Committee Secretary
Senate Standing Committees on Rural Affairs and Transport
PO Box 6100
Parliament House
Canberra ACT 2600
Australia

Pilot training and airline safety including consideration of the Transport Safety Investigation Amendment (Incident Reports) Bill 2010

Public Submission by: Dr Susan Michaelis PhD

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Dear Committee members,

As a former Australian commercial pilot, it has recently been highlighted to me that the above inquiry is being held. I feel I am uniquely qualified to give evidence on the areas involving reporting and maintenance, as I have recently been awarded a PhD by UNSW, the University of New South Wales, that directly relates to these areas.

After commencing flying in 1986 I was awarded the Civil Aviation Authority (CASA) Sir Donald Anderson award for academic merit in 1987, then going on to fly for more than 5000 hours within the Qantas regional network until 1997, as an Australian Airline Transport Pilot. I then commenced researching the issue of aircraft contaminated air after having my medical certificate rescinded in 1999 by CASA after exposure to aircraft engine oils contaminating the bleed air.

I am the Head of Research for the Global Cabin Air Quality Executive (www.gcaqe.org), which represents 20 aircrew unions with around 150,000 members worldwide, specifically on the issue of aircraft contaminated air. I have given evidence to Governments, International conferences, global inquiries worldwide and published a variety of papers on the subject of contaminated air. My PhD in the field of Safety Science is titled: **"Health and Flight Safety Implications from Exposure to Contaminated Air in Aircraft"**. (ISBN: 978-0-95-554377-7)

In 1999 I called for and gave evidence to the Senate Inquiry into cabin air quality and more recently in 2008, I was asked to give evidence on behalf of the GCAQE to the ongoing CASA Expert Panel on Aircraft Air Quality (EPAAQ).

The areas of research in my thesis that relate to your inquiry clearly demonstrate that there are issues you may find of interest and directly relate to your terms of reference. While these do not cover reporting and aircraft maintenance across the whole Australian aviation industry, they relate to a very specific area within the industry and therefore provide evidence action needs to be taken. I will set these out separately after giving a brief overview of the aircraft contaminated air issue

Background: The issue of synthetic jet engine oils leaking into aircraft cabin air supplies dates back to the 1950s and is a consequence of using highly heated air bled from engine compressors as a means to supply the cabin with ventilation and pressurization. The heated oils contain a range of chemicals including organophosphates and a wide range of substances that are released upon thermal degradation and pyrolysis. The substances include irritants, neurotoxins and sensitizers and pose a serious toxicity concern, thus posing significant risk to crew and passenger flight safety and health. The aviation industry has been aware of this

problem since the early 1950s, with exceedingly extensive documentation to support this, as shown in my thesis, yet has failed to deal with the problem adequately.

Senate Inquiry findings: In 2000, the Australian Senate Inquiry into cabin air quality made a series of strong findings and recommendations related to cabin air quality, including recognition that there was *'strong evidence of a tendency of pilots to under-report incidents.'* However the Government failed to implement virtually all the recommendations.

Contaminated air, under-reporting

Accurate and complete reporting is absolutely vital so that information can be listed, chronicled and shared between the various bodies within the aviation industry to ensure safe flight is not being compromised.

Cabin air supplies contaminated by leaking synthetic jet engine oils are well recognized to be under-reported by pilots and airlines on a not infrequent basis. Despite the fact that all oil and toxic fume events are reportable major defects, CASA incorrectly insisted until 2004 that such events did not need to be reported. The FAA in 2006 reported that pilots and airlines were not reporting smoke and fume events as required. [1],[2] Fume events have been seen by many as non events (TSB[3]), a normal part of flight (ATSB[4]) and therefore under-reported (ACARM[5]), a nuisance (BAe[6]) and more of a health problem than an aircraft defect. (CASA[7]) Airlines have even advised their crews not to report transient fume events as these were regarded as normal, with the regulator incorrectly accepting this as satisfactory. (DHL[8], CAA[9]) Fume events are no longer seen as rare by many bodies including the RAAF[10], USAF[11] and the ATSB.[12]

My research extensively reviewed a wide range of contaminated air events and the consequences of breathing contaminated air and came to the conclusion that under-reporting is a significant problem. While the airline industry suggests that fume events are rare and often attempts to put a number on the frequency of such events, the only reliable data available is:

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1. FAA (2006) US Federal Aviation Administration. US/Europe Aviation Safety Conference. Presentation by Jim Ballough, FAA Director Flight Standards Service. 'Smoke in the Cockpit' 8th June 2006
2. FAA (2006) US Federal Aviation Administration. Flight Standards Information Bulletin for Airworthiness (FSAW)06-05A, Guidance for Smoke/Fumes in the Cockpit/Cabin 29 March 2006
3 . TSB (2000) Transport Safety Bureau, Canada. Interim Report on Swissair 111 Accident. December 2000
4. ATSB (2002) Australian Transport Safety Bureau. Report. Occurrence Brief 200205865. BAe 146, VH-NJX. 2 December 2002
5 . Michaelis (2007) Aviation Contaminated Air Reference Manual. UK Contaminated Air Events Database. Chapter 12, Appendix 2. ISBN: 9780955567209, 2007
6. BAe (2001) British Aerospace BAe 146 Inspection Service Bulletin. BAe ISB 21-150. Air Conditioning - Inspect Engine Oil Seals, APU and ECS Jet Pump & Air Conditioning Pack for Signs of Oil Contamination. BAe Systems. March 2001: BAe (2002) British Aerospace BAe 146 Inspection Service Bulletin. BAe ISB 21-156: Air conditioning - To Inspect Air Conditioning Sound-Attenuating Ducts For Signs of Oil Contamination. BAe Systems. October 2002
7. CASA (2003) Civil Aviation Safety Authority, Australia. CCH Australia OH&S Magazine, Feb-Mar, 2003, High on the Flight Deck, H. Borger
8. DHL (2007) Info 010/07 Issued by Chief Pilot: Cockpit Fumes - Fault Finding. 26 January 2007
9. UK House of Commons (2007) UK Government, House of Commons Hansard, T. Ellwood, [127960] 19 March 2007
10. Singh B. (2004) Royal Australian Air Force. Aviation Safety Spotlight 0304. In-Flight Smoke and Fumes, 2004
11. Rayman R., McNaughton G. (1983) Smoke/Fumes in the Cockpit. Aviation, Space and Environmental Medicine 67: 738-740,1983
12. BASI (1997) Bureau of Air Safety Investigation, Australia. Occurrence Brief 199702276. BAe 146 - VH-NJF. 10 July 1997

- Significant under reporting is occurring;
- Fume events are not rare;
- Less than 4% of fume events are reported; (Michaelis[13])
- It is not possible to determine a reliable rate of contaminated air occurrences. (EASA[14])

The issue of bleed air contamination is one involving design and expected functionality of how such systems work along with ongoing maintenance and operational/seal wear issues. This system therefore explains the high frequency of contaminated air events and is a regular and 'normal' occurrence, despite oil leakage being an aircraft defect. EASA has correctly stated that it is not possible to determine a reliable rate of contaminated air occurrences but the vast majority of fumes are related to oil, while the FAA has recognized that under-reporting is occuring. With the evidence available, this ongoing problem is foreseeable and one that has major implications for air transport, safety and human health. Under-reporting which is without doubt a serious problem, allows the problem to remain unaddressed.

I suggest you discuss with AIPA and the AFAP how the under-reporting problem should be addressed in Australia.

Contaminated air - Maintenance issues: The high frequency of 'less obvious' aircraft contaminated air events, explained as a function of the design and use of oil bearing seals allowing oil to leak into the cabin air supply is effectively ignored, in favour of focussing on the far less frequent major oil seal failure. This is coupled with maintenance / engineering under-recognition of the problem for a number of reasons clearly identified in my research for the following reasons:

- Multiple fume events recorded as one;
- Contaminated air events accepted as recurring ongoing minor fault;
- Contaminated air events inappropriately not regarded as a major defect;
- MMEL applied inappropriately when bleed air system suspected to be contaminated;
- Engineering reports no fault found, sending aircraft back out with fault reoccurring again;
- Aircraft inappropriately cleared to fly with request to report further;
- Lack of time to fully investigate oil leak reports: source often difficult to find;
- Reports advised to engineers verbally only and reported in aircraft tech log 'for information only'.

Other factors: The failure to accurately report and therefore identify the true extent of this problem, has led to several other issues clearly identified in my research including:

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13. Michaelis S. (2003) A Survey of Health Symptoms in BALPA Boeing 757 Pilots. Journal of Occupational Health and Safety, Aust & NZ.19: 3, 253-261, 2003
14. EASA (2009) European Aviation Safety Agency Advance Notice of Proposed Amendment (A-NPA) No 2009-10 - Cabin Air Quality Onboard Large Aeroplanes. 28 September 2009

- There are significant short and long-term health effects being reported as a direct result to documented exposure events that validate claims of adverse health effects in exposed individuals;
- Air monitoring studies undertaken cannot be used to suggest the air supplied in aircraft is safe and healthful;
- There is extensive data showing that the aviation industry has been aware of exposure to aircraft contaminated air and hazardous effects since the 1950s. The aviation industry and Governments globally have failed to deal appropriately with the problem, particularly as it was known in 1954 that inhalation exposure to highly heated synthetic jet oils was toxic and hazardous;
- The 1950s and 1960s awareness that synthetic jet engine oils leak as a feature of using bleed air with the concerns of increased toxicity hazards with temperatures in more modern engines rising in the future, was then ignored in favour of increased engine temperatures for economic and operational reasons;
- Crews and passengers breathing contaminated bleed air are exposed to serious inflight safety hazards with potential adverse health effects.

I am very happy to provide you with any additional information requested and suggest you look specifically at chapter 6 in my PhD thesis which in detail gives the reasons for under-reporting and acceptance by the aviation industry that allows this problem to remain unresolved.

I suggest that a variety of actions must be undertaken including advising air crew that all suspected oil or contaminated air events are reportable as a defect, engineers are to carry out appropriate investigations according to the legislation and the regulator needs to ensure full understanding of the problem based on current knowledge, with appropriate actions implemented. It is no longer acceptable for the aviation industry to simply say that the reporting system is working, as in this case, it is clear that it is not.

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