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Danger of Continuous Smoke Not Tested for Certification

Continuous smoke remains a recognized danger, yet smoke evacuation standards remain based on the presumption that the smoke stops the moment aircrews can no longer see to effectively control the airplane.

Pilots who have experienced it say that a fire in the fuselage is worse than an engine fire, as a conflagration inside the cockpit, cabin or belly hold tends to quickly fill the inside of a pressurized fuselage with blinding, toxic smoke. The speed with which such smoke4 can accumulate remains a vivid memory.

The presence of smoke in a fire emergency also underscores a fundamental tenet of aviation: to effect an emergency landing, the pilot must be able to read vital instruments and to see outside.

Yet testing for the worst-case condition remains inadequate, according to a recent white paper prepared by the **Aerospace Planning Group** of Bethesda, MD. This paper is based on a trail of industry documents going back to the early 1980's (see p. 1box).

The paper was released last week concurrent with the demonstration of an emergency vision device (see p.8 story).

The paper highlights the gulf between the hazard posed by continuous smoke and FAA test standards for smoke evacuation, which assume the danger is temporary. The **National Transportation Safety Board** (NTSB) has a long-standing concern about continuous smoke. In October 1983, the Board recommended that the FAA "change as necessary the procedures contained in FAA-approved airplane flight manuals (AFM) of transport category airplanes relating to the control and removal of smoke to assure that these procedures address a continuing smoke source."

Continuous smoke scenario not tested

Advisory Circular 25-9A of January 1994 outlines the current FAA guidance on smoke emergencies. The circular affirms that "incidents of fire of smoke that cannot be extinguished continue to occur." Therefore, the circular maintains, procedures should be developed to account for the fact that smoke generation may be continuous, especially from fires in inaccessible areas. Indeed, the crash of **ValuJet** flight 592 in 1996 and of **Swissair** Flight 111 last Sept. 2 are two cases where smoke was reported in the cockpit – and continuous smoke from an inaccessible fire was likely (in the belly hold of the former and in the overhead cockpit panel in the latter).

However, when it comes to smoke evacuation (or dilution) tests, the circular says "smoke generation should be terminated" once the instruments are obscured. At which point, smoke evacuation (or dilution) should restore visibility within three minutes, according to the circular. The three minutes, by the way, is the approximate time when the crew of the ValuJet DC-9 reported smoke in the cockpit and the time the NTSB co9ncluded the airplane crashed into the Florida Everglades. Since an airplane can crash in such a brief time, some believe that even three minute allowance for smoke evacuation should be reduced significantly. (i.e., two minutes).

The circular does allow for and optional test against co9ntiuous smoke, but the implications of a mandatory requirement are evident: cockpits would have to be equipped with stronger evacuation fans or with emergency vision equipment. In fact, the presence of continuous

smoke is a major reason the FAA requires cockpit crews to have ready access to protective breathing equipment (PBE).

Such equipment, however, may be of only marginal benefit in continuous smoke so thick pilots cannot see beyond the inner side of their goggles.

The white paper points out that manufacturers are not required "to demonstrate the ability for pilots to see to safety control and land the airplane…when the smoke cannot be stopped." In an Oct. 1 press conference, Tom McSweeny, the FAA's top official for regulation and certification, defended the current standard (see p.1 box).

Adequacy of certification tests

There appears to be sort of a double jeopardy at work regarding defenses against fire and smoke. Smoke generation is stopped before cockpit smoke evacuation capability is tested. In the case of thermal/acoustic insulation blankets, the FAA only requires a vertical flame test, in which the blankets are far more likely to self-extinguish. But under the more challenging cotton swab test, the fierce flammability of aluminized Mylar has been clearly evident in tests at the FAA's Technical Center (see ASW, Oct. 12, p. 9 brief). Now, however, the fire testing standards for certification purposes of insulation blankets are under "fast track" review. Tougher flammability standards are to be developed within six months (see ASW, Oct. 19, p. 1).

This activity reveals the speed with which standards can change once the danger is recognized (the Swissair Flight 111 MD-11 was outfitted with insulation blankets featuring flammable metalized Mylar film). Meanwhile, a tougher standard for coping with smoke remains to be developed. In his "still looking" phrasing, McSweeny at least left open the possibility of mandatory testing against the recognized reality of continuous smoke. >> FAA, tel. 202/267-3479; Aerospace Planning Group, tel. 301/254-9000<<

Demonstration Showed Effectiveness of Emergency Vision Equipment

It works. A device designed to allow limited vision in the presence of thick smoke in the cockpit worked better than expected.

Known as the Emergency Vision Assurance System (EVAS), the device consists of an inflatable clear plastic bag that physically displaces smoke in the cockpit, allowing the crew sufficient vision to see vital instruments and through the windscreen (see photos).

Over the last eight years, precautionary landings due to smoke in the cockpit have been occurring at an average rate of about one per week (see ASW, Oct. 12, p. 5). EVAS is designed to enable crews to effect a landing under the most extreme smoke conditions.

During a demonstration with the Gulfstream II business jet for *Air Safety Week* and other industry representatives, smoke was injected into the cockpit to the point where the pilots literally could not see each other. Instruments, knobs and dials were totally obscured. The view out the windscreen was completely blocked. Indeed, from the outside, all one could see was a milky cloud of thick smoke blanketing the inside of the windscreens. The scenario was described by one pilot who observed it as "pretty scary."

EVAS consists of a 3 x 8 x 10-inch box, about the size of a flight manual, stowed next to the seat. Ina smoke 4emergency, the top cover of the box is pulled off, the folded plastic bag is pulled out and slapped onto a Velcro scrip on the glareshield. Filtered air is pumped continuously into the bag, which is form-fitted for each aircraft model. Deployment takes 15-20 seconds.

In its final report into the 1996 crash of **ValuJet** Flight 592, the **National Transportation Safety Board** (NTSB) recommended that emergency vision equipment such as

EVAS be evaluated for possible installation in airliners (Recommendation No. A-97-61). The crew of the doomed jet reported smoke in the cockpit.

Further evaluation, based on the system's observed performance, seems to be a moot point. The visibility through the plastic was much better than expected. The inflated bag even features a pocket where one can insert a smoke/fire checklist. It was easy to read during the demonstration. The checklist was impossible to read with smoke goggles alone.

The device already has been fully FAA-certified (including inflight testing) for installation in DC-9, MD-80 and 737 series aircraft. EVAS is battery-powered so that it can function independent of the total loss of aircraft electrical power. The bag can be kept inflated for more than 2 hours.

George Reenstra, president of a company that operates a fleet of corporate aircraft whose airplane was used for the demonstration, said, "If you cannot see, you cannot fly. This system is going on all of our aircraft at the first opportunity."

Indeed, sales have been spurred by the crash of **Swissair** Flight 111 (see ASW, Sept. 21, p.2). At least three major international air carriers recently have expressed interest in installing the system on its entire fleet. EVAS already is found in more than 100 corporate jets. An Oct. 29, 1998, **Raytheon Aircraft Parts Inventory and Distribution Co.** memorandum said the CEO of parent Raytheon has put out a bulletin saying, "NO Raytheon plane will fly without an EVAS system."

During the deliberations of a White House commission on aviation safety two years ago, numerous experts declared the EVAS system did not work. These assertions appear to illustrate a case of "data-free analysis." The demonstration was convincing. The device, built by Vision Safe Corp. of Kaneohe, Hawaii, costs about $10,000 (see related story, p.1). >>Reenstra, tel. 201/995-9570; VisionSafe, tel. 1-800-441-9230<<

The Smoking Paradox

- **12 Years ago:** The FAA's July 1986 Advisory Circular 25-9 on smoke detection asserts a problem but does not test against it:

  The problem: "Continuous smoke in the cockpit" is "reasonably probable" based on the fact that "incidents of fire or smoke that cannot be extinguished continue to occur."

  The test: "When…cockpit instruments are indiscernible…smoke generation should be terminated…the smoke should be reduced within three minutes such that any residual haze does not distract the fightcrew or interfere with operations under instrument or visual flight rules."

- **6 years ago:** A draft revision *circa* July 1992 added the requirement to test against continuous smoke:

  "To demonstrate protection from smoke generated by a contours source in the cockpit, smoke should be generated continuously. The crew should don protective breathing equipment and initiate smoke evacuation procedures and/or activate smoke displacement devices, if needed, as soon as smoke becomes evident. The ability of the crew to safely operate the airplane should not be impaired by loss of vision due to smoke from the continuous source in or continuous with the cockpit."

- **4 years ago:** The final version, issued as AC 25-9A in January 1994 deleted the language in the draft version, saying instead:

  "Protection against continuously generated smoke in the cockpit, although not specifically required by the regulations, is provided by present smoke evacuation procedures…Although not mandatory, if the applicant wishes to demonstrate protection from smoke generated by a continuous source…the crew should don protective breathing equipment and initiate evacuation procedures as soo9n as smoke becomes evident, and activate any *optional* vision enhancement devices, if approved." (Emphasis in original)

- **3 months ago:** Tom McSweeny, deputy FAA administrator for regulation and certification, defends the *status quo* but hints it could change:

  "The test is designed to distinguish pass and fail very accurately…They are required to let the entire cockpit full up with smoke…to the point where you can't see your hand in front of your face. Then they must be able to evacuate the smoke…But do we stop there? No. Because we are continuing to look at exactly what question: should we have a different test for continuous smoke? At this point we have not concluded that we should be we are still looking."