Smoke and Fire Events for 2001

In April of 2000 I presented a paper at the SAE Conference in Daytona Florida. This paper was later published by the SAE. The general conclusions of this paper were as follows:

1. There appears to be an under reporting of significant events in the FAA incident database.
2. The data in the SDR database under reports the significance of the problem.
3. There is an average of more than one unscheduled landing a day due to smoke or fire based only on SDR data.
4. There are a very high number of smoke or fire events occurring on transport category aircraft in the US and Canada.
5. Approximately 82% of the high temperature events were related to aircraft electrical systems or components.
6. In most cases the crew had limited ability to recognize or control the malfunction, or have access to the area of the malfunction.
7. SDR reports involving tripped circuit breakers being reset for systems with internal or external short circuits indicate that resets can be extremely hazardous.

Since the publication of this paper there has been numerous questions as to the whether the data was anomalous or if it is still current. To answer these questions I undertook to do another analysis of SDR data for the year 2001. The results were very similar. The following is a compilation of that analysis.

FAA SDR records produced 1093 records of smoke and fire sans duplicates for 2001. Of these events 991 actually had smoke or fire related to them. As in my earlier paper I sorted out the events with subjective descriptors as to whether the event would be considered High Temperature or Air Contamination, Crew Accessibility to the event location, and whether the component was Electrically Related or not.

> 4. There are a very high number of smoke or fire events occurring on transport category aircraft in the US and Canada.

The following table gives an overview of all the events. Of significant note is that there were 991 events involving "High Temperature" or "Air Contamination" in the SDR database for the 2001 year. This equates to 2.72 smoke or fire events per day. Forty-one percent of theses events were of the high temperature condition and electrically related.

2001 SDR Smoke and Fire Event Count

Electrical?	Part Condition	Count	Percentage
TRUE	HIGH TEMPERATURE	452	41%

FALSE	AIR CONTAMINATION	362	33%
FALSE	HIGH TEMPERATURE	130	12%
FALSE	N/A TO FUSELAGE	64	6%
TRUE	AIR CONTAMINATION	47	4%
TRUE	OUT OF TOLERANCE	15	1%
FALSE	OUT OF TOLERANCE	14	1%
TRUE	N/A TO FUSELAGE	9	1%
	Total	1093	100%
	High Temperature/Air Contamination	991	91%
	Duplicates (Not included above)	45	
Per day		2.72	

1. There appears to be an under reporting of significant events in the FAA incident database.

I will not be addressing this here. In the earlier paper I noted that there were only 21 reports relating to smoke or fire in the FAA Incident database when there were well over 700 in the SDR database.

2. The data in the SDR database under reports the significance of the problem.

This was my opinion based on numerous reports from operators on what the criteria they used to send in an SDR. Since this time the FAA has moved to improve SDR reporting. The jury is still out on its effectiveness.

3. There is an average of more than one unscheduled landing a day due to smoke or fire based only on SDR data.

The following table shows the precautionary procedure utilized by the crew. Of note is that 24% of the procedures were "None". This means there was not an entry for this in the report. The Secondary and Tertiary Precautionary Procedures were not analyzed for this report. If quantified this would have increased the numbers slightly. Even with this there were 342 flight interrupts for the year, or nearly one per day due to smoke/fire/fumes. The rate for un-scheduled landings was 0.7 per day due to smoke/fire/fumes.

Flight Interrupts in Bold
Precautionary Procedure Used For All Events

Precautionary Procedure	Count	Percentage
OTHER	280	26%
NONE	267	24%
UNSCHED LANDING	**258**	24%
DEACTIVATE SYST/CIRCUITS	147	13%
RETURN TO BLOCK	**71**	6%
ENGINE SHUTDOWN	27	2%
ACTIVATE FIRE EXT.	18	2%
ABORTED TAKEOFF	**13**	1%

EMER. DESCENT	6	1%
MANUAL O2 MASK	3	0%
DUMP FUEL	2	0%
INTENTIONAL DEPRESSURE	1	0%
	1093	
Flight Interrupts	342	31%

Of greater significance is that about a third of the flight interrupts mentioned above were of a high temperature nature as depicted in the table below as a Part Condition "A". This equates to about one flight interruption with a cause suggesting a higher level of risk every three days.

5. Approximately 82% of the high temperature events were related to aircraft electrical systems or components.

As shown in the following table the numbers for 2001 are very similar with 78% of the high temperature events being related to electrical systems.

HIGH TEMPERATURE	582	
High Temp Electrically Related	452	78%
High Temp Not Electrically Related	130	22%

6. In most cases the crew had limited ability to recognize or control the malfunction, or have access to the area of the malfunction.

The determination as to whether the crew had access was first dependent on if they knew what the problem or source of the smoke/fire was. If they did not know the source or the location of the generation of the smoke/fire or this location was not accessible to the crew in-flight so they could have "No Access". If the source would allow them to isolate the generator of the smoke/fire, but they did not know the source then the control was "Possible". From the following table it can be seen that in the large majority of cases the crew had neither "Access" nor "Control" over the event. For the most part they did not know what was causing the generation of the smoke/fire.

Crew Access?	Crew Control?	Count	
N	N	701	64%
N	Y	114	10%
Y	Y	109	10%
N	POS	63	6%
N/A	N/A	42	4%
N	MIN	12	1%
MIN	N	11	1%

MIN	Y	10	1%
MIN	POS	9	1%
Y	N	5	0%
MIN	MIN	4	0%
Y	POS	4	0%
UNK	UNK	3	0%
N	UNK	2	0%
UNK	N	1	0%
N/A	Y	1	0%
Y	MIN	1	0%
N	N/A	1	0%
		1093	

7. SDR reports involving tripped circuit breakers being reset for systems with internal or external short circuits indicate that resets can be extremely hazardous.

No numerical data was collected on the earlier report as to how many times crews were resetting CBs in-flight, but the frequency seemed much too high to this investigator. Because of that conclusion, work was initiated in cooperation, with the ATSRAC and the FAA to educate the pilot force. The education process was at least a partial success. Subjectively there are less of these events, but they are still there, and with too great of a frequency. I found several instances during the reporting period where crews reset tripped CBs in-flight. In no case was the item that was being re-powered critical, or even needed, for continued flight.

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