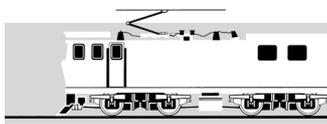
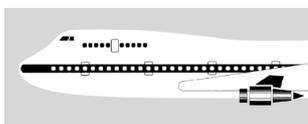


AVIATION OCCURRENCE REPORT

05-007

Piper PA34-200T Seneca II, ZK-MSL, Wheels-up landing,
Napier Aerodrome

7 July 2005



TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND

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Report 05-007

Piper PA34-200T Seneca II

ZK-MSL

wheels-up landing

Napier Aerodrome

7 July 2005

Abstract

On Thursday 7 July 2005 at 0852, the pilot of ZK-MSL, a Piper PA34 Seneca II, intentionally landed the aircraft at Napier Aerodrome with the landing gear retracted after both normal and emergency procedures failed to extend the nose landing gear. The pilot and the sole passenger were not injured. Aircraft damage was largely confined to the propellers.

The nose gear had failed to extend because the centering spring attachment bolt had jammed against the nose gear door aft tube assembly. The bolt had been installed incorrectly 9 weeks earlier during maintenance. Contributory factors were overloading of the nose baggage compartment and a possible lack of rigidity in the nose cone.

Safety issues identified included the need for aircraft maintenance engineers to refer to appropriate documentation when carrying out unfamiliar tasks, the ongoing compliance with an Airworthiness Directive concerning the attachment bolt, and the effectiveness of the associated Service Bulletin.

Safety recommendations were made to the Director of Civil Aviation and to the aircraft manufacturer regarding the Airworthiness Directive and Service Bulletin respectively. The maintenance provider took action to improve staff maintenance practices, therefore no safety recommendation was made to that organisation.

Contents

- Abbreviations ii
- Data Summary iii
- 1 Factual Information..... 1
 - 1.1 History of the flight..... 1
 - 1.2 Damage to aircraft..... 2
 - 1.3 Personnel information 2
 - Pilot 2
 - Maintenance engineer 2
 - Trainee engineer 3
 - 1.4 Aircraft information 3
 - Nose landing gear centering spring attachment 5
 - 1.5 Meteorological information 7
 - 1.6 Tests and research 7
 - 1.7 Organisational and management information 9
- 2 Analysis 10
- 3 Findings 13
- 4 Safety Actions 13
- 5 Safety Recommendations 14

Figures

- Figure 1 PA34 nose gear oleo strut assembly..... 4
- Figure 2 Attachment bolt contacting aft tube assembly (gear retracted)..... 8
- Figure 3 Attachment bolt, incorrectly installed with head up (gear extended)..... 8
- Figure 4 Wear in aft tube assembly 9

Abbreviations

AC	Advisory Circular
AD	Airworthiness Directive
AFM	aircraft flight manual
ARA	annual review of airworthiness
ATC	air traffic control
CAA	(New Zealand) Civil Aviation Authority
CAR	Civil Aviation Rule
CG	centre of gravity
FAA	Federal Aviation Administration (United States)
G	acceleration due to gravity
IA	Inspection Authorisation
IPC	illustrated parts catalogue
kg	kilogram(s)
KIAS	knots indicated airspeed
kt	knot(s)
LAME	licensed aircraft maintenance engineer(s)
m	metre(s)
MCTOW	maximum certificated take-off weight
Piper	Piper Aircraft Corporation; or The New Piper Aircraft Inc.
p/n	part number
QRH	Quick Reference Handbook
SB	Service Bulletin
SM	Service Manual
UTC	coordinated universal time
VMC	visual meteorological conditions

Data Summary

Aircraft registration:	ZK-MSL
Type and serial number:	Piper PA34-200T Seneca II, 34-7770224
Number and type of engines:	2 Continental TSIO-360
Year of manufacture:	1977
Operator:	Air Napier Limited
Maintenance provider:	Flight Care Limited
Date and time:	7 July 2005, 0852 ¹
Location:	Napier Aerodrome latitude: 39° 27.9' south longitude: 176° 52.2' east
Type of flight:	air transport, freight
Persons on board:	crew: 1 passengers: 1
Injuries:	nil
Nature of damage:	substantial to propellers, minor to fuselage
Pilot's licence:	Commercial Pilot Licence (Aeroplane)
Pilot's age:	24
Pilot's total flying experience:	1368 hours (240 hours on type)
Investigator-in-charge:	K A Mathews

¹ All times in this report are New Zealand Standard Time (UTC + 12 hours) and are expressed in the 24-hour mode.

1 Factual Information

1.1 History of the flight

- 1.1.1 On 6 July 2005 at about 2000, the pilot landed ZK-MSL, a Piper PA34-200T Seneca II, at Palmerston North Aerodrome after a scheduled freight service from Napier Aerodrome. A non-revenue passenger accompanied him on this flight and the return flight the next day.
- 1.1.2 On 7 July at 0430, the pilot arrived at the Palmerston North Aerodrome freight depot to prepare for the scheduled return freight service to Napier, Wairoa and Gisborne.
- 1.1.3 The freight load comprised mail and courier bags that weighed 180 kilograms (kg). Additional courier bags that the pilot estimated to weigh 30 kg, and which actually weighed 31 kg, were delivered later. The pilot then separated some of the Napier freight and put it in the nose baggage compartment. The remaining freight was put on the cabin floor and secured with a net.
- 1.1.4 Napier Aerodrome was affected by fog, so the departure of the flight was delayed until about 0645. The pilot then departed on an instrument flight rules plan, with Gisborne as the nominated alternate aerodrome.
- 1.1.5 As ZK-MSL approached Napier, air traffic control (ATC) advised the pilot that the aerodrome was affected by fog. The pilot elected to continue to Wairoa Aerodrome, where he anticipated visual meteorological conditions (VMC), to deliver one consignment of freight.
- 1.1.6 During the approach to Wairoa, the “landing gear unsafe” warning light remained illuminated following selection of gear down. Using the mirror mounted on the left engine nacelle, the pilot confirmed that the nose landing gear had not extended. The pilot discontinued the approach and recycled the landing gear, but the nose gear still did not extend.
- 1.1.7 The pilot held clear of Wairoa in VMC and advised ATC of his problem before reviewing the Quick Reference Handbook (QRH) and aircraft flight manual (AFM) abnormal procedures. He used a cellphone to call the chief pilot who discussed the matter with staff of his maintenance provider.
- 1.1.8 The pilot attempted the emergency, or manual, extension procedure, but this was unsuccessful. Slight application of positive G and yawing and rocking the aircraft also failed to extend the nose gear, but the pilot performed those manoeuvres gently out of concern for the passenger who had little flying experience and was feeling uncomfortable.
- 1.1.9 At the chief pilot’s suggestion, the pilot attempted to dislodge the nose gear by doing a “touch-and-go” landing at Wairoa, but this too was unsuccessful. The pilot re-selected the landing gear up, and returned towards Napier Aerodrome to hold in VMC until the fog cleared. ZK-MSL had enough fuel to hold for one hour before having to divert to another aerodrome.
- 1.1.10 The pilot opted to land on grass runway 16 at Napier with all of the landing gear retracted. He briefed the passenger on what action to take during and after landing.
- 1.1.11 At about 0840, the fog had cleared enough for the pilot to attempt a landing. ATC declared a full emergency, but asked the pilot to wait 10 minutes until city emergency services had arrived to augment the one-man rescue fire service provided by the airport company.
- 1.1.12 The pilot configured the aircraft according to the AFM procedure for a gear-up emergency landing, with the landing gear and flaps selected up, and an approach speed of about 80 knots (kt). Just prior to the touchdown, the pilot shut down the engines by moving the mixture levers to cut-off, and turned the master electrics switch off. The aircraft touched down about 50 metres (m) after the start of grass runway 16, with no appreciable pitch down, and came to rest after about 200 m. The occupants promptly exited the aircraft without injury. No fire occurred.

- 1.1.13 On behalf of the Commission, and under Police supervision, the freight was removed from the aircraft, inspected, documented and weighed before being released. The actual weights were 141 kg of freight in the cabin and 71 kg of freight, plus a plastic tray of miscellaneous items estimated to weigh less than 2 kg, in the nose baggage compartment. A witness described the nose compartment as “stuffed full”, with freight sitting “on and around the fibreglass cowling that covers the front wheel assembly”.
- 1.1.14 ZK-MSL was lifted by crane to permit its removal to the maintenance provider’s hangar at the aerodrome. The emergency system was selected to lower the landing gear and the main gear extended properly. Although the nose gear doors began to open, the nose gear did not extend. There was no obvious obstruction, and “light to moderate” hand pressure was enough to pull the nose gear into the down and locked position.

1.2 Damage to aircraft

- 1.2.1 The blades and hubs of both propellers were damaged beyond repair. Some lower antennae and the right rear cabin step were broken off. The fuselage belly received minor abrasion damage.
- 1.2.2 Cracks were found in some parts of the fibreglass nose cone structure under the floor of the baggage compartment. Previous fibreglass repairs were identified in the same general area.

1.3 Personnel information

Pilot

Age	24
Licence and ratings	Commercial Pilot Licence (Aeroplane), B & D category flight instructor
Aircraft type ratings	Piper PA28, PA38, PA32, PA34, Cessna 152 and 172
Medical certificate	Class 1, valid until 29 August 2005
Last competency check	18 May 2005
Last instrument rating check	18 May 2005
Last biennial flight review	14 March 2005
Flying experience	1368 hours, 240 on type
Time on duty	4.5 hours
Time off between duties	8.5 hours

- 1.3.1 The pilot gained his Commercial Pilot Licence in October 2001. He obtained a PA34 type rating on 22 February 2003 and commenced full-time employment with the operator in November 2004. At the time of the accident, he was the operator’s chief flying instructor. The pilot held a Class 1 medical certificate with no conditions, restrictions or endorsements.
- 1.3.2 The pilot’s typical roster was a daily flight from Napier to Palmerston North in the evening, returning the next morning. This was the third successive day of this split duty pattern. He had most weekends free of duty and averaged about 100 duty hours and 45 flight hours per month.
- 1.3.3 The pilot reported that he had had about 8 hours off duty after landing at Palmerston North on 6 July, and had achieved about 7 hours of good sleep. He said he was fit for the flight on 7 July.

Maintenance engineer

- 1.3.4 A licensed aircraft maintenance engineer (LAME), employed by the maintenance provider, supervised and certified maintenance relevant to the occurrence. This was performed on 2 May 2005.

- 1.3.5 The LAME had had 14 years of continuous experience in the aviation industry before he immigrated to New Zealand in 1999. He converted his foreign aircraft engineer's licence to a New Zealand licence that year, and then worked for 2 New Zealand aviation companies before joining the maintenance provider in 2004. At the time of the accident, he held the appointment of line maintenance supervisor for the maintenance provider.

Trainee engineer

- 1.3.6 A trainee aeronautical engineer (the trainee), employed by the maintenance provider, performed the relevant maintenance on ZK-MSL on 2 May 2005, under the supervision of the LAME.
- 1.3.7 The trainee had between 3 and 4 years of training with the maintenance provider.

1.4 Aircraft information

- 1.4.1 ZK-MSL, a PA34-200T Seneca II, manufactured by the Piper Aircraft Corporation (Piper)² in the United States of America (USA), was a twin-engine, low-wing aeroplane fitted with Teledyne Continental TSIO-360 turbo-charged engines driving constant-speed, feathering propellers. The aircraft was manufactured in 1977, imported into New Zealand in 1988 and registered to the operator in 1994.
- 1.4.2 The aircraft had a Non-terminating Certificate of Airworthiness, and the maintenance provider's records showed that ZK-MSL had been maintained in accordance with the operator's maintenance programme. The last annual review of airworthiness (ARA) was completed on 2 May 2005. Up to 7 July 2005, the aircraft had flown a total of 10 611.6 hours, and 39.3 hours since the last 100-hour check on 12 June 2005.
- 1.4.3 The aircraft could carry a pilot and 5 passengers or, as configured for this flight, the centre and rear seats could be removed to allow freight to be loaded on the floor and secured with nets.
- 1.4.4 The actual take-off weight at Palmerston North was 2012 kg, compared with the maximum certificated take-off weight (MCTOW) of 2073 kg. The pilot used a load distribution matrix provided by the operator to show the centre of gravity (CG) was within limits. After the accident, the CG was re-calculated for the heavier load in the nose compartment and found to be still within limits.
- 1.4.5 The aircraft was equipped with electrically controlled, hydraulically operated, fully retractable tricycle landing gear. A selector switch on the instrument panel activated a hydraulic pump that directed system pressure to extend or retract the landing gear. When the landing gear reached the selected position, a limit switch shut off the pump. Mechanical locks held the gear in the down position, and retained hydraulic pressure held it in the up position.
- 1.4.6 The nose gear strut was attached to the forward cabin bulkhead, and retracted forward into a fibreglass nose cone. When retracted, the nose gear was fully enclosed by doors that operated via linkages to the strut. The doors and their actuating assembly were attached to the nose cone.
- 1.4.7 The upper half of the nose cone was a baggage compartment accessible from the left side of the aircraft. A raised box, into which the nose wheel retracted, occupied part of the compartment. The AFM weight limit for the nose baggage compartment was 100 pounds (45 kg).
- 1.4.8 A centering spring assembly was installed on the nose strut to ensure that the nose gear was centred during the retraction sequence (see item 11, Figure 1).

² Now "The New Piper Aircraft Inc."

- 1.4.9 A guarded emergency gear extension knob was located next to the landing gear selector switch. When the knob was pulled, the trapped hydraulic pressure was released, which allowed the landing gear to free-fall. Air loads helped lock the nose gear into the down position.

PIPER SENECA II SERVICE MANUAL

(Figure 7-1)

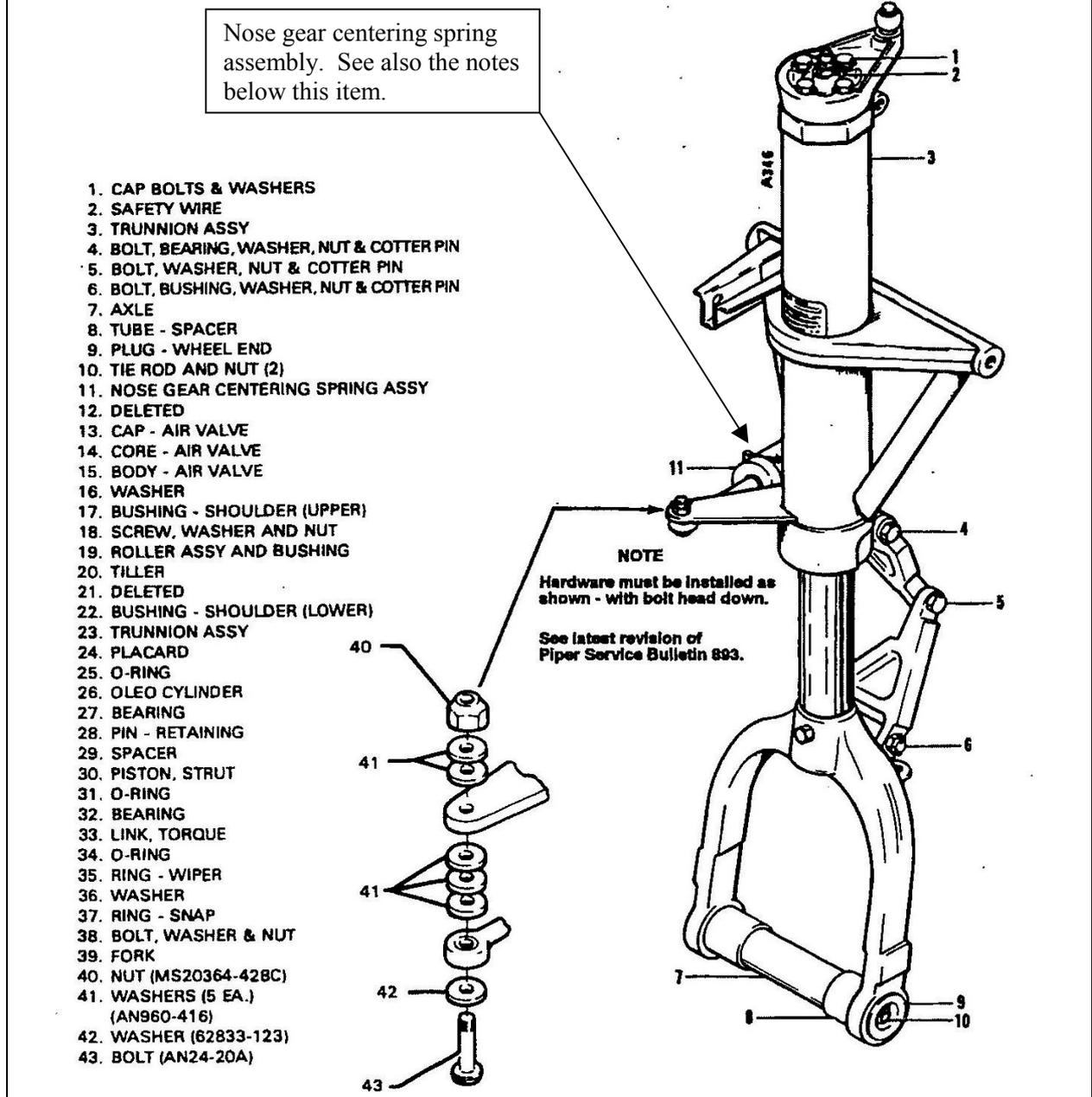


Figure 1
PA34 nose gear oleo strut assembly

1.4.19 Piper advised that the placard was first added to production aircraft in 1978, and was first listed in the Illustrated Parts Catalogue (IPC) in September 1978. Piper's practice was to put placards related to operating the aircraft into the AFM, and those related to aircraft maintenance into the IPC. The Service Manual (SM) was revised in October 1979, with the following note added:

NOTE

Hardware must be installed as shown – with bolt head down.
See latest revision of Piper Service Bulletin 893.

1.4.20 If installed incorrectly, there was reduced clearance between the bolt end and the aft tube assembly when the nose gear was retracted.

1.4.21 Piper considered compliance with SB 893 to be mandatory, but it was not until 1992, when the Federal Aviation Administration (FAA) of the USA issued Airworthiness Directive (AD) 92-13-05, that it became mandatory. The New Zealand Civil Aviation Authority (CAA) then issued its own AD, DCA/PA34/22 "NLG [nose landing gear] Centring Attachment Bolt – Replacement", effective 26 June 1992. The CAA AD, which had no requirement for repetitive action, described the requirement as:

To prevent failure of the NLG to extend due to contact between the hex-head bolt attaching the NLG centring spring rod-end and the door actuation aft tube assembly, replace the hex-head bolt with clevis-head bolt per Piper SB 893.

1.4.22 The AD was carried out on ZK-MSL on 29 May 1992, the date the aircraft returned to service following the earlier wheels-up landing.

1.4.23 On 20 April 2005, the nose gear centering spring was removed from ZK-MSL and fitted as a serviceable part to another PA34 owned by the operator.

1.4.24 The trainee, who had assisted with the removal of the centering spring on 20 April, installed a replacement part to ZK-MSL on the afternoon of 2 May. He had not previously installed a centering spring. The SM, SB and IPC diagrams all showed the attachment bolt installed head down, and the SM diagram also instructed "see latest revision of Piper Service Bulletin 893".

1.4.25 The relevant page of the IPC was with the task card. The trainee recalled seeing the IPC page but stated that he did not read it. He did not check the SM or IPC prior to the task. At the time, the trainee was not aware of Piper SB 893. He said he thought the job was simple and he probably would have installed the bolt in what he thought was the standard way, head up.

1.4.26 Civil Aviation Rules (CAR) 43.51 and 43.101 required the work performed by the trainee to be supervised and certified by a LAME. Although the task did not require a duplicate inspection, the trainee requested one. He also asked the LAME whether a retraction test was needed, and was told that none was required.

1.4.27 The same LAME had certified the transfer of the part from ZK-MSL to the other PA34 on 20 April. He had not previously worked on a PA34 nose gear centering spring but said that he considered the task was simple. He did not refer to the SM or IPC prior to inspecting and certifying the trainee's work on 2 May, but said he would do so any time he was unsure of a job. At the time, the LAME also was unaware of SB 893. He noted there was often nothing to prompt a check for applicable SB or AD, unless one happened to recall it or the requirement was added to the task card.

1.4.28 Over the period 7-12 June 2005 the maintenance provider replaced the right engine of ZK-MSL and performed SB 1123A, "Nose gear inspection and product improvements". That SB involved extensive inspection and rigging checks in the nose gear bay and required many landing gear retraction tests to be carried out. These were performed without any binding of the centering spring attachment bolt being noticed. The SB inspections did not include the centering spring or the landing gear door actuation aft tube assembly.

- 1.4.29 Between 2 May and 7 July 2005, ZK-MSL flew about 90 hours over 43 days without any report of a nose gear defect.

1.5 Meteorological information

- 1.5.1 On 7 July 2005, fog and mist affected Napier Aerodrome between 0700 and 1000. The special weather report issued at 0900 for the aerodrome included, in part:

Wind 290° True at one kt, visibility 200 m to the south, mist in the vicinity, few cloud at 2000 feet, temperature 8° Celsius, dew point 7° Celsius.

1.6 Tests and research

- 1.6.1 After the accident, ZK-MSL was placed on jacks with the landing gear extended. The nose compartment was empty. No defect or mis-rigging of the nose gear was immediately apparent. The landing gear was satisfactorily retracted and extended numerous times, using both the normal and emergency systems. No binding or hesitation in nose gear extension was noted.
- 1.6.2 Some missing fasteners and cracks were noted in the nose compartment liners. Direct manual force on the top and sides of the nose wheel box did not obstruct nose wheel extension.
- 1.6.3 By manually restricting the speed at which the nose wheel lowered from the retracted position, it was found that the nose gear centering spring attachment bolt was rubbing on the gear door aft tube assembly. A clevis-head bolt was fitted, but it was installed incorrectly, with the head up. The thread end of the bolt had worn a groove almost through the thickness of the tube wall, and the interference sometimes prevented nose gear extension (see Figures 2, 3 and 4).
- 1.6.4 After the initial post-accident inspection of ZK-MSL, the bolt was installed correctly. However, in a subsequent retraction and extension test, the head of the clevis bolt contacted the aft tube.
- 1.6.5 The maintenance provider's quality assurance manager provided the results of tests that showed the effort applied by the landing gear system to extend the nose gear was proportional to the amount of weight in the nose compartment. With the bolt incorrectly installed, weight in excess of about 20 kg could overcome the capability of the aircraft system to extend the nose gear. With the bolt installed correctly, but only 20 kg of voluminous freight crammed into the compartment in the manner found after the accident, there was also some bolt-to-tube contact. An access panel was removed from the lower rear nose cone in order to perform these tests.
- 1.6.6 Tests were carried out on a similar PA34 to examine the effect of overloading the baggage compartment on nose gear extension. Approximately 78 kg of weight was distributed in the compartment. While there was slight distortion of the compartment floor, nose gear extension and retraction were unaffected.
- 1.6.7 During a later visit to the maintenance provider, it was demonstrated that the nose cone on ZK-MSL had lost some structural rigidity. The maintenance provider repaired the nose cone structure in accordance with an approved repair scheme.
- 1.6.8 A placard to warn of non-standard bolt installation, required by DCA/PA34/22 and SB 893, was not fitted to the nose gear strut of ZK-MSL at the time of the accident. A caution placard was also missing from the operator's other PA34, but the centering spring attachment bolt was correctly installed on that aircraft. Another operator's PA34 was observed to have an incorrect placard installed on the nose gear strut. A sample of other PA34 operators found that 4 of 8 aircraft surveyed did not have the placard fitted. No other incorrectly installed attachment bolts were found or reported.

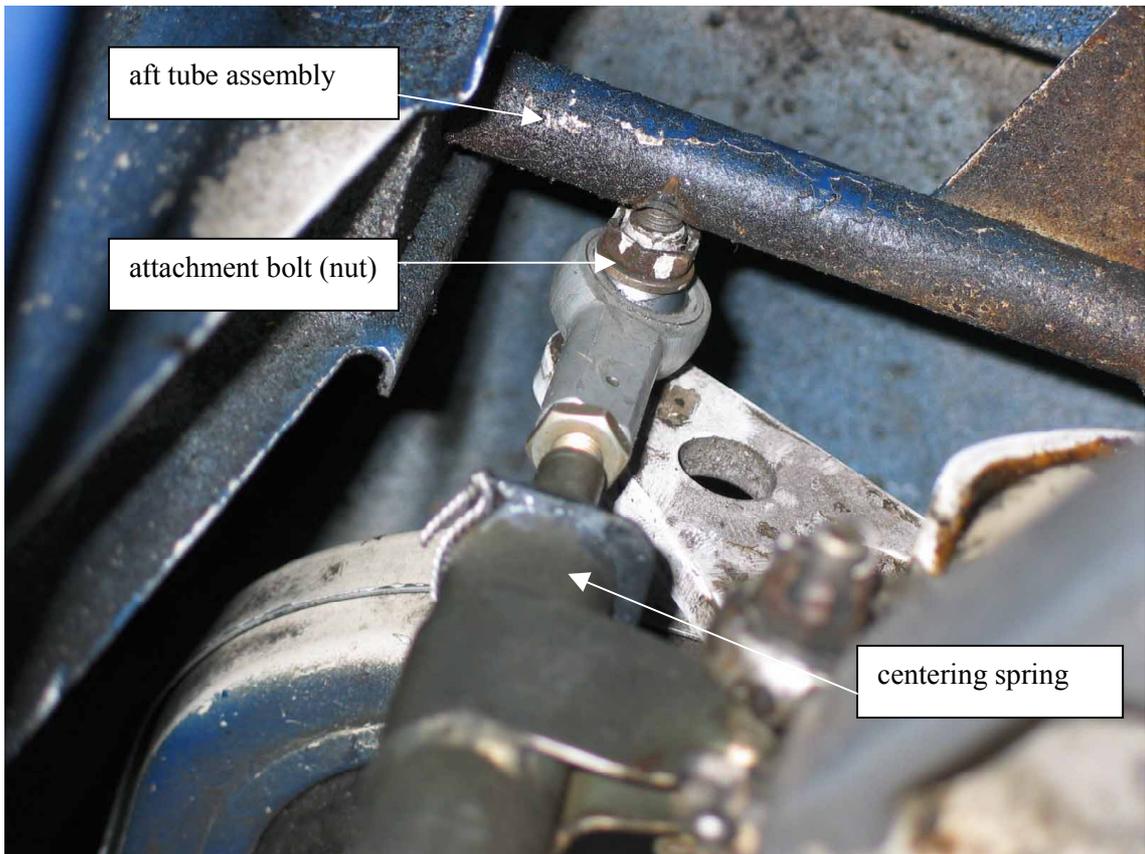


Figure 2
Attachment bolt contacting aft tube assembly (gear retracted)



Figure 3
Attachment bolt, incorrectly installed with head up (gear extended)



Figure 4
Wear in aft tube assembly

1.6.9 No relevant nose gear events had been reported to the CAA since DCA/PA34/22 was issued in 1992.

1.7 Organisational and management information

1.7.1 The maintenance provider employed 15 engineering staff, 9 of who were LAMEs and 4 trainee engineers, at its premises on Napier Aerodrome. Maintenance was performed under CAR Part 43, which, in general terms, permitted appropriately licensed persons (within or outside a non-certificated organisation) to perform maintenance on aircraft with an MCTOW of not more than 5700 kg or a maximum of 10 passenger seats.

1.7.2 Current maintenance documentation for the PA34 and other aircraft maintained by the organisation was held and readily accessible within the hangar.

1.7.3 CAR 43 stated in part:

43.51 Persons to perform maintenance

(a) ...a person shall not perform maintenance on an aircraft or aircraft component unless they—

(1) hold a current aircraft maintenance engineer licence and an appropriate type rating issued under Part 66; or...

(5) perform maintenance under the direct supervision of—

(i) the holder of an aircraft maintenance engineer licence with an appropriate type rating, issued under Part 66, ...

43.53 Performance of maintenance

- (a) A person performing maintenance on an aircraft or component must—
- (1) be familiar with the maintenance actions required for the continued airworthiness of that aircraft or component; and ...
 - (3) use methods, techniques, and practices that—
 - (i) are prescribed in the current manufacturer's maintenance manual or Instructions for Continued Airworthiness; or...

- 1.7.4 The CAA's Advisory Circular (AC) 43-1B elaborated on the meaning of "direct supervision" to include the active and timely involvement by the supervisor to ensure the correct work was done and approved. The AC also noted that persons were required to be familiar with the aircraft component and understand the technical data required to accomplish the maintenance.
- 1.7.5 The last ARA on ZK-MSL had been performed by one of the maintenance provider's staff who held an Inspection Authorisation (IA). Among other requirements, an ARA checked that all applicable ADs had been recorded as having been carried out, and that any placards required by the AFM were in place. The PA34 AFM did not list placard p/n 582-943.

2 Analysis

- 2.1 The operation of ZK-MSL on 7 July 2005 was uneventful until the pilot selected the landing gear down on approach to Wairoa Aerodrome, and discovered that the nose landing gear would not extend. Later inspection showed that the nose gear centering spring attachment bolt was not installed correctly, and that the thread end of the bolt had contacted the nose gear door aft tube assembly. Binding of the aft tube assembly was a known cause of the nose gear failing to extend.
- 2.2 The attachment bolt had last been installed on 2 May 2005. From then until the accident flight, ZK-MSL had flown about 90 hours, including air transport operations similar to that of 7 July 2005. The operator's record of "Daily hours flown" did not show the number of landings carried out, but the total number of landing gear cycles since the centering spring was replaced was probably about twice the number of flight hours. The substantial wear on the aft tube showed that there had been bolt-to-tube contact during that period, but no nose gear defect had been reported. Therefore, the incorrectly installed bolt was probably not the sole cause of the nose gear failing to extend on 7 July.
- 2.3 At Palmerston North, the pilot had accurately estimated the total weight of the additional courier bags, but the weight of freight that he loaded in the nose compartment exceeded its limit by 26 kg (58%). However, the pilot probably did not appreciate the accumulating total weight as he loaded the individual items. Despite the excessive compartment weight, the aircraft CG remained within limits.
- 2.4 The volume and weight of freight crammed into the nose compartment probably distorted the fibreglass nose cone. The nose door actuation assembly was attached to the nose cone, so distortion could alter the geometry between the aft tube assembly and the nose strut. Any gross overloading made contact between the aft tube assembly and an incorrectly installed bolt more likely.
- 2.5 After the accident, the maintenance provider explored why there was still slight binding evident, even with the bolt installed the correct way and with the nose compartment empty. The maintenance provider reported that 20 kg of voluminous items, crammed into the compartment in the manner found after the accident, could cause a correctly fitted bolt to contact the aft tube assembly. That contradicted a test performed on a similar aircraft, which showed that, with the bolt installed correctly, the nose compartment could be grossly overloaded without affecting nose gear extension.

- 2.6 The maintenance provider also found that with the bolt installed incorrectly, binding would occur with 20 kg or more weight in the nose compartment. ZK-MSL most likely had been operated on similar freight operations since 2 May with at least 20 kg of freight in the nose compartment, less than the compartment limit, and no nose gear defects had been reported.
- 2.7 While excessive weight or volume in the nose baggage compartment could distort the nose cone, the main reason for the maintenance provider's adverse test results was probably damage incurred in the accident. It was also possible that the nose cone had some pre-existing lack of rigidity associated with the older, undocumented repairs.
- 2.8 When ZK-MSL was repaired after the May 1992 wheels-up event, AD DCA/PA34/22 was about to be issued, and it was carried out before the aircraft was returned to service. Therefore, a clevis bolt was most probably installed correctly at that time. If there had been any loss of rigidity from the older repairs, it probably went unnoticed while the attachment bolt was correctly installed, and the nose compartment not overloaded.
- 2.9 During the fitting of the centering spring to ZK-MSL on 2 May 2005, the trainee and the LAME were probably misled by the apparent simplicity of the task. Their unfamiliarity with it, and not having had the benefit of first removing a correctly installed part as part of this task, should have prompted them to check the relevant documentation. The LAME might have been complacent in this respect, but his not checking the manuals was probably not unusual behaviour in the industry, especially for a straightforward task. However, given the training context, the LAME should have demonstrated a better supervisory standard.
- 2.10 Performance of a maintenance task "by the book" was a fundamental engineering requirement, supported by CAR 43.53, which required persons performing maintenance to be familiar with the task and to follow the manufacturer's published procedures. The rule did not prevent those who were fully conversant with a maintenance procedure performing it from memory without direct reference to the SM. However, as maintenance procedures for similar aircraft types may have subtle differences for an apparently similar task, or an AD or SB may have altered a learnt procedure since it was last carried out, reference to the SM should be the normal standard.
- 2.11 The trainee's request for a duplicate inspection of the centering spring was intended to be an additional safeguard, but was not a requirement. Proper supervision, checking and certification of the task by the LAME should have been sufficient. In the event, the LAME's certification check did not reveal the incorrect installation, because he had not referred to any relevant documentation.
- 2.12 The LAME had certified the correct installation of a similar component on the operator's other PA34 aircraft 12 days previously, also without checking the SM. The different results for the same task illustrated the potentially random outcome of a maintenance action if proven practices were not followed.
- 2.13 A note in the SM directed the reader to the "latest version of SB 893". The purpose of SB 893 was to prevent contact between the aft tube assembly and the centering spring attachment bolt head, a scenario known to cause failure of the nose gear to extend. The SB was primarily concerned with ensuring that the correct type of bolt was fitted, not with its orientation or the installation of a caution placard. Even if SB 893 was not referred to, and regardless of whether or not a placard was fitted, the SM and the IPC provided clear guidance for the correct installation of the bolt.
- 2.14 Replacement of the centering spring was not a common task, so the non-standard bolt installation was probably infrequently encountered. Placard p/n 582-943, therefore, was a further defence against incorrect installation, primarily for engineers and, to a lesser extent, for pilots conducting pre-flight inspections.

- 2.15 Although there was no placard fitted to the nose gear strut of ZK-MSL, a placard most probably would have been fitted in May 1992 when AD DCA/PA34/22 was carried out. Any subsequent reference to SB 893 would have led an engineer, once a clevis bolt was found installed, to omit the SB procedural step that checked for a placard.
- 2.16 The placard was a requirement of SB 893, and hence for compliance with AD DCA/PA34/22. This accident vindicated the placard requirement. However, the requirement was contained only in the IPC and SB 893 step 6(C), both of which might not be referred to, even if maintenance were carried out on the nose gear.
- 2.17 Because the placard was not listed in the AFM, and the IPC was not listed as a document to be checked for placard requirements, it was reasonable that the IA did not find, during the ARA, that ZK-MSL did not have one fitted. The ARA process included a requirement for the IA to confirm that applicable ADs had been certified as carried out, but there was no requirement to verify that the associated work, such as SB 893, had been done. Therefore, the absence of a placard from the nose strut could go unnoticed for an extended period.
- 2.18 After finding other PA34 aircraft were missing the placard, the Commission made an immediate safety recommendation to the Director of Civil Aviation regarding on-going compliance. The Commission also recommended that the manufacturer amend SB 893 so that the placard check was required each time the SB was referred to.
- 2.19 The LAME's decision to not perform a retraction test was reasonable. The SB procedure would not have required one. As the landing gear operation after replacement of the centering spring was trouble-free until the accident, a retraction test might not have indicated anything untoward, particularly as a test would have been carried out with the nose baggage compartment empty.
- 2.20 The maintenance performed over the period 7-12 June 2005, particularly the extensive nose landing gear inspection and test requirements of SB 1123A, could have provided an opportunity for the incorrect bolt installation or the wear on the aft tube to be noticed. However, neither of those areas was specifically included in the work, and the gear retraction and extension tests required by SB 1123A were performed with the nose compartment empty.
- 2.21 The pilot took the appropriate action in response to illumination of the landing gear unsafe warning light. However, the attempt to bounce the nose gear down during a touch-and-go landing at Wairoa involved a risk of a propeller strike on the runway.
- 2.22 Amongst pilots, it was fairly common knowledge that if the landing gear failed to extend by normal or alternate means, an application of positive G and manoeuvring might assist extension. The pilot followed the additional QRH advice to "shake and yaw" the aircraft, but he was constrained from applying substantial positive G because of the QRH reference to reduced stall margin, and his passenger's discomfort. Although the nose wheel was manually pulled down without great effort after the aircraft was recovered, it was not certain that the pilot could have achieved the same result by applying more positive G, because the excess weight in the compartment might have exacerbated the nose cone distortion and binding.
- 2.23 The AFM did not recommend a specific landing configuration in the event the nose gear only would not extend. The choice of landing with all the landing gear retracted or with whatever was extended, or to land on a hard or soft surface, was up to the pilot. The outcome demonstrated that the pilot's choice was reasonable and well handled.

3 Findings

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

- 3.1 The pilot was appropriately qualified, authorised and fit to conduct the flight.
- 3.2 The aircraft was suitable for the operation being flown.
- 3.3 The aircraft was intentionally landed with the landing gear retracted because the nose landing gear would not extend.
- 3.4 The nose gear doors were prevented from opening by an incorrectly installed centering spring attachment bolt binding on the door aft tube assembly.
- 3.5 Excessive weight in the nose compartment, and possibly some lack of nose cone rigidity, distorted the nose cone and caused the bolt to jam and prevent nose gear extension.
- 3.6 Although the weight of freight loaded into the nose baggage compartment exceeded the AFM limit, the aircraft weight and centre of gravity were within limits.
- 3.7 A trainee aircraft engineer had installed the centering spring attachment bolt incorrectly.
- 3.8 The supervising LAME did not ensure that the trainee's work complied with the maintenance requirements.
- 3.9 The aircraft was released to service in an un-airworthy state because the bolt had been incorrectly installed.
- 3.10 The absence of the caution placard on the nose gear strut removed a defence against incorrect installation of the bolt.
- 3.11 The manufacturer's SB 893 did not ensure that the caution placard would be installed.
- 3.12 Without the caution placard installed, the aircraft was not airworthy because it was not in compliance with AD DCA/PA34/22.

4 Safety Actions

- 4.1 On 8 November 2005, the Managing Director of Flight Care Limited, the maintenance provider, provided evidence that he had investigated the accident and prepared a presentation on the "active, system and organisational failures". He advised that staff had viewed the presentation, and the CAA "Risk Management" DVD. He said he had held meetings with staff specifically to discuss the event with the aim of preventing a similar occurrence. The Managing Director advised that he had engaged an independent consultant to examine the maintenance provider's internal procedures further.

5 Safety Recommendations

Safety recommendations are listed in order of development and not in order of priority.

5.1 On 14 July 2005, the Commission recommended to the Director of Civil Aviation that he:

5.1.1 instruct PA34 Seneca operators to ensure that all the requirements of DCA/PA34/22 have been complied with, including the ongoing requirement for a placard on the lower nose landing gear housing. (076/05)

5.2 On 22 August 2005 the Director of Civil Aviation replied in part:

The Civil Aviation Authority has accepted your final safety recommendation 076/05. We are currently mailing out a letter to all registered owners of Piper PA34-200/200T aircraft requesting they check compliance with [re-issued] Airworthiness Directive DCA/PA34/22A.

5.3 On 22 December 2005, the Commission recommended to the Manager, Air Safety Investigations, The New Piper Aircraft, Inc. that he:

5.3.1 arrange for Piper Service Bulletin SB 893 “Nose Gear Centering Attach Bolt” to be amended, so that the instruction step 6(C), which is to check for installation of placard p/n 582-943, is performed each time the SB is referred to. (104/05).

Approved on 16 December 2005 for publication

Hon W P Jeffries
Chief Commissioner



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