



Firefighting Safety in France



Colonel Eric PEUCH,

Introduction

The safety of the fire fighters on duty is a major preoccupation of the Department of Civil Defense and Public Safety. Numerous accidents have killed 196 firemen (160,000 wounded) these last ten years. Consequently the government has appointed the chief of the Fire Services National Inspection Staff (colonel POURNY) to write a complete report on the subject in order to make proposals to improve such a dramatic situation. This paper describes the "POURNY report" published in 2004. A few years ago the Fire Officers Academy developed a new operational management and a new method of command. This new organisation began in the 90^s as a response to dramatic forest fires in the south-east as well as the reform of the radio-communications networks and a complete overhaul of the chain of command. This new "school of thought" develops decision making process used in the French military including anticipation, clear-sightedness, intelligence, pyramidal organisation and sharing of the tasks. Furthermore, several fire and rescue departments are carrying on research on the subject of passive safety. For example, several departments are working on the safety standards on the fire engines. Another one is developing the culture of safety in the fire brigades. The development of the forest fires-fighting methods, initialised by the training school of the South-East F.D., has influenced the behaviour of each fireman in France regarding safety. The major example of integration of safety in the teaching of forest-fire fighting is the interactive 3D simulator of the "Valabre Castle" Training School.

This report will present basically the organisation of the civil defense in France, the official apprehension of forest fire fighting training, the progresses in safety rules and the evolution of R and D.

The organisation of the Civil Defense in France

In France the civil defence and the public safety are organized on three main levels:

1. The national level:
 - The Interior Ministry is responsible for the organization of the safety and for the security of the French people.
 - The Department of Civil Defense and Public Safety is a department of the central administration of the Interior Ministry. It is responsible for :
 - The preparation, coordination and implementation of civil defense measures, the policy of population protection, of prevention of civil disasters of all nature, and the planning of measures of defense and emergency preparedness.
 - Rescue operations.
 - National emergency response operational resources.
 - Assistance to local fire fighting and rescue services
 - Promotion of the teaching of emergency management and training of fire department officers.

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- The information of the minister and the government in crisis situation. The Emergency Management Operational and Crisis Centre keeps minister's cabinet informed, proposes operational methods and prepare and coordinates the activities of the government operational resources. It coordinates all the rescue resources and constitutes a single tool for continual monitoring.
2. The "zonal" level. (Defense Zones)
 - 7 defense zones encompass several administrative regions. It is the privileged area for military-civilian cooperation. It ensures that civil protection plans are coherent with military defense plans. It coordinates the activities of the local circumscription fire departments and controls the efficiency of the local means.
 - The "zonal" operational centre coordinates the local means in case of emergency events touching several local circumscriptions.
 3. The local level.
 - 95 "local circumscriptions" (similar to US "counties") run a fire and rescue department composed of several fire brigades (from 30 to 60). It is in charge of prevention and fighting individual or collective accidents, fires, forest fires, and disasters.
 - The local headquarters directs personal, financial and operational aspects and coordinates the local fire brigades. The personnel and the engines of the brigades belong to it.
 - The Local Command and Coordination Centre is a 24/24h call centre and a coordination centre.

The local fire and rescue departments are financially run by local authorities but they follow national rules and methods. The fire chief is appointed by both the local circumscription Chairman and the Ministry of Interior.

Forest Fire fighting organisation is based on fire brigades

The fire and rescue department and national civil protection organizations have responsibility for forest-fire fighting. However local associations or administrations and other state departments deal with forest fires. Protection (prevention and surveillance for instance) without fighting. They may be equipped with light vans containing a few gallons of water and a pump to deal with a small developing fire.

1. Fire fighter resources in France
 - a. 195, 917 part-time or volunteer firemen
 - b. 45, 172 professional firemen
 - c. 10, 000 military firemen (Paris, Marseilles and Emergency Response Training and Operation Units)
 - d. 6, 200 doctors
 - e. 900 foresters
2. Training

a. In the risky areas every fireman is trained to F.F. Fighting. More than 50% of the French firemen are trained for forest fire fighting, even on the elementary level, in order to send capable reinforcements, if required.

b. There are 5 levels of training, from “team member” up to “chief commander”. Special qualifications exist like “aircraft officer”, “tactical fire specialist”, “squadron chief officer”...

c. The Fire Department National Academy trains the officers to the general command. The “Valabre Castle Training Centre” in southern France is specialised in forest fire fighting techniques of commanding. With this end in view, the school developed a special 3D interactive digital simulator. The officers can improve their theoretical knowledge through the commanding of a fire, at their own level (aircraft officer, platoon chief, squadron chief, chief commander, mobile HQ chief...) Even planes and helicopters pilots train on this simulator.

The French methods for fighting forest fires

The principles are based on the anticipation of the hazards. The primary objective is to reach the fire as soon as possible. Constructions and houses are never very far from the fire. Protecting a village requires many means. It is often the reason why a fire becomes a wild fire.

The general doctrine is:

- 1- save lives,
- 2- save estates and goods,
- 3- save environment

The Headquarters must always be ready. Fire department officers work together with forecast engineers of the National Weather Forecast Board. Biologists and physicians of the CEREN (laboratory for fire development research) are also consulted. During summer or early spring a level of risk is published daily so that fire brigades, foresters, aircraft crews, policemen, city patrols, forest parks patrols ... are on alert. During a “severe+” day for instance, hundreds of firemen are positioned at different cross roads or cross tracks ready to start, planes are filled up with retardant and fly over the risky areas (prevention flying patrols), fire-brigade motorcyclists or horse riders go through the forest, some forest parks are closed to the public, patrols watch the suburbs, picnics and barbecues (even at home) are strictly forbidden.

Prevention and fighting are organised around 4 main aims:

1. **Prevention:** fire and rescue department participate in fire prevention as well as other departments, administrations and official boards. All together they:

- identify and treat the causes (human, natural, industrial)
- estimate and forecast the hazards
- develop dissuasive surveillance
- give information to the public
- develop strategic cuts of trees
- clean and clear the forest and the bushes around the houses
- build access into the forest
- control the economic use of the burned areas

2. **Control developing fires:** 80% of the early and massively attacked fires keep standing under 400 m.i²

- The attack of the developing fire is a major act in fighting

- A strong task force must be ready to take action
- Aircraft fleet and the local, “zonal” or national fire fighters units must be on hand for prevention actions or fighting
- The gathering of intelligence must be developed

3. Anticipation: the development of fires can be anticipated as follow:

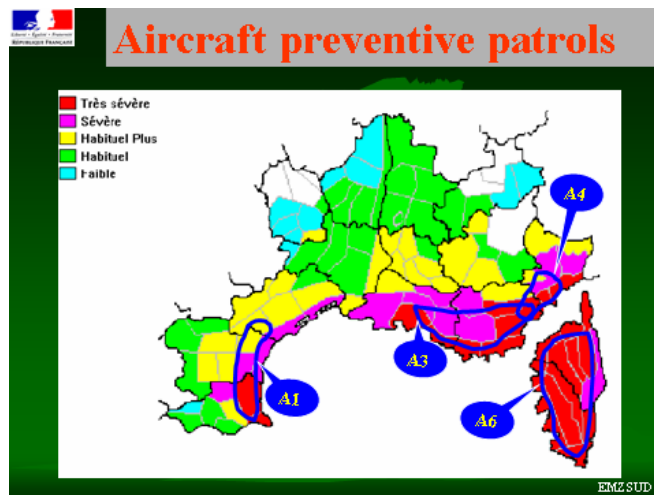
- Instantaneous degrees of air temperature, wind speed and direction, level of moisture in the air, precise weather forecast
- Moisture level in the wild plants
- History of the local climate and water reserves in soil
- Human phenomena as hunting, picnics tourism, arsonist, activation of garbage dumps, industrial activity
- Natural events such storms

4. Make arrangements in organising a pre-emptive plan :

- Define one out of five levels of risk: **low – usual – usual + – severe – severe +**
- Position fire squadrons or platoons at forest cross tracks
- Position reinforcements into fire stations or military camps
- Dispatch aircrafts in different air bases
- Decide to send aircraft preventive patrols
- Activate forest control towers
- Make dissuasive patrols (motorcyclists, horse riding)

5. Maintaining the fire-fighting aircrafts: the majority belongs to the State (Ministry of Interior) but the local authorities, especially in Southern France, may rent helicopters or light planes. The following aircrafts are used:

- water bombing airplanes: 11 Canadair CL 415, 12 Ttackers CS2F, 2 Hercules C 130 (until 2003)
- investigation airplane: 2 Beech 200
- 36 helicopters: squirrel, lark, EC 145, I Mig (rent)
- Locally rent aircrafts: Bell 412, squirrel.



6. **Avoid catastrophic developments** is obviously the main purpose of the head quarters. As Carl Wilson wrote in 1996 about Californian wild forest fires, 97% of the fires are successfully fight. The catastrophic assessment is based on the uncontrolled 3% in their primary exponential development. It is the same in France, even nowadays.

The part of the chief commander is essential , he :

- Develops an aggressive and mobile strategy
- Combines efficiently field and aerial actions
- Uses intelligence and information, be aware of any elements, fact, forecast. Makes a good use of the planning.
- Anticipates the capabilities of the personals. Prepares reinforcements before the fire starts, gets on disposal a medical assistance. Is aware of non-efficient reinforcements.
- Reinforces the anticipation abilities in the Head Quarters

The organization of the command

“the means you need, when you need them, where you need them”

A pyramidal organization for radio-communication, including safety.

In the 1980's huge forest fires involved up to 200 engines and more than 1,000 fire fighters using only 2 or 3 radio frequencies. The command in such conditions was very difficult because everybody could listen to everyone, but nobody could give a clear order to an engine or a group of engines. Any personnel who were in danger had problems getting through. He was not sure to be heard by his chief or by the H.Q. The reorganisation of the radio – communication network was based on the military model. At least a hundred frequencies were distributed by the Ministry of Interior. Some of them are more powerful than others. There are 4 levels of power. For example every engine of the same group can listen to another engine or to their leader. The leader can listen to his engines and to the district commander and to the other group leaders of the same district etc... But everybody is allowed to call an airplane for assistance (a shared frequency).

A pyramidal organisation of the command

The organisation of the command is based on the sharing of activities and on the sharing of the field.

The Mobile Command Unit is staffed by four officers at least:

- Intelligence officer
- Anticipation officer
- Action and Transmissions officer
- Means and Logistics officer

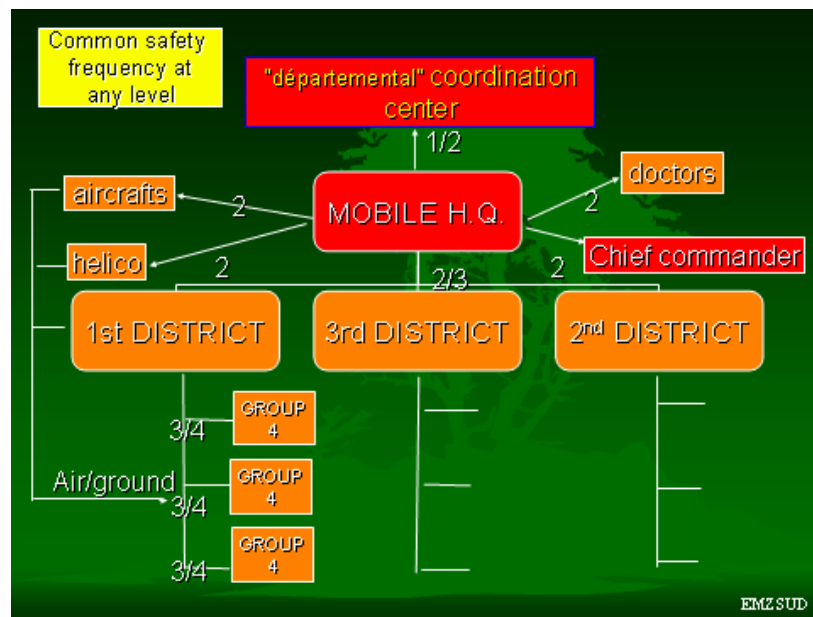
They have to prepare firefighting strategies (Anticipation Officer). The Chief Commander according to events or the information (Intelligence Officer) will decide which one has to be ordered. Then they have to “translate” the decision of the chief (Action/Communication Officer), to the officers on the field (chiefs of district) and adapt the plan to what is needed in the field (Means and Logistics Officer).

This organization also includes other team members:

- An officer stays at the check-point and transmits the orders to the reinforcements.
- An officer stays in the command helicopter or/and the plane leader.
- A medical team stays at the Mobile Command Unit. Each squadron (3 or 4 platoons, 60-80 firefighters) has its own medical staff.

The chief commander divides the field in 3 or 4 districts (that can be divided in other sub-districts in case of important fire). Each district (or sub-district) is commanded by a captain who rules 3 squadrons (200-240 fire-fighters).

Diagram of radio-transmission NETWORK



Collective and individual safety

Safety is the responsibility of everyone. Especially in forest fire fighting where fire-fighters meet many potential causes:

- The fire (burns, flashover, smoke)
- The field (falls, canyons, slope)
- The environment (wind, air temperature, moisture, sun)
- The engines (break-down, conception)
- The water bombers aircrafts dropping tons of water
- Radio-transmissions (break-down, incapability)
- Function (incapability, disorganisation, disinformation, imprecise orders)
- Individual: Stress, feeling of invisibility, missing individual equipment, indiscipline
- Structural: no feedback, inefficiency of training,
- Medical: tiredness, sunstroke, intoxication, asphyxia, traumas, individual health estate, alcohol, lack of drinks...

Basic emergency drills:

Fire-fighters are taught on emergency drills. Every crew member of any F.F. engine must be aware of safety. Cadet fire-fighters learn how to fit their individual protection equipment:

- “Nomex type” blue jacket and trousers with “3M” type reflecting stripes.
- Leather boots “rangers” type
- Goggles “ski” type
- “Nomex type balaclava
- Leather and “Kevlar” type gloves
- Regular belt
- Fire jacket (multi sheets material)
- Eventually, Individual Escape Kit (kind of poncho made of heatproof material with an aluminium sheet)
- F.F. type helmet “MSA-GALLET F2”, red colour for members, white for leaders



During the first level training session student fire-fighters are trained in escape or protection drills. The drills concern an isolated engine crew or a group of engines (platoon). The platoon consists of:

- 1 command-car (Land Rover 110 Type)
- 3 medium 4 wheel drive fire-engine (850 US Gallon)
- 1 heavy fire-engine (1,700 US Gallon) or a medium one

The main safety drills are:

- Driving position on road
- Driving position on track
- Escape from fire on the track
- Protection of a 1 + 4 + 0 platoon against fire when trapped
- Protection of a 1 + 3 + 1 platoon against fire when trapped



Active safety:

The “POURNY Report”* is a complete study about the risks potentially facing any fireman in any conditions. According to the case of F.F. Fighting this major report indicates that **“the fire engine must provide a safer shelter for the protection and the survival of the fire fighters”**. This statement implies that no fire-fighter should be combating far from a fire engine or far from a water-pump. Even the “commandos-platoons” who are sent close to the fire, when there is no track for engines, are supposed to be protected by a water supply. It can be a water-pumper in case of very long hoses lines or a supply tank led by the helicopter in a glade. Light motor-pumps and hoses are carried by the fire-fighters special rucksacks. Hoses are connected as the commando goes up hill. Commandos are usually brought by heavy helicopters.

The active safety concerns

1. The protection of the life space (cabin of the fire engine *DITO*): *positioning of isolating “3M type “film on the wind-screen and panes of the engine, waterin the panes and the tyres of the engine by mist distributor through an independent hydraulic system.*
2. The protection of the hydraulic system: *the water tank must never be empty. An emergency hand drive must be available en case of pneumatic brake down. There is an independent power-driven emergency pump.*
3. The ability to breath in a smoky environment: *bottles of compressed air and individual air masks are fitted inside the cabin. The bottles must be easy to open. Pressurised cabin from a single bottle is operated by the driver. Having individual mask allow individual firemen to go into the cabin (crew + 1).. Individual breathing kit can be used instead of collective compressed air system.*
4. The continuity of the operation of the engine; *in case of engine break-down, an independent source of energy must carry on activating the pump to restore water pressure. Four fire-fighters died in 2003 because the engine broke down. The pump became inefficient to run a mist diffusion system to water and protect the engine.*
5. The geographical positioning of the appliance *in order to guide the planes and reinforcements.*



Mist protection

Pourny Report: from the name of the colonel who was appointed in 2003 by the government to write a report about safety in the fire-services

The passive safety concerns:

1. Structural protection with anti-crash interior cage (COMPULSORY!), rolling skis in case of falling in a gully and anti branch external cage to protect the cabin.
2. White paint around the door handles

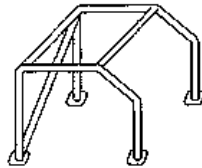


Figure A.1 — Arceau de sécurité (forme minimale)

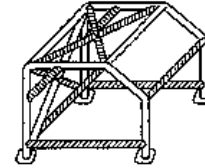
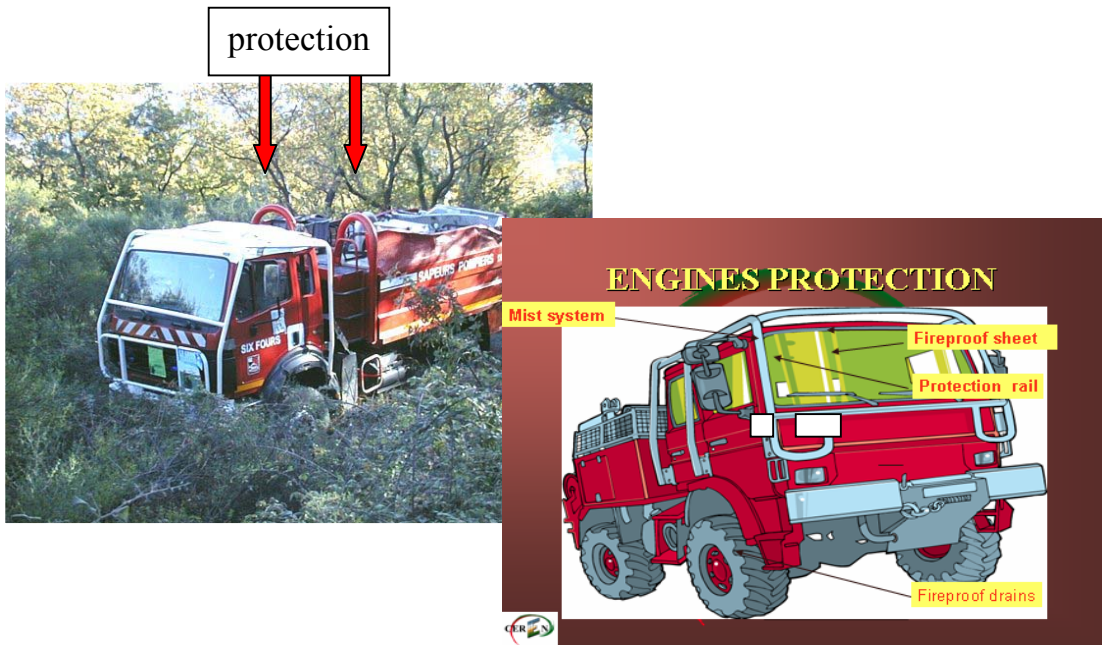


Figure A.2 — Arceau de sécurité (forme renforcée)

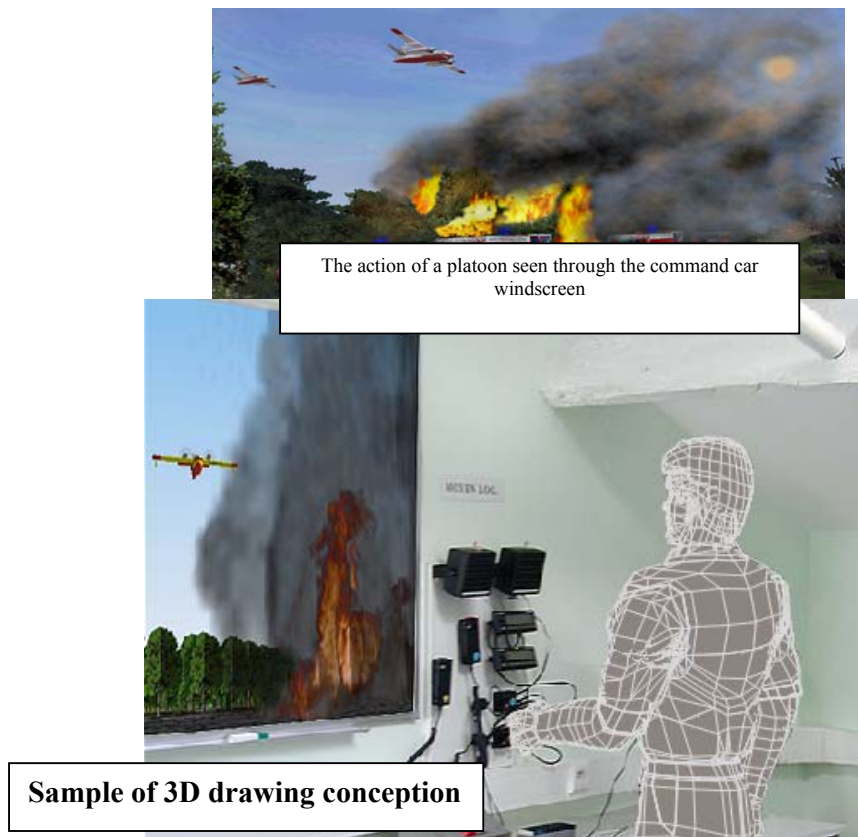


Training: the “Valabre Castle” interactive 3D simulator



Generations of fire-fighters officers have been trained in the “Valabre castle” school where the fighting strategy was invented, developed and modernised. A few years ago, upper levels students used to be trained on a scale model of representation of a natural area.

Nowadays a very sophisticated interactive software has been developed by two specialists belonging to the school. The third generation of the system is currently been used. The school is looking for the 4th one, using plasma panoramic screens. The virtual training field represents a real natural site near Marseilles. This site is very well known by local firemen because many large fires have occurred around this area. The virtual system shows the actions that every “student officer” is supposed to do when leading his platoon or the Command Unit or the aircraft fleet or the check-point ... The means (engines, planes, helicopters) are perfectly drawn in 3D. The orders given by the “student officer” through a real radio network are taken in account by the staff once this order is clearly received. For example a group of engines is sent to deal with an extension of the fire, an other to protect a village. Every “player” is isolated from the other but he can see the engines following their route on the tracks if he is supposed to be in the helicopter. The action of the fighters against the flames is reproduced, as well as the action of the water bombers (different if it is water or retardant). There are planes or helicopters simulators. Real pilots train for bombing during the fire officers sessions, learning how to work with the field on the field. The training staff can easily change data. For example they can change the weather, the wind direction or its strength or make accidents. Then the students must react in order to save their fighters (use the proper radio channel, order for protection drill, ask for a plane, send the platoon into a safer area...). Everyone is allowed to experience a large number of fire and rescue situations.



The CEREN is a public laboratory for research fire behaviour and on the efficiency of different means of fighting. Tests, experiments, fundamental research and analysis can be contracted by private companies as well as national or local agencies. The CEREN works closely with the South-East fire and Rescue Service. High level scientists work there under

The CEREN has discovered the influence of certain volatile components of distillation on the behaviour of the firemen. Some Volatile Compound Organics (VCO) attack the nervous system influencing the capabilities of a leader fire-fighter. Fatigue with VCO result a deterioration of individual performance.

Conclusions

The specificities of the French methods in Forest Fire-Fighting may be summarised as follow:

- Forest Fire Fighting is the responsibility of the fire and rescue service
- No fire fighter should stay far from water on pressure
- The cabin of the engine is the best shelter when trapped by fire
- Medical support is requested on every large fire
- Operational management is improving owing to new methods of training such as the simulator

Those following items are taken into account:

- Forecasting and anticipation
- Feed back must be systematic after large fires
- The procedures of commanding must be developed
- Radio and GPS transmission must be dependable
- Made-up tracks are the best mean of penetration and escape
- Individual protection should be improved (materials, colour...)
- R and D must be developed on the behalf of collective and individual safety

Safety has really improved these few past years because of major fatal accidents during F.F-fighting as well as metropolitan fire-fighting. The French government has reacted firmly organizing a serious study of the phenomenon. This study carried by Colonel POURNY included the input of fire officers all over officers to work the country. Everyone dealing with safety (firefighting methods, engine protection, individual protection, new fighting means and methods, new ways of management, R and D, forest and tracks conception etc...) should know fire safety becomes a top priority.

Safety must be in all minds, but every body knows that fire-fighters facing the danger with pride and conviction may forget to follow the rules. In that matter, the "POURNY" report proposes a new function within the Fire and rescue Services: "the **safety officer**". He must be a well experienced and trained fireman who perfectly knows the fire and the human behaviour. Half an angel – half a warder he is supposed take care of everybody on the field. He is able to improve the rules about safety and health at work, he interferes in case of danger or high risk on the field, he analyzes every accident at work, he prepares the feed-back after the fire, he controls the specifications of the purchase of individual protection means or appliances.

"Save or Die" was the French fire-fighters motto. "Save but Not die" should be the next one.

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References

Published reports: Rapport POURNY, DDSC 2003, “les accidents thermiques” colonel Claude MARET, « la sécurité lors des feux de forêt » CEREN, Nicolas RAFALLI, « La puissance du feu-rayonnement thermique » Robert CHEVROU.

Conventions and presentations : “Safety and individual protection in Spain” Iturri -Seville 2004, « Sécurité des CCF » Majors PERSOGLIO-PATIMO –Congres national – Montpellier 2004, « contrôle de qualité des équipements et matériels » Dr Frédérique GIROUD, CEREN 2004, « projet de référentiel formation feus de forets », « quide nationaux de référence » DDSC 2005, « ordres national, zonal, départemental feux de forêt » DDSC.

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