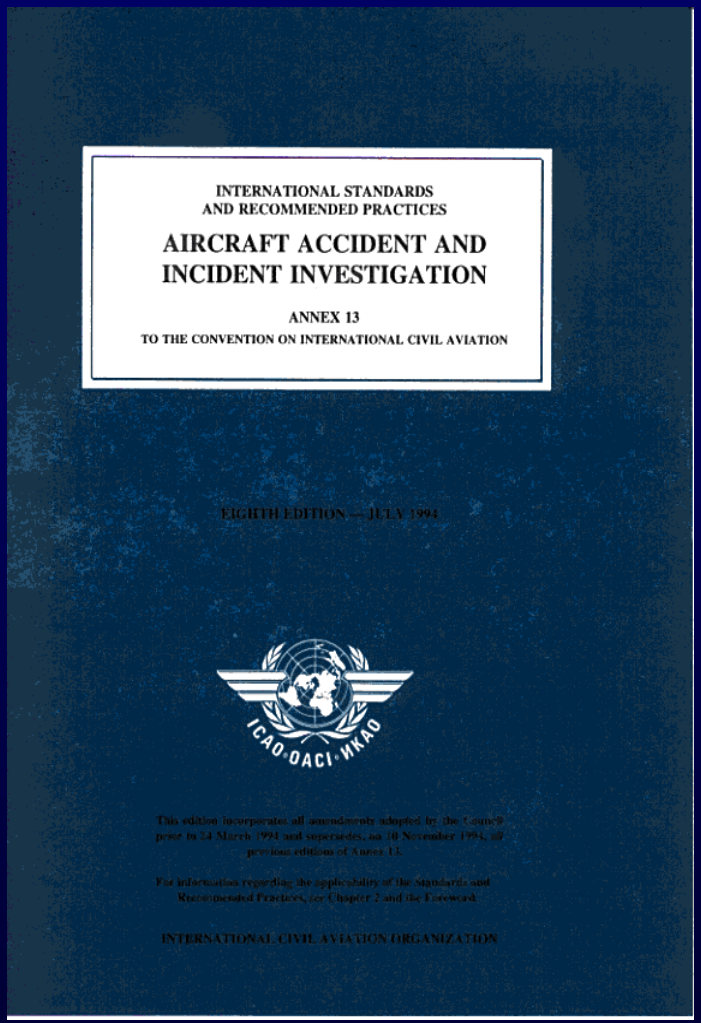
Airborne fires from damaged electrical wiring - Recent investigations and recommendations

Rob Carter & Anne Evans

Air Accidents Investigation Branch, Farnborough, UK



ICAO Annex 13

(Ninth edition - July 2001)

Accidents and Serious Incidents

" … the difference between an accident and a serious incident lies only in the result … "

Four AAIB serious incidents
Nov 2002 - July 2003

- 1) Concorde, G-BOAC, 13 June 2003
- 2) Boeing 737-300, G-LGTI, 20 July 2003
- 3) Boeing 737-436, G-DOCE, 30 May 2003
- 4) Boeing 737-436, G-DOCH, 8 Nov 2004

- all AAIB ‘Field’ investigations

Wiring fault fires on BA aircraft linked to crashes

By Ben Webster
Transport Correspondent

AIR accident investigators have highlighted a series of electrical fires on British Airways jets with similarities to two disasters that cost more than 450 lives.

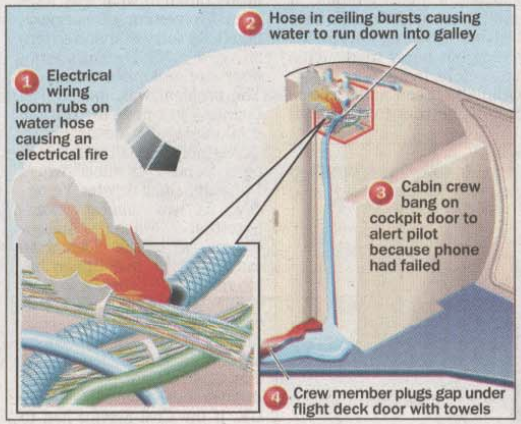
Ken Smart, Chief Inspector of Air Accidents, was so concerned that he has issued a special report identifying the links between the incidents.

All the fires happened in the past 18 months and involved damage to electrical wiring resulting from maintenance errors. The report says that airlines had failed to eliminate faults connected with wiring, despite being alerted to the problem by a series of serious crashes.

The two worst accidents listed in the report involved either electrical arcing or damage to wiring. TWA Flight 800 crashed off New York in 1996, killing 230 people. Two years later, Swissair Flight 111 crashed off the coast of Nova Scotia, killing 229.

In the most serious of the four incidents involving BA aircraft, smoke began to seep into the cockpit of an aircraft which had just taken off from Heathrow bound for Kiev on November 8, 2002.

The captain heard crackling sounds and smelt burning while climbing to cruising altitude. Both pilots put on oxygen masks and began the emergency procedures for a cockpit fire. They heard banging on the locked cockpit door. They tried to contact the cabin crew by phone but the line had been cut



investigate the cause. After opening the cockpit door, he found water cascading from the ceiling. Cabin crew used towels to stop it damaging instruments. The aircraft later returned safely to Heathrow.

An investigation revealed that an engineer had tied a water hose to a bundle of wires. These had rubbed together, exposing the wires and causing sparks. The Air Accidents Investigation Branch (AAIB) identified a series of problems with maintenance and also with emergency procedures used by pilots when detecting smoke.

The investigators also said that the requirement to lock the cockpit door, introduced after the hijackings of September 11, 2001, had created additional problems "related to communication between the flight deck and the cabin".

A cabin crew member had on the locked door. The AAIB report found links between this incident and three others on BA aircraft last year. In May, passengers on a flight from Marseilles to Gatwick were slightly injured when the cabin's pressure control system failed. The pilots were forced to dive 24,000 ft and make an emergency landing at Lyons. The cause of the incident was traced to short circuits and burning of wires.

In June, a fire broke out close to a fuel tank on a Concorde en route from London to New York. Fuel had seeped from the tank and been ignited by chafed wiring. In July, an aircraft preparing to leave Newcastle was evacuated after the captain smelt burning and saw smoke. Insulation material on wires beneath the cockpit floor had been torn away during maintenance six months earli-

The BA aircraft may have wiring problems similar to those that brought down TWA Flight 800

Deadly entertainment

LIKE two of the incidents involving British Airways aircraft, the disaster that befell Swissair Flight 111 in September 1998 began when pilots noticed an unusual smell in the cockpit (Ben Webster writes).

Cabin crew were handing out evening meals on board the McDonnell Douglas MD-11 aircraft which had left New York's JFK airport 53 minutes earlier bound for Geneva.

Smoke from a fire in the ceiling above the pilots' heads ten minutes later the aircraft crashed into the sea near Peggy's Cove, Nova Scotia, killing all 229 people on board.

The probable source of the fire was traced to wiring in the in-flight entertainment system. Modern jets have thousands of extra miles of wiring connected with the increasingly sophisticated entertainment and internet systems which airlines provide for passengers.

Canadian accident investigators criticised the use of flam-

WORLD NEWS

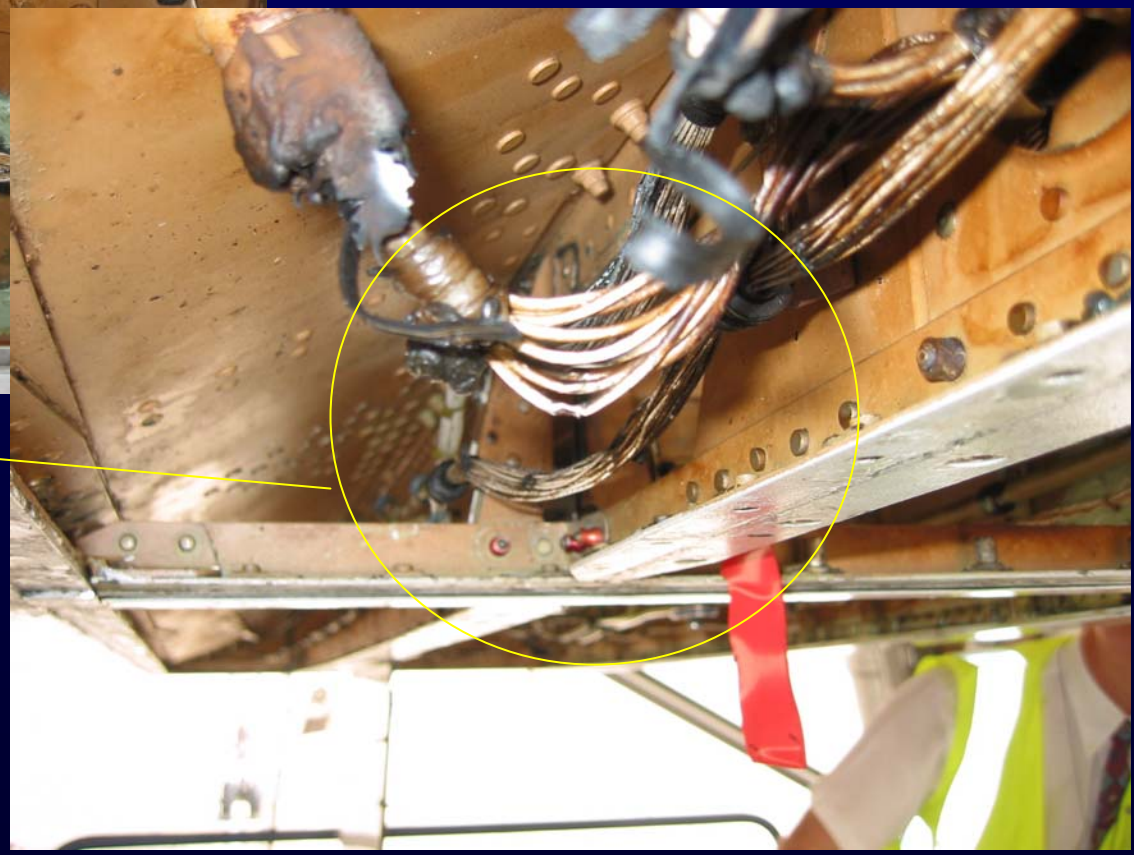
▶ Mission to halt African bloodshed

- UK Press - The Times, London, June 2004

Incident 1 - Concorde G-BOAC on 21 June 2003


Tank 3
Refuel valve
1st Standby
Fuel
Pump
Tank 3
2nd Standby
Fuel
Pump
Tank 3
Area of
fire damage

‘Spark Erosion’ hole in aluminium honeycomb panel



Chafed Wire

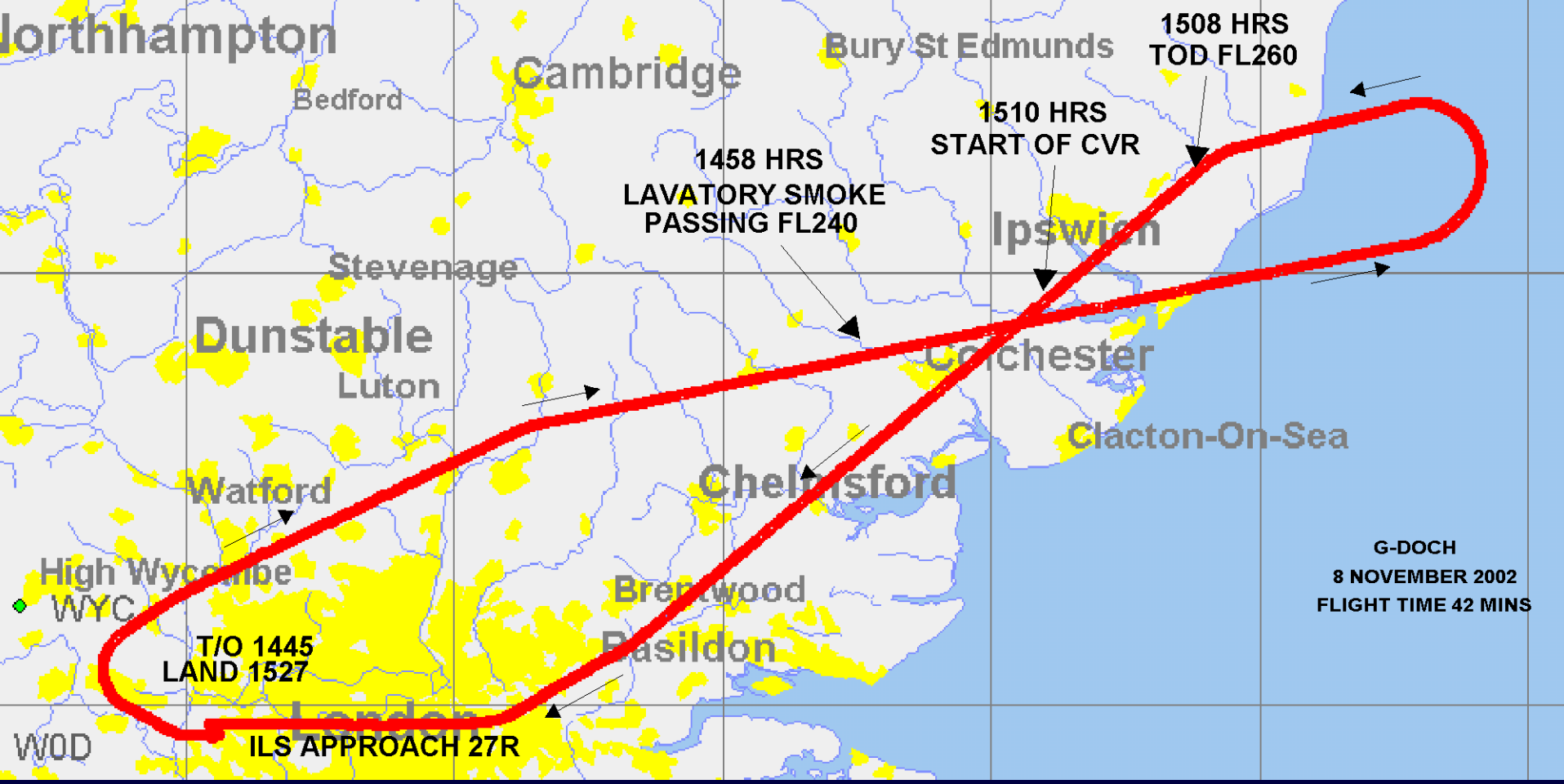
Incident 2 -
B737-300, G-LGTI, 30 July 2003

Fwd toilet service panel

Fwd toilet service panel

Incident 3 -
B737-436, G-DOCE, 30 May 2003

- G-DOCE - 30 May 2003

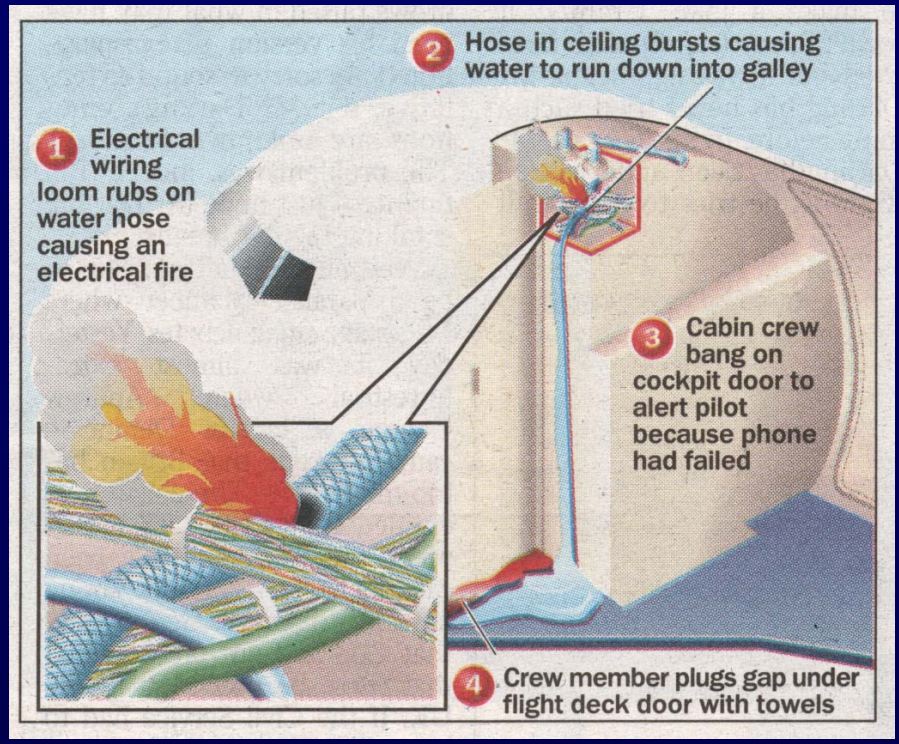


Incident 4 - B737-436, G-DOCH, 8 November 2002

London Heathrow to Kiev, 68 passengers

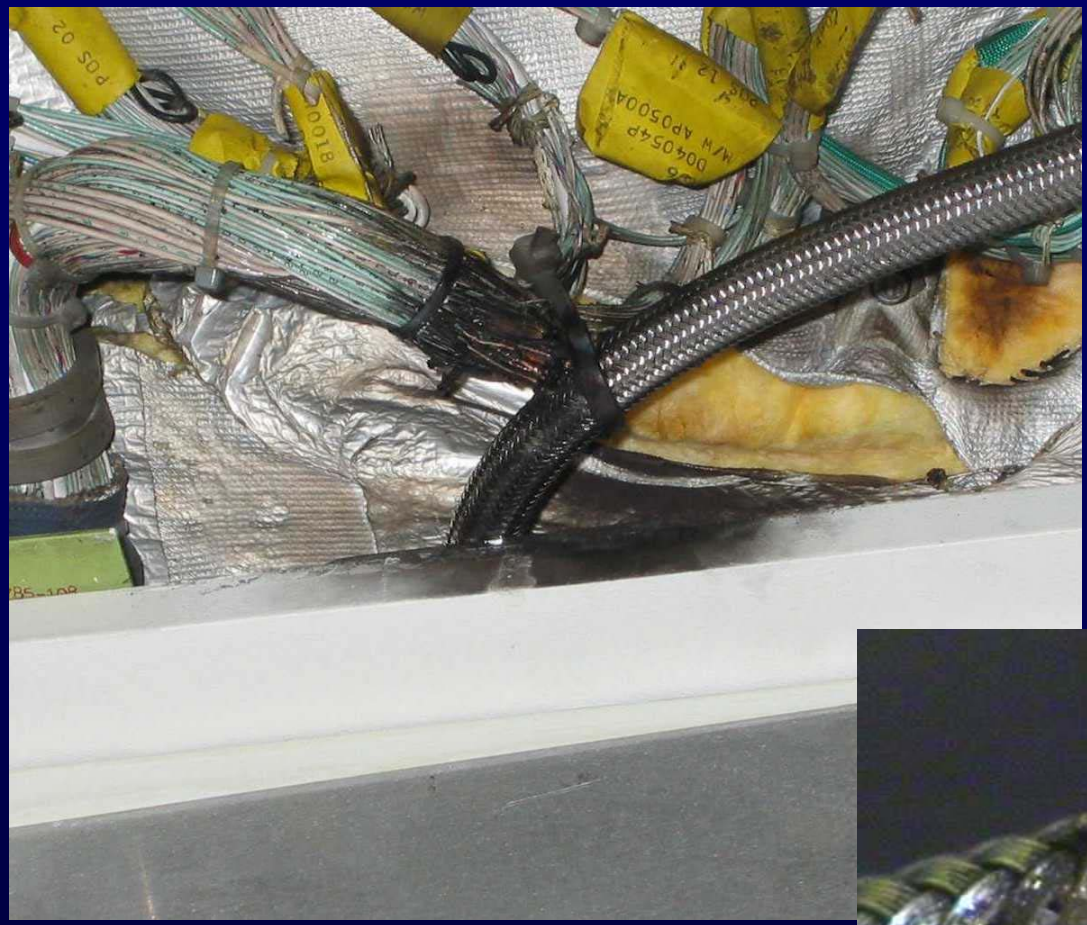
Event started ~78 nm west of Stansted, passing FL240

Turnback to Stansted, divert to Heathrow, landed 29 minutes after event



G-DOCH - Forward galley area

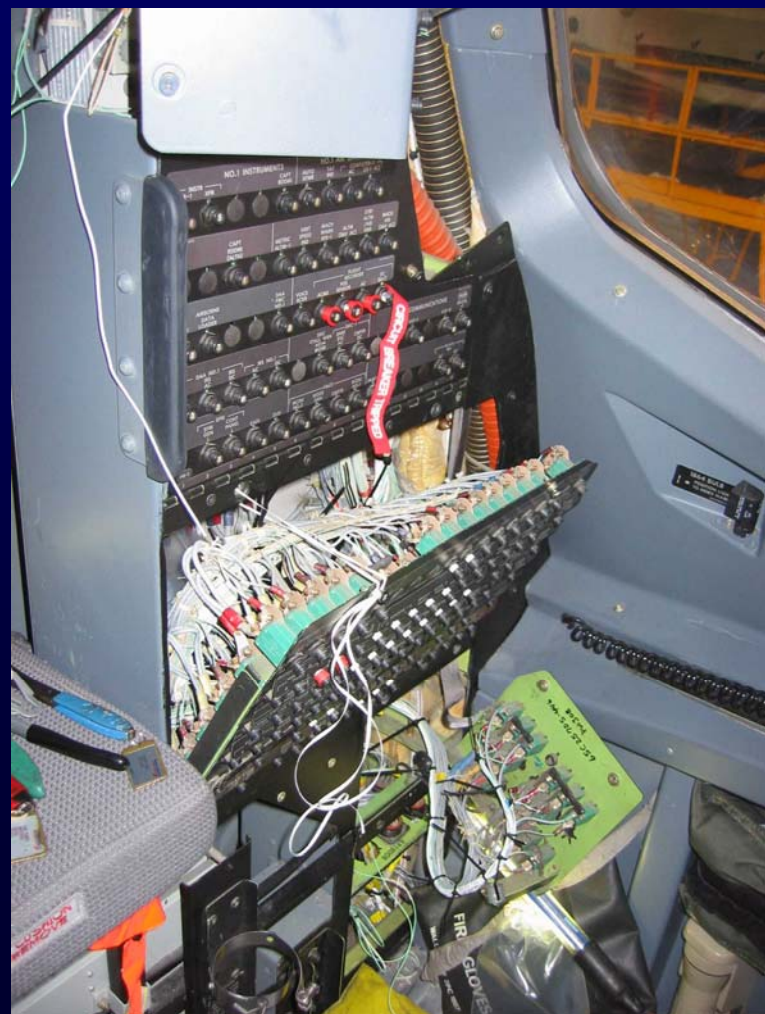
G-DOCH 8/11/02

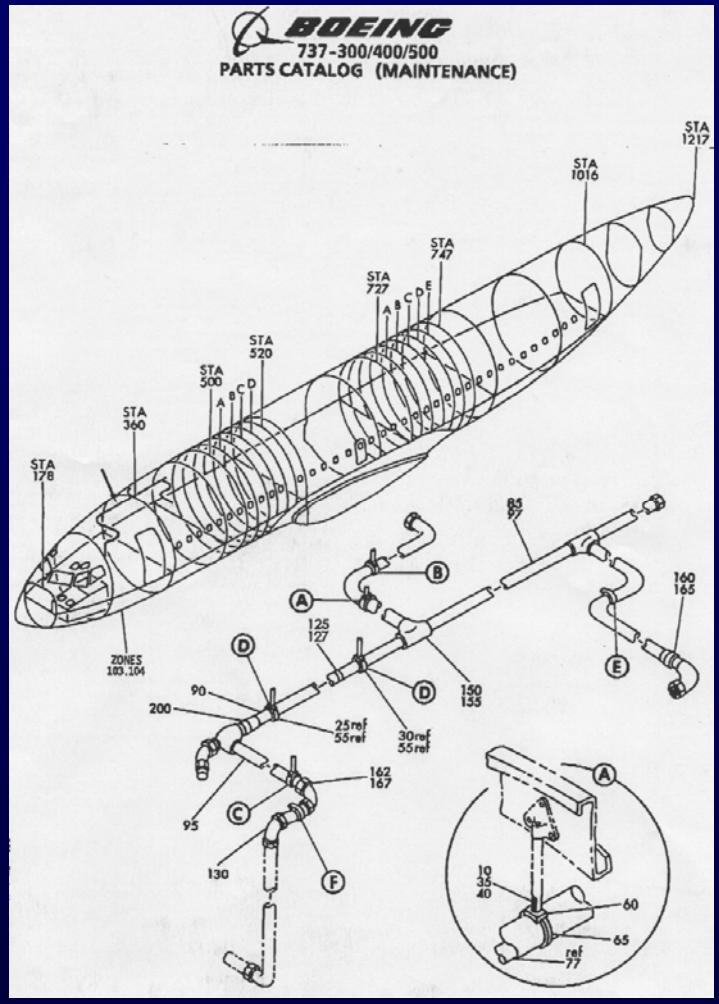


Water hose, Ty-Wraps/
’Zip’ straps & wiring looms

Braided water hose detail

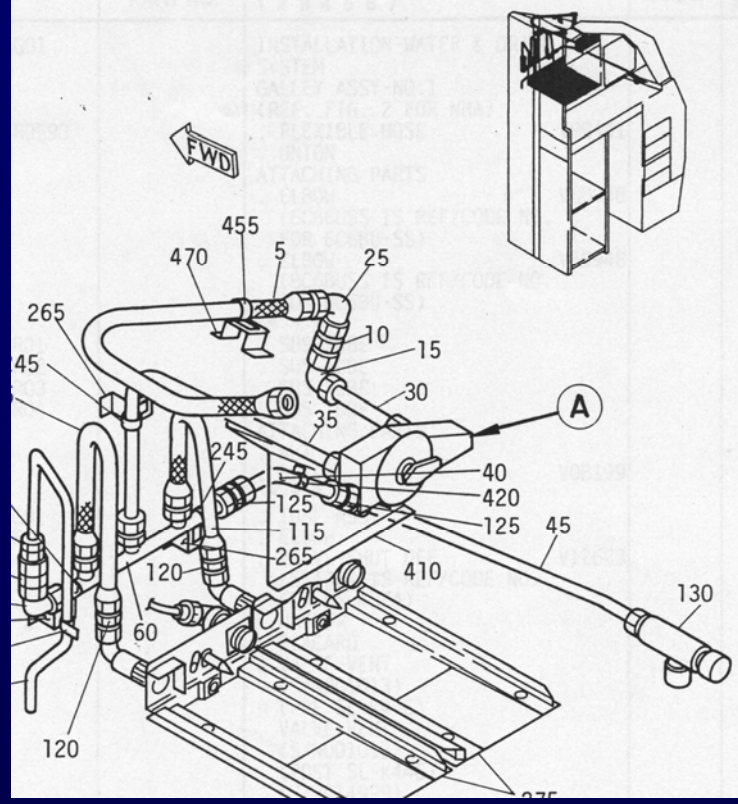
Circuit breakers - G-DOCH



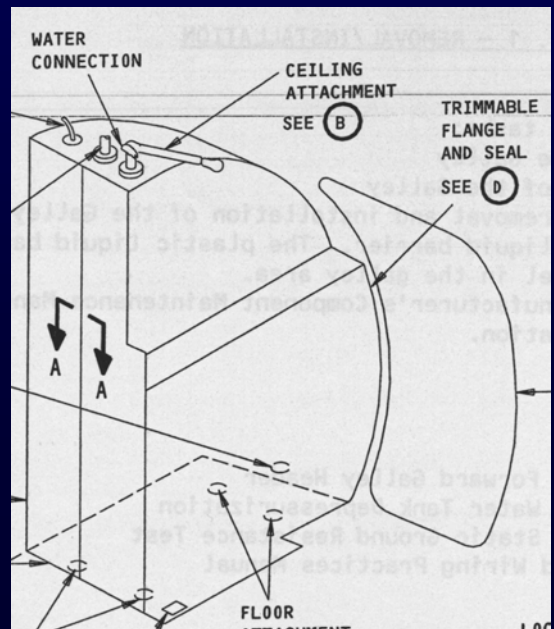


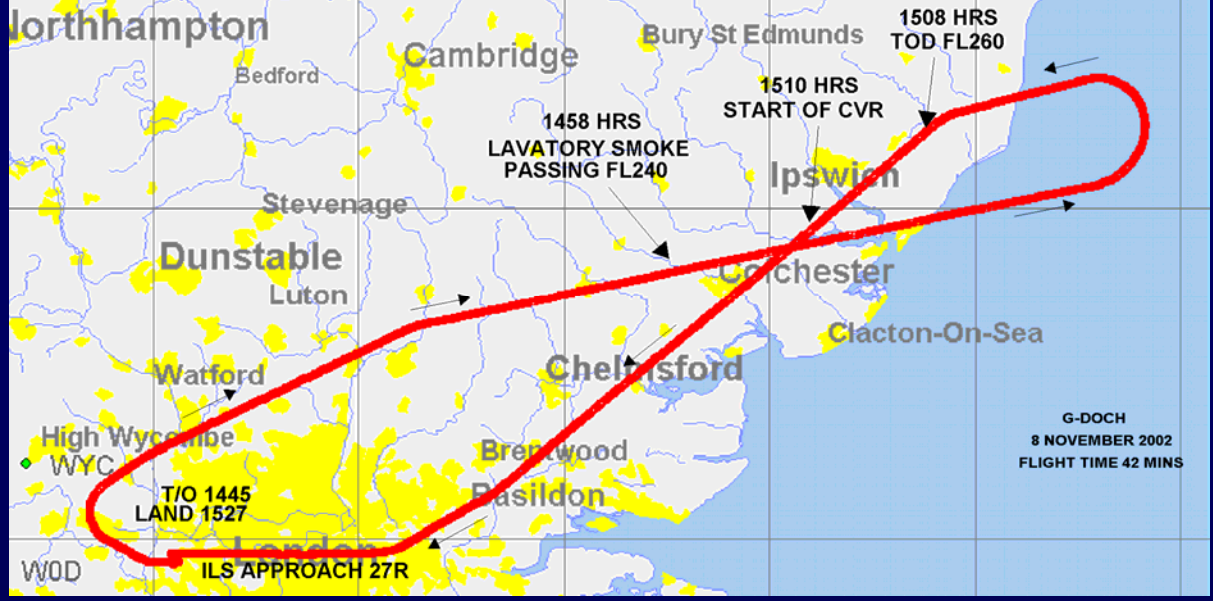
Airframe Parts Catalog

Galley CMM



Aircraft MM





G-DOCH, Operational issues

Communications isolation of flight deck from cabin

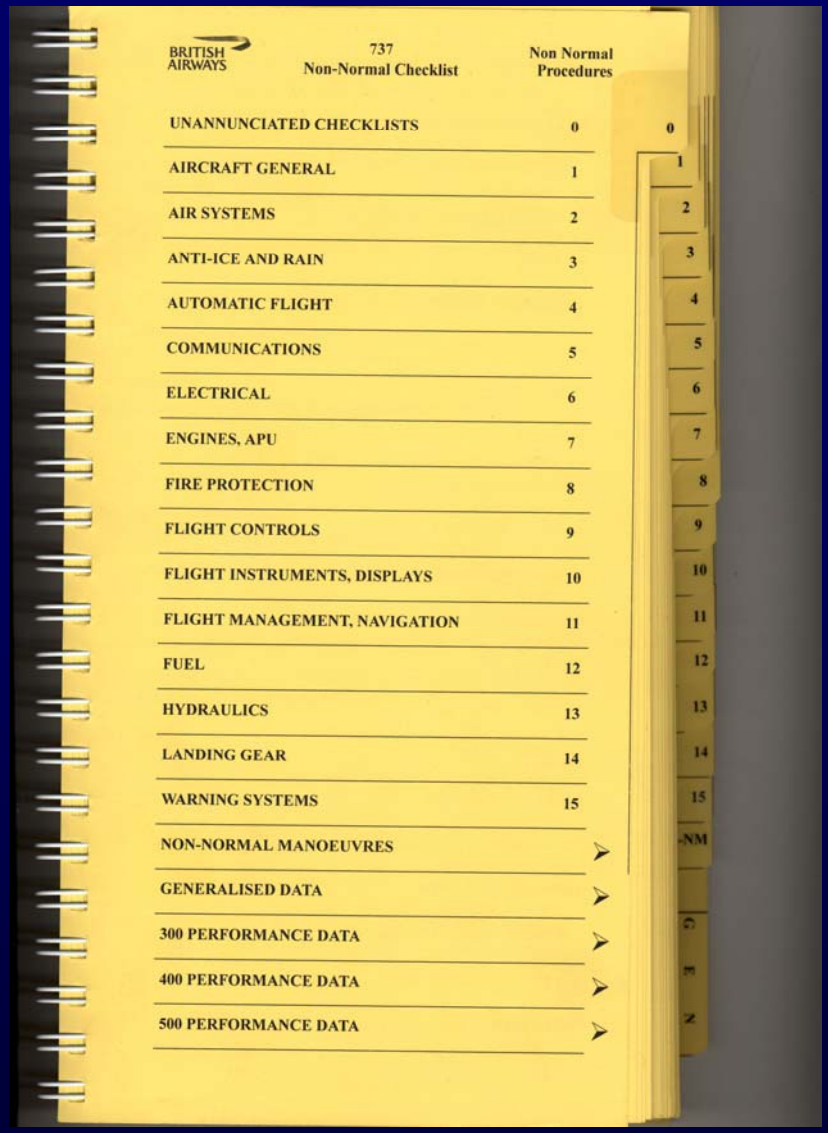
Difficulty of reaching door with oxygen mask on

Commander off flight deck - no monitoring of FO

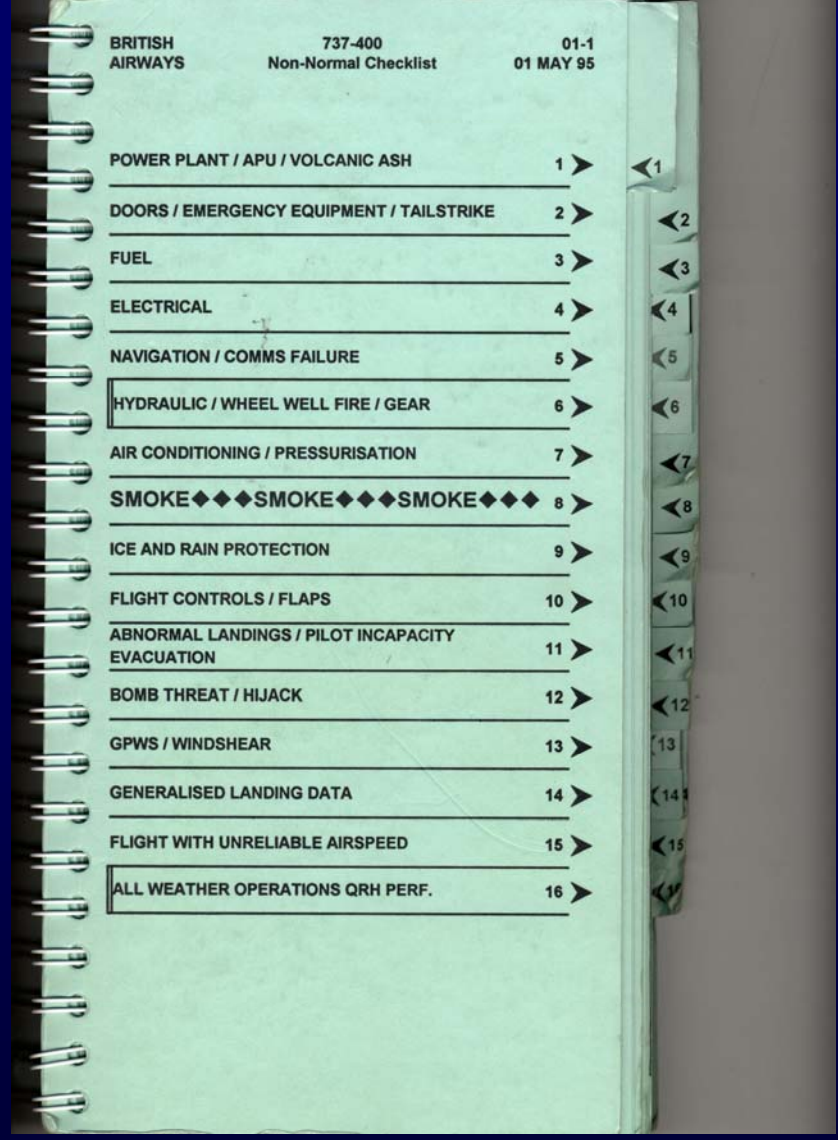
Selection of diversion - diverted traffic

Electrical locking of Phase 2 doors

'SMOKE' checklist design in QRH/FRCs



New



Previous

- QRH checklist redesign

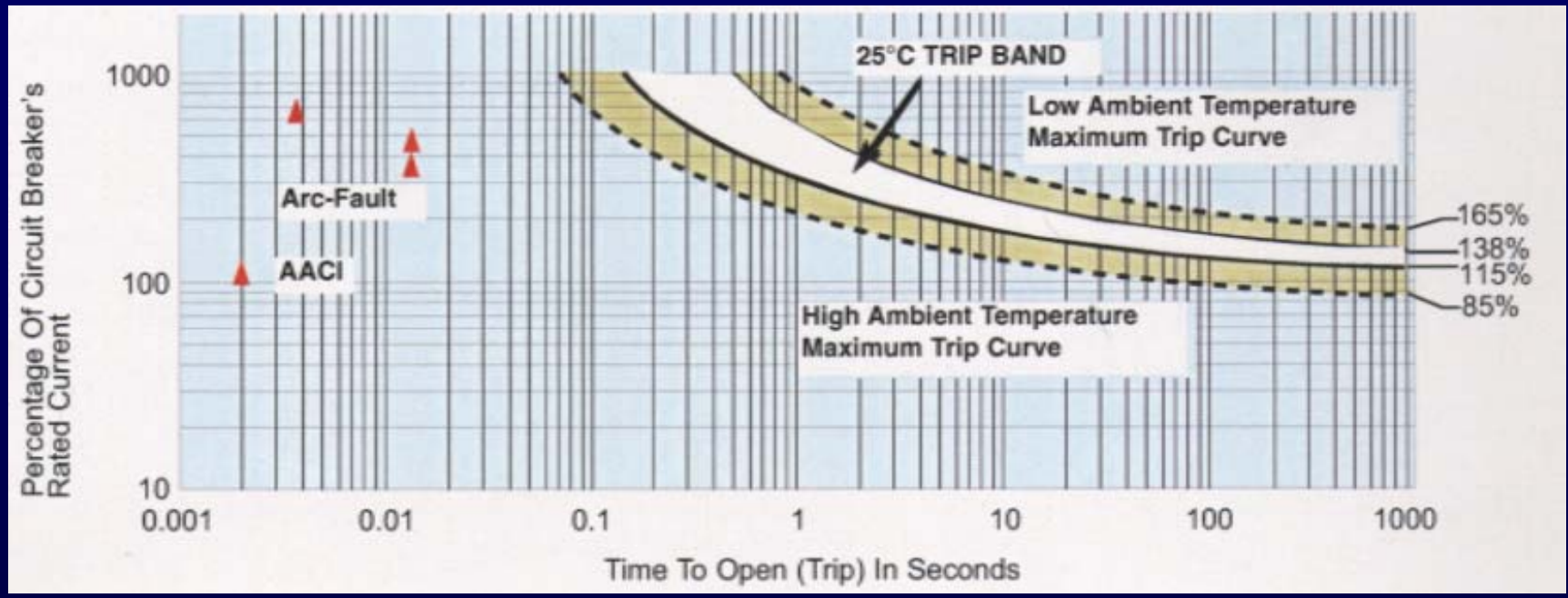
ATSRAC & EASG

- Ageing Transport Systems Rulemaking Advisory Committee
- Chartered January 1999
- Tasks 1 to 10, with Working Groups (Regulators, DoD, airframe manufacturers, airlines, trade associations …)
  - Sampling inspections
  - Maintenance criteria
  - Existing training programs
  - Wiring Practice manual
  - Enhanced maintenance
  - Fleet history
  - Standard practices
  - Systems certification
  - Enhanced training
  - Small transport aeroplanes

Results ...

- Initial tasks completed - further tasks added
- Draft Advisory Circulars (ACs) on:-
  - EZAP (Enhanced Zonal Analysis Procedure)
  - Visual inspections
  - Protections and cautions
  - Wiring practices manual
  - **Development of enhanced training programmes**
- Recommendations to FAA and changes to industry practices
- Recommendation to FAA " … *aggressively pursue and promote arc-fault circuit breaker development*."
- Draft FAA NPRM

Arc fault interrupters/CBs ...



AAIB Recommendations

- Safety Recommendation 2004-18 -
  - "… that the FAA accelerate publication and adoption of guidance material produced by ATSRAC …"
- Safety Recommendation 2004-19 -
  - " … that the EASA expedite the transcription of the material in the FAA Advisory Circulars …"
- Safety Recommendation 2003-108 -
  - " … that the FAA expedite a requirement for the replacement of existing type circuit breakers by arc fault circuit breakers …"
- Safety Recommendation 2003-128 -
  - " … that the EASA expedite a requirement for the replacement of existing type circuit breakers by arc fault circuit breakers …"

Air Accidents Investigation Branch

- Thank you

The Fourth Triennial International Aircraft Fire and Cabin Safety Research Conference