

# **CIVIL AVIATION AUTHORITY PAKISTAN** **FLIGHT STANDARDS DIRECTORATE**



This Information Bulletin, adopted by Flight Standards Directorate aims to keep members of Pakistani Civil Aviation community updated on latest concepts in areas of common interest, and developments within the aviation industry. It is anticipated that the material would be of relevance to AOC, Training, Standards and helpful to the Safety Managers who implement their policies.

The Bulletin is designed to serve the objective of Flight Standards Directorate that is “To improve upon Safety Standards”.

## **INFORMATION BULLETIN**

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# FIRE

## Definition

A fire which occurs while an aircraft is airborne.

This article considers some aspects of airmanship which are applicable to all aircraft and situations.

## Description

Fire in the air is one of the most hazardous situations that a flight crew can be faced with. Without aggressive intervention by the flight crew, a fire on board an aircraft can lead to the catastrophic loss of that aircraft within a very short span of time. Once a fire has become established, it is unlikely that the crew will be able to extinguish it.

**Time is critical** from the first indication that there is a fire onboard the aircraft, the crew historically has approximately 17 minutes to get the aircraft on the ground.

## Types

- **Engine Fire.** An engine fire is normally detected and contained satisfactorily by the aircraft fire detection and suppression systems. However, in certain circumstances (e.g. an explosive breakup of the turbine), the nature of fire is such that onboard systems may not be able to contain the fire and it may spread to the wing and/or fuselage. Where an engine fire has been successfully contained, there is still a risk that the fire may reignite and therefore it is still advisable for the crew to land the aircraft as soon as possible and allow fire crews to carry out a visual examination of the engine.
- **Cabin Fire.** A fire within the cabin will usually be detected early and be contained by the crew using onboard firefighting equipment. As with an engine fire, it is still advisable to land the aircraft as soon as possible and carry out a detailed examination of the cause of the fire and any damage.
- **Hidden Fire** A hidden fire may be detected by onboard fire detection systems or by the crew or passengers noticing smoke or fumes, a hot spot on a wall or floor, or by unusual electrical malfunctions particularly when the systems are unrelated. This is the most dangerous type of fire for 2 reasons:

- Hidden fires are difficult to locate and access in order to fight them. The time delay may allow the fire to take hold and do considerable damage to the aircraft.
- A hidden fire may initially be difficult to confirm and the crew may be slow to initiate an emergency landing. The consequence of such a delay may be that the fire becomes non-survivable before the aircraft has an opportunity to land.

## Effects

- **Smoke & Fumes.** Smoke can reduce visibility within the aircraft. An electrical fire in an aircraft typically generates a lot of thick white smoke which can render the flight crew blind; unable to see the instruments or see out of the windows. In such circumstances, unless the smoke can be cleared, the crew are unable to control the aircraft. Smoke and fumes from an in-flight fire are likely to be highly toxic and irritating to the eyes and respiratory system. Smoke and fumes may therefore quickly incapacitate the crew unless they take protective action.
- **Heat.** Heat from fires will affect aircraft systems and ultimately affect the structural integrity of the aircraft both of which will lead to Loss of Control

## Solutions

### LAND AS SOON AS POSSIBLE

**Crews should follow Company approved emergency procedures, and manufacturers guidance regarding the conduct of the flight, management of aircraft systems, identification of the source of a suspected fire, and fire fighting.**

## Protection

At the first indication, or suspicion, of smoke and fumes, or a fire within the aircraft, the flight crew should don smoke goggles and oxygen masks. Goggles and masks need to fit tightly and 100% Oxygen with overpressure selected to minimize any ingress of smoke and fumes into the mask.

Unless smoke and fumes are clearly present on the flight deck, the captain may elect, in order to maintain communication with the cabin crew, to delay fitting his own mask until the co-pilot has donned his protective equipment and is in a position to take control of the aircraft.

### LAND AS SOON AS POSSIBLE

## Plan for Immediate Descent and Landing

Many smoke and fire warnings turn out to be spurious. Passengers and cabin crew reporting unusual smells and fumes may be inclined to downplay the situation for fear of embarrassment if they are wrong. Fire/smoke warnings and reports of smoke or fumes should be taken seriously until there is POSITIVE confirmation that the warnings are false. If it is a real fire, then a flight crew does not have a long time to deal with the situation - time is critical.

The crew should commence descent immediately and begin planning for an emergency landing. An emergency should be declared and ATC told that the aircraft is in descent. In a high traffic area, when there may be a number of aircraft in close proximity, it would be a good idea to declare the emergency and ask for descent and vectors to the closest airfield before commencing descent. However, if that clearance is not immediately forthcoming, descend without it. Putting an aircraft on the ground within 15 minutes of a fire being detected is a challenge if you are at cruising altitude in a modern passenger jet - for example, descent at maximum speed and full drag will still take at least 5 minutes from cruise altitude to sea-level in an A320 - so any delay in commencing descent may prove fatal.

Over western Europe or the eastern seaboard of the USA, there are numerous airfields, both active and disused, which are suitable for an emergency landing. The same is not the case for an aircraft over the open oceans or over sparsely populated land regions such as northern Canada or eastern Russia. If there is quantifiable evidence of an uncontrolled fire, then there is a real possibility of loss of control in the short term, and therefore an off-field landing or ditching may be the only way of surviving the experience.

## Fight the Fire

While the requirement is to land the aircraft as soon as possible, the crew needs to do all that they can to isolate and control the fire. "aggressively pursue" to describe the urgency with which cabin crew need to locate the source of fire and attack it using all available resources, which may include deadheading crew members and passengers. Crews should follow Company procedures for fighting an in-flight fire.

**Fire in the passenger cabin**, a lavatory, galley, or luggage compartment within the cabin during flight is among the worst situations that cabin crew can be faced with.

- **Crew Incapacitation.** Heat, toxic smoke, and fumes building up in this confined space can quickly incapacitate the crew and passengers, and may lead to death by suffocation or the inhalation of toxic gasses.

- **Loss of Control.**
  - Panic among passengers rushing to either end of the airplane may create an out of balance condition making the aircraft difficult to control.
  - Aircraft systems may be damaged leading to a loss of control situation.

Time is critical - an established in-flight fire is difficult to bring under control and so every effort must be made to extinguish the fire as soon as it is detected. See the article Fire in the Air.

## Types of Cabin Fire

Most carriers prohibit smoking in the aircraft. This, coupled with the use of fire resistant materials, has reduced the likelihood of a seat or trim fire caused by a cigarette. Nevertheless, despite highly publicised criminal charges being made against offenders, a small minority of passengers continue to smoke in the lavatories.

- **Galley fire.** Airlines comment that most in-flight and ground fire/smoke events relate to the galley and involve some kind of electrical equipment. Oven fires may occur because of items being placed inside the oven that are not heat resistant (e.g. oven being used as storage place for folders or checklists, or to dry shoes) or because of overheating, or electrical overload/short circuit. In addition to ovens, there is a lot of equipment in the galley which could cause a fire (e.g. coffee or water heaters ON without any water in).
- **Electrical fire.** Electrical fires can be quickly controlled by cutting off power to the piece of equipment concerned. However, the source of the smoke and/or fire, and the electrical system concerned, may not always be easily identified, or accessible.
- **Lavatory fire.** Lavatory fires are often caused by burning cigarettes being placed in the waste paper bin, but there is also electrical equipment inside a lavatory which may cause a fire (e.g. toilet flush, lights, etc)
- **Waste container fire.** Waste container fires may have many different causes: burning cigarettes, excessive heat due to spilled hot drinks or hot plates, or chemical reactions. Waste container fires are normally easily contained.
- **Overhead compartment fire.** The source of these fires is often to be found in passengers' hand luggage (e.g. nail polish remover, medicinal or toilet articles, safety matches, and other prohibited items).
- **Seat fire.** In flight seat fires are rare because of the fire resistance of materials used in construction and are easy to identify. Increasingly complex entertainment systems and services supplied to individual seats does present the possibility of an electrical fire in a seat.

## Aircraft Equipment

- **Smoke detectors.** Optical Smoke Detectors are installed in aircraft toilets and usually in cargo compartments as well. They are usually only activated by a significant reduction in visibility attributable to thick smoke from, say, a waste bin fire. Cigarette Smoke will not usually activate them.
- **Portable fire extinguishers.** Portable extinguishers are to be found in the cockpit and in the cabin. They are designed to fight small fires and as such their capacity is limited. The portable fire extinguishers may contain HALON 1211 (BCF), Water Glycol, or CO2 as extinguishing agents.
- **Automatic fire extinguishing systems.** Some aircraft have automatic fire suppression systems in the lavatory waste bins. Cargo compartment systems usually require a deliberate action from the crew to discharge. On long range aircraft, the cargo fire suppression agents are usually slow release in order to afford protection long enough for the crew to fly to an airport from the worst case position (e.g. where an aircraft has a 180 minutes ETOPS capability).
- **Fire/crash axe.** Fire axes are provided to obtain emergency access to areas and parts of the airplane which are not easily accessible (e.g. behind sidewall, electrical or ceiling panels). The handle is insulated to protect against electric shock. In the past, fire axes might be found in the flight deck and in the passenger cabin but on most carriers, in compliance with anti-terrorism regulations and procedures, axes are no longer carried in the passenger/cargo compartment.
- **Fire protection gloves.** These gauntlet-type gloves are kept in the flight deck and/or in the cabin to protect the user against heat/fire. They can also be used to handle hot or sharp objects. Furthermore, they will provide protection from evaporative cooling at the portable fire extinguisher nozzle during discharge.
- **Smoke protection devices.** There are several different smoke protection devices for cabin crews. PBE (Protective Breathing Equipment), most commonly referred to as a Smoke Hood, incorporates a small oxygen generator, which provides the wearer with Oxygen for a limited amount of time, typically 15-20 minutes. Portable oxygen bottles with full face masks are also carried in aircraft cabins, principally for therapeutic use but may also be very useful in smoke/fumes (although not fire!) situations.
- **Smoke goggles.** Smoke goggles may be found in the flight deck for use with PBE. Some aircraft are equipped with oxygen masks with integral smoke goggles.

- **Fire Blankets.** Some operators have fire proof blankets onboard which can be used to suffocate a fire by cutting off the supply of oxygen.

## Basic Fire Fighting Principles

- FIND AND IDENTIFY source of fire or smoke
- EXTINGUISH fire immediately and aggressively
- COMMUNICATE with the flight crew
- COLLECT all necessary firefighting equipment
- WATCH for re-ignition
- PASSENGERS - re-seat away from fire/heat, instruct to protect nose and mouth with tissues.

CAUTION: If moving passengers away from the source of the fire, consideration should be given to the effect this might have on the centre of gravity of the aircraft - this is particularly the case with smaller regional turboprop aircraft. If moving passenger to new seating, the cabin crew must keep the flight deck informed of their actions.

### **Aggressive fire fighting and timely communication is essential.**

In some airlines, the flight attendant who discovers the fire "owns" the fire - they are the primary fire fighter. The second flight attendant on the scene assumes the role of "communicator". The communicator's first responsibility is to make the rest of the cabin crew aware of the problem and they respond by bringing all of the firefighting equipment to the site to back up the fight. Second (immediate) priority is to advise the flight deck.

As soon as the flight deck is made aware of smoke in the cabin, they will go into the QRH Smoke/Fire checklist. Immediate actions may include turning off the cabin recirculation fans and going to override on the avionics blower and extract valves, in order to start eliminating the smoke, and turning the power to the galleys and cabin accessories OFF. Most critically, if the source of the smoke cannot be positively identified or the fire not immediately extinguished, a diversion will be initiated.

## Communication

Communication with the flight deck is very important since the Captain will need to make a judgment as to whether to continue the flight to destination, land at the nearest suitable airport, or, in extreme circumstances, where the aircraft may soon become uncontrollable, land off-field.

### **Security Considerations**

Communication between flight crew and cabin crew has been made all the more difficult by the security requirement to keep the flight deck door closed and locked. The captain might consider it appropriate for one of the pilots, especially if there is a third pilot/second officer, to go into the cabin in order to assess the situation. If so, security procedures should be strictly adhered to as there is a possibility that the fire might have been started by someone deliberately in order to gain access to the flight deck. Furthermore, in a smoke and fumes situation, it will also be a good idea to keep the flight deck door closed in order to reduce the amount of smoke entering the flight deck.

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