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Dealing with an in-flight fire

Introduction

Historically, if there is a cabin or cargo fire and the crew are unable to extinguish it within two minutes from its detection, then they almost certainly will not be able to extinguish it. Furthermore, if there is an inextinguishable fire the flight Crew have on average only seventeen minutes to land or ditch and evacuate the aircraft.

So what does this mean? Obviously the first scenario to be considered is to land as soon as possible. If the source of the smoke cannot be found and extinguished within two minutes, then the Flight Crew should immediately perform the required smoke/fire checklists and find the most suitable emergency place to land. Aircraft manufacturers and the airline industry should, in addition, ensure that their smoke/fire checklists are as simple as possible (besides ensuring adequate legislation/training/fire detection/protection etc. is as up to date and efficient as possible).

As previously stated, the common factor in almost all fire emergencies resulting in a total hull loss with fatalities, is that the time frame between the first indication that something was wrong (e.g. smell, fumes or circuit breaker tripping), and the resultant crash is anywhere from several to a maximum of seventeen minutes. Present emergency procedures depend on isolating the probable cause of the fire, and evaluating the result of subsequent actions, which takes time.



Types of Fire

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 the fire is such that onboard systems may not be able to contain the fire and it may spread to the wing and/or fuselage. Even 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 cabin crew using onboard fire-fighting 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

caused.

Hidden Fire: A hidden fire may or may not 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 two reasons:

1. 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 or even catastrophic damage to the aircraft.
2. 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.

Additionally, the hold fire suppression system will not deal effectively with a lithium-battery fire, although this system could prevent the fire spreading to the other contents in the hold.

Fire on the Ground

With regards to tackling an aircraft fire, then the place to have the fire is on the ground. However, there have still been many cases where such fires have resulted in a major disaster with considerable loss of life. It cannot be over-emphasized how rapidly and catastrophically a fire can spread, as was demonstrated by the British Airtours (Boeing 737-236) disaster at Manchester, UK in 1985. This accident demonstrated how quickly a fire can spread under these specific conditions, and a number of safety recommendations were made following this accident, including fire resistant seat covers, floor lighting, fire-resistant wall and ceiling panels, more fire extinguishers and clearer evacuation rules.

It is important to maintain airflow to the cabin to avoid smoke inhalation by the cabin occupants. It is also extremely important to be certain that the cabin outflow valves and/or cabin vents are open before shutting down the engines. In one case the engines were shut down with the outflow valves closed. The cabin was so airtight that the doors could not be opened and with the engines shut down it was impossible to establish power to open the outflow valve. All the passengers and crew perished in the subsequent fire because the cabin exists could not be opened. It has to be expected that all flight crew members are well acquainted and constantly retrained with the appropriate emergency evacuation procedures for the aircraft on which they are qualified.



Above: 'Fire On the Ground', Manchester Airport 1985



Fire In-Flight

A fire in flight should always be treated as an extreme emergency. If there is immediate confirmation of the fire, such as detectable smoke or flames, then there can be no question of the seriousness and the flight crew should immediately declare an emergency. Early communication with ATC is essential declaring the emergency and the flight crew intent and request for assistance is required. It is distressing to read accident reports of catastrophic fires in flight where the flight crew did not declare an emergency, did not squawk 7700 and/or ask for expedited clearance to land.

Fire Over Water

If a flight is operating remotely over an ocean, and there is certain confirmation of a fire the Flight Crew must immediately prepare for the scenario of having to ditch whilst hoping that the fire fighting procedures are effective in extinguishing the fire. However, the flight Crew must not delay their emergency descent and preparation for ditching. Accident records are full of cases where an entire aircraft was lost by delaying a decision to put the aircraft down.

The problem can also occur when operating over the ocean and the Flight Crew are unable to confirm the presence of a fire. For example, there is a valid warning but the Flight Crew and Cabin Attendants are unable to see/locate the fire. There is a question mark on whether ditching is an option if there is a chance the warning may be false. In this instance, if near a coastal area, the Flight Crew should immediately squawk 7700 and declare an emergency on the controlling frequency. Requesting an intercept could be an option as many countries maintain fighter aircraft in coastal areas with rapid response and intercept capability. An alternative option would be to contact other aircraft in the vicinity to establish a visual inspection.

In the meantime the Flight Crew should still prepare for an emergency descent and ditching. It is important at this stage to determine the condition of the sea if ditching is required. Assistance from any ocean vessel is desirable, and with modern navigation equipment, position reporting prior to a ditching should not be a problem.

General

In the event of any in-flight fire, whether it be over land, water or on the ground, it is critical that the Flight Crew follow their company approved emergency procedures. In addition there must be adherence to the aircraft manufacturer's guidance regarding the conduct of the flight, management of aircraft systems, identification of the source of a suspected fire, and fire-fighting.

References and further information

UK CAA: *A benefit analysis for enhanced protection from fires in hidden areas in transport aircraft*

<http://www.skybrary.aero/bookshelf/books/210.pdf>

Airbus: *Cabin Operations – Managing In-Flight Fires*

<http://www.skybrary.aero/bookshelf/books/1177.pdf>

Boeing: *Flight Crew response to In-Flight Fire, Smoke or Fumes*

http://www.boeing.com/commercial/aeromagazine/articles/qtr_01_09/article_03_1.html

Skybrary: *In-Flight Fires – Guidance for Crews*

http://www.skybrary.aero/index.php/In-Flight_Fire:_Guidance_for_Flight_Crews

Royal Aeronautical Society: *Smoke, Fire and Fumes in Transport Aircraft*

http://aerosociety.com/Assets/Docs/Events/SAFITA_2013.pdf



Safety Targeted Awareness Report from the ERA Air Safety Group

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