

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 items of common interest and developments within the aviation industry. It is anticipated that, the bulk of 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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POST CRASH FIRES & CABIN FIRE

Definition

Post Crash Fires are fires which occur after an aircraft has crash landed or has impacted obstacles or other aircraft during ground movement, runway incursion, or runway excursion.

Description

In the event of an impact with the ground or an obstacle, which results in structural break-up of the aircraft, a fire can start if fuel comes into contact with hot surfaces. Equally, if containers carrying flammable material are being carried as cargo on an state aircraft (fuels, explosives, etc) are damaged, they may ignite as a consequence of impact, contact with hot surfaces or, in the case of unstable chemicals, the atmosphere.

Fire can spread quickly to the fuselage and through the cabin generating heat, smoke, and toxic decomposition products. If the temperature of trapped smoke and gasses reaches the auto-ignition temperature, flashover will occur, rapidly engulfing the aircraft the aircraft in flames.

Effects

Depending upon the severity of the crash, and any resulting fire, the effect on the aircraft can vary from minor damage to total hull loss. Similarly, the potential casualty consequence of a crash/fire event ranges from no injuries to the loss of life of all on board. Collateral damage and casualties are possible dependent upon the location of the crash.

Defences

- **Aircraft Design.** Aircraft structures and fuel systems can be designed to minimize the quantity of fuel spillage
- **Fuel** - Virtually all large passenger aircraft burn jet fuel and not avgas. The much higher flashpoint of jet fuel reduces the potential for a post crash fire.

Solutions

- **Preparation of the aircraft** - where the crash landing is anticipated, for example if an off-field landing is necessary or the aircraft has a landing gear malfunction, then there are several things that can be done to reduce the probability and severity of a fire:
 - Dump Fuel - if time and aircraft design allow, to reduce the amount of fuel and improve the handling of the aircraft. Note that, in the case of an onboard fire, smoke, or fumes, dumping fuel is not a good idea if it results in any delay to landing the aircraft.
 - Isolate fuel systems - close cross feed valves.
 - Cabin - Prepare the cabin for emergency landing.
 - Cargo - Jettison flammable cargo if possible and practical.

- **Aircraft Evacuation** - Expeditious emergency evacuation of the aircraft will minimize the loss of life in the event of a post crash fire. Consequently, robust training of the cabin crew in evacuation procedures is essential.
- **Engine Shutdown & Aircraft Systems** - To minimize the potential for injury during the evacuation, the flight deck crew will take all necessary actions to shut down and, using fire handles, condition levers, or fire push button (depending on aircraft type) isolate the aircraft engines. Depending upon the degree of damage to the aircraft, this may not always be possible.
- **Rescue and Fire Fighting Services** - Rescue and Fire Fighting Services (RFFS) are instrumental in saving lives and minimizing the damage from a post crash fire. If the crash occurs within the airfield boundaries, the initial RFFS response units will be on site within a very short period of time; often less than a minute. Response to an off airfield crash may take considerably longer due to the time it may take to locate the crash and to the accessibility of crash site.

Contributing Factors

Large amounts of fuel can be carried by modern aircraft and an aircraft crash has the potential to rupture the fuel tanks. Should the spilling fuel be exposed to a spark or open flame a fire may occur. This is particularly true of fuels with low flashpoints such as avgas. While jet fuels have a higher flashpoint and are less susceptible to sparks, exposing them to operating engines or to hot engine components may raise the temperature of the fuel to its auto-ignition point and a fire will result.

CABIN FIRE

General

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.

Description

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

Effects

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 North American and European 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 publicized 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 spoiled 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 fire-fighting 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 passengers 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 fire-fighting 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 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. 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 on the flight deck.

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