

# HOW TO DEAL WITH A FIRE IN FLIGHT

Original idea from Bill MELVIN

## Smell, Smoke ? Land Fast !

In the wake of the Swissair crash, the two largest operators of MD-11s in the U.S. are instructing pilots to land quickly if they smell smoke or encounter major electrical problems. Delta and FedEx have put out the word to *"land now, troubleshoot later."* The FAA has urged since 1980 that pilots smelling smoke should get on the ground ASAP (As Soon As Possible).

Why are you telling you this? Because we did an extensive investigation after this tragedy to resolve problems of smoke and fires in aircraft. Something important came out of that research:



**HISTORICALLY,** If you have a cabin or cargo fire and aren't able to extinguish it within TWO MINUTES from its start time you WILL NOT BE ABLE TO EXTINGUISH IT.

**FURTHER,** if you have an inextinguishable fire you have only FOURTEEN MINUTES to land/ditch and evacuate. If you fail to do this within that time, the fire will have destroyed the aircraft!

The SAA Combi lasted twelve minutes. The Swiss Air flight disappeared from radar within this time. ICAO/FAA and other records show that all aircraft that were lost to fires in the cabin, succumbed within this time frame. So, what does this mean to us ? In my opinion we should take the first item on our checklist, "LAND AS SOON AS POSSIBLE" very very seriously. If we have not found the source of the smoke and extinguished it within TWO MINUTES, I would not worry about dumping fuel unless I could do it without wasting one second. I would probably leave any outstanding checks to my co-pilot while I concentrated on finding the most suitable emergency place to land and attempt to do so within fifteen minutes of the first smoke/fire warning.

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. are as up to date and efficient as possible). Our associations world wide should continue to pressure these organizations to conduct extensive research into this problem so the future of our industry and the lives involved are protected.

The common factor in almost all fire emergencies resulting in total hull loss with fatalities, is that the time frame between the first indication that something was wrong (e.g. smell, circuit breaker tripping), and the fatal crash is anywhere from several to a maximum of eighteen minutes. Present emergency procedures depend on isolating the probable cause of the fire, and evaluating the result of such action. This takes time and, armed with the above knowledge, time is precisely what we do not have.

## **FIRE ON THE GROUND**

The best place to have a fire is on the ground, but there have been many cases where such fires have resulted in a major disaster with considerable loss of life. It cannot be over-emphasized how rapidly a fire can spread.

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 shut. The cabin was so airtight that the doors could not be opened and with 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 exits could not be opened. It is assumed that all flight crew members are well acquainted with the appropriate emergency evacuation procedures for the aircraft on which they are qualified.

## **FIRE IN FLIGHT**

A fire in flight should be treated as an extreme emergency. If there is immediate confirmation of the fire - such as detectable smoke or flame - then there can be no question of the seriousness. Pilots should immediately declare an emergency. Although you should ask for any information you need, such as the closest piece of pavement long enough to land on, you shouldn't ask for permission to do anything.

Tell the ground controllers what you intend to do and request assistance as desired. It is distressing to read accident reports of catastrophic fire in flight where the flight crew never declared an emergency, never squawked 7700 and *asked* for clearance to land. In such a condition, the sky is yours.

Make everyone else get out of your way!

Now comes the hard part.

## **FIRE OVER WATER**

Suppose you are over the ocean. If you have certain confirmation of fire you must immediately prepare for an ocean ditching while hoping that your fire fighting procedures are effective in putting out the fire. However, you cannot delay your emergency descent and preparation for a ditching. The accident records are full of cases where an entire aircraft was lost by delaying a decision to put the aircraft down. Remember, the historical evidence is that you have a maximum of fourteen minutes to ensure a chance of survival.

Suppose you are over the ocean but you don't have *confirmation* of a fire. What you have is a fire warning on the centre-engine of a three-engine aircraft. Knowing how the system works you consider this a valid warning but you can't see it to confirm it. Should you risk an ocean ditching if there is a chance the warning is false? What to do? What you need is information. If near a coastal area, you should immediately squawk 7700, declare an emergency on the controlling frequency and again on the guard channel. Immediately request an intercept if available. Many countries maintain fighter aircraft in coastal areas with rapid response and intercept capability. Otherwise try to get in contact with any other aircraft in the vicinity to establish a visual inspection. (This is one case where you might choose to maintain altitude).

Meanwhile you should be preparing for an emergency descent and ditching. Is it possible to make it to a nearby landing area? What is the condition of the ocean? North Atlantic on a winter's night or South Pacific on a summer's day? If a ditching is required, assistance from any ocean vessel is desirable. With modern navigation equipment, position reporting prior to a ditching should not be a problem.

## **OCEAN DITCHING**

After World War 11, the U. S Navy and Coast Guard experimented with different techniques to determine the best method of ditching in the open ocean. They sank a whole squadron of sea-planes. Generally, there will be two distinct wave patterns. One will be the major pattern of waves with high and deep troughs which is caused by major ocean effects. In addition, there is the minor pattern which is usually different, and caused by the prevailing wind. The result is smaller waves on top of the major waves. Careful observation will show that if there are breakers, the white foam will fall down the backside of the wave, leaving streaks pointing in the direction the wind is coming from.

The best way to land in the open ocean is parallel to the major wave structure and as close into the wind as is possible. The major waves will rise and fall beneath you. You should attempt to land on top of a wave as it passes under you. The aircraft will then settle down into the trough without the waves breaking over. The worst case scenario is to land perpendicular to the face of the major wave pattern.

## **SOME DITCHING TECHNIQUE**

The aircraft could be established with thrust on and held off above the waves (at about 50 feet) using the radio altimeter. As the crest comes up, select reverse thrust. This will make a big splash, but it will put you on top of the wave where you want to be. Nose attitude is important - not too high or too low. Holding the aircraft off and then dropping it in is the technique used by U.S. Navy and Coast Guard seaplanes for open ocean landings. If the sea is relatively calm and you feel confident in holding altitude, 25 feet on the radio altimeter would make for a softer landing.

You might consider using the spoilers to put the aircraft down, as is done with sailplanes, although there is no known recommendation by manufacturers for using this technique. But then neither is there any known recommendation for using reverse thrust. You have to balance the risk involved with the magnitude of the waves you are about to land on.

The main point here is that you want to land on top of, and parallel to, the major wave system. A modern air transport will float for a long time if it isn't flooded inadvertently, which brings up another point. Do not, under any circumstances land in the water with the gear down. This was a mistaken concept passed around a few years ago and it is extremely dangerous. If in doubt, ask any pilot of amphibious aircraft about the danger of landing on water with the gear extended.

Several years ago, a B-727 hit the water on a non-precision approach to Pensacola, Florida when the pilots misread their altimeter. Upon stopping, the top of the fuselage was sticking out of the water. All passengers survived the landing, but a number of them died from fuel-vapour inhalation during the subsequent evacuation. The fuel tanks ruptured because the landing gear was extended.

After landing in the water, it is important for the cabin crew to determine the waterline before opening the emergency exits. Most models of transport aircraft have never been landed in the water, but the manufacturers have usually done water tests with models. On some older aircraft it may be difficult to close a cabin door once it is opened, especially if water is rushing in. If the aircraft has over-wing exits this is usually the preferred choice for evacuation. A commercial transport should float for a long time if the openings are closed to water as much as possible. This means landing with the outflow valves closed, but with some other means of assuring depressurization of the aircraft. A flight deck window or hatch may need to be opened.

If fire and smoke are in the cabin it is important to maintain air flow for as long as possible. But it is also necessary to land with the outflow valves closed and yet not have the situation where the cabin doors cannot be opened due to cabin pressure. Each aircraft will be different, but if some prior thought is given to the problem, with an understanding of the issues it should be possible to devise a plan for each individual aircraft type.

There have been cases where a military aircraft crashed at sea during carrier operations and the aircraft had to be sunk because it wouldn't sink by itself. A *deliberate* water landing should have the best chance of assuring structural integrity, especially if the landing gear is retracted and the touchdown is properly executed.

## **FIRE OVER REMOTE LAND AREAS**

If an emergency landing is required in a remote land area some consideration should be given to a water landing. The two major causes of death in aircraft accidents are fire and impact, both of which can be minimized with a water landing. Many remote regions have no good landing area, but have reservoirs, lakes etc. which might make a good ditching spot if the aircraft can then be safely evacuated. It may be possible to land in shallow water or close to a shoreline or island where the risk could be further minimized.

Without a major wave to deal with, the aircraft can be flown onto the water. However, a major problem with water landings in open areas is inadequate reference for depth perception which makes it difficult to judge height above the water. This can be solved by having the non-handling pilot call out radio altitudes. Remember, pitch attitude is extremely important in a water landing. Aim to touch down in a relatively flat attitude with the nose slightly raised. Too low or too high can result in disaster.