Report 07-004 **Boeing 737-319, ZK-NGK, electrical burning and fumes in the cockpit leading to a precautionary landing at RNZAF Base Ohakea** **3 May 2007**

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Report 07-004

Boeing 737-319

ZK-NGK

electrical burning and fumes in the cockpit leading to a precautionary landing

RNZAF Base Ohakea

3 May 2007

Abstract

On Thursday 3 May 2007 at about 2120, ZK-NGK, an Air New Zealand Boeing 737-319, en route from Wellington to Auckland, was landed at Royal New Zealand Air Force (RNZAF) Base Ohakea as a precaution because of fumes in the cockpit from electrical burning. On board the aircraft were 121 passengers, 3 cabin crew and 2 pilots. Nobody was injured in the incident.

The electrical burning resulted from a coffee spill in the cockpit by a different crew about 4 hours earlier. As the coffee dried, the sugar content provided sufficient conductivity to bring about a slow electrical breakdown, which resulted in spurious warning light indications, electrical burning of an avionics component and an eventual short circuit.

Management of crew drinks in the cockpit was a known hazard that had been identified, documented and mitigated by standard operating procedures. A safety issue identified was the need for flight crew to make maximum possible use of available resources, including those beyond the cockpit, during emergency and non-normal situations.

An Air New Zealand Boeing 737-319

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Abbreviations

RNZAF	Royal New Zealand Air Force
UTC	coordinated universal time

Data Summary

Aircraft registration:	ZK-NGK
Type and serial number:	Boeing 737-319, 26318
Number and type of engines:	2 CFM 56-3C-1 turbofans
Year of manufacture:	1995
Operator:	Air New Zealand
Date and time:	3 May 2007, 2120[1]
Location:	RNZAF Base Ohakea latitude: 40° 12.4´ south longitude: 175° 23.22´ east
Type of flight:	scheduled air transport
Persons on board:	crew: 5 passengers: 121
Injuries:	crew: nil passengers: nil
Nature of damage:	nil
Pilot in command's licence:	airline transport pilot
Pilot in command's age:	34
Pilot in command's total flying experience:	8020 hours (3600 hours on type)
Investigator-in-charge:	K A Mathews

[1] Times in this report are New Zealand standard time (UTC + 12 hours) and are expressed in the 24-hour mode.

Factual Information

1.1 History of the flight

1.1.1 At about 2030 on Thursday 3 May 2007, ZK-NGK, an Air New Zealand (the operator) Boeing 737-319, departed from Wellington International Airport bound for Auckland. On board were 121 passengers, 3 cabin crew and 2 pilots. The captain was the pilot flying.

1.1.2 The aircraft was near Paraparaumu and climbing through about 20 000 feet when a number of warning lights on the cockpit overhead panel began to illuminate. The warning lights included panels such as engine overheat, engine and wing anti-ice, dual hydraulic system failure, pressurisation altitude, window overheat and auxiliary power unit. The captain immediately stopped climbing the aircraft and, in order to diagnose the problem, handed over control to the first officer, who, at 2042, advised the terminal radar controller they were having some electrical problems. The first officer asked for clearance to flight level 240,[2] and at 2044 was told to contact the area radar controller.

1.1.3 The pilots said they were presented with an apparent multiple systems failure they had not previously encountered. They assessed from the aircraft and engine instruments and the control responses that the primary systems, including cabin pressurisation, were functioning as they should. The captain cycled the light test switches, which gave differing results with flickering. The pilots said they consequently believed the numerous warning lights were probably spurious signals because of some electrical malfunction.

1.1.4 The captain called the purser and explained the problem to her. He had her check the cabin with the 2 flight attendants, but they found no indication of anything abnormal and smelled no burning.

1.1.5 The captain consulted the Quick Reference Handbook but found that it provided no help because of the number of different lights, so he contacted the operator's maintenance watch for advice. The maintenance watch personnel provided no solution, but mentioned that the problem could be linked to a fluid spill in the cockpit that afternoon.

1.1.6 At 2050, the first officer advised the area radar controller of the warning lights problem. He got clearance to climb ZK-NGK to flight level 270[3] in order to conserve fuel while the pilots considered their situation and the captain did further checking, including whether any circuit breakers had tripped. No circuit breakers were found to have tripped.

1.1.7 The pilots considered their options for continuing to Auckland, returning to Wellington, or diverting to one of the closer aerodromes at the RNZAF Base Ohakea or Palmerston North Aerodrome. They decided that if they had to divert they would go to Ohakea because the surrounding terrain was flatter, the emergency services were of a higher capacity, the runway was longer and at that time of night there was no air traffic service at Palmerston North.

1.1.8 In the meantime the pilots found no further indications of a possible source of the problem but saw that some of the lights had begun to flicker on and off. The captain called the purser to the cockpit to advise her of the situation. Just before the purser entered the cockpit, the first officer had begun to smell what he thought was electrical burning. As the purser entered the cockpit she immediately smelled a strong electrical or plastic burning smell and noticed the various warning lights illuminated in the overhead panel. She saw a slight haze but no smoke. When the purser opened the cockpit door the first officer also smelled a strong burning odour.

1.1.9 The first officer announced that there was smoke on the flight deck and immediately donned his smoke goggles and oxygen mask, in accordance with standard procedures. The captain also smelled the burning, so he briefed the purser. He told her to prepare the cabin for a

[2] Approximately 24 000 feet.
[3] Approximately 27 000 feet.

precautionary landing at Ohakea, and that they would probably stop on the runway and for her to wait for further instructions at that point. He then donned his smoke goggles and oxygen mask.

1.1.10 At 2054, the captain declared a state of urgency to air traffic control and requested a diversion to Ohakea for a precautionary landing. The area radar controller gave the pilots vectors to follow and at 2057 the captain contacted Ohakea radar control.

1.1.11 The captain said he followed the Quick Reference Handbook for electrical smoke, fumes and fire (see 1.3.10), and read the passenger evacuation checklist. He also made an announcement to the passengers advising them of the situation and that they would be landing at Ohakea.

1.1.12 The purser later said they were aware of the lessons learned from the evacuation of a company Boeing 737 at Auckland in September 2006, when smoke entered the cabin after landing.[4] She studied the aircraft emergency procedures manual and briefed the 2 flight attendants about the possibility of an evacuation, ensuring that they each understood their respective responsibilities. She also made sure they had loudhailers ready to use in the event the normal electric public address system malfunctioned, and ensured the emergency fire gloves were at the ready. She then used the public address system to tell the passengers to prepare for landing.

1.1.13 As the flight attendants prepared the cabin for landing they detected what they thought was a burning smell near the middle of the cabin, similar to the smell in the cockpit. The purser briefed an off-duty Boeing 767 captain with 737 experience, who was seated next to an over-wing exit. He had also detected the smell and offered to assist. The purser had him remain next to the exit so that he could control that area, if necessary. The purser advised the pilots about the smell in the cabin and that there was an off-duty captain who could provide assistance.

1.1.14 At 2103, the captain asked the controller to ensure that emergency services were available for the landing. He advised that they would stop on the runway after landing to consider the situation and that they may have to evacuate the aircraft.

1.1.15 The captain took control of the aircraft for the landing, and at 2108 when NZ-NGK was about 10 nautical miles from the aerodrome the pilots continued on a visual approach and completed the landing checks earlier than normal. The pilots said they believed that after selecting the landing gear down they got 3 green lights showing the gear was locked down, but a check on short final approach found there were no green lights confirming that the landing gear was extended, so the captain carried out a go-around leaving the landing gear lever selected down. The captain told the cabin crew and passengers about the landing gear problem and said that they were re-circuiting to land.

1.1.16 One of the flight attendants asked the off-duty captain if he had heard the landing gear extend, but he was not certain. He made a suggestion about the landing gear selector lever, which the flight attendant passed to the pilots.

1.1.17 The captain asked the aerodrome controller if he could see whether the landing gear had extended, but although it appeared to be extended, the controller was not able to positively confirm that all 3 landing gear legs were locked down.

1.1.18 The first officer followed the manual landing gear extension checklist (see 1.3.11) but the 3 green lights for the landing gear did not illuminate to show that the gear was locked down. Although the checklist called for the gear down lock visual indicators (viewing ports) to be checked in such a case, the pilots considered the situation and their options and elected not to use the viewing ports to check that the landing gear was extended. They believed it was an indication problem, and were confident – by their recollection of having earlier seen 3 green lights after first selecting the gear down, the controller's report, the feel of the aircraft, the gear noise, the extra thrust required and the lack of resistance when the manual gear extension

[4] Report 06-003.

handles were pulled – that the landing gear was extended. The captain knew that the time involved would delay the aircraft landing, and with a potential electrical fire, landing as soon as possible was a priority.

1.1.19 The burning odour began to diminish during the circuit, approach and landing. The aircraft was landed at about 2120 and the first officer opened his side window to clear any remaining fumes. As the captain brought the aircraft to a slow taxi speed, the pilots considered whether they should remain on the runway and evacuate the passengers. They saw no evidence of smoke and noted that the burning smell had abated. When the purser advised that the passenger cabin was clear, the captain considered that the safest option was to taxi to the apron and disembark the passengers normally using air stairs.

1.1.20 Emergency services were ready at the aerodrome when ZK-NGK landed, but they did not detect any burning. At the apron they helped assist the passengers from the aircraft.

1.1.21 RNZAF and civilian medical staff were available to attend the passengers, and boarded the aircraft to check on the crew. Afterwards, the crew debriefed the event. The captain later addressed the passengers, advising them that the operator was dispatching another aircraft to fly them to Auckland.

1.1.22 No one was injured during the incident.

1.2 Personnel information

1.2.1 The captain held an airline transport pilot licence (aeroplane) and a class 1 medical certificate valid until 27 April 2008. He had flown approximately 8020 hours, including 3600 hours on the Boeing 737.

1.2.2 The first officer held a commercial pilot licence (aeroplane) and a class 1 medical certificate valid until 22 June 2007. He had flown approximately 4900 hours, including 700 hours on the Boeing 737.

1.3 Aircraft information

1.3.1 ZK-NGK was a Boeing 737-319 manufactured in the United States in 1995. Installed beneath each wing was one CFM 56-3C-1 turbofan engine.

1.3.2 The aircraft had flown 35 582 flying hours and 25 614 cycles. The aircraft was subject to daily inspections and scheduled maintenance checks. The last scheduled check was an "A" check on 6 April 2007. At the time of the incident there were no defects that required the application of the aircraft minimum equipment list procedures.

1.3.3 At about 1645 on the day of the incident a different flight crew was preparing the aircraft at Wellington for a flight to Christchurch. While the first officer did the pre-flight inspection, the captain got each crew member a coffee. The coffees were in disposable cardboard cups with lids. He placed a cup in each pilot's cup holder located on the forward side of the centre control pedestal that was situated between the pilots.

1.3.4 The first officer seated himself in his seat (the right seat) and with his left hand picked up his cup of coffee. As he did so the lid came off the cup, and some of its contents landed on the first officer and the floor beside him. In addition, some coffee spilt onto the right rear corner of the centre control pedestal (see Figure 1). The captain immediately got some paper towels and began to mop up the spilt coffee, before advising an aircraft engineer who was on board at the time.

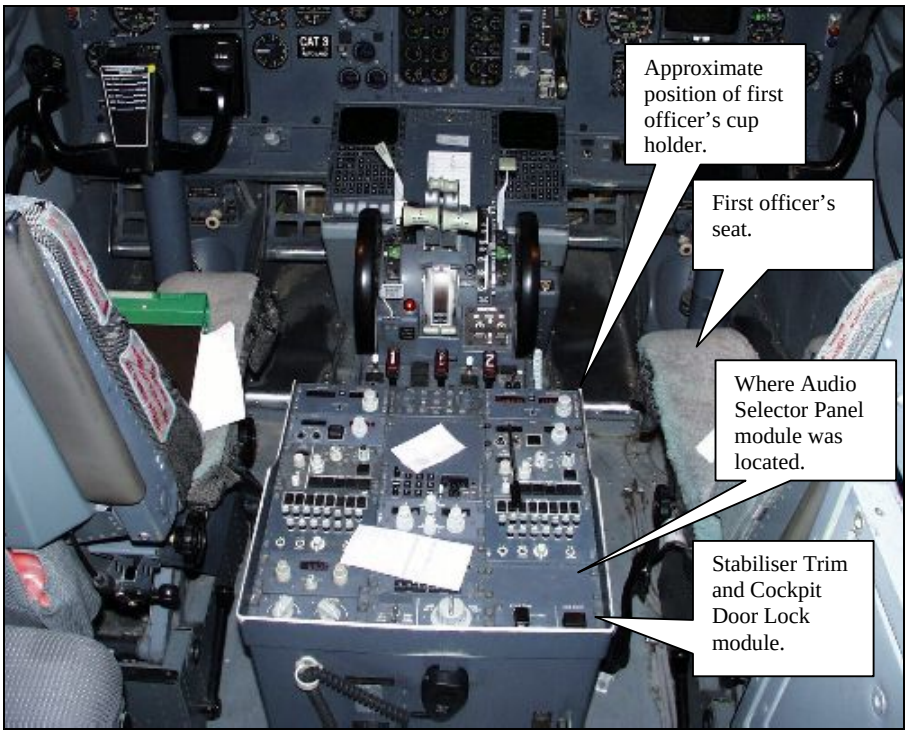

Figure 1
A Boeing 737-300 cockpit avionics control pedestal

1.3.5 The engineer had an avionics authority, and after the pilots had mopped up the coffee he assessed the extent of the spill and its possible implications. Located in the right corner of the control pedestal were the first officer's Audio Selector Panel module, and the Stabiliser Trim and Cockpit Door Lock module. The avionics control modules in the pedestal were fluid splash resistant. There was evidence of fluid around the audio selector panel so he removed it and examined the area around and under it. He saw no evidence that the fluid had affected other areas, including the other modules. He mopped the panel and swapped it with the observer's audio selector panel located in the overhead pedestal. A functional check of the various modules and other electrical systems showed that they were operating normally.

1.3.6 The operator's standard operating procedures said that fluids on the flight deck were a hazard and had potential to cause serious damage, particularly on or near the pedestal and the flight deck instruments or controls. The procedures advised that fluid containers were not to be placed on the pedestal, and whenever possible fluids were to be passed to crew members around their outer shoulder and never over the pedestal.

1.3.7 The pilots said they were aware of the operator's standard operating procedures for the aircraft regarding fluid spills. They said they had not been involved in any previous spills and were careful when passing drinks to ensure they went around the console and never over it. They said this case was unusual in that the coffee cups had lids and the cups had been placed in the proper holders but unfortunately the lid popped off when the first officer took hold of the cup.

1.3.8 The 2 pilots involved in the diversion incident said they were aware of the operator's procedures about fluid spills and the hazards they posed. Several other pilots also said they were aware of the hazards of fluid spills and suggested this was well known amongst pilots.

1.3.9 The engineer made an entry in the aircraft technical log about the fluid spill and the action he had taken. He noted that the affected module would need to be replaced. The pilots then flew the aircraft to Christchurch without incident. A different crew returned the aircraft to Wellington, again without incident. The aircraft then departed for Auckland on the incident flight under the control of the crew who carried out the precautionary landing.

1.3.10 The operator's Boeing 737 Quick Reference Handbook contained a checklist titled Electrical Smoke/Fumes or Fire, and included the following actions:

Condition: Electrical smoke/fumes/fire is identified.

Oxygen masks and smoke goggles
(if required) ……..On
Crew Communications
(if required) ……..Establish
Recirculation Fan Switch …….Off

If smoke/fumes/fire source is known:

Electrical power
(affected equipment) …….Remove

If smoke/fumes/fire persists or source is unknown:

Bus Transfer Switch ……..Off
Galley Power Switch …….Off
Equipment Cooling Supply/Exhaust Switches ……..Alternate
Cabin Reading & Galley Attendant Work Lights …..On

Instruct flight attendants to:
Turn on cabin reading lights
Turn on galley attendant work lights.

Cabin Equipment ……....Off

Instruct flight attendants to:
Turn off galley power switches
Turn off cabin fluorescent light switches.

Plan to land at the nearest suitable airport.

Accomplish the smoke/fumes removal checklist, if required.

1.3.11 The operator's Boeing 737 Quick Reference Handbook contained a checklist titled Manual Gear Extension, and included the following actions:

Landing gear lever ……Off

Manual gear extension handles …….Pull
Wait 15 seconds until the last Manual Gear Extension Handle is pulled

Landing gear lever …….Down

If landing gear indicate down and locked:

Land normally

If a green landing gear indicator light still fails to illuminate:

Wheel well light switch …….On

Gear down lock visual indicator(s) ……..Check

If the gear down lock visual indicator(s) verify gear down and locked:

Land normally.

If one or two landing gear are not verified down and locked:

Accomplish the Partial or Gear Up Landing checklist.

If all landing gear remain retracted:

Accomplish the Landing Gear Lever Jammed In The Up Position checklist.

1.3.12 The flight deck door was fitted with an electrically actuated lock under the control of the flight crew that could be disarmed by removing power. The security door did not inhibit communications with the cabin crew, and in the event they needed access to the cockpit for any reason, such as to help fight a fire, they had access by means of a keypad.

1.4 Meteorological information

1.4.1 The aircraft was operating at night under instrument flight rules when the incident occurred, and was landed at night in visual meteorological conditions.

1.5 Flight recorders

1.5.1 The aircraft was equipped with a digital flight data recorder and a cockpit voice recorder that were secured following the incident. Because sufficient information was available for the investigation, the recorders were released back to the operator without accessing any of their data.

1.6 Fire

1.6.1 There was some smouldering of the Stabiliser Trim and Cockpit Door Lock module test switch components.

1.7 Tests and research

1.7.1 Examination of the aircraft after it had landed at Ohakea showed that a circuit breaker that protected the Stabiliser Trim and Cockpit Door Lock module had tripped at some stage. A strong acrid smell emanated from the module.

1.7.2 Examination of the module showed burning and melting of 2 warning light push-to-test switch assembly components (see Figures 2 and 3). The module was in the same electrical system as the various electrical lights that had displayed spuriously in the cockpit, including the landing gear indicator lights.

1.7.3 Specialist examination of the module found a sticky residue present around the lights test switch contacts and diodes, which suggested some form of fluid ingress. The fluid ingress had occurred around the edge of the module and had run down the outside of the light assembly. There was evidence of a slow electrical breakdown and gradual heat build-up and an eventual short circuit. The examination determined this was because of the partially conductive nature of the fluid, which contained sugar. Heat build-up had led to water evaporation and the eventual burning and carbonising of the sugar. The carbonised sugar was a better conductor than liquid coffee, and current flow subsequently increased and generated more heat. The heat build-up caused thermal damage to the light assembly components, until an electrical short occurred and the protection circuit breaker tripped.

Figure 2
External burning of light switch assembly component

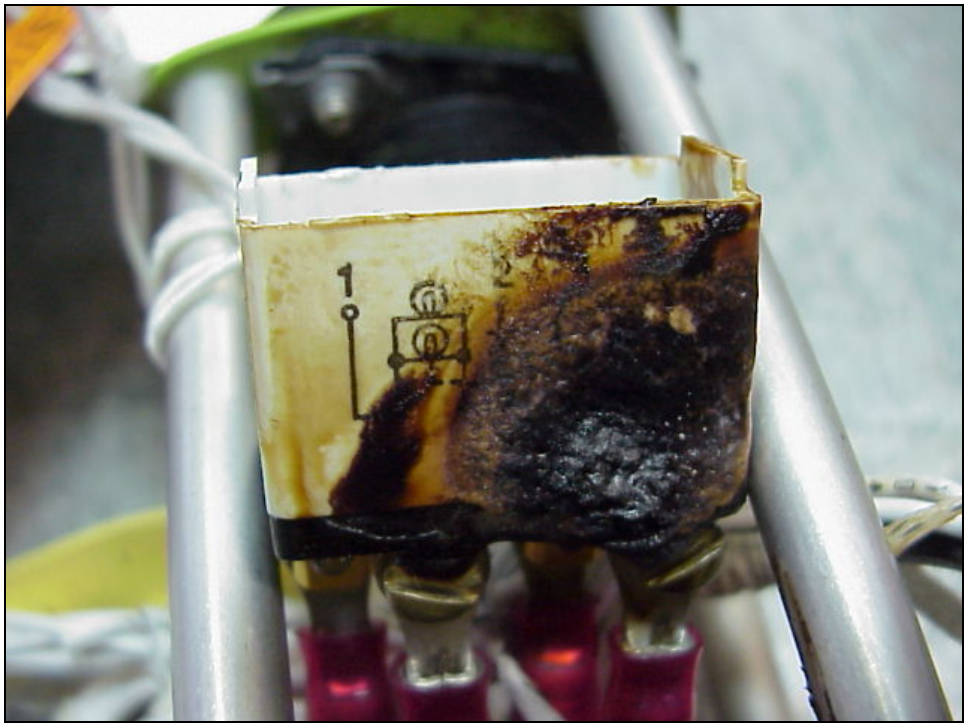

Figure 3
External burning of adjacent light switch assembly component

1.7.4 A review of the Civil Aviation Authority's and the operator's databases showed 3 other flight deck fluid spills for the 4-year period from January 2004 to December 2007: a tea spill, a coffee spill and a water spill. The tea and coffee spills occurred before departure and caused minor

delays while some avionics components were replaced and tested. The water spill was after arrival and did not cause any delay.

2 Analysis

2.1 The flight was a scheduled public transport flight between Wellington and Auckland. However, after about 10 minutes during the climb to cruising altitude the pilots noticed various warning lights illuminate in the cockpit overhead panel.

2.2 The pilots stopped climbing the aircraft to determine the significance of the lights and the actions to be taken with the apparent multiple systems failure, and to ensure that the safety of the aircraft had not been affected. The pilots had not been exposed to this type of scenario before, and consultation with the aircraft Quick Reference Handbook did not give a solution to the problem, or direct the pilots to a particular course of action, because several different systems appeared to be affected.

2.3 Although discussion with Maintenance Watch personnel did not provide a reason for the problem, they did allude to the previous coffee spill as a possibility. After attempting to find the source of the failure, and from their general knowledge and experience, the pilots believed the fault was in the lights test circuit. However, the primary aircraft and engine instruments were still available for their reference. Lessons learned from another incident with a different crew on the aircraft type helped the pilots decide that it probably was some electrical fault rather than a multiple systems failure.

2.4 The pilots were considering their options when the purser entered the cockpit and she and the first officer immediately smelled strong electrical burning. Although the first officer had begun to detect a smell a short time earlier, the change in the airflow to the cockpit once she opened the door could have stirred the air so that the electrical burning smell became evident. Smoke or fumes and electrical burning from an unknown source can present an immediate danger to aircraft, and the pilots were conscious of the risk that a potential fire posed.

2.5 The pilots quickly decided that, because of the undetermined electrical burning that had probably caused the illumination of the various warning lights, immediate diversion to the nearest suitable aerodrome at Ohakea was the most appropriate action. By donning their oxygen masks and smoke goggles, the pilots followed standard procedures and ensured that they would not be overcome by the effects of any smoke or fumes.

2.6 When they prepared the cabin for the precautionary landing the purser and her crew took into account some lessons learned from a different smoke and passenger evacuation incident, and thus ensured that emergency equipment was readily available and that an off-duty pilot was ready to assist in an evacuation if necessary.

2.7 During a check on short final approach to land, the pilots had to contend with another potential emergency when, having already completed the normal landing checks, they did not have 3 steady green lights confirming that the landing gear was locked down. Although they did not have a positive indication that the gear was locked down, they had taken all the available actions to extend the gear and they believed that it was an indication problem. Their recollection of seeing 3 green lights earlier, and the indications they did have from the noise of the gear lowering, the trim and extra thrust required, and the aerodrome controller's observation, gave the pilots confidence that all the gear was locked down. Because of this, the captain elected not to spend extra time circuiting at night while they checked the gear viewing ports, because his priority was to land as soon as possible because of electrical burning and fumes potentially endangering the flight. The captain's decision, however, meant there was some risk the aircraft might have landed with all or some of the gear unlocked, which could have collapsed on landing. Although completion of the checklist would have taken a few extra minutes, there would have been some safety benefit in having the off-duty captain use the viewing ports to verify that the main landing gear was locked down.

2.8 By the time the aircraft landed, and with the first officer opening his window immediately after the landing, the burning smell had reduced markedly and there was no evidence of smoke or fumes in the cockpit or cabin. The aircraft depressurising for landing, and the captain turning off the recirculation fan called for in the electrical fumes or fire checklist, probably helped clear or prevent further fumes from reaching the cabin. The captain had no reason to evacuate the passengers on the runway, so to prevent the risk of injury posed by an evacuation he elected to taxi to the apron and disembark the passengers normally.

2.9 The reason for the emergency landing was traced back to a coffee spill in the cockpit by a previous crew about 4 hours earlier. Although the spilt coffee had been mopped up as quickly as possible, some fluid had leaked into the Stabiliser Trim and Cockpit Door Lock module located by the first officer in the centre avionics control pedestal. The engineer's assessment concentrated around the adjacent Audio Selector Panel module and its replacement where there was evidence of coffee dripping from the module. There was no evidence that the Stabiliser Trim and Cockpit Door Lock module had been affected, and after a functional test showed that all the systems were working correctly he cleared the aircraft to depart. The previous captain's desire to clean up the spill immediately was understandable, but it may have given the engineer an incorrect impression of the extent of the spill and fluid ingress.

2.10 Some spilled coffee had probably entered the Stabiliser Trim and Cockpit Door Lock module light assembly and gone undetected by the engineer. However, aircraft attitude changes during the subsequent 2 sectors may have caused some liquid coffee to migrate to the module. The heat generated by the lights in the module and the surrounding area slowly evaporated the water in the spilled liquid, leaving a sticky residue of carbonised sugar that was a better conductor than liquid coffee. Consequently, the electrical current flow gradually increased and generated more heat, resulting in the slow electrical breakdown and subsequent melting and burning of the light assembly components in the module. This culminated in the electrical indication problems encountered on the incident flight, because of the common circuitry, until a short circuit occurred and the protection circuit breaker eventually tripped, protecting the components from further damage.

2.11 When the crew smelled the burning it was probably at an advanced stage shortly before the circuit breaker tripped. The time at which the circuit breaker tripped could not be determined, but it is likely to have occurred prior to the burning smell diminishing during the landing approach.

2.12 This incident illustrated the adverse effects, uncertainty and potential danger that fluid spills onto avionics or other electrical components can create. Faced with a potential unknown electrical fire and fumes, the crew followed procedures and took the action that was necessary by diverting and landing as soon as possible at the nearest suitable aerodrome. The situation could have been more critical had a suitable aerodrome been some distance or time away. The operator's concern about the hazard that fluid spills posed was well founded, and this incident has highlighted that concern and the need to properly manage fluids in the cockpit to prevent spills.

3 Findings

Findings are listed in order of development and not in order of priority.

3.1 An earlier coffee spill by a previous flight crew member onto an avionics module in the cockpit control pedestal led to electrical short circuiting, spurious light indications, and burning of electrical components causing fumes in the cockpit and cabin.

3.2 Once the electrical burning became evident, the crew's decision to immediately divert to the nearest suitable aerodrome for a precautionary landing complied with standard procedures.

3.3 Proper management of fluids in the cockpit is necessary to prevent spills and avoid the potential adverse consequences of such spills, which was covered by the operator's standard procedures.

3.4 Following standard procedures is important for the safe conduct of a flight, and by exercising their judgement the crew's use of the emergency procedures during this incident mitigated many of the potential risks. Nevertheless, by not completing the landing gear extension checklist they did not know for certain that the landing gear was locked down for landing.

3.5 This incident highlighted the importance of making full use of all resources, including those beyond the cockpit. In this case, the off-duty pilot seated in the cabin could have assisted the flight crew by confirming that the main landing gear was down and locked.

4 Safety Actions

4.1 Following the incident the operator advised that it had taken the following actions:

> A Maintenance Highlight is to be produced highlighting to all engineers the hazard fluid poses on the flight deck and the need to complete an accurate assessment and clean-up process before releasing the aircraft back into service.
>
> An article on fluid spillages in aircraft will be published in the next edition of the Company Safety Magazine.
>
> The Boeing [737] standard operating procedures will be amended so that any time a fluid spillage occurs in the flight deck during flight, or on the ground, an operational occurrence report will be filled out, in addition to the information currently being put into the aircraft technical log.
>
> Training will be reviewed to emphasise completing checklists and using the landing gear viewing ports if required.
>
> Although it had no bearing in this case, technical operations looked at the feasibility of moving the cup holder from the forward face of the centre pedestal, but decided that due to equipment outboard of the pilots (printer and oxygen panels) that it was not practical to move the holder and it was best left where it was.
>
> After the event, it was also re-enforced to all crew that all fluids are passed around the outside of the pilots, although once again that was not a factor in this occurrence.

5 Safety Recommendation

5.1 On 4 March 2008, the Commission recommended to the Director of Civil Aviation that he:

5.1.1 circulate a summary of this report to industry to highlight the safety benefits of using resources, both inside and outside the cockpit, to manage emergency situations. (007/08)

Approved on 21 February 2008 for publication

Hon W P Jeffries
Chief Commissioner

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