

# **The FAA's position that unstoppable blinding smoke in the cockpit is not an "unsafe condition"<sup>1</sup> violates its Congressional mandate**

## **Unstoppable, blinding, smoke in the cockpit is a serious long-standing un-addressed safety and security deficiency**

Congressman Oberstar's hearings in the spring of 2008 revealing the safety debacle with the FAA, Southwest Airlines, and American Airlines did not involve any loss of aircraft or lives. On the other hand, the FAA's failure to properly enforce current smoke-in-the cockpit certification regulations has been a cause or a factor in hundreds of passenger deaths and many hundreds of millions of dollars worth of aircraft destroyed.<sup>2</sup> The DOT and the FAA are required by statute to fix this deplorable condition. The National Transportation Safety Board shares this opinion. It wrote in late September 2007 that "[t]he Board considers any kind of fire and/or smoke in the cockpit to be a serious issue that could affect other aircraft systems, lead to a loss of visibility, provide a distraction, or incapacitate the crew and possibly lead to an accident."<sup>3</sup> The FAA does not certify planes using dense, continuous smoke. Present systems and procedures cannot cope with sources of dense unstoppable smoke.

The FAA has a regulation that requires airline manufacturers to demonstrate that they can remove smoke so pilots can see. The regulation reads: "If accumulation of

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<sup>1</sup> The FAA has defined an "unsafe condition" as "any condition that would jeopardize the continued safe flight and landing of the aircraft."<sup>1</sup> (Testimony of Thomas McSweeney, FAA Director of Certification, before the United States Senate Committee on Commerce, Science & Transportation, Aviation Subcommittee, Nov. 8, 1993.)

The European Aviation Safety Agency has a more expansive definition:

An unsafe condition exists if there is factual evidence (from service experience, analysis or tests) that :

- (a) An event may occur that would result in fatalities, usually with the loss of the aircraft, or reduce the capability of the aircraft or the ability of the crew to cope with adverse operating conditions to the extent that there would be :
  - (i) A large reduction in safety margins or functional capabilities, or
  - (ii) Physical distress or excessive workload such that the flight crew cannot be relied upon to perform their tasks accurately or completely, or
  - (iii) Serious or fatal injury to one or more occupants. . . .

Note 4 : There may be cases where events can be considered as an unsafe condition if they occur too frequently (significantly beyond the applicable safety objectives) and could eventually lead to consequences listed in (a) in specific operating environments. Although having less severe immediate consequences than those listed in (a), the referenced events may reduce the capability of the aircraft or the ability of the crew to cope with adverse operating conditions to the extent that there would be, for example, a significant reduction in safety margins or functional capabilities, a significant increase in crew workload, or in conditions impairing crew efficiency, or discomfort to occupants, possibly including injuries. (ACJ 39.5 "Definition of an Unsafe Condition." RST 02/2, doc 17d) Available at:

<http://www.smokeinthecockpit.com/references/ACJ-39.5-Definition-of-an-Unsafe-Condition.pdf>

(last visited Nov. 7, 2008) or see the EASA definition at:

[http://www.easa.eu.int/ws\\_prod/g/doc/Agency\\_Mesures/Certification\\_Spec/decision\\_ED\\_2003\\_01\\_RM.pdf](http://www.easa.eu.int/ws_prod/g/doc/Agency_Mesures/Certification_Spec/decision_ED_2003_01_RM.pdf)

<sup>2</sup> <http://www.smokeinthecockpit.com/references/List-of-Some-Smoke-Related-Accidents.pdf>

<sup>3</sup> U.S. National Transportation Safety Board, "Safety Recommendation," A-07-49-A-07-50 (Sept. 4, 2007) available at [http://www.nts.gov/Recs/letters/2007/A07\\_49\\_50.pdf](http://www.nts.gov/Recs/letters/2007/A07_49_50.pdf)

hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished, starting with full pressurization and without depressurizing beyond safe limits.”<sup>4</sup>

Even though there is nothing in the regulation that excludes “continuous” smoke, the FAA has never interpreted the regulation to include “continuous” smoke. In a letter of explanation, former FAA Administrator Thomas Richards wrote that the purpose of the smoke in the cockpit evacuation regulation was to “be a means or procedure to evacuate smoke that may be present in the cockpit, thereby providing an adequate view of the instruments and the outside world.” But then Richards qualified his comment to exclude continuous smoke. “The rule, [14 CFR §25.831(d)] as issued in 1957 and as applied ever since, does not address continuous smoke in the cockpit.”<sup>5</sup>

As threatening as these accidental smoke-in-the-cockpit events are, in most cases, (but not all) the aircraft land without loss of life. However, we now live in an era in which terrorists sit around contemplating how to intentionally accomplish death and destruction of lives and property. The 9/11 Commission<sup>6</sup> said that the Al Qaeda training camps in Afghanistan, . . . provided fertile ground for its operatives “to think creatively about ways to commit mass murder, . . .”<sup>7</sup>

### **Terrorist attacks on airliners are foreseeable**

Although the 9/11 terrorist attacks on the Twin Towers in New York City was visually memorable, it had an enduring collateral effect of throwing the airlines into economic chaos. Indeed, the headline of a September 2004 *Washington Post* article reads “3 Major Airlines Try to Fly Above Financial Failure.”<sup>8</sup> These effects, no doubt, are not lost on Al Qaeda operatives. It would not take much musing during one of these contemplative periods for these terrorists to consider the use of a hand-full of \$5 smoke bombs to bring down scores of aircraft. Furthermore, the Transportation Security Administration (TSA) had admitted that it cannot detect smoke bombs. The fatal bombings on two Russian airliners in late August 2004 are a twin reminder that airliners will continue to be targets of terrorist’s attacks.

#### *Previous terrorist attacks on aircraft*

The first of 34 bomb explosions on an aircraft that resulted in fatalities occurred in 1955. Since then, airlines have lost approximately the same number of lives due to terrorists’ bombs as were lost simultaneously in the 9/11 World Trade Center attack. The trend-line of deaths from terrorist’s attacks on airliners is increasing while the trend for deaths due to accidents is declining. But more to the point, some of the 34 terrorists attacks would have been survivable if the pilots had been able to see through the smoke.

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<sup>4</sup> 14 CFR §25.831(d)

<sup>5</sup> Richards correspondence, January 14, 1993.

<sup>6</sup> U.S. The National Commission on Terrorist Attacks Upon the United States. The 9/11 Commission Report.

<sup>7</sup> The ideas included “taking over a launcher and forcing Russian scientists to fire a nuclear missile at the United States; mounting mustard gas or cyanide attacks against Jewish areas in Iran; dispensing poison gas into the air conditioning system of a targeted building; and last, but not least, hijacking an aircraft and crashing it into an airport terminal or nearby city.” (Dan Eggen, “Al Qaeda Scaled Back 10-Plane Plot: Attacks Evolved Amid Infighting, 9/11 Panel Reports, *The Washington Post*, (June 17, 2004): A14)

<sup>8</sup> Keith L. Alexander, “3 Major Airlines Try to Fly Above Financial Failure,” *The Washington Post* (September 2, 2004), page A01.

### *Smoke bombs have reached the airlines*

Terrorists threw two phosphorus smoke bombs aboard a Pan American flight in Rome, Italy in December 1973 while the airplane was on the tarmac. 30 people were killed. More recently, on a July 2003 flight from Missoula, Montana to Seattle, Washington, a passenger passed security with a four-inch knife and a golf-ball sized explosive. His act was discovered only after he showed some minor children a "smoke-bomb-like device." The children testified that the passenger asked them if he should "light the device."<sup>9</sup>

In the event that a terrorist believes it would be difficult to get readily available smoke bomb past security, recipes for the separate (and legal) ingredients for these devices are available.<sup>10</sup> On one web site, [www.rotteneggs.com](http://www.rotteneggs.com), a writer describes how to make a smoke bomb (and a heat bomb) that "could be used to destroy aircraft."<sup>11</sup> The concept of terrorists bringing separate ingredients on board aircraft is also documented.<sup>12</sup>

### **The FAA and foreseeable events**

Many terrorist acts would have no fatal effects if FAA enforced its own regulations. One states that the equipment in the cockpit must work under any foreseeable condition. "The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane" must be extremely improbable.<sup>13</sup> The FAA translates "extremely improbable" to mean a minimum safety standard of less than one occurrence in one billion flight hours. Since there have not been that many flight hours worldwide on FAA certified aircraft over the last half century,<sup>14</sup> and since there have been more than

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<sup>9</sup> Ericka Schenck Smith, "Airline arrest suspect behaved 'strangely,' witnesses report." Missoulian.com News Online. (<http://missoulian.com/articles/2003/07/09.news/mtregional/news08.txt>)

<sup>10</sup> Materials:

Potassium Nitrate (Get it at a drug store)

Sugar (Not the powdered stuff, the regular crystal kind)

Directions:

Get a cat food, metal can, and put 6 parts Potassium Nitrate in it, and 4 parts sugar. Put it on the stove over ! -= LOW -= ! heat. Keep stirring it with a non-plastic spoon. Until it starts turning brown all over, when it is totally nasty smelling and looks nasty enough take it off the heat and put the mixture in a pixie cup. Put it in the freezer for 15 minutes. Now go into the woods, and light the cup. You get a lot of thick white smoke!

You can add sawdust to make it better. A pound of this stuff will cover an entire block with thick white smoke! (<http://www.textfiles.com/magazines/BTR/btr-03.txt>)

<sup>11</sup> <http://www.rotteneggs.com/se/400071.html>

<sup>12</sup> Jason Burge, "Terrorist bid to build bombs in mid-flight," *The Observer*, (February 8, 2004. See also <http://www.observer.com.uk>)

<sup>13</sup> 14 CFR § 25.1309 Equipment, systems, and installations.

(a) The equipment, systems, and installations whose functioning is required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition.

(b) The airplane systems and associated components, considered separately and in relation to other systems, must be designed so that—

(1) The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable, and

(2) The occurrence of any other failure conditions which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions is improbable.

<sup>14</sup> Boeing Corporation, "Statistical Summary of Commercial Jet Airplane Accidents: Worldwide Operations 1959-2007," (2008), available at:

20 fatal accidents in which smoke was a cause or a factor, the FAA is far overdue to correct this serious smoke in the cockpit safety deficiency and clear violation of the DOT/FAA's Congressional mandate. Simply put, the DOT and the FAA are failing to comply with their own regulations and have not implemented any corrective safety action, with one exception: they have installed equipment that permits their pilots to see when continuous blinding smoke invades the cockpits on their own planes! As a result, the DOT and the FAA have in essence created a two-tier safety system—one for government officials and one for the public. The Department of Defense has done likewise. Only their VIP planes are equipped to ensure pilots can see to land during emergencies with blinding smoke in the cockpit—a higher safety standard for high ranking officers and a substandard one for all others.

During 1993-94, Sen. Inouye (D Hawaii) was instrumental in an attempt to get the FAA to insure that pilots were able to see at all times, particularly under conditions of dense, unstoppable smoke in the cockpit. He introduced legislation (S. 1491) to force the FAA to interpret its current regulation to require aircraft manufacturers demonstrate during certification that they could cope with unstoppable blinding smoke from the cockpit. Unfortunately, the Conference Committee rejected his sage advice. Tragically, since Inouye's attempt, more than 300 lives have been lost and more than 300 million dollars worth of aircraft have been destroyed in North America alone—both military and civilian—where smoke in the cockpit was a cause or a factor.

Congress recently appropriated funds for emergency vision technology for the military's KC-135 fleet. The Air Force used a portion of the money to get ARINC to do a study on emergency vision technology. ARINC recommended to the Air Force that it install such technology on the KC-135 fleet. The Air Force ignored the conclusions for the KC-135 but installed the technology on its VIP planes. In so doing, the Air Force has emulated the two-tier safety system of the FAA—one level of safety for the generals and another for the men.

In response to a request to the FAA to act on these unsafe conditions,<sup>15</sup> the FAA took the position that when pilots are blinded from smoke in the cockpit that cannot be stopped, no "unsafe condition" exists.<sup>16</sup> The FAA claims that current procedures work. The FAA has been provided with irrefutable evidence that continuous, blinding smoke in the cockpit cannot be cleared using half-century-old procedures.<sup>17</sup> The FAA has also received independent expert's explanation as to why current procedures do not work.<sup>18</sup> It has also received a video of a smoke evacuation test that confirms the analysis.<sup>19</sup> Furthermore, another report by an independent expert concluded that loss of an aircraft due to smoke in the cockpit is "reasonably probable."

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<http://www.smokeinthecockpit.com/references/statsum.pdf>

<sup>15</sup> Letter to N. Sabatini available at <http://www.smokeinthecockpit.com/references/Sabatini-Final.pdf>

<sup>16</sup> Sabatini to Werjefelt, letter, July 8, 2008, available at <http://www.smokeinthecockpit.com/references/Letter.from.Nicholas.Sabatini.FAA.070808.PDF>.

<sup>17</sup> Past attempts at smoke removal available at <http://www.smokeinthecockpit.com/references/Past-attempts-at-smoke-removal.pdf>

<sup>18</sup> Paul Halfpenny, "Smoke Hazards in the Flight Station," available at <http://www.smokeinthecockpit.com/references/Smoke-Hazards-Flight-Station.PDF>

<sup>19</sup> Failed attempt to evacuate continuous smoke from a Boeing 747-400 video available at <http://www.smokeinthecockpit.com/references/Smoke-Evacuation-Test.mpg>

FAA Associate Administrator for Aviation Safety, (see footnotes 13 & 14) Nicholas Sabatini, acknowledged that there is technology that provides means for pilots to see in the presence of dense, continuous smoke in the cockpit. He also confirmed that this technology is on the Secretary of Transportation's aircraft and several other FAA aircraft. But then he wrote "no unsafe condition exists that warrants mandating the installation" of the technology and that "current procedures work." Why has the FAA, DOT, and DOD added emergency vision technology to their aircraft if current procedures work?

The former FAA director of safety, Sabatini's predecessor, has stated that the regulations require pilots to see when there is smoke in the cockpit but the FAA was unable to enforce it. The safety director also said numerous aircraft had crashed involving loss of pilot vision due to blinding smoke in the cockpit that cannot be stopped. Aviation authorities and industry worldwide, he added, had been unable to solve the safety problem for decades.

The FAA must take the necessary action, required by statute, to eliminate an "unsafe condition" that results when unstoppable blinding smoke enters the cockpit. There are many methods, or combination of ways, to deal with smoke such as use of ram air, depressurization, emergency vision, smoke evacuation ports, and opening doors and windows. But for the sake of pilots, flight attendants, and the flying public, the FAA must demonstrate that pilots can see to perform their tasks under conditions of unstoppable blinding smoke.

For the DOT and FAA to say that when pilots are unable to see to land, no unsafe condition exists strains credulity and supports a conclusion that the DOT/FAA is out of control. Ignoring the NTSB's numerous recommendations to the FAA for more than 40 years to solve the continuous smoke in the cockpit safety problem, could be viewed as misfeasance. However, due to the number of lives that have been lost, DOT/FAA malfeasance might be the better description. This follows because of the FAA's acknowledgement of the problem.

### **The FAA admits that smoke can be continuous**

"Incidents of fire or smoke that cannot be extinguished continue to occur. Smoke and fire procedures should, therefore, be formulated considering that the fire or smoke exposure may be *continuous*."<sup>20</sup> (Emphasis added.)

The FAA also reiterated, "it is likely that any Part 25 type design airplane will experience smoke in the cockpit from sources not effectively dealt with by emergency smoke clearance procedures (e.g., electrical smoke)."<sup>21</sup>

As recently as the fall of 2008, the FAA published on its website that an "uncontrolled fire represents one of the most serious safety threats of all [accident threat] categories. An uncontrolled fire can threaten the airplane and safety of the occupants during ground or flight operations, or following a crash.

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<sup>20</sup> U.S. Dept. of Transportation. Federal Aviation Administration. "Advisory Circular: Smoke detection, Penetration, and Evacuation Tests and Related Flight Manual Emergency Procedures." ANM-110 (July 29, 1986): 2 available at <http://www.smokeinthecockpit.com/references/Smoke-Evacuation-Advisory-Circular-25-9-July-29-1986.pdf>

<sup>21</sup> "Transport Airplane Directorate Designee newsletter," August 1, 1991, p. 47 available at <http://www.smokeinthecockpit.com/references/Transport-Airplane-Directorate-Designee-Newsletter.pdf>

“The accidents included in this threat category represent some of the most significant in helping shape safety requirements and policies related to fire threats.”<sup>22</sup> The old saying “where there’s smoke, there’s fire” can also be stated, “where there’s fire, there’s smoke.” Yet in spite of this admission, the FAA through Mr. Sabatini, claims no unsafe condition exists.

### **The Airline Pilots Association (ALPA) has made requests for a solution to continuous smoke in the cockpit**

“ALPA is very concerned that aircraft cockpits must be able to evacuate smoke effectively, so that the crew can safely land the aircraft. . . . [T]here is a need for the continuous smoke evacuation capability.”<sup>23</sup>

The Airline Pilots Association also made a study and found that there is, on average, one unscheduled or emergency landing per day in North America alone due to smoke. ALPA also claims that there are more diversions due to smoke than engine problems.<sup>24</sup>

As recently as 2004, the Airline Pilots Association (ALPA) evaluated emergency vision technology. While the ALPA has a policy of not endorsing products, it acknowledged that there is technology that permits pilots to continue flight under conditions of unstoppable, continuous smoke in the cockpit.<sup>25</sup>

### **The International Civil Aviation Organization (ICAO) Journal has stated that smoke accidents are preventable**

ICAO has gone on record that “smoke-related accidents may be preventable,” in its publication:

In-flight emergencies involving dense continuous smoke in the cockpit have resulted in a number of fatal accidents. In such cases, the lives of crew and passengers were lost because the smoke overwhelmed the capacity of the smoke evacuation system and obscured pilot vision.

Technology is now available to ensure the pilot can see the instruments and out the window no matter how dense the smoke becomes on the flight deck. Instead of evacuating the smoke, the new technology positively displaces it to provide the necessary visibility to control, navigate and safely land the aircraft.<sup>26</sup>

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<sup>22</sup> <http://accidents-ll.faa.gov/> (last visited October 17, 2008)

<sup>23</sup> Air Line Pilots Association letter to FAA (Dec. 11, 1992) See, <http://www.smokeinthecockpit.com/references/ALPA-comments-on-AC-25-9A-Draft.pdf> See also, “Potential In-Flight Fire Events Occur Daily; Many in Inaccessible Areas”, [http://findarticles.com/p/articles/mi\\_m0UBT/is\\_ /ai\\_61655312](http://findarticles.com/p/articles/mi_m0UBT/is_ /ai_61655312) visited Oct. 27, 2008.

<sup>24</sup> *Air Safety Week*, “Smoke Triggers More Diverted Flights Than Engine Problems,” (Oct. 20, 2003) available at [http://findarticles.com/p/articles/mi\\_m0UBT/is\\_ /ai\\_109037125](http://findarticles.com/p/articles/mi_m0UBT/is_ /ai_109037125)

<sup>25</sup> ALPA to Parker (6 September 2004). Available at:

<http://www.smokeinthecockpit.com/references/ALPA-Endorsement-Letter-9-6-2004.pdf>

<sup>26</sup> “Smoke-Related Accidents May Be Preventable,” *ICAO Journal: Official magazine of International Civil Aviation*, (October 1991), available at <http://www.smokeinthecockpit.com/references/ICAOJournal.pdf>

## **The NTSB has for many decades repeatedly recommended that the FAA solve the safety problem of continuous smoke**

In discussing the continuous blinding smoke in the cockpit of a Varig accident, ICAO wrote:

“ ‘The lack of visibility in the cockpit prompted the crew to decide on a forced landing.’ ”<sup>27</sup> As a result of the Varig accident, the National Transportation Safety Board issued a safety recommendation six months later. It asked the FAA to “provide operators of the subject aircraft with data to enable flightcrews to identify smoke sources, and require operators to establish procedures in their operating manuals to control and evacuate smoke effectively during the specific flight regimes.”<sup>28</sup>

As a result of its investigation into the PanAm flight 160 accident, a 707 that crashed due to smoke in the cockpit, the NTSB again issued safety recommendations. With this second of two smoke-related accidents so close together, the NTSB uncovered an effect that seemed counter intuitive. It wrote that opening the window was not a good idea.

“Two Boeing 707’s involved in accidents this year had smoke or fire in the cabin area. On each flight the crewmember in the left seat opened the cockpit side window for visibility and ventilation. In each case the smoke from the cabin area was drawn forward into the cockpit and out through the window. . . .”<sup>29</sup>

In 1976, cockpit smoke was a cause of another fatal accident. “The [NTSB] determines that the probable cause of the accident was the deterioration of the cockpit environment, due to smoke to the extent that the crew could not function effectively in controlling the aircraft under emergency conditions.”<sup>30</sup>

Six years later, smoke continued to be an issue in the safety of flight. As the NTSB wrote in 1982, “the light smoke had changed to heavy, black smoke that filled the cockpit and restricted the flightcrew’s visibility to a few inches.”<sup>31</sup>

The following year, smoke in the cockpit became a factor in the fatal crash of Air Canada flight 797. Although not listed as a probable cause, the final report said, “with smoke entering the cockpit, [the pilot] had difficulty seeing the instruments.”<sup>32</sup> The National Transportation Safety Board reiterated its concern about continuous smoke by issuing the following Safety Recommendation:

“Evaluate and change as necessary the procedures contained in the 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

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<sup>27</sup> Aviation Safety Network. Varig flight 820, July 11, 1973, Citing from ICAO Circular 132-AN/93 (68-78). <http://aviation-safety.net/database/record.php?id=19730711-0&lang=en> visited Aug. 31, 2007.

<sup>28</sup> NTSB. Air Accident Report. *Air Canada Flight 797 McDonnell Douglas DC-9-32. C-FTLG Greater Cincinnati International Airport Covington, Kentucky, June 2, 1983* NTSB AAR-86/02 p. 71 (hereinafter “Air Canada 797 Report”) available at <http://www.airdisaster.com/reports/ntsb/AAR86-02.pdf> citing Safety Recommendation A-73-121 issued January 10, 1974.

<sup>29</sup> NTSB. *Aircraft Accident Report. Pan American World Airways, Inc. Boeing 707-321C, N458PA, Boston, Massachusetts, AAR-74-16. November 3, 1973*, p. 94, hereinafter “PanAm flight 160 Report.”

<sup>30</sup> NTSB, Aircraft Accident Report: Air Chicago Freight Airlines, Inc., North American TB-25N, N9446Z, Midway Airport, Chicago, Illinois, August 6, 1976.

<sup>31</sup> NTSB Aircraft Accident Report, *Pilgrim Airlines Flight 458 de Havilland DHC-6-100 N127PM Near Providence, Rhode Island Feb. 21, 1982*. NTSB-AAR-82-7 p. 2

<sup>32</sup> hereinafter “Air Canada 797 Report.” p. 63,

and are explicit with regard to the presence of fire and the optimum use of cabin pressurization and air conditioning systems.”<sup>33</sup> (Emphasis added.)

Referring back to the PanAm flight 160 accident in Boston, the NTSB added:

The FAA acted promptly in response to [the Pan American flight 160] Safety Recommendation A-73-121 to assess the adequacy of the smoke removal procedures on the Boeing 707 airplane. As a result of the FAA’s assessment and tests, the relevant section of the airplane’s Flight Manual was revised to include improved and clearer smoke removal procedures. Both the recommendation and the FAA’s actions were specifically directed to the Boeing 707 airplane. On that basis, Safety Recommendation A-73-121 was closed and FAA’s response was deemed acceptable. However, the circumstances of the Air Canada accident indicate that the flightcrew encountered difficulty in controlling smoke in the cockpit of the McDonnell Douglas DC-9 airplane. The Safety Board questions the applicability of the prescribed procedures when a cabin fire continues to generate smoke and toxic gases. Further, testimony at the public hearing disclosed uncertainties among both flightcrew and expert witnesses regarding optimal smoke control procedures, such as the best use of cabin air conditioning systems. The Safety Board, consequently, believes that smoke removal procedures in all types of air carrier airplanes should be reassessed.<sup>34</sup>

The NTSB has been issuing safety recommendations for decades asking the FAA to solve the unsafe condition associated with smoke in the cockpit. In response to the ValuJet 592 accident in 1996, the NTSB recommended that the FAA “evaluate the cockpit emergency vision technology & take action as appropriate.”<sup>35</sup>

The only action the FAA took was to put “cockpit emergency vision technology” on its own aircraft.<sup>36</sup>

### **Foreign aviation safety organization recommendations to eliminate the unsafe condition of continuous unstoppable smoke**

#### ***Switzerland***

In 1970, a bomb exploded on Swissair flight 330. “[T]he aircraft was flyable but ultimately crashed because the pilots couldn’t see their flight instruments, which are critical to maintaining safe flight.”<sup>37</sup>

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<sup>33</sup> NTSB Safety Recommendation A-83-77.

<sup>34</sup> “Air Canada 797 Report,” p. 74.

<sup>35</sup> U.S. National Transportation Safety Board. *Aircraft Accident Report: In-Flight Fire and Impact with Terrain ValuJet Airlines Flight 592 DC-9-32, N904VJ Everglades, Near Miami, Florida (DCA96MA054)* ([Washington, D.C.]: NTSB, August 19, 1997): 138. Available at <http://www.airdisaster.com/reports/ntsb/AAR97-06.pdf>

<sup>36</sup> See N. Sabatini letter footnote 8 above.

<sup>37</sup> Otto Rentsch, Head of Swissair Safety, correspondence (October 22, 1993). Facsimile of correspondence available at [http://www.smokeinthecockpit.com/references/otto\\_rentsch\\_letter.html](http://www.smokeinthecockpit.com/references/otto_rentsch_letter.html)

### **Barbados**

In 1976, a Cubana DC-8 experienced a bomb on board the aircraft. After the explosion, the aircraft remained flyable. The pilot attempted to make an emergency landing. "Finally it became impossible to see the flight instruments because of the smoke." As a result, the Commission of Enquiry recommended: "The criteria for the certification of large Commercial aircraft should include requirement for a positive means of smoke removal, particularly from the cockpit area."<sup>38</sup>

### **United Arab Emirates**

In September 1983 The British Civil Aviation authorities held that the cause of a Gulf Air Boeing 737 crash was due to possible sabotage. The cockpit voice recorder indicated that the "pilots unable to see instruments due [to] smoke."<sup>39</sup>

### **South Africa**

In 1987, a Boeing 747 combi-cargo aircraft was lost at sea. The problem began when the Captain radioed to Mauritius air traffic control. In the crews' conversation with air traffic control, the conversation was reminiscent of many other smoke-related transmissions:

*Pilot:* Er, good morning, we have, er, a smoke problem and we are doing an emergency descent to level one five, er, one four zero.

*Mauritius ATC:* Confirm you wish to descend to flight level one four zero?

*Pilot:* Ja, we have already commenced, er, due to a smoke problem in the aeroplane.<sup>40</sup>

Although the investigative report considered a breakup in flight or carbon monoxide poison, it also considered "disorientation consequent of reduced cockpit visibility in smoke, or pilot distraction."

### **Norway**

In late 1989, an SAS DC-9 experienced heavy smoke while at altitude. The pilots made an emergency descent. On final approach, the smoke intensified to the point that the "smoke intensity on flight deck seriously impaired the pilot's ability to see the flight instrumentation."<sup>41</sup>

### **Germany**

In 1993, Swissair 551 reported smoke in the cockpit due to an electrical fire. The captain elected to return to his departing airport. Within four minutes, he declared an emergency and told his co-pilot that he could no longer see his instruments. The pilots miraculously got the aircraft on the runway but on rollout were unable to see outside. The German FUS recommended use of an "inflatable view channel between the crew,

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<sup>38</sup> Report of the Commission of Enquiry, "Aircraft Accident Cubana de Aviation DC8-43 Aircraft CUT-1201 which crashed into the sea northwest of Bridgetown, Barbados on October 6, 1976 with the loss of all on board." (Bridgetown, Barbadoes, March 1977). Available at <http://www.smokeinthecockpit.com/references/Cubana-DC-8-1976.pdf>

<sup>39</sup> 1983 Smoke in the cockpit crash report available at <http://www.smokeinthecockpit.com/references/UAE-smoke-crash-report-1983.pdf>

<sup>40</sup> Aviation Safety Network, [http://aviation-safety.net/investigation/cvr/transcripts/cvr\\_sa295.php](http://aviation-safety.net/investigation/cvr/transcripts/cvr_sa295.php), last visited 10-16-08.

<sup>41</sup> Tore Hultgren "Emergency Landing at Trondheim Airport, Norway after electrical fire." Incident Investigation Report. No. DC989013, (December 1, 1989)

their instruments and the cockpit windows.”<sup>42</sup> In other words, the German equivalent of the NTSB recommended the same technology that the Secretary of Transportation and the FAA have on their aircraft.

The German safety investigators recommended that airlines invest in emergency vision technology. Swissair seriously considered solving this critical safety issue.<sup>43</sup> However, it appears that for economic reasons, it chose not to do so.<sup>44</sup> Unmotivated to invest in safety equipment, the cost of which would have been approximately \$35,000 per aircraft, Swissair invested a few years later in an in-flight entertainment network (IFEN), at a cost of \$3.4 million per aircraft,<sup>45</sup> one of which became implicated in the crash of Swissair 111.<sup>46</sup>

### **Canada**

The 1998 crash of Swissair 111 began with a hurried transmission from the cockpit reporting, “smoke in the cockpit.” After a thorough investigation, one of the important observations the Canadian Transportation Safety Board made was that “... the end of the checklist de-emphasizes the importance of anticipating that any *unknown smoke condition in an aircraft can worsen rapidly*.”<sup>47</sup> (Emphasis added.)

All these aircraft involved in these accidents above have one thing in common: *all were certified by the American Federal Aviation Administration*.

The FAA has repeatedly stated that its goal is to eliminate the cause of the fire that could lead to the smoke. But that is the functional equivalent of building inspectors claiming buildings don’t need fire escapes because regulations will be written to prevent fires in the first place.

No universal fire prevention solution exists and one is highly unlikely. With all the evidence of the DOT/FAA’s failure to solve this unsafe condition of blinding smoke in the cockpit—after facing it for over 60 years—one would think it is time for the DOT/FAA to implement an actual solution while they indulge their fantasy of eliminating any possibility of fire.

The number of fatalities in which smoke in the cockpit was a cause or a factor exceeds the number of fatalities due to water landings.<sup>48</sup> Yet, every flight begins with a warning to passengers on what to do in such an event. While the FAA instructs passengers on how to put on flotation gear, it fails to warn pilots they won’t be able to see when smoke in the cockpit cannot be stopped. In contrast to the myriad of other

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<sup>42</sup> <http://www.smokeinthecockpit.com/references/Swissair-551-translation-final-report.pdf>

<sup>43</sup> John R. Emshwiller, “Entrepreneur Says Airlines Let Smoke Get in Their Eyes.” *Wall Street Journal* (June 25, 1991). Available at <http://www.smokeinthecockpit.com/references/Entrepreneur-says-airlines-let-WSJ-6-25-1991.pdf>

<sup>44</sup> Otto Rentsch letter,” (October 22, 1993). Facsimile of correspondence available at [http://www.smokeinthecockpit.com/references/otto\\_rentsch\\_letter.html](http://www.smokeinthecockpit.com/references/otto_rentsch_letter.html)

<sup>45</sup> Gary Stoller, “Doomed plane’s gaming system exposes holes in FAA oversight.” *USA Today*. Available at [http://www.usatoday.com/money/biztravel/2003-02-16-swissair-investigation\\_x.htm](http://www.usatoday.com/money/biztravel/2003-02-16-swissair-investigation_x.htm) (January 2, 2004)

<sup>46</sup> Aviation Investigation Report, “In-Flight Fire Leading to Collision with Water Swissair Transport Limited McDonnell Douglas MD-11 HB-IWF Peggy’s Cove, Nova Scotia 5 nm SW 2 September 1998 Report Number A98H0003” hereinafter, “TSB Final Report, Swissair,” 111, 43-51, 254 available at <http://www.tsb.gc.ca/eng/rappports-reports/aviation/1998/a98h0003/a98h0003.pdf>

<sup>47</sup> “TSB Final Report, Swissair” p. 255 available at <http://www.tsb.gc.ca/eng/rappports-reports/aviation/1998/a98h0003/a98h0003.pdf>

<sup>48</sup> [http://en.wikipedia.org/wiki/Water\\_landing](http://en.wikipedia.org/wiki/Water_landing)

warnings sprinkled throughout the Aircraft Flight Manual, one must ask why the FAA has failed to warn pilots that they won't be able to see. The FAA covers itself by telling pilots, when smoke cannot be stopped "land as soon as possible." But how are pilots supposed to land when they cannot see?

The Airline Pilots Association recently gave safety awards to two America West pilots when they had smoke in the cockpit. The quote below is a recounting of their experience. It should be self-evident that this is not the standard of safety the public expects when flying on American certified aircraft.

Capt. Dave Haugen and First Officer Ryan Daniels were the pilots of America West Flight 44, Airbus A319 service from Phoenix to Washington, D.C., on April 27, 2003. In cruise at 37,000 feet, the pilots heard a "thump," followed shortly by an instrument panel advisory of an oil filter clog on the No. 1 engine.

At first, maintenance controllers on the ground recommended that the pilots monitor the engine and continue on to Washington because all the other engine instrument indications were normal. Ten minutes later, the pilots felt two more "thumps," and Capt. Haugen decided to divert to St. Louis, Mo., the nearest suitable airport.

As the airplane started its descent to St. Louis, the cockpit immediately filled with dense smoke. Visibility inside the cockpit was nil. The two pilots donned their emergency oxygen masks and pressed their faces as close as they could to the instrument panel to read the instruments.

Multiple warning indications appeared on the cockpit displays, including a warning of smoke in the electronic equipment compartment and in both cargo compartments. The flight attendants, calling to advise that the cabin was also filled with dense smoke and that the passengers were having trouble breathing, asked the pilots to deploy the passenger oxygen masks, which they promptly did.

Meanwhile, descending through 15,000 feet, the pilots saw a cockpit display warning of low oil pressure in the No. 1 engine. The pilots shut down and secured the malfunctioning engine. Shortly afterward, the dense smoke in the cockpit and cabin began to clear. The landing at St. Louis was uneventful, and the pilots were able to taxi the airplane to the gate.

As the America West MEC said in nominating the flight crew of Flight 44 for the ALPA Superior Airmanship Award, "These pilots'...efforts and cooperation in a potentially life-threatening situation are exemplary and representative of the highest standard among professional pilots."<sup>49</sup>

Fortunately this incident involved an Airbus with side stick controllers. The common control-yoke design by other manufacturers would have prevented the pilots from

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<sup>49</sup>[http://www.alpa.org/DesktopModules/ALPA\\_Documents/ALPA\\_DocumentsView.aspx?itemid=1049&ModuleId=1284&TabId=256](http://www.alpa.org/DesktopModules/ALPA_Documents/ALPA_DocumentsView.aspx?itemid=1049&ModuleId=1284&TabId=256)

pressing their faces against the instruments and would most likely have resulted in a catastrophic outcome.

The FAA's approach to solving the problem of blinding, unstoppable smoke in the cockpit is like a physician claiming that he is going to cure disease by eliminating all bacteria instead of treating the patient once he or she becomes sick. In like fashion, the FAA wants to eliminate all sources of smoke instead of offering a prescription once continuous smoke invades the cockpit. This approach is echoed by the similarities between the FAA mindset and the authorities evaluating the HMS *Titanic*. Builders of the *Titanic* believed they had anticipated every possible event that could sink the ship. It was considered by experts as unsinkable. Consequently, the requirement to carry enough lifeboats to serve every passenger was considered unnecessary. As a result, 1,500 passengers died. Fortunately, since the "unsinkable *Titanic*" sank almost a century ago, all ships are required to have enough lifeboats to save every passenger.

In like manner, the FAA believes that it can identify and eliminate every potential source of smoke. As a result, the FAA believes lifeboat equivalents in the cockpit are unnecessary. However, a sinking passenger ship and an airliner with unstoppable blinding smoke in the cockpit have a lot in common: both are going down. The maritime regulators saw the need to provide a last ditch solution to save lives. Unfortunately, the DOT and the FAA's "Titanic mentality" does not see it—well, except for protecting its own, such as the DOT Secretary, FAA senior staff, prominent military generals. For crew and passengers on airliners to not have the elementary equivalent of lifeboats, i.e. the ability for the pilots to see to land safely is, in the words of one very prominent member of Congress, "unconscionable." To only provide such lifesaving features for high government officials is reprehensible.

Creating a two-tier safety system—one for government officials and one for the public—is unacceptable. (Former Secretary of Transportation, Norman Mineta, participated in a smoke in the cockpit demonstration and he was working on corrective action just prior to leaving his position.) An NPRM process would be an unnecessary delaying tactic when the appropriate regulations are already on the books. The FAA need only enforce the plain meaning of the existing smoke evacuation regulation.

The DOT/FAA are required by statute to enforce minimum safety standards.<sup>50</sup> They are also required to demand the highest possible safety standards of the airlines.<sup>51</sup> Nothing is more important than requiring pilots to be able to see at all times. It is so self-evident that it should not invoke a discussion.

Based on the FAA safety standards concerning catastrophic events, there should not have been a single accident involving dense blinding smoke in the cockpit for the last 50 years. Notwithstanding its safety standards, the DOT/FAA has failed to enforce the

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<sup>50</sup> 49 USC § 44701. General requirements (a) Promoting Safety. - The Administrator of the Federal Aviation Administration shall promote safe flight of civil aircraft in air commerce by prescribing et. sec. Available at, <http://www.smokeinthecockpit.com/references/U.S.-Code-44701.html>

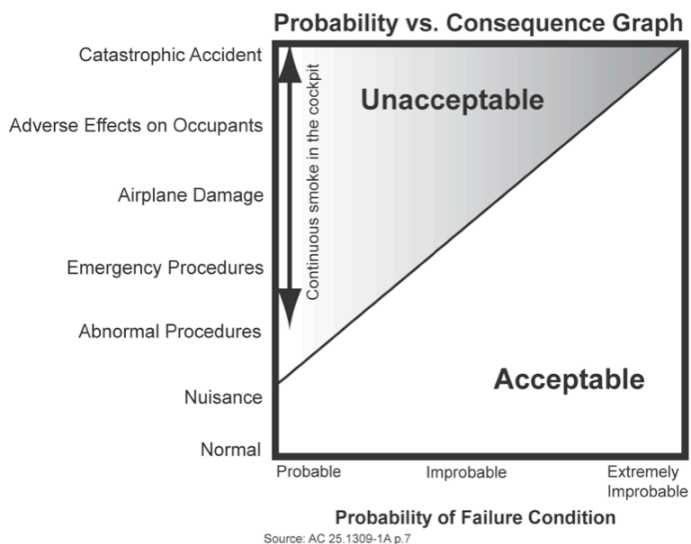
<sup>51</sup> 49 USC § 44701 (d) CONSIDERATIONS AND CLASSIFICATION OF REGULATIONS AND STANDARDS.—When prescribing a regulation or standard under subsection (a) or (b) of this section or any of sections 44702–44716 of this title, the Administrator shall—

(1) consider—

(A) the duty of an air carrier to provide service with the highest possible degree of safety in the public interest; *et sec.*

regulation that requires equipment to work under any *foreseeable* circumstances. The regulation states:

“The equipment, systems, and installations whose functioning is required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition.”<sup>52</sup>



If the probability of failure is “extremely improbable,” then any failure that results in a range from “nuisance” to “adverse effects on occupants” is acceptable. If a failure is “probable,” any condition above a “nuisance” is unacceptable. Blinding, unstoppable smoke in the cockpit is “probable.” Therefore “smoke in the cockpit” results in a failure according 14 CFR §1309.

Clearly the occurrence of blinding smoke in the cockpit is *foreseeable*. If it were not, the FAA would not have emergency vision technology on its aircraft. Numerous accidents confirm this. But the probability of smoke in the cockpit is not the only issue. The other is the consequence of continuous smoke on the cockpit. It is not only “foreseeable” that cockpits will experience continuous blinding smoke; it is “probable.” The “Probability vs. Consequence Graph” (shown above) is used to evaluate compliance with 14 CFR §25.1309. The chart shows a low threshold for “acceptable” consequences if the failure condition is “probable.” Anything greater than a “nuisance” is “unacceptable.” Blinding, unstoppable smoke in the cockpit is clearly more than a nuisance; it would inevitably lead to a situation somewhere between “emergency procedures” and “catastrophic accident.” The service history showing numerous catastrophic accidents verify that it is not only probable—as Paul Halfpenny’s report explains—it happens repeatedly.

<sup>52</sup> 14 CFR §25.1309(a) available at [http://edocket.access.gpo.gov/cfr\\_2008/janqtr/pdf/14cfr25.1309.pdf](http://edocket.access.gpo.gov/cfr_2008/janqtr/pdf/14cfr25.1309.pdf)

Congress can take “judicial notice” that pilots should, at all times and under all conditions, be able to see to control the aircraft and to land it. Many pilots mistakenly believe that current evacuation systems will solve smoke in the cockpit problems. But as experience and testing has shown, this is not true of *continuous* smoke. Nor does the FAA require aircraft manufacturers to demonstrate that their aircraft can eliminate continuous smoke in order that their aircraft pass certification tests.

The Department of Homeland Security and the FAA’s ability to see in the presence of dense, continuous smoke on its aircraft should be testimony enough to mandate such action for the flying public. The cost objections appear to lie in one of three areas:

- (1) lack of funds;
- (2) the belief that there is a requirement to perform a cost-benefit analysis; or
- (3) that mandating that airlines implement a method to see in the presence of dense, continuous smoke would financially burden an already weakened industry.

#### *Lack of funds*

No government agency’s budget needs to be involved. The implementation of such equipment could be paid for from revenue generated from a surcharge of pennies per ticket. The same society that pays \$5 per month for cell phone insurance, would not hesitate to pay a few pennies to guarantee that the pilot of its flight could see in the presences of continuous smoke. Such fundamental safety is already assumed by the passengers to be included in the price of their tickets. More to the point, you would find an outraged public if it were to discover after a smoke bomb incident that for a few extra cents, the pilot could have safely landed.

Under the “Improved Flight Deck Integrity Measures” section of the Aviation and Transportation Security Act, the TSA has been authorized to “take such other action, including modification of safety and security procedures and flight deck redesign, as may be necessary to ensure the safety and security of the aircraft.”<sup>53</sup> (Emphasis added.) Since security (as distinguished from safety) falls under TSA jurisdiction, the emergency vision device that the German Safety Board recommended (after a near fatal accident from smoke in the cockpit) and the FAA use of it on its fleet of aircraft, should be justification enough to incorporate it as part of airline crew security training, as outlined under §44918 “Crew Training,” specifically “(4) Use of protective devices,” (7) Flight deck procedures . . . to defend the aircraft,” and “(8) Any other subject matter deemed appropriate by the [TSA] Administrator.”<sup>54</sup>

#### *Cost benefit analysis*

In one sense, there is no requirement for a cost-benefit analysis because it was done at least 40 years ago with the introduction of FAR 25.831(d), the smoke evacuation regulation, as well as the pilot vision regulations setting standards for pilots to see. Clearly, these regulations are designed to ensure that pilots can see at all times under normal and smoke in the cockpit conditions. It would be illogical to require excellent eyesight surrounded by continuous, opaque smoke.

On the other hand, the TSA’s enabling legislation permits it to waive a cost-benefit

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<sup>53</sup> 115 STAT. 605-606.

<sup>54</sup> 115 STAT. 610-611.

analysis.<sup>55</sup> It could easily justify the installation of the NTSB-recommended emergency vision technology. The TSA issued a contract for \$61 million to study defenses against surface-to-air missiles fired at airlines, even though there are few if any examples of an airline having been shot down from them. Therefore, it should be easy to justify a solution that would guarantee that every pilot on every air carrier could see from a threat known to exist.

### *Financially weaken an ailing industry*

Arguing that requiring smoke-displacement equipment on airliners would provide a mortal wound to an ailing industry is specious. Swissair avoided a \$35,000 cost per aircraft for the same emergency vision technology that the FAA purchased for its aircraft, only to turn around and spend \$3.4 million per aircraft for an entertainment system that was implicated in the crash of one of its aircraft. This crash, according to many financial analysts, was a strong contributor to its financial downfall. In hindsight, emergency vision technology might have averted its bankruptcy. One can only wonder what the economic effects would be if the flying public were to learn that airliners were crashing because of the airlines failure to add pocket change to the cost of a ticket.

### **Conclusion**

It is self-evident that the consequences of unstoppable smoke in the cockpit are significantly more than a nuisance, they are catastrophic.<sup>56</sup> This follows because current aircraft are unable to evacuate continuous smoke from the cockpit, as amply demonstrated in the 747 smoke evacuation video (see footnote 17). The Paul Halfpenny report provides a detailed explanation as to why it is virtually impossible. These examples and explanations are supplemented with the long list of accidents in which smoke was a cause or a factor (see footnote 2 above).

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<sup>55</sup> 115 STAT. 600-601.

<sup>56</sup> The FAA defines “catastrophic” as “failure conditions which would prevent continued safe flight and landing,” which indeed is the case when the pilots cannot see to fly and /or land the aircraft – which has happened repeatedly. (U.S. Department of Transportation. Federal Aviation Administration. Advisory Circular 25.1309-1A “System Design and Analysis.” (June 21, 1988): 4.)

There is ample evidence that some aircraft have survived a terrorist attack only to crash due to the pilots’ inability to see in the presences of dense, continuous smoke. While terrorist attacks fall in the jurisdiction of the TSA, once the attack is over, and the pilot finds the aircraft flight-worthy, it becomes a safety issue as to his or her ability to see to land the aircraft. Accordingly, either the FAA or the TSA can justify the mandating of FAA-certified emergency vision technology.

The hijacking of airplanes has been a known threat for decades. Various ground and in-flight procedures as well as security measures were put in place to some degree around the world. Even though there were close to 900 aircraft hijacking events between 1967 and 1996,<sup>56</sup> it was not until the disastrous consequences of 9/11 that something substantive was done to stop unauthorized access to the cockpit.

While we applaud the increased integrity of the cockpit with bullet-proof doors, we remind you that smoke can still migrate to the cockpit. The evidence that at least three airliners survived terrorist attacks, only to crash because the pilots could not see, is reason enough to prepare aircraft against the possibility of future terrorist attacks in which smoke is a direct or indirect cause of a fatal accident.

There is ample evidence to get the Department of Homeland Security and the Department of Transportation to direct the TSA and the FAA to mandate the elimination of a known safety and security condition the solution to which the DOT, DHS, and the FAA have already installed and which has been certified by the FAA. We do not believe the public will, nor should it, tolerate the failure to address this known serious safety and security defect.

The aviation transport industry in the western world has not yet flown a billion hours over the last 50 years. Given the FAA's own minimum safety standard that catastrophic events involving smoke must be "extremely improbable" (less than one in a billion flight hours), there should not have had been a single event of this sort for the last 40 to 50 years worldwide. Yet, numerous catastrophic accidents involving smoke have occurred on American certified planes. Furthermore, given all of the safety recommendations for the last half century by the NTSB (and its predecessors), foreign aviation safety authority recommendations, the long standing request by the Airline Pilots Association, the FAA's own statements about continuous smoke, and common sense, the FAA's position expressed through Mr. Sabatini, (see footnote 13 above) that unstoppable continuous smoke in the cockpit is not an unsafe condition makes malfeasance a charitable characterization.

The DOT, DHS, FAA, and DOD must enforce the certification process for new aircraft to enable pilots to see when dense, blinding smoke in the cockpit cannot be stopped as required by 14 CFR §25.831(d). The FAA does not test or certify planes using dense continuous smoke. The language of the regulation is clear. There is nothing in it that implies that enabling pilots to see in the presence of blinding, unstoppable smoke should be excluded as a criterion for certification.<sup>57</sup> Furthermore, since unstoppable blinding smoke in the cockpit is an unsafe condition, 14 CFR §39.5 requires the DOT/FAA to issue Airworthiness Directives for existing aircraft to enable pilots to see under these unsafe conditions.

In-flight failures and associated emergency landings are not uncommon. The recent safe landing on the Hudson River—after the failure of both engines—was the result of pilot skill, proper training, adequate procedures, and equipment. This resulted in making it a manageable emergency with a successful outcome. In stark contrast, had this instead been a failure that generated blinding unstoppable smoke in the cockpit, the outcome would have been catastrophic for crew, passengers, and a high probability of claiming many fatalities in the densely populated area.

Unlike the DOT, DHS, and FAA executive airplanes, there is no equipment, no training, and no procedures in place for most airline (and military) pilots to make blinding, unstoppable smoke in the cockpit a manageable emergency. Many fatal accidents attest to this unacceptable unsafe condition. (See <http://www.smokeinthecockpit.com/references/List-of-Some-Smoke-Related-Accidents.pdf> ) It is easily possible to convert the potentially disastrous results of blinding unstoppable smoke in the cockpit into a manageable emergency and safe landing. It only takes the will of Congress to impose statutory and regulatory oversight.

The Congress must pass legislation (draft legislation available at <http://www.smokeinthecockpit.com/references/FAA-House-Reauthorization-Bill.pdf> requiring the Department of Transportation, Department of Homeland Security, Department of Defense, and the FAA to promptly enforce, as a minimum safety requirement for certification of aircraft and carriers, that pilots must be able to see at all times, including, but not limited conditions of blinding unstoppable smoke in the cockpit in order to—

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<sup>57</sup> "If accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished, starting with full pressurization and without depressurizing beyond safe limits." 14 CFR §25.831(d)

- 1) see their flight path and relevant surrounding traffic;
- 2) see their vital instruments;
- 3) see written emergency instructions and navigational information;
- 4) maintain normal cockpit and cabin crew communications; and
- 5) have suitable respiratory protection for the duration of the descent to the closest adequate airport.

This will ensure that civilian and military pilots are able to see at all times—even under conditions of dense, opaque, continuous smoke in the cockpit—so that civilian and military passengers have the same level of safety as those officials entrusted with their safety and security.