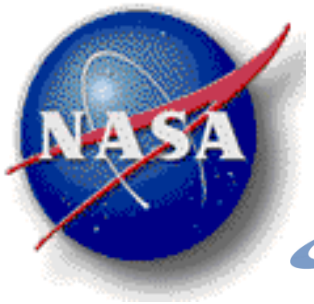
Responding to the Emergency: Using All the Tools

Decision Making and Workload Management

Barbara Burian, Ph.D.
Human Systems Integration Division
NASA Ames Research Center



Human Systems
Integration Division

This work is currently funded through the NASA Aviation Safety Program.

Decision Making and Workload Management

- Knowledge and Uncertainty
- History and Experience
- Effects of Stress
- Crew Communication and Coordination (Helena)
- Guidance
  - Checklists
  - Company Policies and Procedures

Knowledge and Uncertainty

- Alerts and Cues
- Type, Location, and Severity
- Time Available

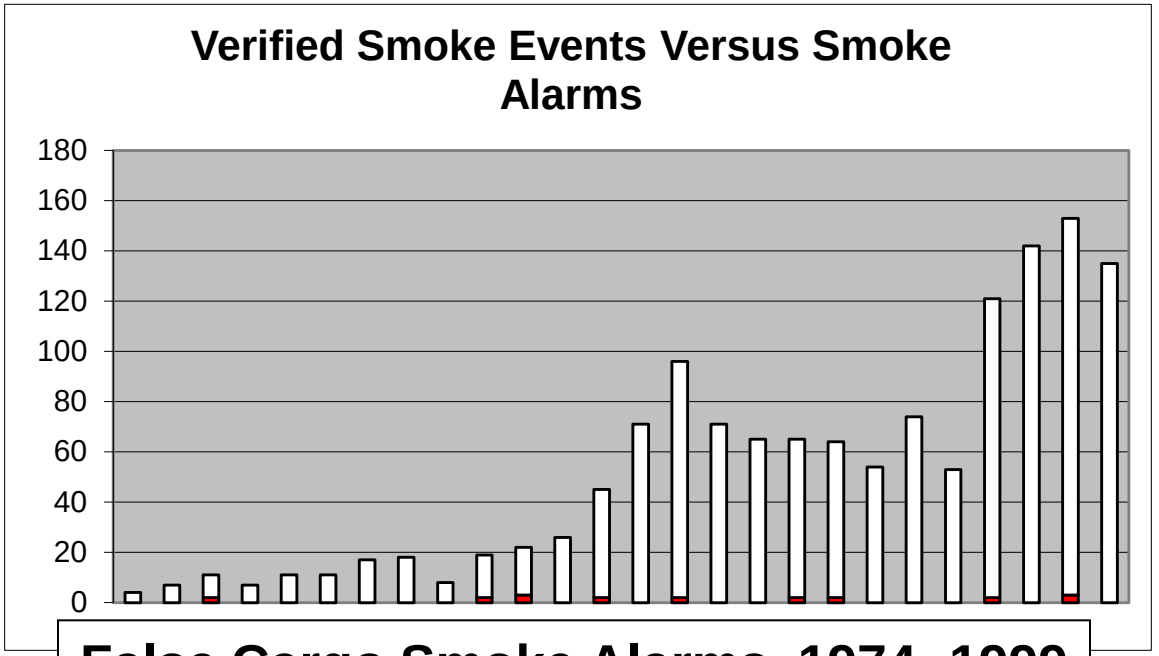
Misunderstanding about Amount of Time Available

In a study of 15 in-flight fires that occurred between January 1967 and September 1998, the TSB of Canada determined that the average amount of time between the detection of an on-board fire and when the aircraft ditched, conducted a forced landing, or crashed was 17 minutes.

History and Experience

- Personal
- Company
- Industry
- Training

D. Blake, 2000



Effects of Stress

- On Cognition:
  - Narrowing of attention
  - Working memory constriction
  - Slowed cognitive processing
- On Decision Making:
  - Greater use of heuristics (“rules of thumb”)
  - Greater influence of biases (e.g., confirmation bias)
  - Fewer options considered
- On Workload Management:
  - Interleaving tasks becomes difficult
  - Prioritization, task shedding, task neglect
  - Shift to reactive and tactical over proactive and strategic
  - Difficult to maintain/attain view of the “big picture”

Crew Communication and Coordination

Flight Crew Procedures

Cabin Crew Procedures

Crew Communication and Coordination

EMERGENCY?

Acknowledge — *Make sure you understood the nature of emergency and acknowledge accordingly.*

Separate — *Don't forget to establish/maintain separation!*

Silence — *Impose silence on your control frequency if necessary.*
Don't disturb urgent cockpit actions by unnecessary transmissions!

Inform — *Inform your supervisor and other sectors/units concerned.*

Support — *Give maximum support to pilot and crew.*

Time — *Allow pilots sufficient time to work on their problem.*

Edition : 1.0 Released Issue Page 25

ATC Procedures for Aircraft Emergencies (Eurocontrol)

Smoke or Fire in the Cockpit

Smoke or Fire in the Cabin

> **Expect**

- High stress level in the cockpit
- Shortest high-speed vector to land – nearest suitable aerodrome
- Poor R/T (oxygen mask) or loss of R/T
- Define appropriate communication failure procedure in due time
- Passenger evacuation
- RWY blocked

> **Remember**

- ASSIST
- Inform Supervisor
- Ask for dangerous goods
- Ask for number of Persons On Board (POB)
- Inform landing aerodrome
- Clear RWY according to local instructions, e.g. when ACFT 20 NM final
- keep safety strip clear
- APP-/ RWY lighting system 100%

> **If needed, inform pilot about**

- Track miles to touchdown of next suitable aerodrome
- Availability of automatic approach low visibility procedure
- Aerodrome details as soon as possible: RWY in use, length, surface, elevation, ILS- and NAV-frequencies
- WX information of landing aerodrome: wind, visibility, ceiling, QNH

A 'Acknowledge - S 'Separate - S 'Silence - I 'Inform - S 'Support - T 'Time

Guidance: Checklists

SMOKE / FUMES OF UNKNOWN ORIGIN

CAB BUS P/B ——— OFF

Pause long enough for cabin crew to evaluate whether smoke or fumes decrease.

SMOKE / FUMES DECREASE

NO — Continue with cabin bus inoperative.

END

CAB BUS P/B ——— ON

SMOKE ELEC/AIR Selector ——— PUSH AND ROTATE

Rotate SMOKE ELEC/AIR Selector clockwise, pausing at each position long enough to evaluate whether smoke or fumes decrease. When a decrease is noted, leave selector in that position for rest of flight.

Continue with that generator channel and air system inoperative and **observe associated consequences.**

NOTE:
- When rotating the SMOKE ELEC/AIR Selector, the autothrottle will disengage and be unusable. The autopilot may disengage but then use another autopilot.
- Nuisance stick shaker may occur. (Stick shaker CBs on overhead panel: Captain E-1, F/O E-31)
- Following essential systems are inoperative or off in accordance with SMOKE ELEC/AIR Selector Pos.

SMOKE Selector Pos. 3/1 OFF:
only Captains VHF 1 and interphone available.
- DU 4, 5, 6; MCDU 2; FMS 2; IRS 2 (after 15 min).
- Radar 2; All Nav aids 2.
- BLEED AIR 1; PACK 1; ECON system; WING anti-ice.
- F/O pitot heat.
- Auto slat extension.
- Landing gear aural warning.
- Autobrakes.

FOR APPROACH:
- Set FLAP LIMIT Selector to OVRD 1.
- Go-around mode is not available.

SMOKE Selector Pos. 2/3 OFF:
- BLEED AIR 3; PACK 3; WING anti-ice.
- Aux pitot heat.
- Fuel dump low level.
- HORIZONTAL STABILIZER TRIM Switches on control column.
- Engine 2 reverser.

SMOKE Selector Pos. 1/2 OFF:
only VHF 2 and 3 available.
- DU 1, 2, 3; MCDU 1; FMS 1.
- IRS 1 and AUX IRS after 15 min, (AP no longer available).
- Radar 1; All Nav aids 1.
- BLEED AIR 2; PACK 2; WING and TAIL anti-ice.
- Captain pitot heat.
- GPWS, GPWS BELOW G/S lights.
- Auto ground spoilers.
- Engine reversers 1 and 3.

FOR APPROACH:
- Set FLAP LIMIT Selector to OVRD 2.
- On CAPT SISP push FD P/B to OFF.
- Go around mode is not available.

If smoke/fumes are not eliminated, land at nearest suitable airport.

END

MD-11 41.1 Page 10

EMER 2-1
Sep 09/02

CONTENTS **PAGE**

SMOKE OR FIRE

If smoke/fumes are not eliminated, land at nearest suitable airport

Guidance: Checklists

Industry Un-alerted SFF Checklist Template

1	Diversion may be required
2-4	Oxygen Masks, Smoke Goggles (if Req.), Establish Crew Communications
5	Manufacturer's initial steps……..……..Accomplish
Smoke Removal Reminder	At any time smoke or fumes becomes the greatest threat accomplish SMOKE OR RUMES REMOVAL checklist Page x.x.
6-8	If source immediately obvious and can be quickly extinguished – do it & confirm
9	Remaining minimal essential manufacturer action steps (do not meet initial step criteria but are probably ignition sources based on historical fleet data or analysis)
10	Initiate a diversion to the nearest suitable airport while continuing the checklist
Warning	If the SFF situation becomes unmanageable consider an immediate landing
11	Landing is imminent: If Yes, go to Step 16, If No, go to Step 12
12-14	Trouble shooting /source elimination steps for A/C systems XX, YY, ZZ
15	Smoke/fire/fumes continue: Consider Landing Immediately
16	Review Operational Considerations
17	Accomplish Smoke Removal Checklist, if required, page x.x

Guidance: Checklists

Industry Un-alerted SFF Checklist Template

1	Diversion may be required
2-4	Oxygen Masks, Smoke Goggles (if Req.), Establish Crew Communications
5	Manufacturer's initial steps……..……..Accomplish
Smoke Removal Reminder	At any time smoke or fumes becomes the greatest threat accomplish SMOKE OR RUMES REMOVAL checklist Page x.x.
6-8	If source immediately obvious and can be quickly extinguished – do it & confirm
9	Remaining minimal essential manufacturer action steps (do not meet initial step criteria but are probably ignition sources based on historical fleet data or analysis)
10	Initiate a diversion to the nearest suitable airport while continuing the checklist
Warning	If the SFF situation becomes unmanageable consider an immediate landing
11	Landing is imminent: If Yes, go to Step 16, If No, go to Step 12
12-14	Trouble shooting /source elimination steps for A/C systems XX, YY, ZZ
15	Smoke/fire/fumes continue: Consider Landing Immediately
16	Review Operational Considerations
17	Accomplish Smoke Removal Checklist, if required, page x.x

Thanks!

Barbara.K.Burian@nasa.gov