NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
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Attachment 44 - 2004 Smoke, Fire Fumes Initiative

OPERATIONS/HUMAN PERFORMANCE SUPPORT TO THE U.S. ACCREDITED REPRESENTATIVE

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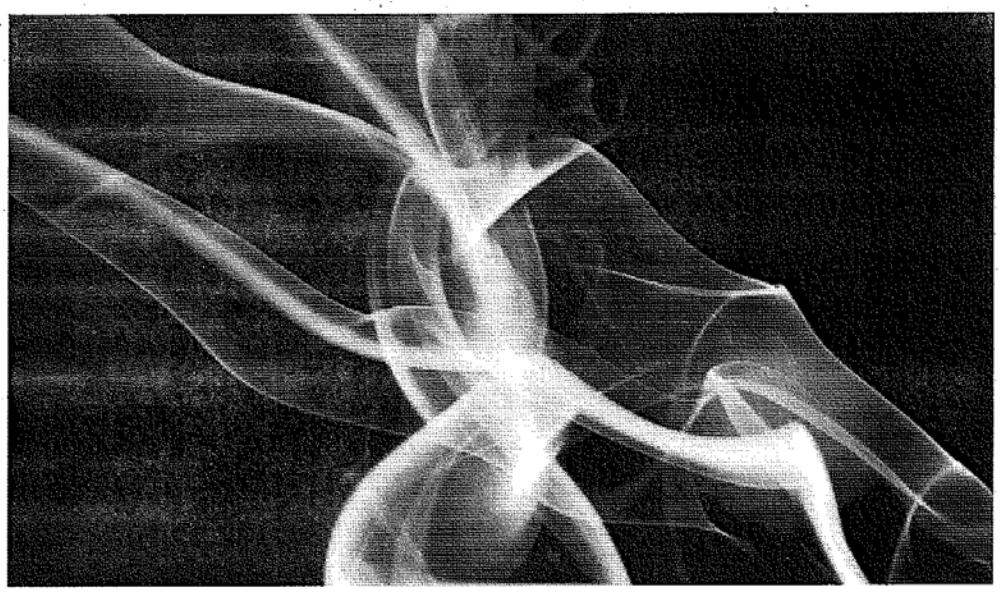

Flight Crew Procedures Streamlined For Smoke/Fire/Fumes

Based on accident/incident research and discussions during international meetings, a philosophy and a checklist template aim to standardize and optimize responses to nonalerted smoke/fire/fumes events.

— FSF EDITORIAL STAFF

An international initiative to improve checklist procedures for airline pilots confronting smoke/fire/fumes has published two documents derived from conference calls, meetings and a final industry symposium March 1–2, 2005, in Atlanta, Georgia, U.S. The *Smoke/Fire/Fumes Philosophy and Definitions* and the *Smoke/Fire/Fumes Checklist Template* (page 33) specifically address flight crew responses to nonalerted smoke/fire/fumes events (i.e., events not annunciated to flight crews by aircraft detection systems). Flight Safety Foundation (FSF) in fall 2004 became the sponsor of this initiative.

These documents take into account a wide range of viewpoints, said James Burin, FSF director of technical programs, and they have been sent to the U.S. Federal Aviation Administration (FAA) for consideration during future revisions of Advisory Circular 120-80, *In-flight Fires* (see "FAA Will Consider Smoke/Fire/Fumes Recommendations," page 36). The following *Smoke/Fire/Fumes Philosophy and Definitions* document provides an overview of the issues addressed by the initiative and the consensus recommendations.

Smoke/Fire/Fumes Philosophy and Definitions

This philosophy was derived by a collaborative group of industry specialists representing aircraft manufacturers, airlines/operators and professional pilot associations. The philosophy was used to construct the *Smoke/Fire/Fumes Checklist Template.*

General

- The entire crew must be part of the solution.
- For any smoke event, time is critical.
- The *Smoke/Fire/Fumes Checklist Template:*
  - Addresses nonalerted smoke/fire/fumes events (smoke/fire/fumes event not annunciated to the flight crew by aircraft detection systems);
  - Does not replace alerted checklists (e.g., cargo smoke) or address multiple events;
  - Includes considerations to support decisions for immediate landing (an overweight landing, a tailwind landing, a ditching, a forced off-airport landing, etc.); and,
  - Systematically identifies and eliminates an unknown smoke/fire/fumes source.
- Checklist authors should consider a large font for legibility of checklist text in smoke conditions and when goggles are worn.
- At the beginning of a smoke/fire/fumes event, the crew should consider all of the following:
  - Protecting themselves (e.g., oxygen masks, smoke goggles);
  - Communication (crew, air traffic control);
  - Diversion; and,
  - Assessing the smoke/fire/fumes situation and available resources.

Initial Steps for Source Elimination

- Assume pilots may not always be able to accurately identify the smoke source due to ambiguous cues, etc.
- Assume alerted-smoke-event checklists have been accomplished but the smoke's source may not have been eliminated.
- Rapid extinguishing/elimination of the source is the key to prevent escalation of the event.
- Manufacturer's initial steps that remove the most probable smoke/fumes sources and reduce risk must be immediately available to the crew. These steps should be determined by model-specific historical data or analysis.
- Initial steps:
  - Should be quick, simple and reversible;
  - Will not make the situation worse or inhibit further assessment of the situation; and,
  - Do not require analysis by the crew.

Timing for Diversion/Landing

- Checklist authors should not design procedures that delay diversion.
- Crews should anticipate diversion as soon as a smoke/fire/fumes event occurs and should be reminded in the checklist to consider a diversion.
- After the initial steps, the checklist should direct diversion unless the smoke/fire/fumes source is positively identified, confirmed to be extinguished and smoke/fumes are dissipating.
- The crew should consider an immediate landing anytime the situation cannot be controlled.

Smoke or Fumes Removal

- This decision must be made based upon the threat being presented to the passengers or crew.
- Accomplish *Smoke or Fumes Removal Checklist* procedures only after the fire has been extinguished or if the smoke/fumes present the greatest threat.
- Smoke/fumes removal steps should be identified clearly as removal steps and the checklist should be easily accessible (e.g., modular, shaded, separate, standalone, etc.).

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Smoke/Fire/Fumes Checklist Template	
Step	**Action**
1	Diversion may be required.
2	Oxygen masks (if required) ..... On, 100%
3	Smoke goggles (if required) ..... On
4	Crew and cabin communications ..... Establish
5	Manufacturer's initial steps[1] ..... Accomplish
Any time smoke or fumes become the greatest threat, accomplish *Smoke or Fumes Removal Checklist.*	
6	Source is immediately obvious and can be extinguished quickly: • If yes, go to **Step 7.** • If no, go to **Step 9.**
7	Extinguish the source. If possible, remove power from affected equipment by switch or circuit breaker on the flight deck or in the cabin.
8	Source is visually confirmed to be extinguished: • If yes, consider reversing manufacturer's initial steps. Go to **Step 17.** • If no, go to **Step 9.**
9	Remaining minimal essential manufacturer's action steps ..... Accomplish [These are steps that do not meet the "initial steps" criteria but are probable sources.][2]
10	Initiate a diversion to the nearest suitable airport while continuing the checklist.
Warning: If the smoke/fire/fumes situation becomes unmanageable, consider an immediate landing.	
11	Landing is imminent: • If yes, go to **Step 16.** • If no, go to **Step 12.**
12	XX system actions[3] ..... Accomplish [Further actions to control/extinguish source.] If dissipating, go to **Step 16.**
13	YY system actions ..... Accomplish [Further actions to control/extinguish source.] If dissipating, go to **Step 16.**
14	ZZ system actions ..... Accomplish [Further actions to control/extinguish source.] If dissipating, go to **Step 16.**
15	Smoke/fire/fumes continue after all system-related steps are accomplished: Consider landing immediately. Go to **Step 16.**
16	Review **Operational Considerations.**
17	Accomplish *Smoke or Fumes Removal Checklist,* if required.
18	Checklist complete.

Operational Considerations

[These items appear after "checklist complete." This area should be used to list operational considerations, such as an overweight landing, a tailwind landing, a ditching, a forced off-airport landing, etc.]

Notes

1. These aircraft-specific steps will be developed and inserted by the aircraft manufacturer.
2. Bracketed text contains instructions/explanations for the checklist author.
3. "XX," "YY" and "ZZ" are placeholders for the environmental control system, electrical system, in-flight entertainment system and/or any other systems identified by the aircraft manufacturer.

- The crew may need to be reminded to remove smoke/fumes.

- The crew should be directed to return to the *Smoke/Fire/Fumes Checklist* after smoke/fumes removal if the *Smoke/Fire/Fumes Checklist* was not completed.

Additional Steps for Source Elimination

- Additional steps aimed at source identification and elimination:
  - Are subsequent to the manufacturer's initial steps and the diversion decision;
  - Are accomplished as time and conditions permit, and should not delay landing; and,
  - Are based on model-specific historical data or analysis.
- The crew needs checklist guidance to systematically isolate an unknown smoke/fire/fumes source.

Definitions

Confirmed to be extinguished: The source is visually confirmed to be extinguished. (You can "put your tongue on it.")

Continued flight: Once a fire or a concentration of smoke/fumes is detected, continuing the flight to the planned destination is not recommended unless the source of the smoke/fire/fumes is confirmed to be extinguished and the smoke/fumes are dissipating.

Diversion may be required: Establishes the mindset that a diversion may be required.

Land at the nearest suitable airport: Commence diversion to the nearest suitable airport. The captain also should evaluate the risk presented by conditions that may affect safety of the passengers associated with the approach, landing and post-landing.

Landing is imminent: The airplane is close enough to landing that the remaining time must be used to prepare for approach and landing. Accomplishing further smoke/fire/fumes-identification steps would delay landing.

Land immediately: Proceed immediately to the nearest landing site. Conditions have deteriorated and risks associated with the approach, landing or post-landing are exceeded by the risk of the on-board situation. "Immediate landing" implies immediate diversion to a landing on a runway; however, smoke/fire/fumes scenarios may be severe enough that the captain should consider an overweight landing, a tailwind landing, a ditching, a forced off-airport landing, etc.

Crew: For the purposes of this document, the term "crew" includes all cabin crewmembers and flight crewmembers.■

Participants in Smoke/Fire/Fumes Initiative

The following volunteers participated in the smoke/fire/fumes initiative:

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