

# **Aerial firefighting**

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## **Introduction**

Italy is a country that links the Mediterranean area with the central part of Europe. It can be divided into two regions:

- northern Italy looks like a Central European Country;
- southern Italy is affected by severe forest fires due to long and dry Mediterranean summers.

The Italian land mass is 30,1323 million hectares (ha). 9.857.000 ha (hectares) of forest covers, i.e. a third of the territory, that amounts to approximately 0,6 percent of the world's forested area. Records of the national burned area are been collected only since the 1970s. On average 9.800 fires per year burn totally 119.200 ha of land, of which 53.000 ha is woodland, with standard variation of up to 25.000 ha. That is to say ~1% Italy's forest is affected by fire every year. About the aforesaid 9.800 fires, the aerial support is requested hardly on 1.000 fires during the year, of which ~40% in August, so many requests cannot be accepted.

Although all the efforts made to prevent and to suppress wildfires have increased greatly in the last few years, the desired goals have not been reached yet. This means that efforts to-date have been insufficient to solve the problem: in fact, there are other factors to be considered in order to prevail in fighting fires: meteorological situation, abandonment of farm lands and socio-economic conditions are considerable guilty factors about fires. Experience shows that the number of fire occurrences is increasing as much as the cost of suppression, so the Parliament has passed a law to address finances where goals have been achieved.

Forests in Italy are very important for two aspects in particular: tourism that has increased in the last few years, and, what interests us more, they are of great value for environment, in fact they keep the air clean and they help to avoid floods and erosion by retaining precipitation in the soil.

Nowadays inasmuch as farms, factories and residences are spread in the lowlands, oaks, which were historically the most common trees on the plain, are running out. What remains of forest is placed most in mountainous or hilly zones. Today dominant species are:

- Maritime Pine and Poplar on the plain;
- Walnut, Olive and Chestnut on the hills;
- Beech and Fir on the mountains.

In Italy the Regions are in charge of protecting the forests within their territory.

The Department of Civil Protection (DPC), within the structure of the Italian Cabinet, owns and operates a fleet of aircraft, always ready to intervene, upon request, carrying out initial air attacks, in support of fire fighting operations.

This presentation aims to describe, as closely as possible, how the Government aircraft fleet works, with particular notice to:

- Communication Command and Control system;
- Comparison between fire fighting helicopters and fixed wing aircraft in fire fighting operations in Italy, (performance and costs).

## **Regions**

Italy is divided in 20 Regions, which by law have to protect their own forests to prevent, to detect and fight forest fires, plus to restore damage areas. Regional plans are updated every year in order to improve their organisation. They also review the previous fire season's outcome, taking into account looking back at lesson learned in accordance with Department's guideline. Other recommendation, opinions on planning and policies to prevent and control forest fires, are suggested by Institutions such (i.e. Law n° 353/2000):

- Forest Service (CFS), Ministry of Agriculture;
- Fire Brigade (VVF), Ministry of Interior;
- Ministry of Environment (MoE).

The plan includes:

- causes of forest fires;
- mapping of burnt surfaces;
- mapping of forest fire risk areas.

Although there are some slight differences, due to local autonomies, Regions are structured in (fig. 1):

- Regional Operation Centre (SOUP) that control operations and allocate resources. They are supported by Fire Brigade, Forest Service, volunteers and when necessary, by the Military (FF.AA);
- District Operation Centres (DOC) manage mechanized brigades, ground personnel workers, volunteers and local inhabitants;
- Forest Stations (FS) detect and assess the woodland fires as well as scrambling fire fighters into operations as quickly as possible.

Some Regions lease their own fleet of light helicopters to fight forest fires, i.e. LAMA SA 315 B "Bambi bucket", ECUREIL AS 350 B3 with integral tanks, plus other smaller helicopters and fixed wings for aerial forest patrol over approved areas, during the index high-risk period.

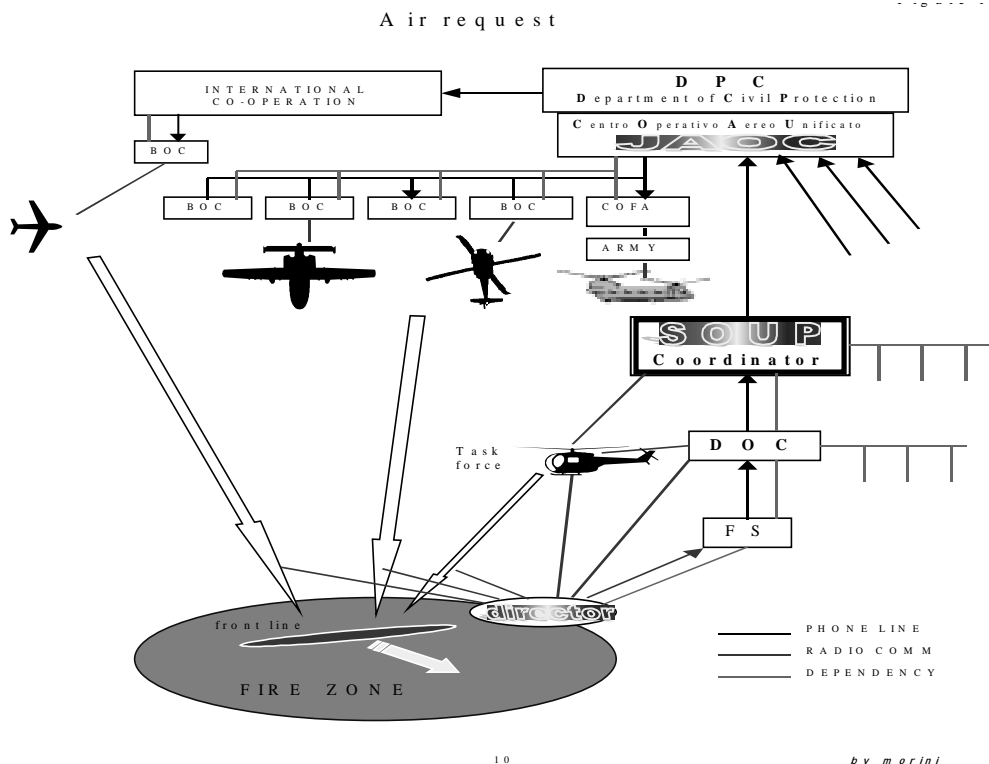


Figure 1. Structure of firefighting organization in Italy

## Fire management

The coordination of fire-fighting operations is under the supervision of a fire Director, normally a Forest Station officer, or District Operations officer, who is expert in forestry. He can request immediate Regional helicopter intervention by directly communicating with the pilot on radio frequency, closest to the fire zone. He also has to inform the Regional Operation Centre (SOUP), which can refuse the dispatch in favour of other more severe fires requiring precedence. Usually Regional helicopters reach their target quickly and sometimes transport a fire fighting crew (task force) from the air base station. The fire Director can also request a fire-fighting support from the Department, through a different procedure, not as immediate, that we are going to know.

In order to manage aerial resources the Director has to:

- maintain a radio contact Ground-Air-Ground (G.A.G.) on frequency, that has to be the same for all air traffic in zone, (e.g. 168.350 Mz or 141.100 Mz national frequency on fire,);
- receive information on the fire behaviour, especially from the aircraft overhead, “inflight”;

- investigate and research the fire relative to all risks, and all resources necessary to fight the fire, i.e. power lines and water sources;
- be Knowledgeable about the aircraft performances in order to vector and request appropriate targets;
- coordinate cooperation between ground teams and the aerial resources;
- utilize aerial resources for initial attack only.

Due to lack of Communication Command and Control (C3) during the management of large fires, lots of aerial fire fighting capability is lost because of:

- lengthy procedures to request and obtain the intervention of aerial resources;
- failure of radio communication G.A.G in fire zone, the aircraft cannot operate;
- difficult to discover in real time the objective conditions of the fire, with problems vectoring the aircraft due to the lack of standardised phraseology, clear the aircraft to operate in the zone without particularly instructions

In order to alert the attention of the fire Directors, the Department of Civil Protection DPC, recognising the requirement to have well trained personnel, organizes pre-post fire season seminars. These meetings are open to fire Director, pilots, operating company's ground staff, i.e. all those involved in the annual fire season campaign, in order to raise consciousness, discuss, assess and analyse. These seminars have become a valuable tool to improve the management of aerial resources.

### **Strategic aerial fire fighting**

The Department controls a fleet of aircraft, fixed/rotor-wing, to fulfil its national fire-fighting duties and operations. These aircraft are deployed on the territory in accordance with the index risk factor, (Italian Fire Danger, Sol numeric and Canadian Fire -performed by E.C. JRC- Space Application Institute- have proven to be valuable particularly within the Italian context (fig. 2) and (fig. 3) .

The fleet is managed by the agency “Joint Air Operation Centre” (JAOC) that is composed of the following officers:

- a Pilot officer, chief of staff, who was used to flying for mission like close air support (A3 Senior);
- a Forest Service officer from CFS;
- a Fire Brigade officer from VVF;
- a meteorological officer from Italian Air Force.

### **Request for air support**

If a disastrous fire is going out of control or threatens lives, property or valuable resources, the fire Director can ask for one or more fire fighting aircraft from the JAOC to obtain the required aerial support (fig. 1) :



## DIPARTIMENTO PROTEZIONE CIVILE - COAU

(TEL.06/68202288 - FAX 06/68897754 - 06/68202472)

### PRONTEZZE ED INIZIO SERVIZIO PER IL GIORNO 20/09/2001

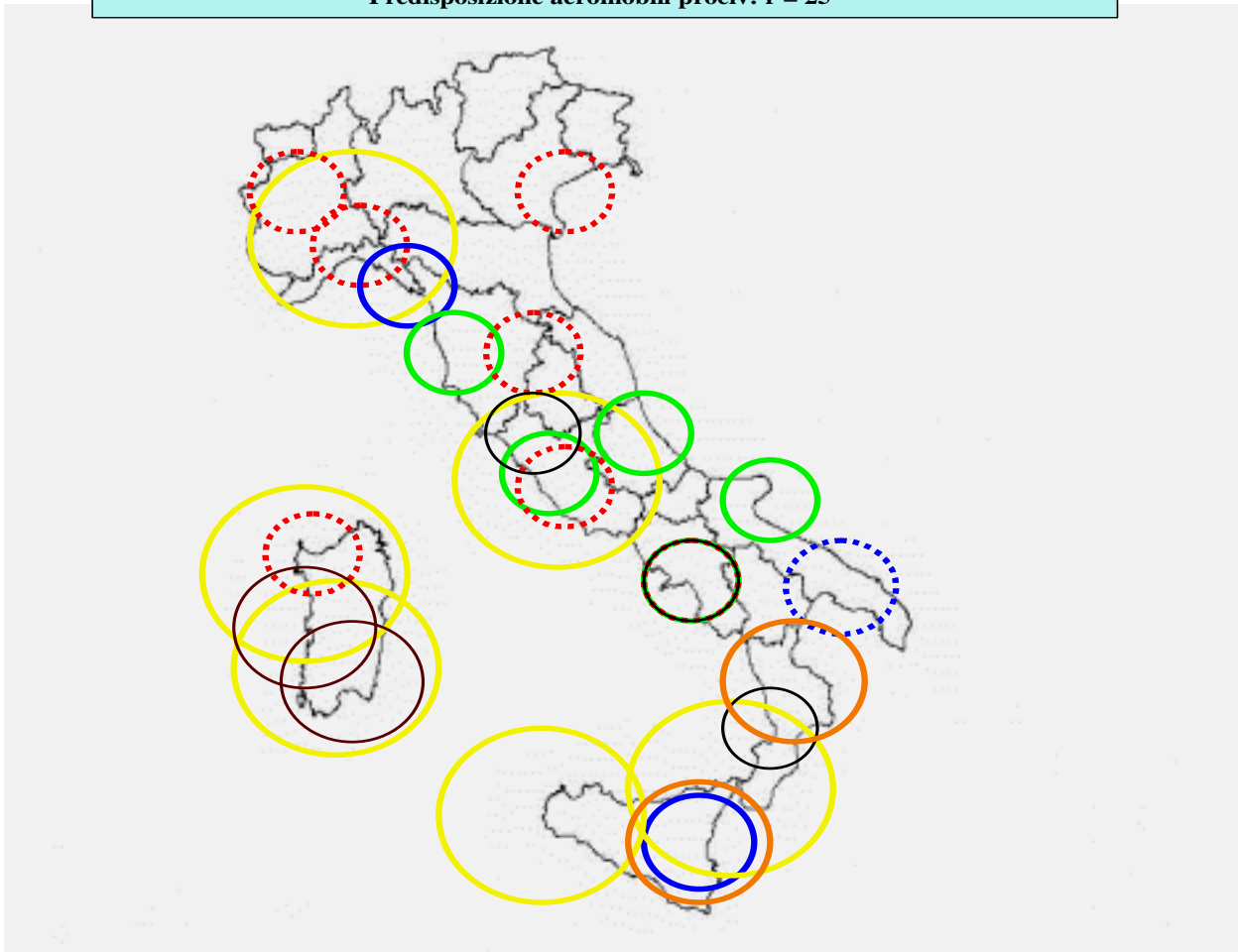
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 COAC.F.S. Urbe (06-88386217) ELILARIO GRAZZANISE (0823-562200)  
 MN. INTERNO VF (064814695) TRANSAVIO LAVELLO (097882206)  
 ELILARIO ALA' DEI S. 079-723455

FLYING UNITS	BASE	READINESS	ON DUTY FROM	EFFICIENCY			NOTE
				ON	OFF	RMKS	
SOREM							
CAN-7	TRAPANI	45'	8.00	x			
CAN-8	CIAMPINO				x	maintenance	
CAN-9	NORTHBAY				x	maintenance	
CAN-10	ALBENGA	45'	10.00	x			
CAN-11	CIAMPINO				x	propeller	
CAN-12	REGGIO CALABRIA	45'	9.00	x			
CAN-14	CIAMPINO				x	propeller	
CAN-15	OLBIA	15'	7.00	x			
CAN-16	CIAMPINO	45'	8.00	x			
CAN-18	GENOVA	45'	8.00	x			
CAN-19	CIAMPINO	45'	8.00	X			
CAN-20	CIAMPINO				x	maintenance	
CAN-21	REGGIO CALABRIA	45'	8.00	x			
CAN-22	CIAMPINO	45'	7.00	x			
C.F.S.							
NH500	VIESTE	60'	7.00	x			
AB412	URBE	60'	7.00	x			
NH500	PESCARA	60'	7.00	x			
NH500	CECINA	60'	7.00	x			
AB412	PONTECAGNANO	60'	7.00	x			
NH500	LAVEZIAT.	60'	7.00	x			
NAVY							
AB-212	LUNI-SARZANA	60'	H/J	x			

Figure 2. Example of aircraft deployment on the territory, on 20/09/2001..

**Concorso aereo A.I.B. – Campagna estiva 2000**

**Predisposizione aeromobili prociv: r = 25'**



**Legenda:**








<b>sorem =</b>		<b>genova, ciampino, Reggio Calabria, trapani, Cagliari, Alghero.</b>
<b>esercito italiano =</b>		<b>viterbo, Lamezia Terme.</b>
<b>marina militare =</b>		<b>Luni, Grottaglie, Catania.</b>
<b>elicarane =</b>		<b>Fenosu, Elmas.</b>
<b>eti 2000 =</b>		<b>Lamezia Terme, Catania.</b>
<b>corpo forestale dello stato =</b>		<b>Cecina, Urbe, Vieste, Pontecagnano.</b>
<b>vigili del fuoco =</b>		<b>Venezia, Torino, Genova, Arezzo, Ciampino, Pontecagnano, Sassari.</b>

Figure 3. Distribution of aircraft bases

- the Director has to call on frequency the District (DOC);
- the DOC has to fill in a form with many compulsory items and to fax it to Regional Operational Centre SOUP (fig. 4);
- the SOUP can refuse or consider the request in accordance with other, on going or emerging priorities and fax it to Joint Air Operation Centre;
- some air-resource requests cannot be satisfied because of limited means. Therefore the JAOC accept or refuses a request in relation to:
  - airbase-distance to fire location;
  - water-to fire distance;
  - endurance;
  - experiences;
  - costs/benefits analysis;
- if the request is accepted, the JASC will dispatch one, or if necessary and possible, more aircraft, faxing again the format to the aircraft readiness unit, ordering immediate departure;
- to dispatch Army-operated helicopters the JAOC faxes the format to COFA.CO (Air Force Command), which translates the format request in an operative message to teletypewriter it to the Army unit.

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<b>5) Superficie bruciata (ha)</b>	<b>13) Squadre a terra presenti in zona</b> Nominativo: _____ <input type="checkbox"/> 122.15 <input type="checkbox"/> 122.35 Freq. radio T.B.T. 141.1 (primaria) <input type="checkbox"/> <input type="checkbox"/> 142.50	<b>6) Superficie boscata a rischio (ha)</b>																																												
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Figure 4. Form for aerial support request to be filled by the DOC.

All aerial fire fighting resources that operate in fire zone have to be co-ordinated by the JAOC.

The fire Directors control the aerial resources, until they have completed their mission and are released.

The JAOC does not have a radio contact with aerial means on fire, so it cannot receive any in-flight message to update the fire's situation or give further instructions to divert immediately them if required on a more severe fire.

The normal information from FS to JAOC and vice versa are via DOC, via SOUP; this is too slow and clearly outdated.

Resources such as the S-64 helicopter maintain contact with the JAOC directly by mobile phone, this system, can still be improved, but at present is a big step forward.

JAOC and Directors are not flight controllers, therefore pilots flying on the scene of the fire must control their own separation. If a fire starts to run away, the entire fire zone will be declared "RESTRICTED AREA" for all other aircraft that must therefore respect the Civil Aviation rules:

- AIP Italia.- RAC 1-222
- Forest fire fighting flights
- Provision DGAC 42/739/R1/6-1 dated 28/05/97.
- In case of forest fires, the burning area may be overflowed by military/civilian ACFT participating in fire fighting operations.

Based on airspace classifications pilots not participating to fire fighting operations shall comply with the following procedures:

- Airspace Class A, C and D it is prohibited to fly below 2500 FT AGL within an area of 2 NM from the fire.  
Remark: If a CTR is affected by the fire, SIDs, STARs and approach procedures could be temporarily suspended or modified.
- Airspace Class E, F and G it is prohibited to fly below 3000 FT AGL within an area of 5 NM from the fire. Pilots shall stay well clear of such area and shall use extreme caution flying in the vicinity of the above mentioned area in order to not interfere with possible aircraft participating in fire fighting operations.
- The fire fighting aircraft will have priority over all other traffic.

## **The fleet**

The JAOC operates and manages an optimised fleet of:



13 Bombardier CL-415, Canadair, amphibian turbo-propeller water bomber designed for the fire-fighting role; they drop 6.000 litres of water and foams 4% scooping nearby water surfaces (sea or lakes longer than 2 Km).

The DPC is looking forward to having a total of 15 Canadair's.

The operations of this aeroplane, as configured, are limited to:

- range 300 Km.;
- water-fire distance 25 Km. (fig. 5).

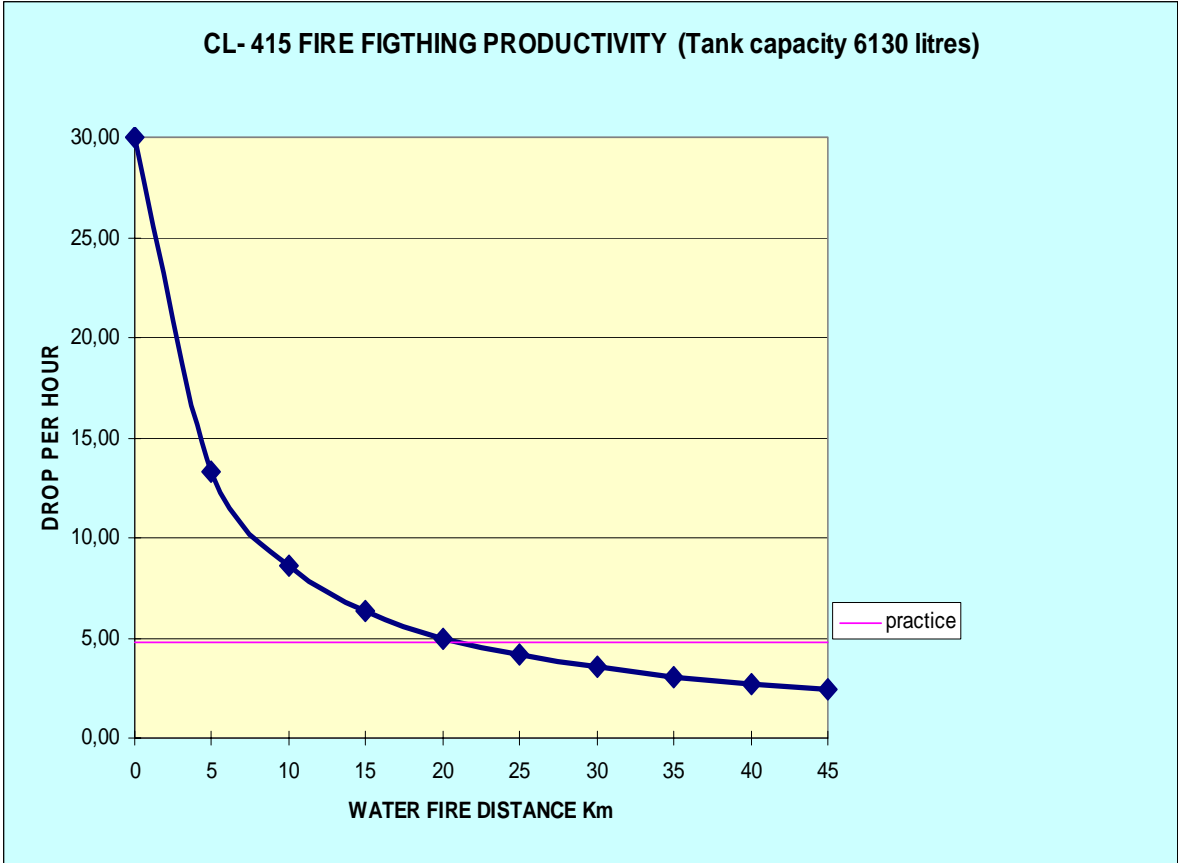


Figure 5. CL-415 fire fighting productivity (drops/hour) in relation to the distance (km) of the water scooping source from the area of operations.

5 Fiat G-222 air-tanker were purchased by DPC to transport goods or people on emergency, (e.g. medical evacuation). A fire-fighting version, loading the aircraft with the SAA system (retardant mixture which is more effective than water) was developed to be used in the summer campaign from 1982. Performance:

- retardant 6800 litres per rotation;
- range 640 Km.

Lately the system was disowning due to costs/benefits analyses on the national level.

2 Lockheed C-130, Hercules, air-tanker fitted out MAFFS retardant system, were used from 1982 through 1996. Performance:  
 retardant 11.350 litres per rotation;  
 range 1.300 Km.  
 They were dismissed because of the above-mentioned costs/benefits analysis.

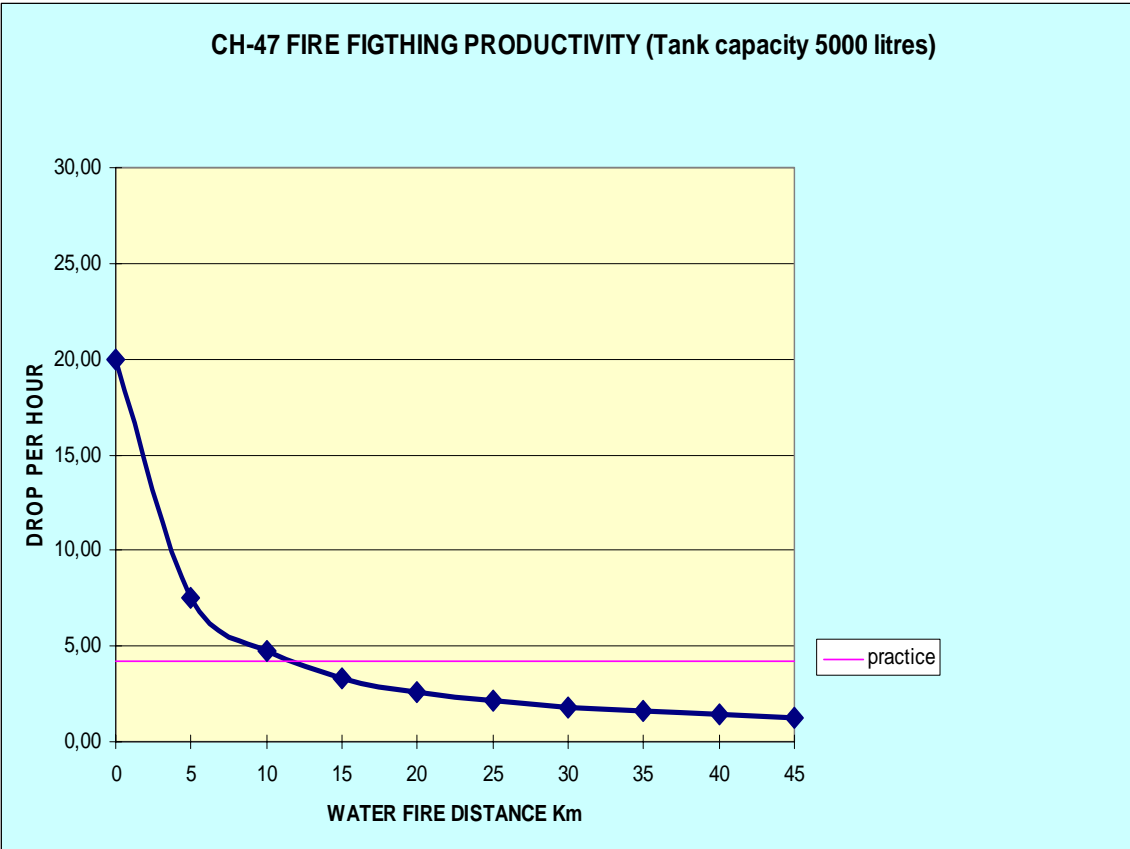


Figure 6. Boeing CH-47 Chinook helicopter fire fighting productivity (drops/hour) in relation to the distance (km) of the water scooping source from the area of operations

11 Boeing CH-47, Chinook, smoky-bucket helicopters. Performance (fig. 6):  
 water 5.000 litres per rotation;  
 range 150 Km..

A project that considered the possibility to develop a helitanker version (fitted with the "Silvani module"), was abandoned. The DPC is going to dismiss the CH.47 line due to very low efficiency in fire-fighting operation for technical failures and difficulties to take off immediately within the mission time requirements.

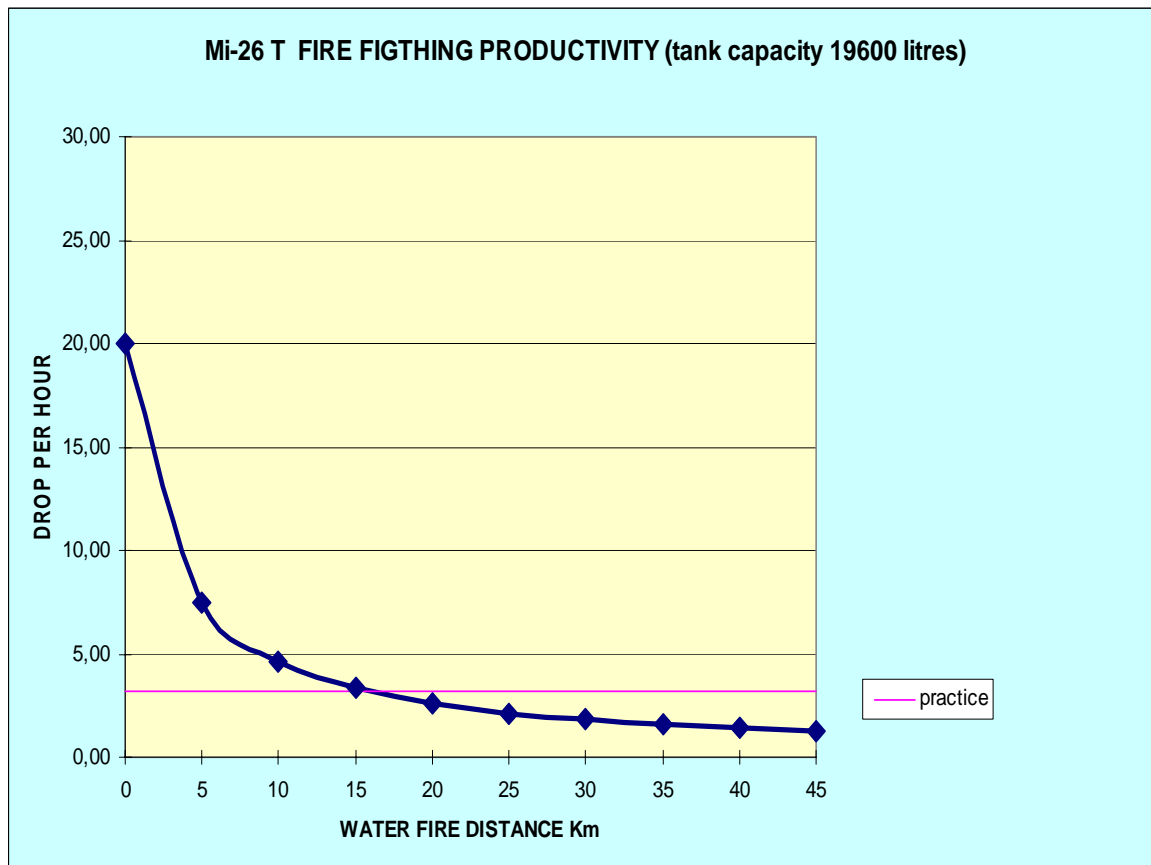


Figure 7. Mil Mi-26 T helicopter fire fighting productivity (drops/hour) in relation to the distance (km) of the water scooping source from the area of operations

2 Mil Mi-26 T, helicopter from the Skytec Company, with the twin "bambi bucket" were rented to test its fire-fighting capability on severe fires, in 1999 and 2000 Campaign. Performance (fig. 7):

water 19.600 litres per rotation;

range 180 Km..

During the 1999 campaign, due to the difficulty of finding adequate and large enough operations sites also its inability to release water in multiple drops, especially on small fires, the Department wondered about their real usefulness, in fire-fighting operations. During the 2000 campaign the operator proposed to furnish on trial a further type of bucket "Betty A 9" capable of making multiple drops within a single load. The bucket was a metallic one with difficulties to:

- operate properly;
- be carried on board;
- be re-positioned on the ground, etc..

The difficulties were still a problem when the campaign was over and this constituted the helicopters final and last chance.

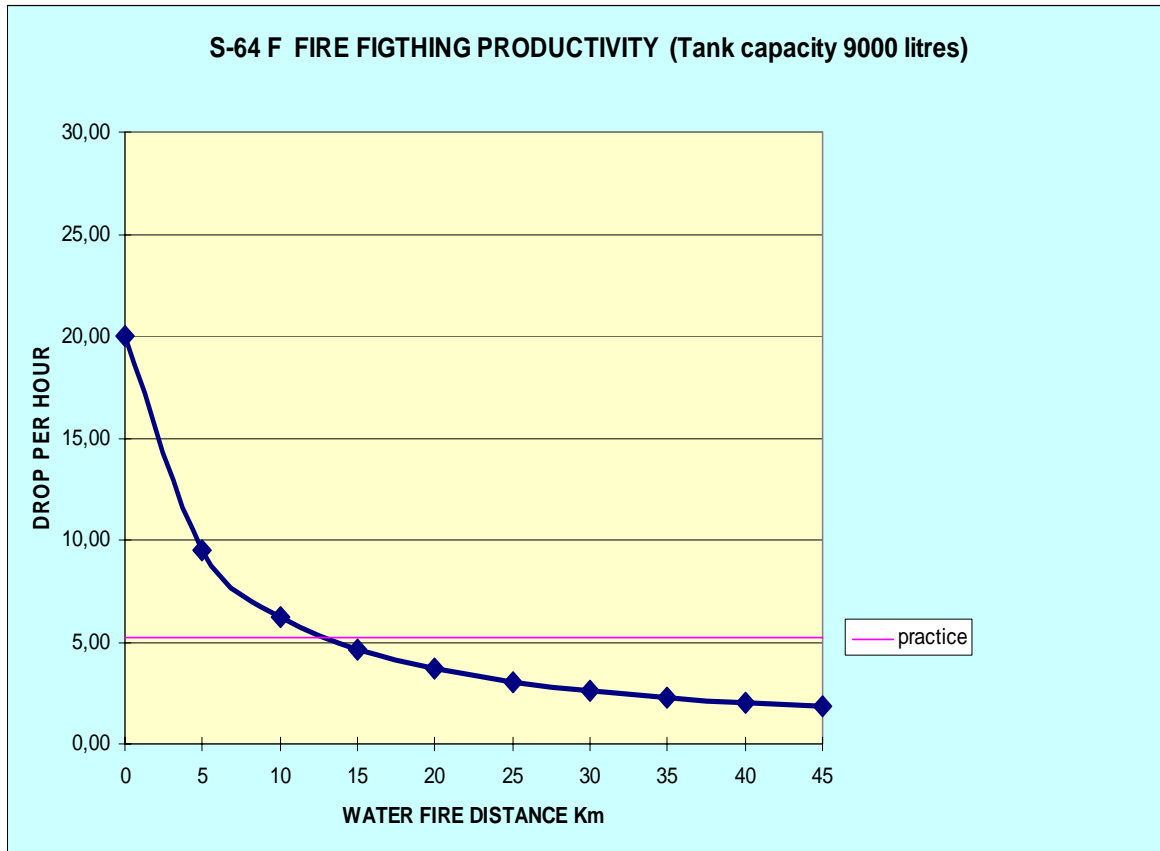


Figure 8. Sikorsky S-64 F, Erickson Air Crane helicopter fire fighting productivity (drops/hour) in relation to the distance (km) of the water scooping source from the area of operations

4 Sikorsky S-64 F, Erickson Air Crane, “Helitanker Version” have been rented to test fire-fighting capability since 1999 Campaign. Performance (fig. 8):

water and foam 9.000 litre per rotation;

range 160 Km..

The S-64 F have been mostly appreciated due to:

- versatility and accuracy to deliver multiple drops in a single load in which the pilot select the volume of each drop;
- facility to find a water source (the helitanker can refill itself in less than 1' by snorkel from a suitable water source as shallow as half a meter). Less time spent on ferrying means more time spent fighting fire.

A new version S-64 E Sea-Snorkel has been operating since the 2000 campaign. It refills water flying at 35 KTS (19 Km/h), avoiding to refill in Hovering Out Ground Effect of the rotor): This means:

- more pay load, because to translate flights requests less power;
- higher safety factor not having to hover, which requires maximum Torque.
- necessity of 600 m. length water sources.

Other helicopters utilised (AB-212, AB-412, NH-500) from national services such CFS, VVF, FF.AA. and planes from private fleets, are always managed by the JAOC.

Thousands of fresh water sources are available for helicopters while only 100 are available for the Canadair fleet especially inland. Away from the coast, operations with helicopters are the only effective option; they can refill from fresh water as well avoiding damage to the soil by salt water drops.

### **Costs**

A costs/benefits analysis was carried out by DPC after the 1999 campaign (fig. 9):

The table and the diagrams already showed give appreciable information, but in order to evaluate if the aerial resources are really good value for money it is necessary to pay attention to other variables such as:

- readiness of the operations;
- accuracy of the drops;
- communications capability;
- flexibility to operate from non stationary bases;
- capability to fly in day/night and with low visibility conditions;
- training and safety of the crews;
- flight and dispatch readiness;
- maintenance and logistics.

### **Final considerations**

Experience shows that the system of fire fighting air support in Italy is able to control extreme fire situation but can be more effective.

Fire policies have to balance suppression cost with values at risk.

To maximise the initial attack support the Department of Civil Protection will:

- produce recommendation on planning and policies to contribute to forest's health;
- provide for institutional co-operation among all stakeholders;
- develop capability to apply systematic fire management procedures;
- improve the communication command and control system;
- improve task force operations to bring professional crews on fire scene;

## Costs

Summer 1999

AIRCRAFT	OPERETOR	HOURS	DROPS	€ per drops
CL-415	Sorem	2745	13039	1.660
Mi-26 T	Eti 2000	202	661	6.870
S-64 F	Elilario	199	1047	3.630
CH-47	Army	121	514	3.400
G-222	It. Air Force	135	113	35.000

The G222 fleet was been used overall for umanitary missions In The Balcany Aerea

Figure 8. Cost-benefit analysis fot the 1999 fire campaign.

- improve the readiness of the assets;
- improve Regional co-operation;
- be leader in projects interesting every Regions (i.e. monitoring and mapping land);
- improve capability in managing fire-fighting;
- develop a standard helicopter fleet to integrate operation with the Regional fleet;

### **In conclusion**

We trust we'll play our little part in saving Planet Earth.