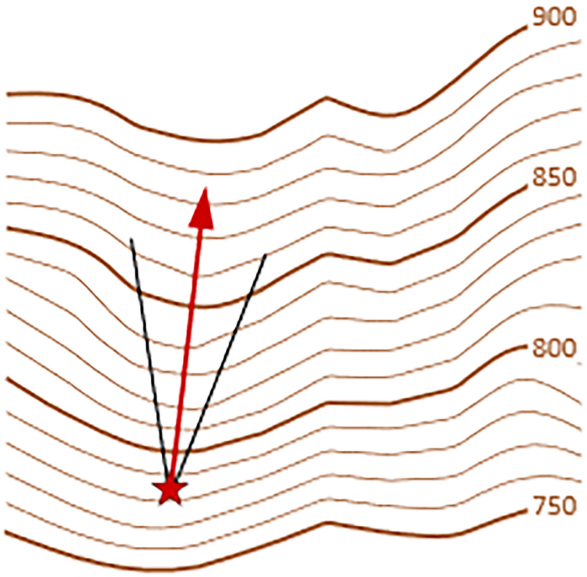
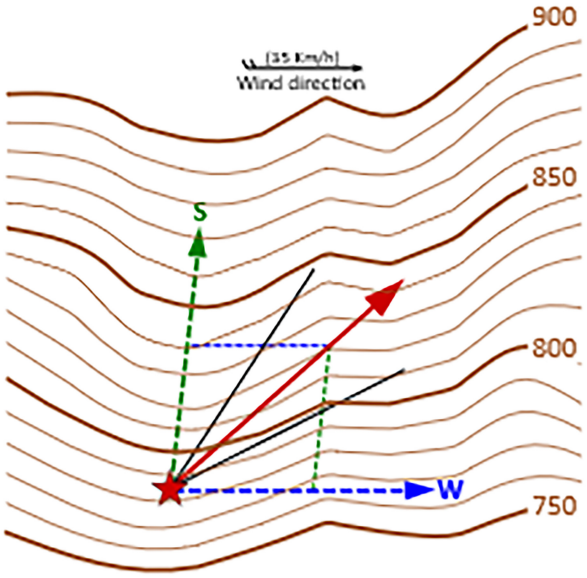
Example of symbology application during a forest fire incident

The following Table B.1 contain a description of the symbol set application (combination of symbols included in clause 5) during a hypothetical scenario of a forest fire incident, providing indicative maps with symbols per phase/step of the scenario.

Table B.1 - Example of symbology application

DESCRPTION	Symbol combination
Fire propagation directions	
Fire parts	

DESCRPTION	Symbol combination
Fire propagation hypothetic cone (degrees can be adjusted depending on the circumstances)	
Fire propagation	
Time-based response planning	

DESCRPTION	Symbol combination
Fire propagation influenced by slope only	
Fire propagation influenced by slope and wind	

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