Edit note

Routine mechanical causes of aircraft air supply contamination

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The sources of air supply contamination are reviewed. They include the sometimes heavily contaminated air at ground level at an aerodrome that is inevitably drawn in to the air supply system. Volatile contaminants carried in the cargo hold of an aircraft can also find their way into the cockpit and passenger cabin. During a flight, throttle changes can exacerbate oil seal leakage and automatic control of the throttle is likely to force almost continuous changes in the loading imposed on seal configurations. Contamination from some of these sources could be significantly reduced by relatively simple ...

Keywords: bleed air autothrottle, auxiliary hold contamination

1. INTRODUCTION **(EXCERPT 1)**

The primary focus of this paper is routine mechanical causes of air supply system contamination—especially with oil fumes—in the cabin and cockpit of transport- certified aircraft during normal operations. Nonroutine “upset condition” oil fume events that are caused by mechanical failures or malfunctions are also referenced, but the primary focus is the routine mechanical sources of fumes supplied to the cabin and flight deck, which are typically not documented.

The content of this paper is derived from the author’s 30-year career as a mechanical engineer, with extensive experience in the manufacture and functional operations of gas turbines, propellers, engine nacelles and airframe systems. In his capacity as a systems engineer with multiple airlines, he had contact with crews at airlines across Europe who formally reported cabin air incidents with a suspected or demonstrated mechanical cause. He was involved in handling and investigating the incidents that pilots recorded in the crew technical log, and personally interviewed and debriefed the crews. In his experience, most airline operators took technical log reports seriously. However, the subsequent maintenance investigations often fail to resolve and satisfactorily explain what occurred during the event period.

“Upset condition” fume events are usually character- ized by an objectionable and persistent odour, which is sometimes accompanied by a visible smoke/haze. During the author’s career, he often interviewed affected crews upon arrival in an effort to locate the mechanical fault.

He noted that crew members often seemed confused and disoriented, and their accounts could differ regarding when the fumes were apparent and what they smelled like in flight.

EXCERPT 2:

CONCLUSIONS

There is ample opportunity for exposure to low levels of oil fumes in the cabin and flight deck of transport- certified aircraft on a routine basis. This is particularly disquieting for crews, who must work in aircraft environ- ment on a regular basis.

The aerospace industry claims that it is essentially able to self-regulate because all major countries have dedicated and talented people working in their companies to ensure safety. Perhaps this contributes to the compla- cency typically shown by aviation licensing regulatory and investigation bodies. Given the inherent financial conflicts of interest between safeguarding health and satisfying corporate shareholders, the present arrangements should be carefully scrutinized and appropriately altered to eliminate such conflicts.

Despite published studies describing the health and safety risks of exposure to oil fumes, there seems to be a general disregard of the need to implement controls. There are procedural changes (e.g., revised main engine/ APU startup sequences) that could be readily implemented to enhance the cabin environment and reduce the risk of exposure to oil fumes for both the crews and passengers.

Design modifications could also be implemented. As one example, the present author instigated the design and certification of a new concept of compressor seal for both fan engines and APUs on a number of aircraft applications. This “hydropad” seal is used by major APU manufacturers and some engine manufacturers in selected programmes to satisfy compressor shaft sealing requirements. Sealing design is still an area worthy of additional research and development.4

The major manufacturers closely protect operational data for their aircraft systems, making it very difficult for component manufacturers and innovators to propose suitable innovative designs. Some trial installations have, moreover, been impeded by improper operation, leading to premature rejection.

The aerospace industry needs to seriously consider operational and design modifications to ensure that everyone has a safe working environment and safe carriage to their destination.

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