



## Flight Operations Briefing Notes Cabin Operations Managing In-Flight Fires

### I Introduction

An in-flight fire is probably the most serious in-flight emergency, and must be brought under control as soon as possible. Considering the crucial role that time plays in this type of emergency, it is imperative that no time is lost when attempting to extinguish the fire.

### II Statistical Data – Background Information

A study conducted by the Transportation Safety Board of Canada, in which 15 in-flight fires between 1967 and 1998 were investigated, revealed that the average elapsed time between the discovery of an in-flight fire and the actual landing of the aircraft is 17 minutes.

In January 2004, the United States Federal Aviation Authority (FAA) issued an advisory circular entitled “In-flight Fires” (AC 120-80). This was a result of a review by the United States National Transportation Board (NTSB) of commercial aviation accidents and incidents involving in-flight fires. This advisory circular provides guidance on how to deal with in-flight fires, and the emphasis on crews taking “immediate and aggressive action” to gain access to the fire source of the fire, and to immediately put it out.

Any fire, no matter how small, may rapidly become out of control, if not dealt with quickly.

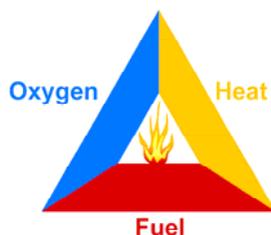
The first priority will always be **to put it out**.

## III Basic Fire Chemistry

To enable cabin crew to effectively fight an in-flight fire, it is important for cabin crew to have a basic knowledge of fire chemistry. This will help cabin crew to understand the importance of selecting the correct fire extinguisher in a given fire situation.

The key to fire prevention is keeping fuel and ignition sources separate.

Combustion consists of three elements: oxygen, heat, and fuel. Together, these elements create a chemical chain reaction and result in a fire. The goal of firefighting is to eliminate at least one element from the fire, in order to extinguish it.



**Figure 1**

*The Fire Triangle*

A fire will continue, unless:

- The fuel supply has been cut off
- There is no more oxygen available
- The temperature has been cooled below the flammability temperature.

**Note:**

*For the purpose of this document, "fuel" refers to "any flammable material".*

### III.1 Fire Classification

Fires are classified into four types: those in solids, those in flammable liquids, those in electrical equipment, and those in flammable metals. These are called, respectively, class A, B, C, and D fires. Class A and C fires are the most commonly encountered fires onboard aircraft. It is important for the cabin crew to select an appropriate fire extinguisher, according to the class of fire.



## Class A

Fires that involve wood, paper, cloth, or plastic. Class A fires need to be cooled. A water extinguisher, or liquid containing a large percentage of water, for example, coffee, tea, juice will extinguish a class A fire.

Do not use liquid containing alcohol!

Water/glycol extinguishers are the most effective for class A fires.

### Smoke:

Usually gray/brown in color. Can be quite thick, depending on the quantity of fuel.



## Class B

Fires that involve flammable liquid, hydraulic fluid, oil, tar or aircraft fuel.

This type of fire cannot be extinguished with water. Foam or Halon fire extinguishers should be used to extinguish class B fires.

### Smoke:

Usually black in color. Very thick, with a distinct oil/petrol-like odor.



## Class C

Fires that involve electrical equipment. This type of fire must be extinguished with a non-conducting mixture, in order to avoid electrocution and damage to electrical circuitry. Halon fire extinguishers are effective for class C fires.

### Smoke:

Usually light grey or white, with a bluish tinge. Very fine and can disperse rapidly. Has a distinct acrid odor.



## Class D

Fires that involve flammable metals, such as sodium, magnesium, lithium and potassium. Special powder extinguishers are effective on class D fires, because of the possible chemical reaction between the burning and extinguishing agents.

Never use Halon fire extinguishers on class D fires.

## IV Firefighting Equipment

### IV.1 Fire Extinguishers

Hand-held fire extinguishers discharge an extinguishing agent for 8 to 25 seconds, depending on their type and capacity. Due to this short period, it is essential to select and use the appropriate fire extinguisher immediately.

There are different types of fire extinguishers:

- Halon – is the generic name for the group of bromochlorodifluoromethane (BCF) extinguishers that can be used for class A, B, and C fires
- Carbon dioxide (CO<sub>2</sub>) for class B and C fires
- Dry powder (DP) for class D fires
- Dry chemicals for class A, B, and C fires
- Water solution (H<sub>2</sub>O) for class A fires.

#### How to Use a Fire Extinguisher

**Note:**

*This can also be easily remembered by using the word P A S S*

- **P**ull the pin, or turn the handle. For some water extinguishers, the handle must be turned in a clockwise direction, in order to pierce the carbon dioxide cartridge and to pressurize the extinguisher
- **A**im the fire extinguisher at the base of the fire. The best firefighting results are achieved by attacking the base of the fire at the closest edge of the fire, and progressing toward the back
- **S**queeze the top handle or lever
- **S**weep the fire extinguisher nozzle from side to side in a sweeping motion
- Do not direct the initial extinguishing agent discharge at close range onto burning material. The high speed of the stream of extinguishing agent may cause the extinguishing agent to splash and/or scatter burning material. Stay at least five to eight feet away from the fire
- Hand-held fire extinguishers should always be used in an upright position.

There are only a limited number of fire extinguishers onboard the aircraft. Ensure that an extinguisher has been fully discharged before using another.

## The Halon Fire Extinguisher

The use of halon fire extinguishers has generated some controversy. Some crewmembers have been hesitant to use halon during in-flight fires. The use of halon fire extinguishers is addressed in the FAA Advisory Circular 120-80, and stresses the effectiveness of Halon, when fighting an in-flight fire.

A halon extinguisher is three times as effective as CO<sub>2</sub> extinguishers that contain the same amount of extinguishing agent.

Because of its chemical composition, some precautions must be taken when using Halon fire extinguishers:

- When a Halon fire extinguisher has been used on a Class A fire, the fire and the surrounding area must be cooled down with a non-alcoholic liquid.
- When halon is used in crew compartments or confined areas, Portable Breathing Equipment (PBE) should be used.

## IV.2 Portable Breathing Equipment

Protective Breathing Equipment (PBE) is designed to protect the cabin crew from smoke, toxic fumes and gases. The cabin crew can still communicate amongst themselves, and with the flight crew via the Passenger Address (PA).

## IV.3 Crash Axe

A crash axe can be used to lever panels, to enable cabin crew to insert the nozzle of the fire extinguisher behind a panel. The crash axe may also be used for moving burning material for example, burnt wiring. The crash axe has an insulated handle and is resistant to high voltages.

## IV.4 Fire Gloves

Fire gloves are fire retardant. These gloves give protection to hands and arms against heat.

## IV.5 Use of Non Standard Emergency Equipment

Cabin crew need to be resourceful when fighting an inflight fire. Be prepared to improvise by using other equipment such as, using pots of coffee/tea, to fight a visible fire for example, a waste bin fire.

## V Operational Standards for an In-flight Fire

### V.1 Crew Communication and Coordination

In the event of an in-flight fire, communication between the cabin crew and flight crew is essential. If a fire is discovered in the cabin, the cabin crew must inform the flight crew immediately.

The firefighting effort requires coordination amongst the cabin crew. The duties are divided into three main roles, the Firefighter, the Communicator, the Assistant Firefighter, all other cabin crewmembers play a supporting role.

#### The Firefighter

The first cabin crewmember that finds the fire will assume the role of the Firefighter.

The Firefighter:

- Alerts other cabin crewmembers
- Takes the nearest appropriate fire extinguisher
- Immediately locates the source of the fire
- Extinguishes the fire.

#### The Communicator

The second cabin crewmember on the scene is in charge of the communicating information about the fire.

This cabin crewmember, called the Communicator:

- Informs the flight crew of the following:
  - Fire location
  - Fire source
  - Severity/density of fire and/or smoke (color of smoke/odor)
  - Time the firefighting action started
  - Firefighting progress
  - Number of fire extinguishers used.
- Maintains the communication link between the cabin and the flight crew, via an interphone near the firefighting scene
- Provides the flight crew with an accurate description of the firefighting effort, and of the situation in the cabin.

## The Assistant Firefighter

The third cabin crewmember on the scene assumes the Assistant Firefighter role.

The Assistant Firefighter:

- Provides additional firefighting equipment
- Supports the firefighting effort
- Removes flammable material from the area
- Must be prepared to replace the Firefighter, and change roles with the Firefighter, if required.

## Support Crewmembers

Other cabin crewmembers who are not directly involved in the firefighting effort, are required to provide assistance, such as:

- Relocating passengers
- Providing first-aid
- Calming and reassuring passengers.

After any fire or smoke occurrence, one cabin crewmember should be responsible for monitoring the affected area for the remainder of the flight, and for regularly reporting to the Purser. Then the Purser will report to the flight crew.

## V.2 Area Specific Fires

### Fires in Hidden Areas

Cabin crewmembers should be aware that hidden fires can occur in areas that are not visible or easily accessible to the cabin crew. There are areas on the aircraft where fires may propagate undetected in hidden areas:

- Sidewalls,
- Ceiling panels
- Floors.

Indications of a fire in a hidden area may be:

- An unusually hot surface
- Smoke emitted from a wall seams or ceiling panels
- Fumes and unusual odors
- Snapping, or popping noises, may indicate electrical arcing.

If the cabin crew suspects a fire in a hidden area, for example, behind a panel, try to locate a “hot spot”, this is an unusually warm area. A “hot spot” generally is a good indicator as to where the source of the fire is.

To find the “hot spot”, move the back of the hand along the panel to find the hottest area.

Use the back of the hand, the skin on the back of the hand is thinner and, is more sensitive to temperature changes than the palm.

It may be necessary to remove panels to access the hidden area, or to make an incision in a panel large enough to insert the nozzle of the extinguisher, to discharge the extinguishing agent.

Cabin crew should consider the use of other equipment to remove panels, these items may include;

- Ice tongs
- Spoons
- Knives
- Scissors (from the first aid kit)
- The manual release tool (which is provided for opening the oxygen mask containers).

Use caution when removing, or making incisions in panel, some of these areas may contain essential wiring or aircraft systems. Carefully lift, lever, or cut a panel.

## Oven Fires

Oven fires are a common occurrence onboard the aircraft. Many oven fires are preventable.

Some of the contributing factors to oven fires have been items left in the oven such as paper towels, saran wrap.

When an oven fire occurs, the oven door should be kept closed. It is hazardous to open an oven door when a fire is present, because this will introduce oxygen and may cause a flash fire.

In the case of an oven fire, the Firefighter should take the following action:

- Keep the oven door closed, to deprive the fire of oxygen. In most cases, the fire will extinguish by itself
- Isolate the electrical power from the oven by pulling the corresponding circuit breaker and turning off the oven power
- Monitor the situation
- Have a fire extinguisher, protective breathing equipment (PBE) and fire gloves ready to use if the situation deteriorates.

If the situation worsens, or fire is still present:

- Don the PBE and fire gloves for protection
- Open the oven very slightly, just enough to insert the nozzle of the fire extinguisher
- Insert the nozzle of the fire extinguisher, and discharge the extinguishing agent
- Close the oven door
- Repeat the procedure, if necessary.

## Fire in Enclosed Areas

In the cabin, all lavatories have smoke detectors and automatic fire extinguishers under each sink. All crew rest areas have smoke detectors and extinguishers. Cabin crew must react immediately to smoke detector alerts.

When fire occurs in an enclosed area, such as, a lavatory, an overhead bin, closet or crew rest area, before opening the door, always check the door panel for heat.

Check for heat using the back of the hand!

- Open the door or the overhead bin slightly ( just enough to pass the nozzle of the fire extinguisher).

If the fire is visible:

- Discharge the fire extinguisher at the base of the fire in a sweeping motion.

If the source of the fire has not been located **do not** randomly discharge the fire extinguisher into an enclosed area.

If the source fire is not visible, the cabin crew must aggressively search the entire area to locate the source of the fire.

## Waste Bin Fire

If there is a fire in the waste bin, the fire extinguisher operates automatically. When a predetermined temperature has been reached, the fusible plug at the end of the discharge tube melts, and enables the extinguishing agent to flow into the waste bin.

Cabin crew should ensure that a preflight check of the pressure gauge is conducted, to ensure that the waste bin fire extinguisher is functional.

Regular check of the lavatories should be conducted in-flight as part of the cabin crew duties.

## VI Operational and Human Factors Involved in In-Flight Fires Management

### VI.1 Human Factors (Situational Awareness)

Cabin crew should always be alert to any, sight, odor or sound that may indicate the presence of fire, these may be;

- Fumes or unusual odors
- Electrical malfunctions, for example, tripped circuit breakers
- Noises, such as popping, snapping or crackling that may indicate electrical arcing
- Hot spots on sidewalls, floors, and panels.

Another possible sign of a fire onboard may be passengers or cabin crewmembers suddenly developing:

- Eye irritation
- Sore throats
- Headaches.

This may indicate that fumes are present, before smoke or fire is visible. The cabin crew must immediately investigate any reports from passengers that may indicate fire, in order to locate and extinguish the fire in its early stages.

### VI.2 Factors Affecting Operational Standards

Analysis of in-service events has demonstrated that operational standards can be ineffective or not applicable in the following situations:

- Ineffective detection of fire:
  - Passenger tampers with lavatory smoke detector, and, drops cigarette but in waste bin.
- Incorrect application of the procedure:
  - A crewmember opens the lavatory doors without checking it for heat with the back of his/her hand, and a flash fire occurs.
- Lack of training:
  - The cabin crew does not immediately react to the fire
  - A cabin crewmember notices the fire, but loses time in locating the nearest fire extinguisher in the cabin
  - The cabin crew does not have adequate firefighting skills
  - Cabin crewmembers do not coordinate their firefighting efforts.

- Lack of Operator procedures and policy:
  - The Operator does not have adequate procedures and policies for cabin crew to effectively deal with onboard fires.
- Ineffective communication with the flight crew:
  - The communicator underestimates the severity of the fire to the flight crew, the flight crew think it's a smoke incident.

## VII Prevention Strategies

Fire prevention should be practiced by cabin crew as part of their daily duties. Cabin crew should maintain continuous vigilance and be alert to any indication of a fire.

Some of the fire prevention duties of the cabin crew can include:

- Frequently monitoring of the lavatories during the flight
- Performing a complete pre-flight check of the ovens and galleys to ensure that they are clean and servicable
- Ensuring that all passengers and crew comply with the NO SMOKING policy.

## VIII Summary of Key Points

It is important to note the following key points:

- Operators should include firefighting training for all crew members, in ab-initio and recurrent training. Fire training should be both knowledge and skill based, including, basic fire chemistry, fire classification, the location and operation of all onboard firefighting equipment, the different techniques used to fight fires in specific areas
- Operators should develop policies and procedures to cover events, such as in-flight fires
- Operators should review fire related incidents that occur during operations. This information should be analyzed in order to enhance their procedures and cabin crew training
- Operators should include all recommendations issued by the aviation authorities in their procedures and training
- Documented procedures should be updated regularly to ensure that the cabin crew has the most up to date operational standards for managing fire events.

## IX Associated Flight Operations Briefing Notes

The following Flight Operations Briefing Notes provide additional information about related subjects:

- **Cabin Smoke Awareness**

- **Effective Briefings for Cabin Operations**
- **Crew Communication**

## X Regulatory References

- FAA – AC 20-42C - Hand Fire Extinguishers for Use in Aircraft
- FAA - AC 120-80 - In-Flight Fires
- CAA – CAP 586 - Improving Passenger Survivability In Aircraft Fires: A Review

## XI Airbus References

- A318/A319/A320/A321, A330, A340 & A380 Cabin Crew Operating Manuals (CCOM) Abnormal/Emergency Procedures - Fire Protection
- Getting to Grips with Cabin Safety (Brochure)

## XII Additional Reading Materials / Websites Reference

- Flight Safety Foundation – Publications - Cabin Crew Safety - September-October 2004
- Flight Safety Foundation – Publications – Cabin Crew Safety - March-April 2001

### **Note:**

*This FSF publication and other FSF Cabin Crew Safety Bulletins are available on the Flight Safety Foundation website: <http://www.flightsafety.org/home.html>.*

This FOBN is part of a set of Flight Operations Briefing Notes that provide an overview of the applicable standards, flying techniques and best practices, operational and human factors, suggested company prevention strategies and personal lines-of-defense related to major threats and hazards to flight operations safety.

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