Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Investigation –200702171
Final

Landing Gear Collapse
Perth Airport, WA
9 April 2007
VH-SGT
Beech Aircraft Corp - Super King Air 200

Australian Government

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Figure 1: Airservices Australia
Figure 2: Hawker Beechcraft Corporation
Figure 3: Hawker Beechcraft Corporation

Abstract

On 9 April 2007, at 1703 Western Standard Time, the main landing gear of a Beech Super King Air 200 (registered VH-SGT) collapsed on touchdown at Perth airport. The aircraft was extensively damaged as a result of the collapse. No injuries were sustained by the pilot or passengers from the accident.

The Australian Transport Safety Bureau investigation revealed that two major system components had failed which could have prevented the landing gear from properly retracting/extending; the geared components within the right main landing gear actuator had fractured, and the left torque tube support bearing had seized from contamination and lack of lubrication. Although each component failure was apparently unrelated, the examination was not able to conclusively establish which failure had been the primary contributing factor in this landing occurrence. The Super King Air 200 aircraft landing gear system configuration was such that should either one of these component assemblies cease to function, extension or retraction of the landing gear would not have been possible.

As a result of this occurrence, the operator changed their system of maintenance to introduce an inspection interval and replacement schedule for all landing gear torque tube support bearings within their Super King Air 200 fleet.

The Civil Aviation Safety Authority released airworthiness bulletin 32-07 to all operators of Hawker Beechcraft 65, 70, Queen Air 90 and 200-series King Air aircraft that recommended changes to the maintenance schedule for landing gear components.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

History of the flight

On 9 April 2007, at 1703 Western Standard Time[1] (WST), the main landing gear from a Beech Super King Air 200 aircraft, registered VH-SGT, collapsed on landing at Perth airport.

Approximately two hours earlier, the aircraft was chartered to fly from Perth to Mount Hale, WA when shortly after takeoff from Perth the aircraft experienced a malfunction of the landing gear system. The main wheels and nose gear had become jammed and were unable to fully retract when selected up by the pilot.

The pilot completed the emergency checklist actions contained in the Aircraft Flight Manual, but was unable to retract or extend the gear using either the automated control or the manual emergency system. The pilot then requested assistance from a passenger to operate the manual emergency extension system. The landing gear remained jammed despite the additional force applied to the lever from the passenger.

The pilot contacted air traffic services and requested further assistance from company engineering personnel to visually assess the extension state of the landing gear. Two aerodrome passes were completed throughout the troubleshooting exercise and the pilot remained in radio contact with both groups during this phase.

Following the flyovers and after holding over Rottnest Island at 5,000 ft for a period of approximately two hours, the pilot flew the King Air back to Perth airport. With the gear still jammed in the partially retracted position, both the left and right main landing gear assemblies collapsed after the aircraft touched down on Runway 24. The aircraft was substantially damaged as a result of the collapse (Figure 1).

The airport Rescue and Fire Fighting (RFF) services and other relevant agencies had been alerted and were waiting in response when the King Air landed.

No injuries were sustained by the pilot or any of the nine passengers on board.

1 The 24-hour clock is used in this report to describe the local time of day, Western Standard Time (WST), as particular events occurred. Western Standard Time was Coordinated Universal Time (UTC) + 8 hours.

Figure 1: The Super King Air 200 on the runway after landing at Perth[2].

Aircraft information

Landing gear system description

The Super King Air 200 (serial number BB-73) had been fitted with a mechanical landing gear system that was controlled through a pilot operated selector switch located in the cockpit on the right side of the pilot's sub-panel. When the switch was selected to either extend or retract the gear, an electric motor drove the landing gear gearbox assembly (Figure 2 and 3).

The main landing gear actuators were driven by torque tubes from the gearbox. The nose gear was driven by a duplex chain from a sprocket on the gearbox torque shaft. Four support bearings in total retained the left and right main landing gear torque tubes. Each outboard torque tube was coupled to a pinion gear within the main landing gear actuator housing.

A spring-loaded clutch between the gearbox and the torque shaft protected the system in the event of a mechanical malfunction. A 60-ampere circuit breaker protected the system from an electrical overload.

Emergency manual extension and retraction of the landing gear was controlled by a floor mounted lever centrally located between the left and right pilot seats. When the lever was manually operated, the landing gear electric motor and gearbox drive mechanisms were overridden, thus allowing extension or retraction of the landing gear system.

2 Image supplied by Airservices Australia.

Figure 2: Illustration of the mechanical landing gear system from the Super King Air 200[3].

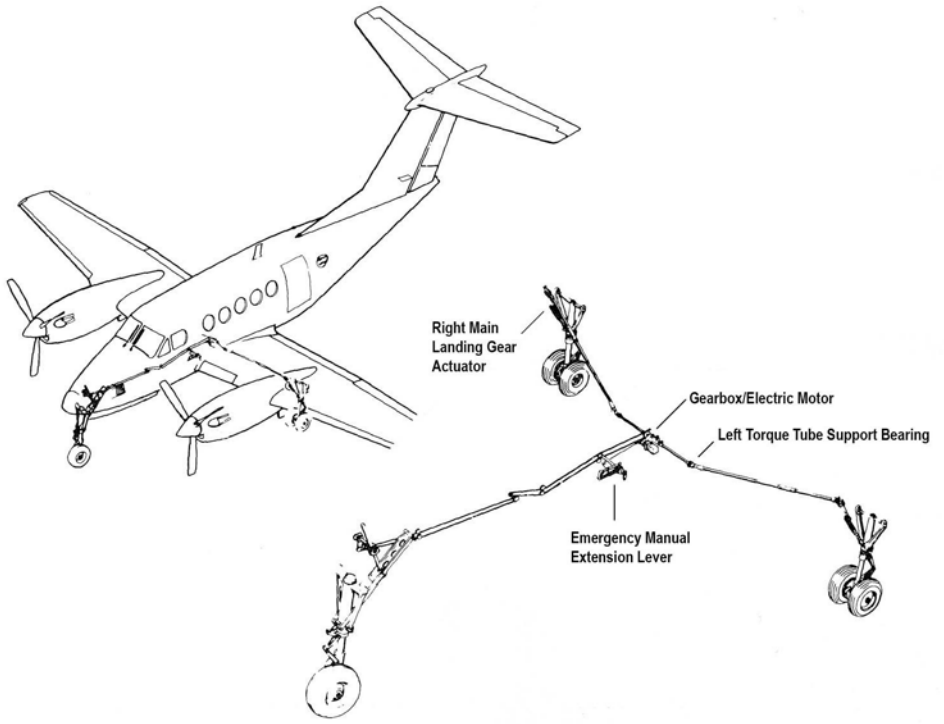
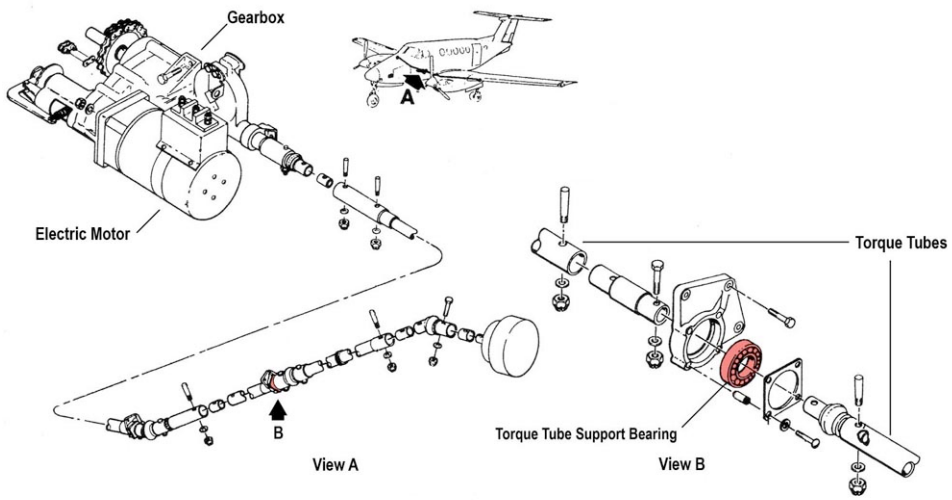


Figure 3: Illustrated part breakdown of the main gear retraction mechanism detailing the torque and gearbox arrangement.[4]



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3 Image source: Beechcraft Super King Air 200 Series Maintenance Manual, P/N 101-590010-19, Section 12-20-00, Figure 304.

4 Image Source: Beechcraft Super King Air 200 Series Illustrated Part Catalogue, P/N 101-590010-19, Section 32-30-01.

Damage to the aircraft

After landing, the operator performed an inspection of the aircraft and a rigging check of the landing gear system.

The lower right wing skin surface had been extensively damaged through severe abrasive contact with the runway. Several internal members within the right wing sustained consequential buckling and permanent deformation.

The nose landing gear had not collapsed and was found jammed in the unlocked position. An inspection of the nose and the left main landing gear actuators found them to be installed and rigged correctly. However, the checks revealed that the collapsed right main landing gear actuator had sustained damage during the landing which prevented a rigging assessment.

Another component found unserviceable was the left inboard torque tube support bearing which was found to be seized. That bearing was integral to the performance of the landing gear retraction mechanism and provided support to the left actuator torque tubes. The three other remaining support bearings from the mechanical main landing gear system were found undamaged and in serviceable condition.

An inspection inside the cockpit cabin showed that the 60-ampere landing gear electric motor circuit breaker had opened.

Both the right main actuator and the left inboard torque tube support bearing were removed from the aircraft by the operator and submitted to two independent aviation maintenance organisations for disassembly and evaluation. Following those examinations, both component assemblies were forwarded to the ATSB for further investigation.

Components received and service history

The ATSB received the disassembled right main landing gear actuator and the left torque tube support bearing from the landing gear system of VH-SGT. Technical details and the known service history of the components at the time of this occurrence are contained in Table 1.

Main landing gear actuator (right)

The failed right main landing gear actuator was released from overhaul on 17 December 2002. On 30 September 2006, the component was installed onto the right side airframe position of VH-SGT. The actuator accumulated 557 hours service and 389 cycles before it was removed from service following this occurrence.

Left inboard torque tube support bearing

The operator's maintenance records indicated that the left (seized) inboard torque tube support bearing was an original item that was fitted to the airframe of VH-SGT when the aircraft had first been registered for service. The bearing had operated for 21,757.3 hours total service with an accumulation of 19,875 cycles[5] in that time.

5 One cycle is defined as: engine start-up and increase to full or partial power, one landing gear retraction and extension and a complete shutdown.

Table 1: Landing gear components, VH-SGT, as-received by the ATSB.

Component Identification				Service History	
Item	**Condition**	**Serial Number**	**Part Number**	**Cycles**	**Total Time in Service**
(Left) inboard torque tube support bearing	Unserviceable – seized –	– –	KP168S	19875	21757.3
(Right) main landing gear actuator	Unserviceable – failed –	9452	99-810057-651	389	557.0

Previous landing gear occurrences

In 2005 VH-SGT (S/N BB-073) was involved in another occurrence where the landing gear could not be extended for landing. This was also investigated by the ATSB[6].

The investigation revealed that the incorrect installation of a lower thrust bearing within one of the main landing gear actuators was found to have affected the aircraft system performance. Incorrect bearing assembly allowed abnormal thrust loads to impinge directly on the geared components within the actuator. The gears were found to have fractured which prevented manual extension of the aircraft's landing gear by the pilot.

Technical examination

Main landing gear actuator (right)

Initial examination of the disassembled right main landing gear actuator indicated two sites of primary damage; the first was located on the body of the actuator housing, and the second located within the gearing of the screw housing (Figure 4).

6 ATSB Occurrence Report 200500167.

Figure 4: The partially reassembled right main landing gear actuator.

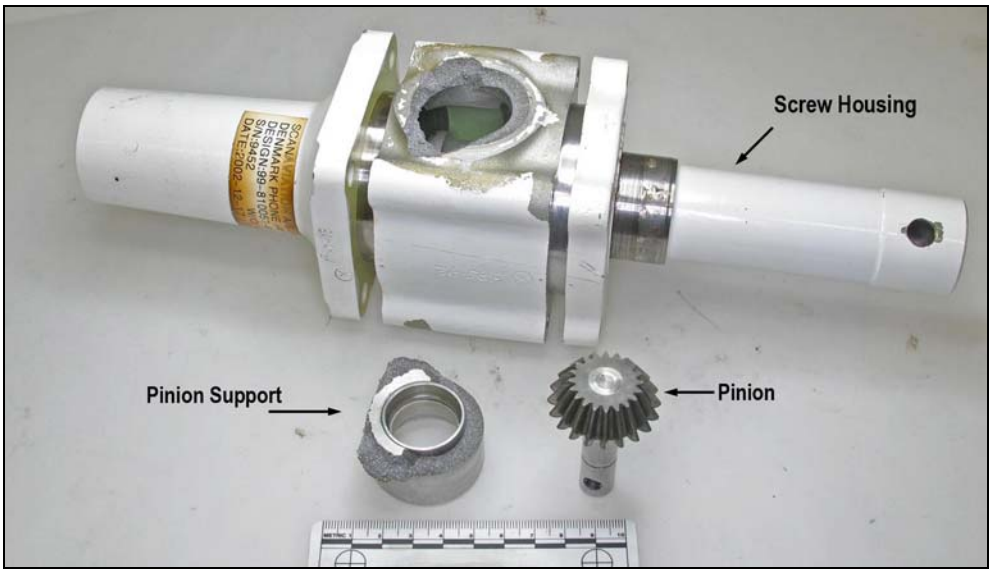
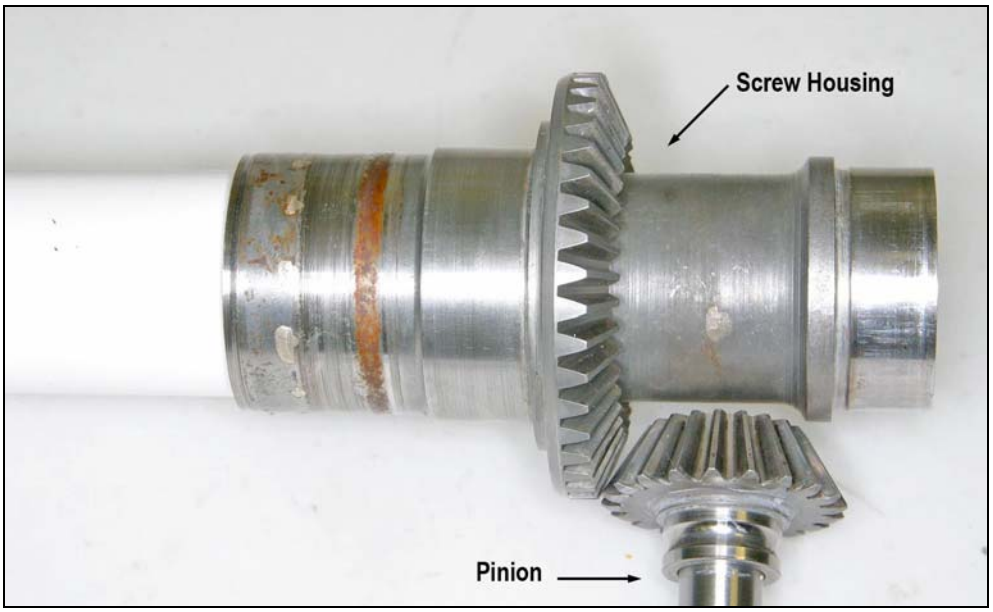


Figure 5: Close view of the mechanical relationship between the pinion and actuator screw.



The side of the actuator housing that supported the pinion gear and bearings had fractured. Examination of the fracture surfaces of the cast aluminium housing was performed at low power using the binocular microscope and at higher power using the scanning electron microscope (SEM). Only features associated with gross overload of the material were observed. Those features indicated that the pinion support within the actuator housing had been exposed to abnormally high loads encountered during the landing event. No evidence was found of a pre-existing crack or defect within the actuator housing.

The second site of damage was located on the screw housing. Four out of the 40 teeth from the bevel gear had completely fractured from the contact face. Close inspection of the remaining gear teeth revealed that most teeth also contained

cracks. The cracks were noted to initiate about the pitch line of the bevel gear assembly. At high magnification, clear and distinct bands of crack progression were observed on the fracture surfaces of the broken teeth. This indicated that the gear tooth failure mechanism was by cyclic fatigue from reverse-bending loads (Figure 6 and 7).

Figure 6: Close-up of the bevelled gear teeth from the screw housing. Note the cracking (arrowed) and tooth loss.

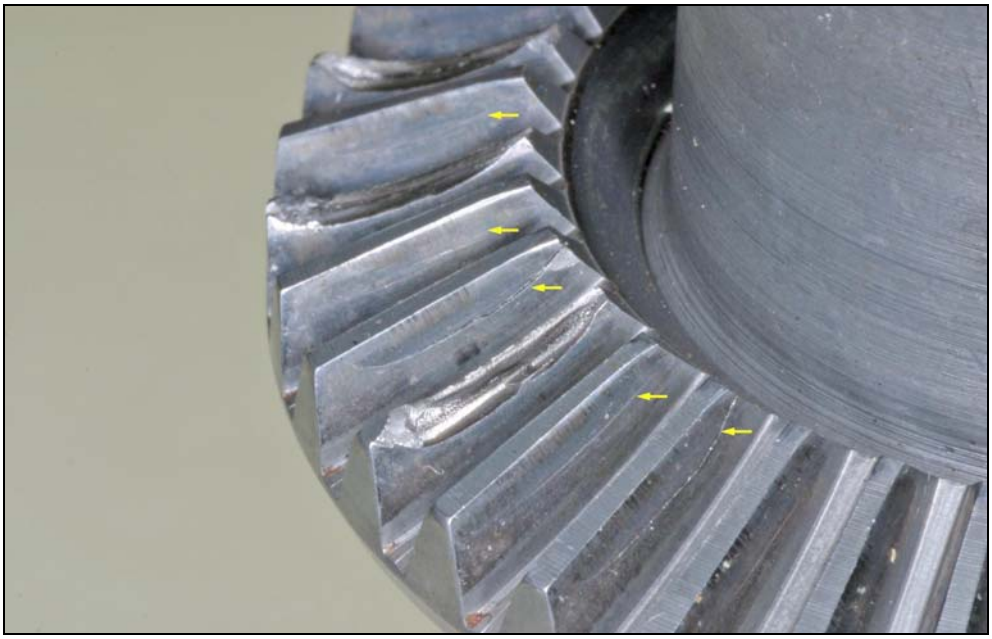
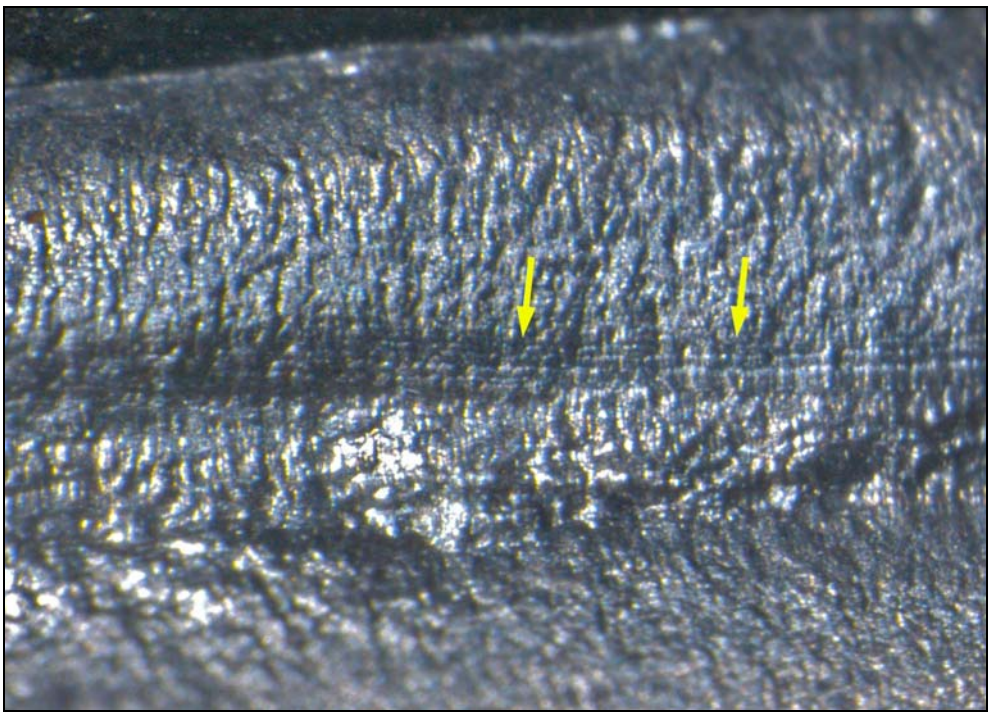


Figure 7: Close-up of the fracture surface from a broken tooth off the screw housing bevel gear.



Bands (arrowed) from progressive fatigue crack growth are clearly visible.

Another feature of significance was the pattern of irregular wear around the innermost corner of each gear tooth. The pattern indicated that the screw housing gear teeth may have been misaligned when they engaged with the pinion gear during service, resulting in the observed corner damage (Figure 8).

Figure 8: Image montage showing abnormal wear features (circled) on the inner radial meshing teeth off the screw housing and pinion gear.

Metallographic examination of screw housing

Samples of material taken perpendicular to the screw housing gear teeth fracture plane were prepared for microstructural examination. The samples were prepared using metallographic techniques and the microstructure of the steel comprising the gear teeth examined in the as-polished and etched conditions.

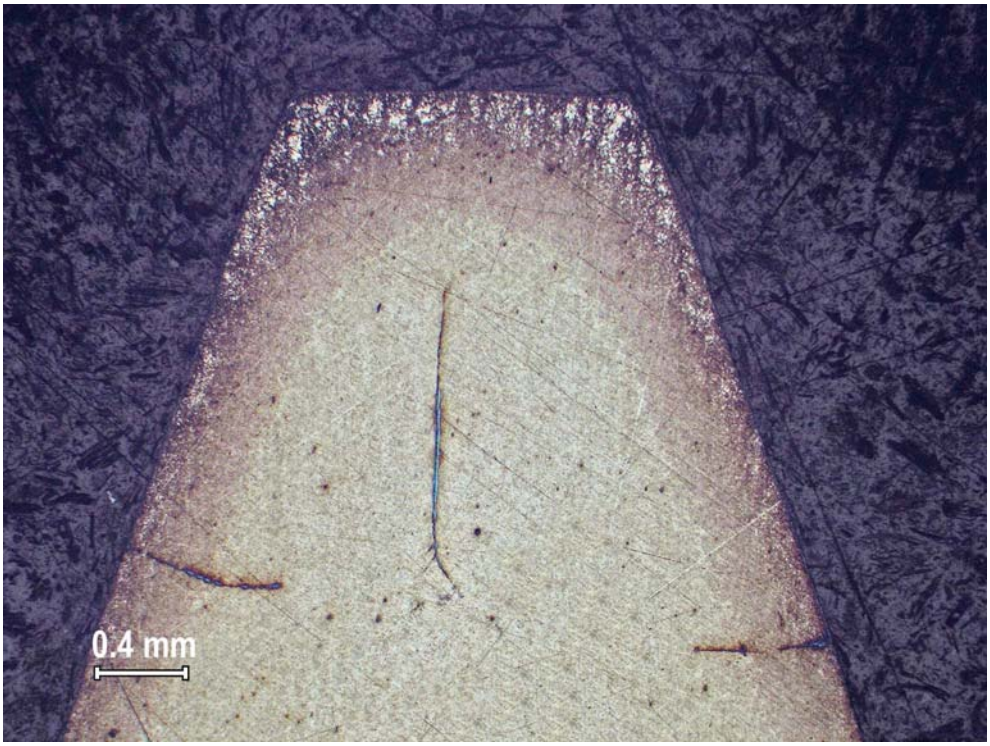
Examination of the etched metallographic specimens revealed a core steel microstructure that consisted primarily of finely tempered martensite. The actuator screw teeth had been carburized to a depth of approximately 0.4 mm (Figure 9). Carburizing is a case-hardening process commonly used to improve the surface properties of a component by producing a strong, wear resistant surface layer (as needed for gear-type mechanical applications).

Within the case-hardened layer, a lighter etched phase of retained austenite was observed close to the surface in the uppermost corner of each gear tooth. Excessive amounts are considered detrimental to the mechanical properties of a component; for example, lower hardness and bending fatigue resistance. The amount of austenite in the component was considered moderate and unlikely to have contributed to the premature failure of the gear teeth.

The metallographic cross-sections also exposed further detail on each of the previously identified cracked gear teeth. Not only were both transverse cracks at the screw housing gear tooth pitch line identified, but vertical cracks were also found through the centre of each gear tooth. The vertical cracks were internally located and unable to be identified using visual inspection or by magnetic particle crack detection techniques (refer to Figure 9 for detail).

The presence of such cracking implied that the geared components within the right actuator had been subjected to abnormal elevated loads during service.

Figure 9: Polished and etched metallographic cross-section through one of the cracked teeth from the screw housing. One internal vertical crack and two transverse cracks can be seen.



Main landing gear actuator (right) – assembly of the lower thrust bearing

The lower bearing that had been fitted into the bottom housing of the right actuator was a thrust-type bearing. Incorrect installation of a thrust bearing of this same type had been attributed to the previously investigated landing gear event for this aircraft. The bearing, manufactured by Fafnir with part number 7017KR, had the instructions 'THRUST HERE', stamped on the face of the outer race.

The bearing must be installed correctly to resist thrust loads encountered during service and this is reflected in the manufacturer's component maintenance manual[7] with the cautionary statement:

> CAUTION
>
> The lower bearing (20) must be installed correctly to resist thrust.
>
> c. Press the lower bearing (20) onto the screw housing (10) with the thrust side of the bearing (as marked on the outer bearing race) away from the housing (21).

After the occurrence, when the right actuator was initially removed and disassembled from the King Air, the maintenance organisation that performed the work reported that the lower thrust bearing had been correctly installed in accordance with the listed instructions in the component maintenance manual.

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7 Beechcraft Super King Air 200 Series Manufactured Component Maintenance Manual, Landing Gear Actuators, P/N 99810057, 32-31-01, page 5, 27 July 1979.

Left inboard torque tube support bearing

The left inboard torque tube support bearing assembly was received by the ATSB disassembled to the piece-part level (Figure 10). An attempt was made to rotate the bearing which confirmed that it had seized. Examination showed that the seized bearing (part number KP168S; a sealed spherical roller bearing) comprised primarily small steel ball rollers and with inner and outer races that had been cadmium plated. Thin flexible Teflon seals and steel rings had been used to seal the ball bearings from the external service environment. The seals were found to be intact and showed no evidence of breakdown or abnormal degradation.

It was required that the bearing be normally filled with MIL-G-811322 grease. On inspection, no grease or any other type of lubricant was found within the bearing.

A reddish brown substance had become dispersed within the spherical rollers. Both bearing races were examined and found to be in good condition with no sign of damage or breakdown of the rolling surfaces (Figure 11 and 12).

The red/brown substance was loose and could easily be cleaned from the surfaces of the spherical rollers. This substance was chemically analysed using energy dispersive spectrometry (EDS) under the scanning electron microscope. The analysis revealed that the contaminant consisted primarily of iron (Fe), and oxygen (O). Smaller amounts of magnesium (Mg), silicon (Si) and sulphur (S) were also found. As such, the substance was probably a contaminant that had migrated from the external service environment into the rolling elements.

Aside from the bearing contamination, no evidence was found of other known failure mechanisms; for example, corrosion, brinelling, spalling, overheating, misalignment, or excessive loading that could have contributed to the seized state of the bearing.

Figure 10: An assembled torque tube bearing support assembly.

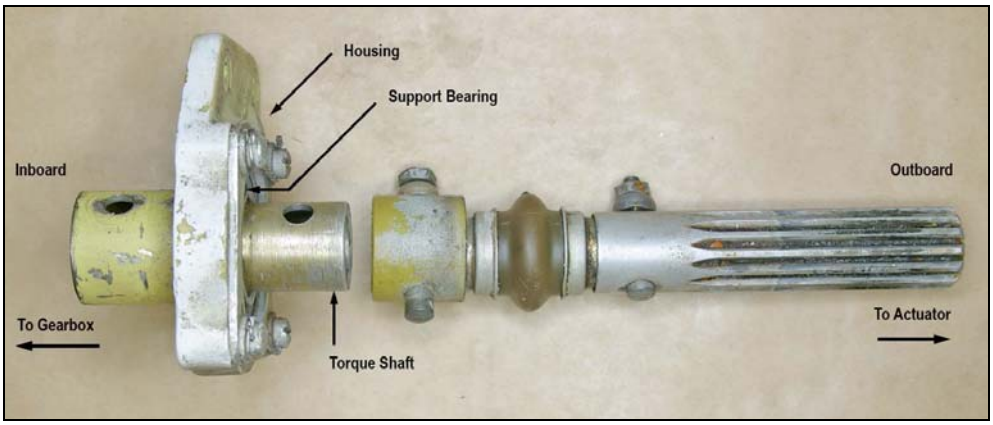

Figure 11: Bearing (P/N KP168S) from the left inboard torque tube support assembly.

Note the reddish discolouration on each of the balls.

Figure 12: Close-up of the balls from the left bearing showing gross amounts of red contamination over the rolling surfaces.

System of maintenance - torque tube support bearings

A review of the Beechcraft Super King Air 200 series maintenance manual[8] revealed that inspection criteria and inspection intervals for the aircraft were divided into four phases of 200 hours each. A complete inspection cycle totalled 800 hours or 24 months. Inspection of the aircraft's torque tube components within the mechanical landing gear system was required at phase-one and -two, which was at the 200 and 400 hundred hour period. The maintenance manual provided the following detail with regard to inspection of the torque tube support bearings within the aircraft's main landing gear system:

> MECHANICAL LANDING GEAR TORQUE TUBE AND ASSOCIATED COMPONENTS
> Inspect torque tube, bearings, supports, universal joints, and hardware for security of attachment, wear, cracks, breaks, bends, splits, chaffing, alignment and clearance from associated structures and their components.

When an aircraft was operated outside of normal usage parameters and in excess of average environmental conditions, the maintenance manual also provided an additional statement[9] to Super King Air 200 operators:

> SPECIAL CONDITIONS CAUTIONARY NOTICE
> Airplanes operated for Air Taxi or other than normal operations and airplanes operated in humid tropics, or in cold damp climates, etc., may need more frequent inspections for wear, corrosion, lubrication, and/or lack of maintenance. Under these adverse conditions, perform periodic inspections in compliance with this guide at more frequent intervals until the owner/operator can set his own inspection periods based on the contingencies of field experience.

At the 600 and 800 hour service interval (phase-three and -four), the maintenance manual offered the following guidance:

> LANDING GEAR RETRACTION
> Inspect all landing gear components and attaching hardware, structure and hydraulic lines for general condition and security of attachment.

It was noted that the maintenance manual did not provide a life-limit for scheduled replacement of the torque tube bearings.

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8 Beechcraft Super King Air 200 Series Maintenance Manual, P/N 101-0010-19, Section 5-00-00.

9 Beechcraft Super King Air 200 Series Maintenance Manual, P/N 101-0010-19, Section 5-20-00 and Section 5-21-00.

ANALYSIS

Shortly after takeoff from Perth airport, the main landing gear of the Beech Super King Air 200 became jammed in a partially retracted state. The main gear subsequently collapsed on the return landing at Perth. The corrective diagnosis and troubleshooting actions performed by the pilot in an attempt to restore the aircraft's main landing gear extension and retraction mechanism were appropriate for the circumstances.

Main landing gear failure

The ATSB examination found that two major main landing gear system components on the King Air had failed; the right main landing gear actuator and the left torque tube support bearing. While either failure could have produced the main landing gear difficulties sustained, the investigation was not able to determine which mechanism was the principal contributor to the event.

The landing gear system configuration was such that should either one of these components cease to function; extension or retraction of the landing gear would not have been possible. Failure of either component assembly would produce a 'lock-up' and disable any attempt (manual or automatic) by the pilot to retract or extend the gear. There was no system redundancy to override a component failure of this nature.

It was likely that each component failure was independent of the other. Seizure of the left torque tube bearing through lack of lubrication and dirt and dust contamination would not have magnified the service loads experienced by the right main landing gear actuator. Similarly, premature failure of the right actuator would not have affected the left support bearing.

Failure of the right main landing gear actuator

The investigation revealed that premature failure of the geared components within the right main landing gear actuator could have contributed to the landing gear lock-up and eventual collapse. Several of the screw housing gear teeth had fractured due to fatigue cracking. Had one of those fractured teeth migrated and become jammed between the meshing teeth within the actuator, extension or retraction of the actuator would have been disabled.

The presence of such cracks indicated that the screw housing gear teeth had been abnormally stressed as the right main landing actuator extended and retracted during service. The fatigue cracks had not developed as a result of this landing occurrence.

Abnormal wear marks between the intermeshing pinion and screw housing gear teeth suggested that an incorrect clearance or misalignment may have been present during operation. Such misalignment may have elevated the tooth bending loads sustained by the bevel gear and pinion, thus contributing to the premature component failure.

Due to the damage the actuator had sustained during the gear collapse, it could not be established whether the internal tolerances between the pinion and landing gear

actuator were within the limits published within the manufacturer's component maintenance manual.

No defects associated with the assembly of the lower thrust bearing within the right actuator, as found in the 2005 accident, were identified that could have contributed to this occurrence.

Failure of the left torque tube support bearing assembly

The investigation also revealed that one of the four torque tube support bearings from the main landing gear system had seized. Seizure of that bearing could have produced a lock-up and prevented the main gear from properly retracting after takeoff. The examination showed that the seized bearing was unlubricated and had become contaminated with dirt and dust from the external service environment. Those contaminants had migrated into the spherical bearing rollers which directly contributed to the bearing failure.

System of maintenance - torque tube support bearings

When operated under normal conditions of service, the Beechcraft Super King Air 200 maintenance manual provided only basic instructions for the inspection of the mechanical landing gear torque tube components. Such inspections were required at the 200 and 400 hour service interval period within the complete inspection schedule. When the aircraft was to be flown outside of normal operating conditions, the manual indicated that the frequency and level of inspection should be increased.

The ATSB considers that those instructions provided insufficient guidance to maintenance personnel regarding when the torque tube support bearings should have been lubricated.

The absence of any detailed maintenance instruction or a specified bearing life-limit suggested that the manufacturer considered the support bearings to be maintenance free, not normally requiring particular action during the service life of the aircraft.

FINDINGS

Context

From the evidence available, the investigation revealed that two major system components had failed which could have prevented the Beechcraft Super King Air 200 landing gear from properly retracting after takeoff. The following findings with respect to those failed landing gear system components should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The left torque tube support bearing had not been lubricated and had seized due to the accumulation of dirt and grit contaminants that had migrated from the external service environment and into the bearing.
- The geared components within the right main landing gear actuator prematurely failed.

Other safety factors

- The aircraft manufacturer's maintenance manual contained insufficient instruction or guidance for operators and maintainers of Super King Air 200 aircraft for the lubrication of the landing gear torque tube support bearings. *[Safety Issue]*

Other key findings

- Both component assemblies were integral to the function and normal operation of the Super King Air 200 mechanical landing gear system. A break down of either component assembly would have prevented any attempt by the pilot to retract or extend the aircraft's main landing gear. However, while either failure could have produced the landing gear difficulties sustained, the investigation was not able to determine which mechanism was the principal contributor to the event.
- The investigation was unable to conclusively establish why the geared components within the right main landing gear actuator had prematurely failed.
- The lower thrust bearing within the right main landing gear actuator had been correctly installed.

SAFETY ACTIONS

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

Operator

Immediate post-accident actions

As a result of this occurrence, the operator reported that a detailed inspection and check of the landing gear retraction mechanisms was performed on all other aircraft within their Super King Air 200 fleet. No additional airworthiness issues were found.

Maintenance manual guidance

Safety issue

The aircraft manufacturer's maintenance manual contained insufficient instruction or guidance for operators and maintainers of Super King Air 200 aircraft for the lubrication of the landing gear torque tube support bearings. *[Safety Issue]*

Action taken by the operator

The operator changed their system of maintenance by the introduction of an inspection interval and replacement schedule for all landing gear torque tube support bearings within their Super King Air 200 fleet.

Civil Aviation Safety Authority

Maintenance manual guidance

Safety issue

The aircraft manufacturer's maintenance manual contained insufficient instruction or guidance for operators and maintainers of Super King Air 200 aircraft for the lubrication of the landing gear torque tube support bearings. *[Safety Issue]*

Action taken by the Civil Aviation Safety Authority

On 3 May 2007, the Civil Aviation Safety Authority released airworthiness bulletin (AWB) 32-07 to all operators of Hawker Beechcraft 65, 70, Queen Air 90 and 200-series King Air aircraft. The CASA AWB recommended the introduction of a lubrication schedule change to include the inspection, lubrication and mandatory replacement of the four support bearings (part number KP16BS or KP16B), universal joints and spline shafts on both sides of the main landing gear retraction mechanism.

A copy of the AWB is contained in Appendix A.

Hawker Beechcraft Corporation

Maintenance manual guidance

Safety issue

The aircraft manufacturer's maintenance manual contained insufficient instruction or guidance for operators and maintainers of Super King Air 200 aircraft for the lubrication of the landing gear torque tube support bearings. *[Safety Issue]*

ATSB safety advisory notice SAN20080002

The Australian Transport Safety Bureau advises that Hawker Beechcraft should consider the safety implications of this safety issue and take action where considered appropriate.

APPENDIX A

Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

Beech 65, 70, 90 and 200 Main Landing Gear

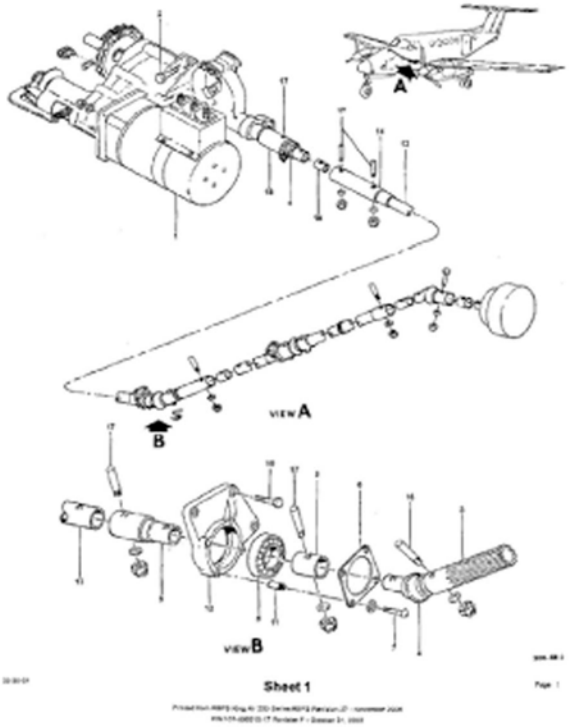
AWB 32-007 **Issue** : 1
Date : 3 May 2007

1. Applicability

All Hawker (Raytheon) Beech 65/70 Queen Air, Beech 90 King Air and Beech 200 Super King Air aircraft incorporating an electric main undercarriage retraction system.

2. Purpose

To recommend the introduction of a lubrication schedule change to include the inspection, lubrication and mandatory replacement of the four support bearings Part Number KP16BS or KP16B, universal joints and spline shafts on both sides of the main landing gear retraction system.



The assembly shown is the Left Hand Side; the same assembly is repeated on the Right Hand Side. The failed bearing is indicated by No 8

3. Background

- A recent Service Difficulty Report after an accident has reported that the support bearings for the main landing gear retraction system had seized.
- This caused a complete failure of the system preventing the main undercarriage being extended during a landing.
- These universal joints and bearings are not included in the lubrication schedule for the aircraft.
- These universal joints and bearings are currently not included in the manufacturer's maintenance requirements.
- There is currently no inspection schedule for these universal joints and bearings recommended by the aircraft manufacturer.

4. Recommendation

- It is recommended that operators of Hawker (Raytheon) Beech 65, 70 Queen Air, 90 King Air and 200 Super King Air aircraft incorporating an electric Main undercarriage retraction system consider:
  - Inspecting the two Main Landing Gear Retraction System support bearings part Number KP16BS or KP16B, and the universal joint part number 101-810001-3 at the next scheduled inspection to determine their condition.
  - Amending the System of Maintenance to include regular inspection of these bearings, torque tube splines and universal joints to coincide with the Raytheon 200 or 800 hrs inspections or coincident with the maintenance release inspection (or equivalent).
  - Amending the System of Maintenance to include a lubrication schedule for these bearings, torque tube splines and universal joints using a lubricant specified by the bearing manufacturer at intervals not exceeding 1200 hrs TIS.
  - Replacing all bearings and universal joints at either 6 year or 8000 cycle intervals which ever comes first to coincide with the undercarriage overhaul schedule regardless of condition.

- Replacing all bearings, torque tube splines and universal joints, that show any sign of corrosion, damage or binding.

5. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link e-mail address: AirworthinessBulletin@casa.gov.au

Or in writing, to:

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