Report 10-003: Cessna C208 Caravan, ZK-TZR, engine fuel leak and forced landing, Nelson, 10 February 2010

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Final Report

Aviation inquiry: 10-003

Cessna C208 Caravan, ZK-TZR
engine fuel leak and forced landing
Nelson, 10 February 2010

Approved for publication: 23 February 2011

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (the Commission) is an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

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Chief Commissioner	John Marshall, QC
Deputy Chief Commissioner	Pauline Winter, QSO
Commissioner	Captain Bryan Wyness

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Captain Tim Burfoot
Investigator in Charge	Ian R McClelland
General Counsel	Rama Rewi
Assessor	Pat Scotter

Email:	inquiries@taic.org.nz
Web:	www.taic.org.nz
Telephone:	+ 64 4 473 3112 (24 hrs) or 0800 188 926
Fax:	+ 64 4 499 1510
Address:	Level 16, AXA Centre, 80 The Terrace, PO Box 10 323, Wellington 6143, New Zealand

Important notes

Nature of the final report

This final report has not been prepared for the purpose of supporting any criminal, civil or regulatory action against any person or agency. The Transport Accident Investigation Commission Act 1990 makes this final report inadmissible as evidence in any proceedings with the exception of a Coroner's inquest.

Ownership of report

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1980 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.

Cessna C208 Caravan ZK-TZR

Source: mapsof.net

Location of incident

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Abbreviations

CAA	Civil Aviation Authority of New Zealand
FAA	(United States) Federal Aviation Administration
UTC	coordinated universal time

Data summary

Aircraft particulars

Aircraft registration:	ZK-TZR
Type and serial number:	Cessna C208 Caravan, 20800360
Number and type of engines:	one Pratt & Whitney Canada PT6A-114A turboprop
Year of manufacture:	2008
Operator:	Sounds Air Travel and Tourism Limited
Type of flight:	regular air transport
Persons on board:	6
Pilot's licence:	airline transport pilot licence (aeroplane)
Pilot's age:	31
Pilot's total flying experience:	about 4000 hours (1500 on type)

Date and time	10 February 2010, 0705 NZDT[1]
Location	Nelson latitude: 41° 17.9′ south longitude: 173° 13.3′ east
Injuries	nil
Damage	nil

[1] All times in this report are in New Zealand Daylight Time (UTC +13) and are expressed in the 24-hour mode.

1. Executive summary

1.1. On 10 February 2010, ZK-TZR, a Cessna C208 aeroplane, had just taken off from Nelson Aerodrome on a scheduled commercial flight to Wellington when the pilots noticed a reduction in engine performance and a strong smell of fuel in the cabin. There were 2 pilots and 4 passengers on board at the time.

1.2. The pilot contacted the aerodrome controller and arranged for the flight to return to Nelson; he did this without declaring an urgency or distress situation. The aeroplane made a successful landing back at Nelson, with the engine still operating on reduced performance. There were no injuries and no damage to the aeroplane.

1.3. The Transport Accident Investigation Commission (Commission) found that the reduction in engine performance was due to fuel leaking past damaged o-rings that should have sealed fuel being delivered to the engine. The o-rings had been damaged by movement of the fuel-transfer tubes, which had been reduced in size at some time during maintenance by a chemical milling process that had removed the anodic protective coating.

1.4. The Commission also determined that the pilots should have declared an urgency or distress situation to ensure that emergency services were on standby in the event of a different outcome.

1.5. The Commission also found that the Civil Aviation Authority of New Zealand (CAA) system for classifying accident and incident notifications needed reviewing, because the potential seriousness of the defect that led to the forced landing, while initially recognised, was incorrectly classified and not assigned for investigation until 2 months after the Authority was first notified.

1.6. Actions taken by the CAA to address the safety issue regarding the classification of occurrences meant that no recommendation was required to be made. A recommendation was made to the Director of Civil Aviation regarding the use of correct radio telephone phraseology in the event of an emergency.

2. Conduct of the inquiry

2.1. On 4 December 2009, the engine on a Cessna C208 aeroplane (ZK-TZR) failed to start. Maintenance rectification identified the cause as fuel leaking from damaged o-rings sealing the fuel-transfer tubes, and on 25 January 2010 the maintainer submitted a defect report to the CAA. The report was received by the CAA Safety Analysis Unit and classified as "minor", so the incident was not reported to the Commission.

2.2. After the forced landing incident on 10 February 2010, the operator's maintenance provider sent an occurrence report together with a copy of the previous defect report to the CAA Safety Analysis Unit. The occurrence report was inadvertently classified as minor, so again the Commission was not notified.

2.3. On 18 March, the maintenance provider emailed the CAA expressing concern over what it thought was a slow response from the engine manufacturer, and suggested the CAA enlist the help of the Federal Aviation Administration (FAA) of the United States (where the engine had previously been maintained) to assist in tracking the origin of the suspect fuel-transfer tubes. The engine manufacturer's local representative had in the meantime informed the manufacturer and follow-up action was being initiated.

2.4. On 25 March 2010, having received no response from the CAA, the operator notified the Commission directly about the incident. Given the potential consequences of the defect and that the engine type was in common use in New Zealand and worldwide, the Commission opened an inquiry that day.

2.5. Because of the time it took for the Commission to be notified of the incidents, the Commission included a review of the CAA notification process as part of the overall inquiry.

2.6. The pilots of ZK-TZR, the maintainer and the operator were interviewed, and discussions held with representatives of the CAA.

2.7. Under Annex 13 to the International Civil Aviation Organization Convention, the Transportation Safety Board of Canada was asked to appoint an accredited representative to oversee the Canadian manufacturer's inspection and testing of the suspect fuel-transfer tubes, and the FAA was asked to help establish the maintenance history of the aeroplane when it had been on the United States aircraft register.

2.8. The information from all of these sources has been drawn upon to write this report. The aeroplane was not fitted with any flight recorders.

3. Factual information

3.1. History of the flights

3.1.1. On Friday 4 December 2009, ZK-TZR, a Cessna C208 aeroplane, was scheduled for a regular passenger flight from Wellington Aerodrome to Picton Aerodrome in Marlborough Sounds. During engine start, the engine would not accelerate past 36% Ng.[2] The start was discontinued and on inspecting the engine the pilot observed fuel dripping from the engine bay. Maintenance personnel traced the leaking fuel to several fuel-transfer tubes located around the engine combustion chamber. About 12 o-rings fitted to the tubes were found to be damaged, causing the leaks. The o-rings on all 28 fuel-transfer tubes were replaced with rings from a different batch. Four of the transfer tubes were also replaced as a precaution owing to minor damage sustained during their removal. No other defects were noted and the engine operated normally for about a further 112 hours and 265 cycles.[3] The aeroplane underwent a scheduled servicing on 4 February 2010, during which no anomalies with the fuel-transfer tubes were noted.

3.1.2. On Wednesday 10 February 2010, ZK-TZR was scheduled for a regular passenger flight from Nelson to Wellington. The pilot was assisted by a second pilot who was undergoing aeroplane and route familiarisation. Together they prepared the aeroplane and loaded the 4 passengers for the early morning departure. At 0705, the aeroplane took off on a visual departure from runway 02, flown by the second pilot.

3.1.3. Climbing through about 1500 feet, the 2 pilots noticed that the engine torque setting had decreased slightly. The throttle was advanced and about 20 seconds later the 2 pilots started to smell fuel and observed a higher-than-normal fuel flow indicated on the fuel-flow gauge. All other engine instruments indicated normal. The first pilot took over control of the aeroplane and turned back to Nelson Aerodrome. Power was reduced and the Nelson tower controller was advised of the intention to return and land on the reciprocal runway 20. The pilot did not issue a “Mayday” (distress) or “Pan Pan” (urgency) call, either of which would have ensured the aeroplane received priority air traffic clearance and that emergency services at the aerodrome at least would be put on local standby.

3.1.4. Immediately before the tower controller became aware of ZK-TZR returning, the controller had cleared another aeroplane to line up on runway 02. The second aeroplane was unable to be stopped before encroaching on the runway, so the pilot of ZK-TZR elected to land on the adjacent grass runway. A normal landing was made and the pilot taxied the aeroplane to the apron, where it was shut down and the passengers disembarked. There were no injuries and no damage to the aeroplane.

3.2. Engine examination

3.2.1. Following the forced landing, the operator’s maintainer examined the aeroplane at Nelson. Upon opening the engine cowls, the smell of fuel was evident. The maintainer reported that no loose or broken fuel pipes or lines were found, so the engine was motored over with the fuel pump turned on and the ignition turned off. Fuel was observed weeping to varying degrees from most of the fuel-transfer tubes, with the exception of the 4 tubes that had been replaced following the starting incident in December. The leaking fuel-transfer tubes were removed and appeared to the maintainer to be different from the 4 replacement tubes installed in December. Those 4 tubes had been obtained from a recognised parts’ distributor for the engine. Measurement of the suspect tubes confirmed they were smaller than the 4 replacement tubes. The maintainer gave several of the suspected non-conforming tubes to the local representative of the engine manufacturer for further assessment.

3.2.2. Once the Commission had opened its inquiry, it requested the Canadian Transport Safety Board to appoint an accredited representative to oversee the examination of the suspect fuel-transfer tubes by the engine manufacturer based in Longueuil, Quebec.

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[2] Ng refers to the rotating speed of the engine gas producer turbine.

[3] A cycle was one engine start.

3.2.3. An examination of the suspect fuel-transfer tubes confirmed that the part number engraved on the side of the tubes was the correct Pratt & Whitney Canada part number. However, the normal anodic coating was no longer present and the tubes appeared smaller alongside known genuine parts. Measurements of the suspect tubes showed they were between 0.008 and 0.019 inches (0.2 and 0.48 mm) below limits in all areas except one. The internal tube diameters were also larger than new and other used tubes. The material used in the construction of the suspect tubes was determined to be a 2024 aluminium alloy of the type normally used in their construction.

3.2.4. The examination determined that the suspect tubes were genuine in origin but had probably been immersed in a chemical milling solution, although no trace of the solution could be found. The manufacturer noted that chemical milling was not an approved method for cleaning and repairing the tubes.

3.2.5. An examination of the supplied o-rings confirmed they were of the correct composition, microstructure and hardness when compared with original specifications. The o-rings displayed mechanical damage and chipping consistent with having been pinched and rolled.

3.2.6. The examination was not able to determine the timeframe or the number of engine hours over which the deterioration of the o-rings had occurred.

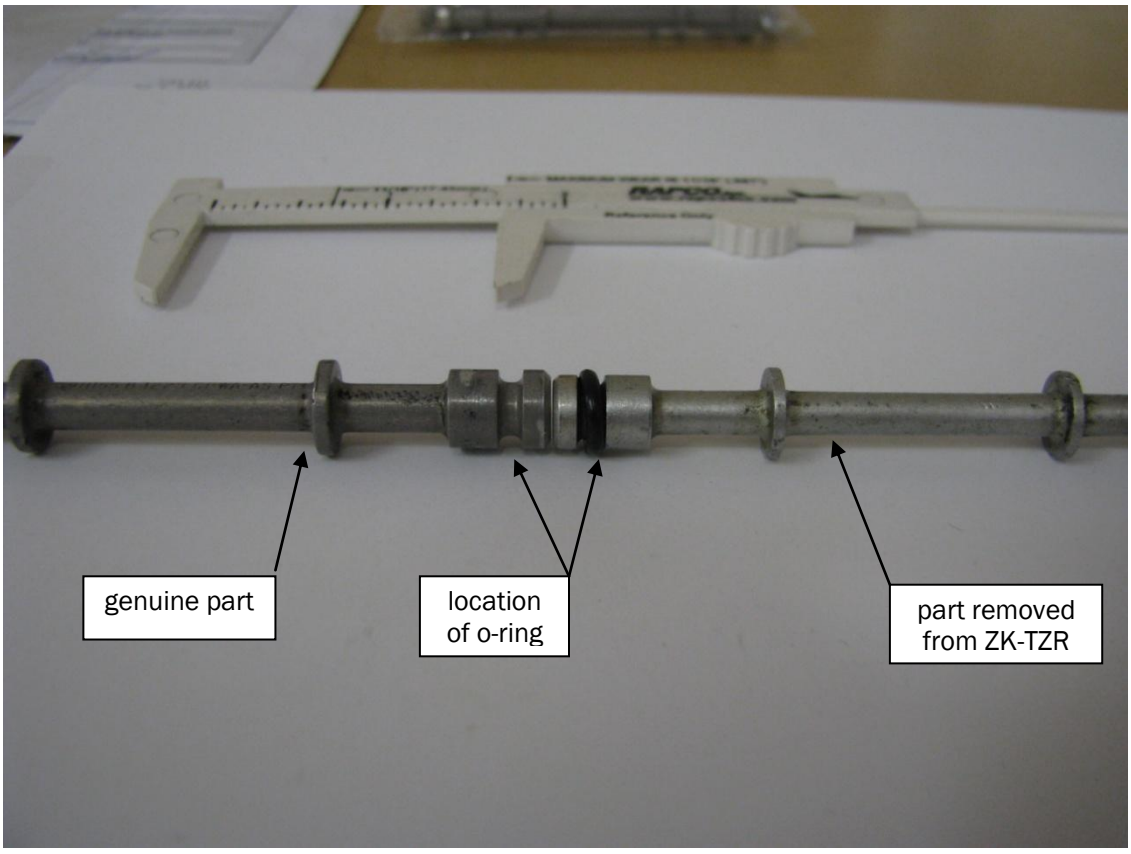

Figure 1
Fuel-transfer tubes

3.3. Aircraft information

3.3.1. ZK-TZR was a Cessna C208 Caravan aeroplane, serial number 20800360, manufactured in the United States in August 2002. It was fitted with fixed tricycle landing gear and had seating for a pilot and 13 passengers. It was powered by a single Pratt & Whitney Canada Corporation PT6-114A turbo-propeller engine, serial number PC-0990. The engine was manufactured in May 2002 and fitted new to the aeroplane during assembly.

3.3.2. The Cessna C208-type aeroplane first flew in 1982 and entered service in 1984. Over 2000 variants of the C208 were built and the aeroplane was normally used for short-distance commuter and freight operations. The aeroplane was approved under Civil Aviation Rules Part 125 for commercial single-engine "instrument flight rules" passenger operations (CAA, 2008).

3.3.3. The PT6-type engine powering the C208 was more common, with 130 PT6A engines operating in New Zealand and more than 23 000 worldwide. In New Zealand, the engine was used on a range of other aircraft, including the Hawker Beechcraft 1900 twin-engine commuter, and the single-engine Pacific Aerospace Cresco and P-750 aeroplanes, primarily used for topdressing and parachuting operations respectively.

3.3.4. ZK-TZR was initially registered as N800RA and remained in the United States until June 2006. During this time the aeroplane accrued 591 hours and 378 cycles. Records indicated the aeroplane had 2 owners during this 4-year period.

3.3.5. The aeroplane was imported into New Zealand in July 2006 and registered as ZK-TZR. The new owner operated the aeroplane for a little over 2 years, during which time it accumulated a further 155 hours and 211 cycles. In October 2008, ZK-TZR was purchased by Sounds Air and Travel Tourism Limited (the operator), which started flying it on commercial routes. It had accrued about 746 hours and 589 cycles when it was purchased by the operator.

3.3.6. ZK-TZR was issued a Certificate of Airworthiness that was non-terminating provided the aeroplane was maintained in accordance with an approved maintenance scheme. Following the purchase of the aeroplane, the operator inducted it into the Cessna maintenance programme and records indicated it had been maintained in accordance with that programme.

3.3.7. Maintenance of the aeroplane was undertaken by an associated maintenance company (the maintainer), which also maintained the operator's other aeroplanes, including another 2 Cessna C208 Caravans. The last recorded maintenance on ZK-TZR before the incident was a scheduled "Phase 6" inspection completed on 4 February 2010. The aeroplane had accrued 1777 hours and 2781 cycles at that time. During the 4 February inspection, a replacement set of fuel nozzles was installed as part of a scheduled clean flow check. The opportunity was also taken at the time to replace all the fuel-transfer tube o-rings as a precaution against a possible bad batch of rings. The aeroplane returned to service and flew 20.4 hours and did 51 cycles before the incident flight on 10 February.

3.3.8. The fuel-transfer tubes were an "on-condition" item, meaning that they did not need to be replaced unless determined to be unserviceable. The maintenance programme called for the fuel nozzles to be checked every 400 hours. The procedure required the fuel-transfer tubes to be removed to access the nozzles. The maintainer confirmed that since starting maintenance on ZK-TZR, the fuel nozzles had been removed for examination on 3 occasions, including on 4 February 2010. The maintainer reported that other than a visual inspection of the tubes, no other work was performed on them before they were re-installed.

3.3.9. A review of the maintenance history of the aeroplane identified at least one other occasion when the fuel-transfer tubes would have been removed to facilitate a fuel nozzle flow check. This was in the United States on 21 November 2005.[4] The aeroplane had accrued 530.7 hours at this time. In response to a request for information, the FAA conducted a review of the maintenance history of the aeroplane while it was operating in the United States. The FAA

[4] The fuel nozzles, and therefore the fuel-transfer tubes, may have been removed on other occasions, but available documentation did not specifically state this.

determined that during the recorded fuel nozzle inspection the fuel nozzles and fuel-transfer tubes were sent to a Pratt & Whitney repair site at Los Alamitos, California, for "inspection/repair". The FAA investigation "found that all repair parts were purchased and installed through the manufacturer's maintenance facility".

3.3.10. At the time of the incident on 10 February 2010 there were no other known or reported defects on the aeroplane that would have contributed to the fuel leak or affected the safety of the flight.

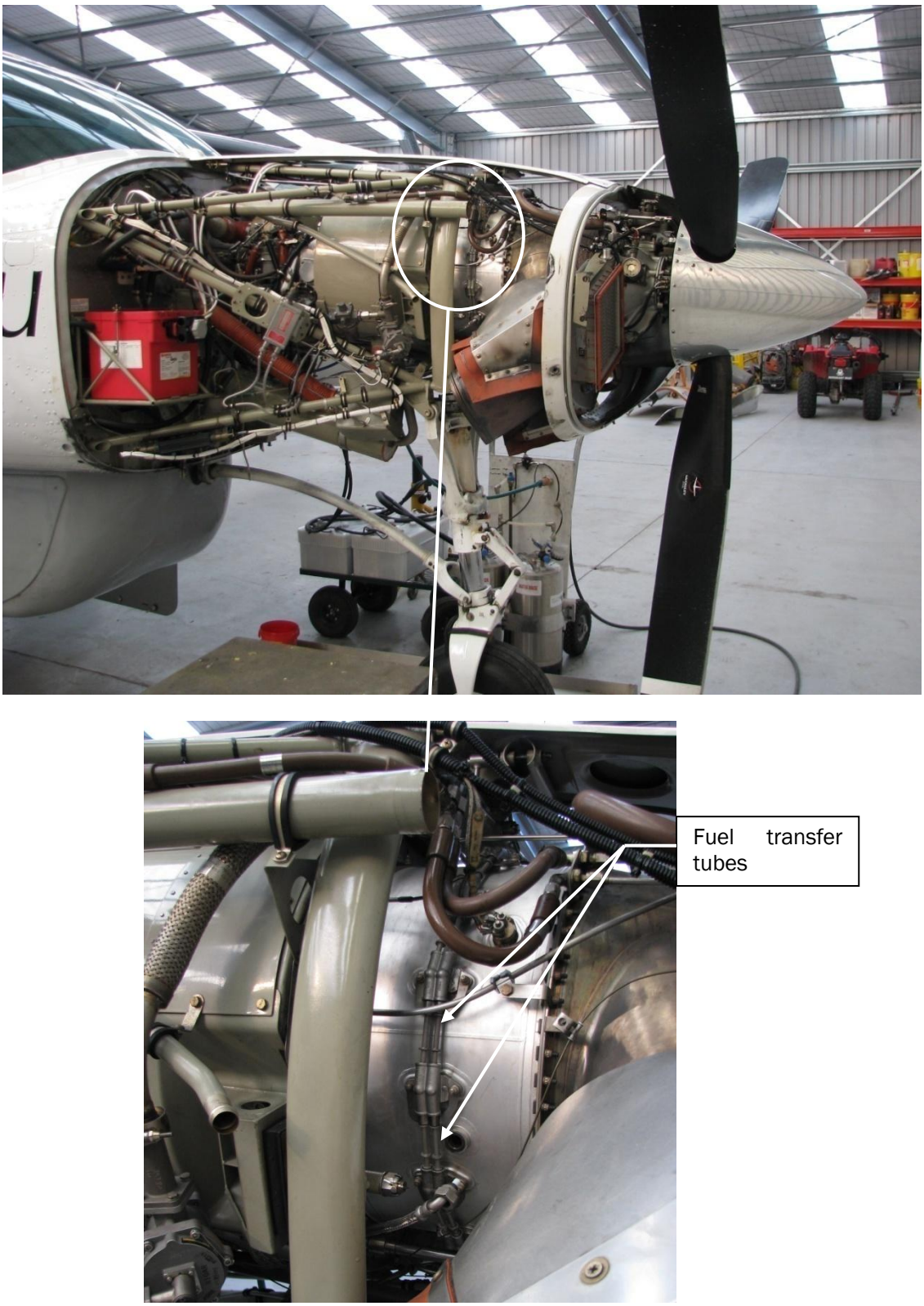

Figure 2
Location of fuel-transfer tubes

3.4. Personnel information

3.4.1. The pilot held an airline transport pilot licence (aeroplane) issued on 18 March 2009 and a current single pilot instrument rating endorsed for the C208 aeroplane type. The pilot was a qualified D-category instructor and had previously held a B-category instructor qualification, which had expired owing to lack of currency.

3.4.2. The pilot joined the operator in September 2005. In September 2008 he left to fly with another operator before returning 11 months later in August 2009. The pilot had accrued a total of about 4000 flying hours, including 1500 hours on the Cessna C208-type aeroplane. His most recent line and instrument checks were on 31 August 2009. He held a current class 1 medical certificate issued on 20 April 2009.

3.4.3. The pilot had flown 10 hours in the preceding week and had had a 5-hour duty day, flying 2.2 hours, the day before the incident. The pilot had reported for duty at 0445 on the day of the incident. He said that he had been in good health and not fatigued.

3.4.4. The second pilot held a commercial pilot licence (aeroplane and helicopter) and a current class 1 medical certificate. He joined the operator on 19 January 2010 and subsequently qualified on the Cessna C208 type aeroplane. He accrued 1252 flying hours and 13 hours on type. At the time of the incident he was undergoing route familiarisation and gaining experience towards his single pilot instrument rating qualification. He also said that he had been in good health and not fatigued.

3.5. Incident notification

3.5.1. Section 26 of the Civil Aviation Act 1990 details the responsibilities for the notification of all accidents and incidents to the CAA. Section 27 of the Act in turn directs the CAA to notify the Commission of aircraft accidents and certain serious incidents. Under the International Civil Aviation Organization's Annex 13, Aircraft Accident and Incident Investigation, an incident with a high probability of an accident or a gross failure to achieve predicted performance during take-off or initial climb would be considered a serious incident.

3.5.2. On 25 January 2010, the maintainer submitted a defect report to the CAA regarding the fail-to-start incident on 4 December 2009. The report briefly outlined the incident and offered 3 possible reasons for the o-rings failing to seal the tubes: o-rings damaged on installation, contaminated fuel causing a chemical reaction, and a "bad batch" of o-rings. The report stated that the o-rings were replaced and that several o-rings had been sent to the o-ring manufacturer for examination. The maintainer's defect report was classified "minor" by the Safety Analysis Unit of the CAA.

3.5.3. After the second incident, the maintainer emailed an occurrence report form to the CAA late on the evening of 10 February 2010. Attached to the report was an additional report that referred to the 4 December incident and outlined the latest incident and initial findings. The additional report stated that the fuel-transfer tubes removed from the engine "were noticeably different in size" from recently replaced tubes. The report also included photographs and measurements showing that the removed fuel-transfer tubes were smaller, causing "the o-rings to be a sloppy fit, which could lead to subsequent in-service damage and fuel leakage". The Safety Analysis Unit classified that report as minor also.

3.5.4. On 11 February 2010, the maintainer sent an "Operational Notice" informing the operator's pilots of the incident and the presumed cause of the fuel leak. Concerned about the possibility of suspect or non-conforming parts entering the parts system, the maintainer also informed the local representative of Pratt & Whitney Canada. Several of the suspect fuel-transfer tubes and a number of the o-rings were subsequently forwarded to the manufacturer through the local representative (refer to section 3.2 Engine examination).

3.5.5. On 18 March 2010 the maintainer, having not heard anything from the manufacturer or the CAA about the incident, emailed the CAA to express continued concern regarding the origin of the suspect fuel-transfer tubes removed from ZK-TZR. The maintainer suggested that the CAA

ask the FAA to help determine the origin of the smaller-sized tubes. The maintainer received no response from the CAA.

3.5.6. The CAA later advised the Commission that after receiving the occurrence report of 10 February, the data registrar emailed the manager of safety investigations on 11 February, informing him of the incident and that it had been classified as a "major" occurrence. However, the registrar omitted to select the "major" classification while entering the occurrence details into the CAA's safety information system. Without the positive selection of a classification code, the filing system automatically defaulted the report to "minor". As a result the Commission was not automatically and immediately sent notification of the occurrence as would normally have happened.

3.5.7. On 25 March 2010, a person representing the safety interests of the operator notified the Commission about the sequence of events and apparent lack of response from the CAA. Simultaneously the Safety Investigation Unit of the CAA was made aware of the events and assigned a safety investigator. The Safety Investigation Unit investigator immediately requested the Safety Analysis Unit, which had received the original defect and incident notifications, to upgrade the 10 February incident from "minor" to "critical", which was done.

3.5.8. On 26 March 2010, the CAA notified the FAA of the incident and alerted it to the possibility of non-conforming parts being installed on an aircraft.

3.5.9. On 7 April 2010, the CAA sent a letter to all 33 operators of the Pratt & Whitney Canada PT6 engine in New Zealand. The letter informed them of the 10 February 2010 incident and recommended they inspect their engines to identify any suspect fuel-transfer tubes. The letter described how this could be achieved and asked for the CAA to be notified of any findings. One response was received regarding a tube that appeared to be different in appearance from others. This was, however, determined to be unrelated as the tube was from a different production run and on further examination was found to meet the design specifications.

3.6. Radio phraseology

3.6.1. In the past 20 years, the Commission has investigated other occurrences where pilots have not used the correct phraseology of "Mayday" or "Pan Pan" to inform others of a distress or urgency situation. Three recent examples in which inappropriate or incorrect radio phraseology was used follow.

3.6.2. On 12 September 2006, a Boeing 737 aeroplane had an electrical failure during take-off from Auckland. The crew was unable to rectify the failure and the aeroplane returned to land. After landing, a ground evacuation was required because of increasing smoke and fumes. At no time was an urgency call made; rather the crew requested "local standby" to indicate the need for airport rescue services to be activated for their return (Transport Accident Investigation Commission [TAIC], 2008a).

3.6.3. On 27 November 2006, a Gippsland Aeronautics GA8 aeroplane en route from Wellington to Kaikoura had a significant engine malfunction that required an immediate return to Wellington. The pilot requested priority for landing, but did not declare any urgency or request the airport rescue services to be placed on standby (TAIC, 2008b).

3.6.4. On 30 December 2006, a fire occurred in the engine nacelle of a Boeing 767 aeroplane soon after landing. The investigation found that because of miscommunication, uncertainty about the severity of the situation and unfamiliarity with the aerodrome emergency plan, there was a 9-minute delay before the aerodrome fire service arrived at the aeroplane (TAIC, 2008c).

4. Analysis

4.1. The Commission opened this inquiry because of the potential consequences of the failure of critical engine components for flight safety. The early indications that the fuel-transfer tubes could have been out of specification or were unapproved components were viewed seriously. Although in this case the components were found to be the approved type, unapproved aircraft parts entering the aviation system is a serious concern to the industry and one that was the subject of a previous Commission report (TAIC, 1996).

4.2. The fuel leak was confirmed as being from the fuel-transfer tubes. The tubes were determined to be genuine aircraft parts, but had at some time been cleaned in a milling solution. This had had the effect of removing the anodised coating and shrinking the overall dimensions of the tubes. As a result, the o-rings did not provide a snug fit when installed and therefore could move with changes in fuel pressure. Eventually the o-rings deteriorated through chipping and rolling to allow fuel under pressure to leak from the tubes. Despite a review of maintenance records, enquiries with relevant New Zealand maintenance organisations and the assistance of the FAA, the facility where the tubes had been removed and cleaned in a non-approved manner could not be identified.

4.3. Aircraft maintainers were taught not to clean critical-fit anodised alloy engine parts using a milling solution, so the manufacturer did not specifically state that it was an unapproved method. The response from New Zealand PT6 engine operators to the CAA notice of 7 April 2010 suggested that the practice was not present in New Zealand and that this case was likely to have been an isolated occurrence.

4.4. The major concern of the maintainer was that the fuel-transfer tubes might not have been genuine parts and other aircraft and operators could have been exposed to a similar failure. The maintainer was therefore being proactive in attaching additional information to the incident report form and emailing the CAA again 5 weeks later to repeat the concern.

4.5. Although the outcome of the forced landing incident was no injury and no damage, there were lessons to be learnt from the way the incident was handled from an emergency response perspective.

4.6. The implications of reduced engine performance and the strong smell of fuel in the cabin were soon identified by the pilots and an immediate turn back to the aerodrome initiated to land as soon as possible. While the landing was successful and the aeroplane was able to be taxied back to the terminal to discharge the passengers, a fuel leak, especially near a hot engine, could have been serious. Fire could have broken out at any time or the single engine could have stopped earlier, leaving the pilot no option but to either ditch the aeroplane in the sea or force land away from the aerodrome. It would, therefore, have been more prudent for the pilot to make a distress call to ensure he obtained priority to land and to alert emergency services.

4.7. The use of terminology such as “Mayday” or “Pan Pan” clearly indicates to a listener that a state of distress or urgency exists, and should generate an appropriate level of response. Terms such as “request priority” to indicate an urgent situation have the potential to create confusion and add delays. The recent examples of miscommunication cited show that some pilots are reluctant to use appropriate radio phraseology to alert air traffic services and other pilots that an urgent or distress situation exists. This reluctance may stem from a desire by pilots and operators not to attract undue attention, for example from the media. However, it is in the interests of all that a proactive approach is taken to minimise harm or damage. The Commission has made a recommendation to the Director of Civil Aviation to address this issue.

4.8. The incident was promptly notified to the CAA, and the data registrar correctly identified the potential significance of an out-of-specification part in the engine fuel system. Although the registrar alerted the manager of safety investigations, by not selecting the “major” classification option when entering the occurrence into the safety information system, the classification defaulted to “minor” and the Commission was not automatically and immediately notified.

4.9. The follow-up email sent by the maintainer to the CAA on 18 March did not alert the data analysis staff to the incorrectly classified notification, possibly because of reliance on the automation of the safety information system. The occurrence classification defaulting to "minor" was a latent fault in the system for which there was little defence, a situation the CAA has since corrected (see Safety actions).

5. Findings

The following findings are not listed in any order of priority:

5.1. The reduction in engine performance was caused by fuel leaking past o-rings that had been damaged by fuel-transfer tubes that were able to move because the tubes were out of size tolerance.

5.2. The fuel-transfer tubes were out of size tolerance owing to the anodic protective coating having been removed during maintenance at some undetermined time and place, probably by their being immersed in a chemical milling solution, a cleaning process not approved by the manufacturer and contrary to good engineering practice.

5.3. The fuel-transfer tubes were genuine Pratt & Whitney Canada-approved parts, while the o-rings were generic items fit for use.

5.4. The CAA process for receiving and classifying occurrence notifications was not robust in ensuring they were correctly classified and given an appropriate level of investigation under section 27 of the Civil Aviation Act 1990.

5.5. Although the aeroplane made a successful landing back at the aerodrome with no injury to passengers and no damage, the potential consequences of an engine failure or engine fire on a single-engine aeroplane approved for instrument flight rules operations should have prompted the pilot to make an urgency or distress call to air traffic control to ensure an appropriate level of emergency services responded.

6. Safety actions

General

6.1. The Commission classifies safety actions by 2 types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission that would otherwise have resulted in the Commission issuing a recommendation

(b) safety actions taken by the regulator or an operator to address other safety issues that would not normally have resulted in the Commission issuing a safety recommendation.

Safety actions that pre-empted a potential recommendation

6.2. The CAA re-programmed its safety information system to prevent the classification of occurrences defaulting to “minor”. The CAA also established the position of Team Leader within the Safety Analysis Unit to “oversee the codification and classification of occurrence reports”. The position was filled in November 2010.

7. Recommendations

General

7.1. The Commission may issue, or give notice of recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector.

7.2. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

Recommendation

7.3. On 24 February 2011 the following recommendation was made to the Director of Civil Aviation:

> The pilot on this occasion did not make what would have been an appropriate urgency or distress call when faced with a strong smell of fuel and the single engine indicating reduced performance.
>
> The Commission has commented in previous reports on the need for pilots to declare the appropriate level of urgency using the standard phraseology for the situation.
>
> The Commission recommends that the Director of Civil Aviation promote to all pilots and operators, through the best means available, the need to use the appropriate phraseology to declare a level of urgency or distress that reflects the true nature of an emergency. (001/11)

On 21 March 2011 the Civil Aviation Authority advised that in response to the recommendation it is intended that the 2012 series of AvKiwi safety seminars for pilots around New Zealand will focus on radio communications, including the need for pilots to declare the appropriate level of urgency using standard phraseology for the situation. However, while the use of correct phraseology in various situations will be promoted, the pilot-in-command still needs to make the appropriate decision in the first instance.

8. Citations

Civil Aviation Authority of New Zealand, 2008. *Civil Aviation Rule 125.79 Air Operations – Medium Aeroplanes – [single-engine instrument flight rules] passenger operations, effective 23 October 2008.* http://www.caa.govt.nz/rules/Rule_Consolidation/Part_125_Consolidation. Lower Hutt (New Zealand): CAA.

TAIC, 1996. Transport Accident Investigation Commission *Report 95-017, Robinson R22 ZK-HKM, tail rotor separated and aircraft collided with terrain, near Optoiki, 25 October 1995*.

TAIC, 2008a. Transport Accident Investigation Commission *Report 06-003, Boeing 737-319, ZK-NGJ, electrical malfunction and subsequent ground evacuation, Auckland International Airport, 12 September 2006.*

TAIC, 2008b. Transport Accident Investigation Commission *Report 06-005, Gippsland Aeronautics GA8 Airvan, partial engine failure, Cook Strait, 27 November 2006.*

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