Fire: Enemy of the relief force soldier

General Tactical Review - Fire

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Tactique générale

Fire remains at the heart of current events and always causes astonishment in the face of its outburst. The millions of hectares burned in Australia in 2020 or the fire at Notre Dame de Paris in 2019 are the latest examples of catastrophic fires. Confronted with this timeless enemy, the fire soldier is constantly evolving his procedures through innovation and hardening. The fight against fire is indeed a real battle, with its codes, means and tactics.

To fight fire, it is first necessary to apprehend it, to appropriate it. Consequently, it is necessary to ask what is the definition of fire for the military member of the rescue forces. How does he approach it? What are his modes of action to fight and defeat it?

Fire has always been the main risk for the firefighter. All the capabilities of the rescue forces have been dimensioned to face this major and feared "enemy". The tactical thinking of firefighting is thus rooted in the fundamentals of military tactics, which the fire soldier has declined in his speciality.

After a presentation of the fire enemy, we will look at the environment in which it evolves and on which it relies, to finally study the different modes of action to fight it.

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The enemy "fire"

In his fight against fire, the firefighter often personifies his enemy. In the language of firefighters in firefighting, it is not uncommon to use vocabulary that brings fire to life and gives it intentions. For example, a fire can sometimes "escape into a roof" or force firefighters to "run behind" it.

These reflections, belonging to the jargon of the trade, show the living aspect of this enemy which is evolving and likely to spread more and more, sometimes in spite of the efforts undertaken against it.

If this enemy had an objective, it would be to survive by developing. To do so, it meets technical criteria and scientific phenomena, which are the conditions of its origins and its existence after it has hatched. Beyond development factors, these are vital needs schematized in a triangle called the triangle of fire:

- this trinity is first composed of an activating energy, a spark for example. This may be ephemeral and seem insignificant, but it can be the starting point of devastating fires;
- to this must be added the fuel, the one that will fuel the fire, be it wood, gasoline, gas or whatever. According to the nature of the fire, the outbreak will be more or less long, more or less easy;
- Finally, the oxidant, the oxygen in the air, participates in the breathing of the fire.

It is therefore possible to try to prevent a fire from starting or developing by acting on one of the elements of this triangle, which is the purpose of fire prevention.

Once a fire hatches, it has two main weapons, heat and smoke. Contrary to popular belief, fire has many more poisoned victims than burned victims. Smoke and hot gases are indeed particularly devious. Many people die in their sleep or in smoke-filled stairwells while trying to escape.

In urban areas, fires usually progress vertically, burning all the rooms that would have left an opening or gap. The fire then spreads opportunistically. It uses three means of action:

- thermal radiation: it allows to overcome distances by jumping from the compartments of the ground. The heat is sometimes so intense that materials a few metres away can catch fire;
- conduction (the most classic): it allows propagation by direct contact. In some cases, it can be vicious, particularly in the presence of metals or wooden structures, for which the signs of propagation are difficult to detect, due in particular to combustion in the heart of the material;
- finally, convection characterized by the vertical transport of heat, in an ascending or descending manner, accompanied by the transport of incandescent materials (mainly ember, brandons, soot).

Depending on the nature of the fire being fought, the modes of action diverge. Inappropriate action could be counterproductive and thus contribute to the development of the fire. Fire fighters may thus be confronted with five different classes of fire, each with its own dangers and extinguishing methods.

These scientific data make the risk mechanically predictable. Firefighting is therefore a science. The means of prevention must make it possible to limit the risk of a fire breaking out and spreading, while protecting people in the event of an outbreak. Indeed, in his tactical reasoning, the fire soldier knows that success factors are specific to his enemy: the weather, inappropriate human reactions, the presence of air flows, dry or flammable materials in quantity and proximity, etc. The fire therefore remains predictable and the firefighter has a doctrine consisting of a set of documents enabling him to fight effectively against its occurrence and its development.

However, fire is capable of creating surprise by relying on the environment. Moreover, the evolution of societies is accompanied by new types of fire. The last decades, which have seen the reign of plastic, the omnipresence of agglomerated wood furniture and the use of fire retardant materials, have seen the development of new types of fire. or the introduction of double glazing, have also been the scene of sneaky and deadly fires, very different from the fires known until then.

The environment

If fire, devoid of spirit and therefore of intelligence, has no intention, it has nevertheless an immeasurable capacity for action. And the environment in which it evolves, whether natural or urban, provides it with opportunities comparable to modes of action. This environment is even a determining factor in survival, development and the ascendancy of fire.

The environment first of all provides the fuel and combustion resources necessary for the birth and development of fire. Above all, the environment directly influences the fire through natural, meteorological or physical phenomena.

Wind is the most decisive influencing factor. In the natural environment, it pushes the flames directly in its direction and systematically accelerates the progression of the fire "downwind". However, if it is rotating or swirling, it unpredictably varies the direction of flame spread. It then complicates the rescue effort and may even present a risk of encirclement. The influence of wind is very similar in a large fire (i.e. a large volume fire, such as a warehouse fire). While in an urban container fire, if the wind blows towards the façade of the building (façade wind), it prevents the natural evacuation of smoke and hot gases towards the outside of the building.outside the building, contributes to increasing the temperature and the lack of visibility in the burning volume, supplies the firebox with air, modifies the aeraulic balance of the building.[1]The fire may even spread to the landing

of the floor in question, or to the upper floors along the façade.

In addition, atmospheric conditions influence the progression of large fires, whether natural or urban. The atmospheric pressure gradient can confine smoke and hot gases to a low altitude and thus act like a bell, helping to keep the heat within a space of a few dozen metres and maintain fires in natural areas.

The configuration of the environment can also incite the vertical propagation of the fire on the principle of the chimney effect or accelerate its progression thanks to the so-called Venturi phenomenon which consists in theThe configuration of the environment can also encourage the vertical propagation of the fire on the principle of the chimney effect or accelerate its progression thanks to the so-called Venturi phenomenon, which consists of the acceleration of the propagation of flames and hot unburned gases, comparable to a fluid, by a phenomenon of depression due to the narrowing of their passage zone.

Beyond that, the environment is a risk factor because of the thermal phenomena or accidents it can induce. These phenomena occur when very precise but also very subtle conditions are met, and the warning signs are sometimes not very perceptible, if not very close to their occurrence.[2]leaving little time for rescue workers to extract and protect themselves. They are therefore particularly feared by firefighters and rescue workers.

In an urban environment, the smoke explosion occurs in an under-ventilated room, under the effect of an air supply in a confined atmosphere, saturated with unburned gases and soot: the thermal accident is then called backdraft. To prevent this, the fire brigade creates an opening in the enclosed volume from the outside of the building (i.e. the façade), often from an aerial ladder. This opening provides the fire with the oxygen it is looking for and guides the tongue of fire and the blast of the explosion to the outside. Kept closed, the access door to the volume offers optimal blast resistance and preserves the rescue personnel able to engage from the landing.

The smoke explosion can also occur by the action of an activation energy on a volume of smoke (soot, dust, unburnt gas) mixed with air.[3]during extinction but also several hours later, during excavation operations, when gaseous pockets remained confined by debris.

Another thermal phenomenon, flashover, can occur in both natural and urban environments. It is the instantaneous, widespread flashover of combustible materials in a partially open volume.[4] (i.e. where the air supply is constant). In the forest, the vegetation is sometimes so dense that it forms a partition similar to a closed volume in an urban environment. To protect themselves from this, rescue workers must watch for the occurrence of roll-over, also known as "dancing angels", or even the generalized pyrolysis of the materials contained in the volume. They must then immediately try to flee or lie down on the ground and form a protective bell (water curtain) with their lance.

Finally, the fire seized every opportunity offered by the midfield configuration to gain ground in all directions.

In buildings, flames spread vertically and horizontally through the smallest, often hidden passage (technical ducts, false ceilings, false floors, wood panelled walls, garbage shafts, expansion joints, etc.). They therefore force the fire brigade to recognize the slightest corner of the damaged building, particularly with the help of thermal cameras. The fire can spread by "jumping" from one floor to another, taking advantage of the accumulation of smoke and hot gases in the upper part of the building or the fallout of incandescent material in the lower part.

In forests, fire is attracted to dense vegetation compartments, which provide more fuel, and to rich vegetation types (softwoods in particular). Based on a principle similar to that of vertical upward and downward propagation in an urban environment, forest fires also take advantage of the variety of vegetation, both low and high, and accelerate their progression thanks to the difference in elevation offered by the terrain. Finally, incandescent plant fragments allow fire jumps that suddenly spread the fire up to several dozen meters further, and can again trap fire fighters.

The fire is therefore treated differently depending on the characteristics and configuration of the environment. Faced with this, the rescue services have one imperative: to adapt the operational response.

Firefighters' modes of action

The fight against fire, whether urban or vegetation, is the subject of a specific national doctrine. Like military doctrine, it is broken down into generic modes of action which, however, require constant adaptation because of the unique nature of each disaster.

Upstream of this doctrine, the fire soldier must call upon acquired skills that translate into factors of operational superiority in order to fulfil his mission. Although no regulatory text for rescue forces mentions superiority factors in these terms, it is nevertheless interesting to analyse the army's FSOs on the spectrum of firefighting.

Indeed, as previously studied, fire is a natural phenomenon that meets physical criteria. The firefighter must therefore first understand its nature, its evolution in the environment and the associated risks to determine the best maneuver to fight it. This manoeuvre is rarely carried out alone, as cooperation is often indispensable with the various services and actors involved in the disaster, such as the internal security forces, the ONF, EDF or GDF for example. In his combat, the agility of the sapper is decisive in coping with any sudden change in the situation. Indeed, he must be capable of instantaneously switching efforts if necessary, in particular by means of the reserve that he will have built up upstream in the form of pre-positioned reinforcements for example. Its capacity to react is based on a mass factor which, at the strategic level, is understood as a territorial network adapted to the risks.[5] and, at the tactical level, by the ability to focus resources on a key point on the ground.

The factors of endurance and fortitude are an integral part of the fire soldier's abilities and cannot be questioned due to the particularly trying nature of the interventions, both

physically and psychologically. They are at the heart of individual and collective training within fire or intervention companies. Influence, in fire fighting, can be understood as the sum of the preventive actions carried out to reduce the risk of fire. In urban areas, it is the raison d'être of prevention cells and company officers aiming at enforcing fire regulations and deepening the knowledge of intervention sectors. In the forest environment, the influence encompasses the developments included under the heading of Defense of the forest against fire (DFCI: creation of trails, water reservoirs, firebreaks, brush clearing, etc.).

Finally, command performance today is based in particular on the technological evolution of decision-support tools for better analysis.[6].

Whether civilian or military, the fire soldier relies on a single national doctrine for structural and vegetation fires. Concerning forest fires, the 2004 doctrine imposes the priority of fighting incipient fires, with the massive use of water-bombing aircraft as soon as they break out. Thus, 95% of fires are neutralized before they reach one hectare. For urban fires, from a tactical point of view, the doctrine determines, in particular, the rules of engagement for firefighters. It also specifies the main phases of the manoeuvre, which it translates into a method or framework of orders inspired by the military model, such as the RSEVAPDDSR for urban fires or the SAOIELC for forest fires.[7].

This doctrine is broken down into specific modes of action for each type of fire depending on the environment, the fuel, the immediate environment and the longer term. Indeed, each fire is unique because its evolution depends on the type of vegetation, the hygrometry conditions, the wind speed or in the case of structural fires, the architecture or the calorific potential present in the building. Thus, each phase of the manoeuvre deserves specific consideration in order to determine the modes of action and the means to be employed, in the same way as a military manoeuvre. As a result, the fire soldier has developed over time both offensive and defensive manoeuvres.

In a forest fire, the offensive manoeuvre is mainly devolved to airborne means, whose role is to bring down the flanks of the fire and attack the front of the flames, thus making it possible to reduce its intensity before it is extinguished by land means, by road when the latter is accessible or by helicopter commandos in inaccessible areas.[8].

The defensive maneuver[9] is more of a prerogative of land-based means and is a real stop-gap action, with upstream land development[10]The main tasks of the project are: - analysis of the balance of power, opening the pumps at the most favourable time, logistical management of the water.

In an urban environment, the manoeuvre is often offensive in order to quickly stop the spread of the fire, maintain the fire in its initial volume and finally extinguish it. The manoeuvre will be defensive when the balance of power is largely unfavourable in the face of a developed fire spreading very quickly and often difficult to access. This is the particular case of roof fires, where the firefighter takes the blaze into account, i.e. voluntarily gives up land to install his hydraulic device more efficiently on support points, often structural.[11]...able to counterattack.

Thus, fighting a phenomenon such as fire requires specific skills needed to analyse its environment and therefore its evolution. The idea of maneuvering and the implementation of modes of action are the result of a decision-making process very close to that used in combat. The challenge for the future is therefore to bring this combat into the modern world while keeping man and his capacity for analysis at the heart of the system.

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All the capabilities of the rescue forces have been dimensioned to deal with the "enemy fire", which is the firefighter's main and feared risk. The tactical thinking of firefighting is continuously rooted in the fundamentals of military tactics, which the fire soldier has declined in his speciality. Moreover, whether he served in the Paris fire brigade or in the military formations of civil security, the military commander of rescue operations constantly keeps in mind the principles of Marshal Foch's war: freedom of action, economy of forces and concentration of efforts.

Considering that fire is increasingly integrated into terrorist modes of action and is becoming an integral part of the threat[12]The risk is no longer confined to the civil risk dimension. It is in the interest of military leaders, in combat and in fire, to maintain their exchanges and to strengthen the mutualisation of the operational preparation of their troops on national territory, within the framework of Operation Sentinel.

1 Depending on their classification, buildings may have been designed to provide ventilation for common traffic.

2 A few seconds at most.

3 National reference guide "Explosion de fumée - Embrasement généralisé éclair", Direction Générale de la Sécurité Civile et de la Gestion des Crises, 2003.

4 Id.

5 Examples: Forest Fire Tankers are mainly positioned in the south of France. CBRN resources are located along the Rhone Valley due to the numerous industrial sites.

6 The most striking example is the current systematisation of the use of aerial and ground UAVs to inform the commander of rescue operations about major interventions.

7 RSEVAPDDSR: Reconnaissance, Rescue, Establishment, Ventilation, Attack, Protection, Clearing, Surveillance, Retex.

SAOIELC: Situation, Anticipation, Objective, Intention, Execution, Logistics, Command.

8 Example of the ForMiSC Helicopter Response Detachment, whose strength is to be able to land in any area of the sappers by ALAT's airborne means.

9 Line of support, sensitive point defence.

10 Tree felling, use of bulldozer-type means for the creation of firebreaks.

11 The Notre Dame fire is an example. Faced with the impossibility of effectively attacking the roof, the emergency services installed a large hydraulic device in the North belfry, leaving the roof to the prey of the flames.

12 Notion of Vertical Terrorism that has occurred in Africa and Asia in recent years. It consists of one or more shots being fired by terrorist groups, in addition to the use of weapons and possible hostage-taking, to hold a building (usually a hotel) and to resist as best they can. The combination of weapons and fire makes the action of the armed forces and rescue services more complex. "Fire as a weapon in terrorist attacks ", Joseph W. Pfeifer, Combating Terrorism Center at West Point, July 2013, volume 6, issue 7.

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