Nine months after its launch, MyBoeingFleet.com is still in its youth, but it has welcomed more than 11,000 new users and now receives as many as 800 log-ins per day. This secure Internet portal has been clearly established as friendly, fast growing, and full of useful data.

If you haven’t logged on to your account lately, you might want to check out our latest offerings, released in December 2000. Operators can now view reports summarizing worldwide fleet service history—schedule reliability, flight hours, landings, utilization, and length of flight information. We also provide quick access to the latest product standards for 707s and for 727 through 777 airplanes. This includes standards for drafting, material, operations, processes, and parts.

MyBoeingFleet also features a site that helps operators manage configuration control of airplane loadable software independently of any hardware. And we continue to add more maintenance documents to the site daily. For example, operators can now review online rework recently delivered Boeing airplanes in their fleet.

Although MyBoeingFleet continues to grow and change, our goal is constant—to be your single online source of maintenance, engineering, and flight operations data. And by giving you exactly the information you need when you need it, we’ll succeed in making it easier for you to do business with us.

I’m excited about what’s ahead for MyBoeingFleet in 2001. We recently invited customers from a number of airlines to a forum and asked them how they use the web site and what we could do to improve it. The wealth of feedback we received will help drive some usability changes to the site during the year. We also look forward to visiting these customers at their work sites to get even more specific data.

We’re on track in 2001 to include our online spare-parts ordering system in our single log-on and to continue adding more online alternatives to hard copy, such as our Data and Services catalog. Making the transition to online documents through MyBoeingFleet can significantly reduce airline costs associated with distributing, managing, and storing paper documents. At the same time, it improves access through online search capabilities and 24-hour, seven-days-per-week availability of data. It also raises quality because documents in the database will have the latest revisions and updates.

If you haven’t yet tried MyBoeingFleet, I’ll hope you will take a look at what we can offer. You may tour the site from www.boeing.com by clicking the customer logon button and selecting “Take a Guest Tour.” Or, if you prefer, you may contact the Boeing Digital Data Customer Support by e-mail at DDCS@boeing.com or by telephone at 206-544-9990 Monday through Friday, 6:30 a.m. to 6 p.m. (U.S. Pacific time).
An in-flight fire or smoke event is a time-critical situation that demands immediate action by the flight and cabin crews. Cigarettes aside, any smoke in an airplane is not normal. Crew response must be timely and use available airplane controls and non-normal procedures.

To help ensure that appropriate steps are taken, the following issues need to be understood:

1. Operational consequences and safety risks of smoke events.
2. Analysis of past smoke events and review of crew procedures.
3. Recommended crew action for known and unknown smoke sources.
4. Capabilities for the remainder of the flight.

**OPERATIONAL CONSEQUENCES AND SAFETY RISKS OF SMOKE EVENTS**

Although most smoke events in the pressurized area of an airplane are resolved and rarely affect continued safe flight, landing, or egress, smoke is always a significant issue with operational consequences. These consequences include flight cancellations, flight schedule disruptions, air turnbacks, airplane diversions, declared emergencies, airport emergency equipment responses, airplane evacuations, accommodations for displaced passengers, diminished goodwill, and extensive unscheduled maintenance following non-normal procedures such as overweight landing inspection, recharging of oxygen, and repacking of escape slides.

Direct crew response to smoke and fumes originating from readily accessible equipment, referred to as known smoke, is key to minimizing operational consequences. Timely and prudent crew response to smoke events of undetermined origin, or unknown smoke, minimizes risks during the remaining flight, landing, and egress. Based on past smoke events, Boeing and other air transport industry leaders are pursuing initiatives to further reduce the likelihood of in-flight smoke. In addition to enhancements to airplane design and maintenance (see “Aging Airplane Systems Investigation,” Aero no. 7, July 1999), these initiatives include improvements to the procedures used by the flight and cabin crews during a smoke event in the pressurized area of the airplane.

**ANALYSIS OF PAST SMOKE EVENTS AND REVIEW OF CREW PROCEDURES**

Boeing performed an analysis of reported in-service events that involved smoke, fumes, fire, and overheating in the pressurized areas of its airplanes between November 1992 and June 2000. Data were compiled for each model and included the following: the area affected in the pressurized area of the airplane, the smoke source perceived by the flight crew, the smoke source identified by the maintenance crew, the category of the smoke source, the airplane system or equipment involved, the means of detection (typically sight or smell by passengers or crew), and the effect on flight completion. (Note: The term smoke in the preceding list and in the remainder of this article refers to odors, smells, fumes, or overheating as well as visible smoke.)

The smoke events under study were categorized into three classes: air conditioning, electrical, and material. Air-conditioning smoke events were cases in which incoming bleed air was contaminated, perhaps from engine oil or contaminated outside air. Electrical events were cases in which electrically powered equipment overheated or emitted smoke or fumes. Material events involved material that gave off smoke or fumes such as food burning in an oven, lavatory waste ignited by a discarded cigarette, or spilled chemicals in the cargo compartment.
Figure 1 depicts a summary profile of air-conditioning, electrical, and material smoke events for each airplane model included in the study. This format enables comparison across airplane models of the three major smoke source categories. For each model, the number of events in each source category was divided by the total number of smoke events for that model, yielding the percentage contributions depicted in the profile. (Note: The three categories for each model may not sum to 100 percent because of insufficient information available to categorize an event.) The models in figure 1 are listed in order of airplane complexity, starting with the most complex on the left. Larger airplanes with more complex systems show a predominance of smoke events of electrical origin, compared with air-conditioning and material smoke events. For each airplane model, the air-conditioning, electrical, and material events were subdivided by airplane system. Figure 2 illustrates such a detailed categorization of smoke event sources for a representative model. The subcategories within the electrical category include systems or functions such as environmental control, electrical power, galleys, and flight deck equipment. Presenting the smoke sources in percentages by airplane system or function allows comparison of multiple models with different fleet sizes, ages, and missions.

Data also were collected on how the crews perceived the in-flight smoke events on all models. The data were grouped in a structure similar to the flight crew Quick Reference Handbook (QRH) produced by airplane manufacturers and operators. Figure 3 shows such a portrayal for a representative model. Most smoke events occurred with the flight crew on board. For many in-flight events, flight crews took action consistent with having identified the smoke source, such as removing electrical power to (i.e., depowering) that equipment. There was a significant number of events in which crew actions suggest that the smoke source could not be identified while in flight. For smoke events in which the flight crew could not determine the smoke source, most were subsequently determined by maintenance crews to be of electrical origin.

**RECOMMENDED CREW ACTION FOR KNOWN AND UNKNOWN SMOKE SOURCES**

The Boeing QRH includes procedural steps for smoke, fumes, fire of air-conditioning and electrical origin, and smoke removal. When a flight crew has determined that smoke is of air-conditioning origin, the Boeing QRH procedure is to isolate the air source, halting the introduction of contaminated air into the pressurized area of the airplane. For electrical and material smoke events, the QRH provides specific procedures to address those sources.

**SUMMARY PROFILE OF REPORTED SMOKE EVENTS IN PRESSURIZED AREAS OF THE AIRPLANE**

**FLIGHT CREW PERCEPTION OF SMOKE SOURCE FOR A REPRESENTATIVE AIRPLANE MODEL**

**SMOKE EVENT SOURCES FOR A REPRESENTATIVE AIRPLANE MODEL**
disruption from a smoke event comes from crew training in responding to smoke, crew familiarity with smoke-clearing procedures, and direct power control to cabin amenities (e.g., an electrical power cutoff switch at each galley location). If the crew cannot confirm that a persistent onboard smoke or fire situation is completely resolved, however, Boeing recommends the earliest possible descent, landing, and evacuation of the airplane.

Unknown smoke sources. A crew may not be able to identify a smoke source because of the location of the failed equipment or because of air circulation throughout the pressurized cabin. Unknown smoke sources include environmental control systems, equipment cooling fans, door heaters, plumbing heaters, avionics equipment, fluorescent lights, and wiring faults.

The serious consequences of compromised structural integrity, system function, or survivable environment warrant timely and prudent action by the crew. Review of historical data on the rare fire events that resulted in hull loss indicates that the time from first indication of smoke to an out-of-control situation may be very short—a matter of minutes. For this reason, flight crew actions when responding to unknown smoke must be timely and appropriate.

QRH procedural steps for addressing an undetermined electrical smoke source call for the removal of electrical power for specific systems not necessary for safe flight, landing, and egress. This accounts for the majority of systems with a significant history of in-service smoke events. Also, as directed by the Boeing QRH non-normal checklist, the crew should plan to land at the nearest suitable airport.

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During the remainder of the flight, the crew should be alert to any new signs that suggest the smoke source and remain mindful of operational functions needed to accomplish the diversion.

Many unknown smoke situations are later attributed to electrical sources, substantiating the positive step of de-powering specific equipment not necessary for the remaining flight, landing, and egress. Flight-critical systems do not have a significant smoke-event history.

CAPABILITIES FOR THE REMAINDER OF THE FLIGHT

QRH procedural steps to remove power from affected equipment must ensure that...
Some known smoke events are directly preventable. Paper may come into contact with hot lighting, either in the cabin or crew rest areas. Food may be left in an oven or a coffeepot heated while empty.

In an extreme situation, a flight crew will benefit from knowledge of airplane systems that would be inappropriate to detail in time-critical procedures. QRH

Many unknown smoke sources are later determined to be electrical, substantiating the positive step of depowering specific components. During such events, the presence of electrical sources in the pressurized areas of airplanes is no longer considered a threat to the flight.

A flight crew may be able to identify unknown smoke as air-conditioning smoke based on subsequent indication. In an extreme situation, a flight crew in an unknown smoke situation will benefit from airplane system knowledge that would be inappropriate to detail in time-critical procedures. For example, a Boeing-designed twin-engine airplanes, the right electrical bus powers a higher proportion of non-essential equipment, while the left electrical bus powers the higher proportion of flight-critical equipment.

In known smoke events, direct crew response minimizes operational consequences, such as flight cancellations and air turnbacks. If a crew cannot confirm that persistent onboard smoke or fire has been completely extinguished, Boeing recommends the earliest possible descent, landing, and evacuation of the airplane.

In unknown smoke events, a prudent crew response minimizes risk during remaining flight. Inordinate depowering of airplane systems beyond QRH procedures is not likely to benefit an unknown smoke situation because such action significantly reduces airplane capabilities for the remainder of the flight without commensurate likelihood of addressing the smoke source. The best response to an event of unknown smoke combines use of prudent QRH non-normal checklists and flight crew discretion based on the particular situation and a thorough knowledge of airplane systems.

SUMMARY

- Engineering design by airplane manufacturers, oversight by regulators, and maintenance practices by operators combine to minimize occurrences of smoke, fumes, and fire in the pressurized areas of airplanes.
- When an in-flight smoke or fire event does occur, it can be a time-critical situation that demands immediate action by the flight and cabin crews.
- Crews should follow QRH procedures, which must be structured to allow flight and cabin crews to promptly respond to an in-flight smoke event.
- In known smoke events, direct crew response minimizes operational consequences, such as flight cancellations and air turnbacks.
- If a crew cannot confirm that persistent onboard smoke or fire has been completely extinguished, Boeing recommends the earliest possible descent, landing, and evacuation of the airplane.
- In unknown smoke events, a prudent crew response minimizes risk during remaining flight. Inordinate depowering of airplane systems is not likely to benefit an unknown smoke situation because such action significantly reduces airplane capabilities for the remainder of the flight without commensurate likelihood of depowering the unknown smoke source.
- Many unknown smoke sources are later determined to be electrical, substantiating the positive step of depowering specific equipment not crucial to the remaining flight, landing, and egress. Historically, flight-critical systems have not significantly contributed to smoke events.
- In an extreme situation, a flight crew will benefit from knowledge of airplane systems that would be inappropriate to detail in time-critical QRH procedures.

TIPS ON MINIMIZING SMOKE EVENTS

- Smoke or actual fire events have been initiated by repeated circuit breaker resets during ground troubleshooting. Even when performed on the ground, circuit breaker resets should be performed cautiously. Important considerations are the number of reset attempts, cooling time between reset attempts, and the stationing of maintenance crew monitoring for unusual sounds or smell.
- A flight crew may be able to identify unknown smoke as air-conditioning smoke based on subsequent indication. In an air-conditioning smoke event caused by leaking engine oil, the first symptom noticed by the crew may be a burning odor of unknown origin. Subsequent engine indications might clarify an abnormal engine situation, and the corresponding bleed air source can be isolated.

The following tips are based on the review and analysis of in-flight smoke events on Boeing air planes between November 1992 and June 2000:

- Although not a serious risk for propagating fire, several events occurring immediately before or after airplane departure were attributed to engine or auxiliary power unit (APU) maintenance activity during the previous ground leg. Most operators have ground crew procedures for engine or APU runs following maintenance. For an operator with concerns in this area, a review of ground procedures that require engine or APU run may be appropriate.
- Some known smoke events are directly preventable. Paper may come into contact with hot lighting, either in the cabin or crew rest areas. Food may be left in an oven or a coffeepot heated while empty.
- The best response to an event of unknown smoke combines use of prudent QRH non-normal checklists and flight crew discretion based on the particular situation and a thorough knowledge of airplane systems.