Report by: J. Schmid

Aircraft Fire

September 2nd, our MD11, Swissair 111, took off in JFK at 2353lt and headed towards New Foundland for the Atlantic crossing, destination Geneva. They had quite a good load, about 85% of the seats were occupied and 14 crew members were on duty, 12 in the 3-class version cabin and two experienced pilots in the cockpit.

About 56 minutes into mission - the cabin crew was serving meals - the pilots noticed a strange smell in the cockpit. They looked around, but could not find any source of that unusual odour. 2 minutes later they realised, most probably in the lightbeam of their torches, light smoke.

According our standard operating procedures both pilots protected themselves with the quick donning full-face oxygen masks. By doing that they protected themselves, but on the other hand lost their most sensitive antenna, the nose.

As the ATC channel was quite busy they used a „pan pan pan“ call to get attention, informed ATC about the actual situation and requested initially a diversion towards Boston, the closest Swissair destination. After the advise, that Halifax is closer they changed the request and started diversion towards Halifax, initiated descent from the actual level 330 in vertical speed mode and descended a little later, from FL 297 downwards to the newly cleared altitude of 10000 ft in emergency descent configuration, that means, throttles idle, speed brakes fully deployed and an indicated speed of 320 kts.

During that descent the pilots contacted the cabin crew and asked if they observed any smoke in the cabin. After a negative answer they informed the maître de cabin about the intention of the diversion and ordered them to stop service and prepare the aircraft for landing. They closed the cockpit door and started with investigation and emergency checklist work. As they had no actual warning, no caution light, no chime, no bell, they checked all the different aircraft systems on the system display. No abnormalities could be found.

Down at 10000 ft, too close to the airport for a normal landing, during a delaying turn to the north, things aggravated quickly. The first indication, beside the slightly visible smoke, which was never dense as long as we have recordings, was the quitting of the autopilot with the appropriate warning. The warning was not or could not been reset. The aircraft was then flown by hand by the first officer. 30 seconds later something dramatic must have happened in the cockpit. Both pilots transmitted together; „Emergency, we have to land immediately“. This call was made without an internal conversation. One minute later all recording stopped, as electrical power failed. Another five and a half minutes later the aircraft crashed into the sea killing all 229 persons on board.

Hours later I was dispatched as a member of the go team to the accident site responsible for the investigation company’s side. The same evening I could circle the ocean near Peggys Cove in a Hercules, a 4-engined military aircraft, still in the search and rescue mode just to discover that there was practically nothing left.

Where do we stand today: We know, that the aircraft was disabled by fire. We know that the fire was behind the panels in the ceiling area in the first class galley and in the cockpit. We know that the temperatures in the cockpit were finally not to survive. But we still do not know where the fire started and why the fire started.

We expect that the final report by TSB Canada will be available summer 2002 and I am personally afraid that the question regarding the root-causes will remain unanswered.

Telling you that story, I want to highlight my personal involvement in an accident caused by fire and the lessons my company learned from that event.

Fire in a two pilot aircraft

Don't be afraid, I will not continue the discussion about 2- or 3- men ops in long-range aircraft. But I want to focus on the question: How to handle a fire in a two-men long-range aircraft. What does it mean for the decision making process? What does it mean for the communication if you can not dispatch a flight crew member out of the cockpit? What does it mean for the initial, what for the recurrent training for flight attendants? And what does it mean, if you don't have an airport in reach the next 15 minutes, if you are overflying oceans, deserts, jungles?

In a second part I will talk about our aircraft, the respective equipment and some aspects of certification criteria.

Get me right, its not to put the blame on someone, its not to point fingers, its only about questions of a flight safety officer who lost two friends in an aircraft disabled by fire.

Decision making process

It would be wrong to be focussed on the accident only and to try to establish a procedure in the hope we could increase the survival chances in what has happened and by doing so, deteriorate the procedures for all other possible scenarios. Each situation will be different, and a canned solution is not possible.

The decision making is the keypoint. During troubleshooting and/or during descent regularly take a step back to get an overview over the situation in order to alter or make further decisions.

Visible smoke must be used as a decision criterion. It is a clear sign of a physical change of any component or wire. Smell only is very difficult to classify and can in most cases not clearly be identified.

Do not hesitate to declare emergency. It helps to get an overall priority and to do your job without being disturbed by communication you are not interested in.

Consider fuel dumping, but be aware that a fire can influence your electrical system considerably and that certain systems do dot work anymore as they should. Also by intentionally deactivating major sources of electrical power some fuel dump valves or fuel pumps cannot be operated anymore.

Be land minded. Whenever the smoke source cannot be positively identified and eliminated, land as soon as possible. Have in mind that a smoke source generally is driven by a fire and the situation can deteriorate within a very short time.

Initiate an emergency descent early enough to increase your freedom of action. If a landing decision has been made descend to an altitude as low as possible, e.g. MOCA/MORA (Minimum Obstacle Clearance Altitude/Minimum Off-Route Altitude).

Be mentally prepared for a forced landing/ditching in case of a rapid deterioration. At MOCA/MORA there might be a better chance for a forced landing /ditching in case of a deterioration in a way that hurts the airworthiness of the aircraft. Consider depressurising the cabin altitude to prepare for a smoke evacuation.

Do not delay your decision plan by checklist work or comfort items. Checklist work is a good help on your way for an emergency landing. However the checklist work can be stopped at any time if a landing possibility is assured.

In the absolute majority of the cases with uncontrolled fire, the flight never continued longer than 10 to 15 minutes. Either they landed safely or the accident was unavoidable.

Communication Cockpit – Cabin

The communication between cockpit and cabin does not start when an emergency situation turns up. The base for a good communication starts much earlier. It starts with the culture and the recognition of each other's tasks, it continues through some common training and shared CRM.

For the flight itself the base for a good communication starts with a common briefing. It is the best moment to get to know each other and to highlight some procedures in normal, abnormal or emergency operation. If you start to communicate if all of a sudden an emergency situation turns up, then you are late, may be too late.

Normally the cabin crewmember in charge is the contact person for the commander. He or she will need some time too, to inform the rest of the cabin crew about the actual situation and the respective intention of the captain.

Initial- and Recurrent-Training

Fire fighting is a main topic in all training-syllabi for flight- and cabin crewmembers. But this training, normally separated between cockpit and cabin should not only be focussed on the specific subjects. Cockpit crewmembers are perfectly trained how to fight fires in the engines, the APU or in the cargo holds. Cabin crewmembers know how to fight fires in the cabin, in the galleys, the ovens, the waste containers in the toilets.

But what about fire behind the panels, with smoke coming through slots of the ceiling-panels. I know, aircraft are built in such a way that this can not happen and they are certified accordingly. But if the unplanned, the unforeseen the impossible happens? These scenarios have to be trained in a common training, communication in such a case has to be established and there should be no hesitation to use the crash axe to get access and to use the fire extinguisher in uncommon places.

Decision making is a crucial part during those unpredictable situations. So this must also be a part of the training, scenarios can and should be discussed during joint sessions.

Fire extinguishers should be discharged at the base of the fire. What to do if you can not see a base of a fire.

Here I would like to refer back to one of my subtitles:

Fire in a two pilot aircraft

Both pilots are needed in the cockpit, there is no direct help coming from the flight deck and time is a decisive question. So empowerment of the cabin crewmembers might be a keyword.

The Aircraft

Let me change now from procedural aspects to the aircraft itself and look into the fire and smoke detection system.

Fire and Smoke Detection

Historically seen, the engines are the most vulnerable part of the aircraft. Piston engines produced quite frequently carburettor fires, so a respective detection system was developed. Adaptation was made for the jet engines, double fail safe loops were introduced and normally two extinguishing bottles are available. As next came the APU as an other hot item which needed detection and protection.

With the introduction of bigger Jets with bigger cargo compartments fire and smoke detection and extinguishing systems were introduced for the lower parts of the aircraft. Initially only on the big birds. Also here we had to learn the hard way, the downing of a ValueJet DC-9 triggered finally the decision to implement a fire detection and extinguishing system also on smaller jets.

But what's about the other areas, what about smoke and fire in the galley overhead, the cockpit overhead and the avionics compartment? So far, electrical power has been underestimated as source for fire.

Miscellaneous Smoke Detection System

During the process of investigating the loss of our MD11 we were brutally faced with the fact, that there was a fire where fires should not occur. A fire which could not be put out and which finally downed the aircraft. Even if the possibility of a recurrence is very small, perhaps close to nil, we could not wait in a passive mode. So we developed together with the manufacturer a advanced smoke detection system.

The system was finally approved from FAA after test flights during June this year and it will be installed in all our MD11 aircraft during the ongoing heavy maintenance visits or special ground times.

The system is designed to detect presence of smoke in the galley overhead area, the cockpit overhead and the avionics compartment. The system consists of dual-loop smoke detectors, control electronic units, a miscellaneous smoke alarm panel, MISC SMOKE light P/B's on the glareshield and a miscellaneous smoke panel. In the event of detected smoke in any of the specified areas, the following non-sequential events will occur in the cockpit:

1. MISC SMOKE indication lights on the glareshield light P/B's will illuminate.
2. Miscellaneous smoke alarm panel will emit an audible alarm
3. Appropriate SMOKE indication light will illuminate on the miscellaneous smoke panel indicating the particular zone.

The audible alarm can then be silenced.

In addition a video camera monitoring system is incorporated to display the different areas on the cockpit monitor. Infrared cameras and infrared illuminators are mounted in each of the three areas, They can provide a visual display on an area upon selection by the flight crew.

A halon delivery system is installed to fight a fire. Halon bottles are available for each of the three detection areas.

Procedures

During the cockpit preparation the system including clear pictures from all 8 cameras are checked on the video monitor display unit. This visual reference serves mainly to eliminate possible false warnings

If a warning appears, the respective emergency procedure has to be followed. Detection and verification are the first points, followed by the SMOKE/FIRE FIGHTING procedure that differs slightly between cockpit, galley and avionic compartment.

In any case a close co-operation between cockpit and cabin crew is of utmost importance and it will be trained during our emergency procedure refresher.

Certification Criteria

Whenever accidents happen where the blame can not be put on the pilots, be it TWA 800, the ValueJet crash or the SR111 (investigation report still pending) the respective Safety Boards, be it NTSB or TSB Canada, publish some recommendations.

In the aftermath of our accident, TSB Canada released already a few recommendations regarding recorders, insulation material usf. On August 28, the TSB issued three additional recommendations intended to address deficiencies in regulatory requirements, world-wide industry standards and practices which considerably compromise the safety of passengers and crew.

The first recommendation calls for improved flammability standards for materials used in the construction of aircraft. The current standards in place are based on survivability considerations in case of a post impact fire, after an aircraft has crash-landed. But we also have to look into the situation developing in a in-flight fire scenario.

The second recommendation deals with more appropriate testing procedures for aircraft electrical wires. The board believes „that the existing certification procedures are inadequate“ and it therefore urges for „a far more stringent certification test regime for electrical wires“. „Test conditions should be very similar to what would be encountered in an actual aeroplane“.

The last of these three recommendations refers to various potentials for certain other aircraft components to aggravate a fire in progress.

TSB confirmed that these deficiencies the TSB accident investigators found during their investigation are not unique to the crashed aircraft type. „They exist in many other types as well like currently used Airbus and Boeing aircraft. These materials were once certified for use and installation by the regulatory agencies“.

It is now up to the US Federal Aviation Administration and its European counterparts, the joint aviation Authority, to change requirements in these areas were such and similar deficiencies have been identified.

There are positive signs in this direction and I would like to close with a quotation from JAA director Klaus Koplin:“We can not expect the manufacturers and operators to solve these issues by there own efforts in due time. Therefore we have to determine soon what priority the recent TSB recommendations will get in Europe“.