

DATA SUMMARY

LOCATION

| | |
|---------------|--|
| Date and time | Saturday, 10 July 2004; 08:40 h local |
| Site | Valencia Airport |

AIRCRAFT

| | |
|----------------|---------------------|
| Registration | EC-FCC |
| Type and model | CESSNA 402-B |
| Operator | Victor Echo |

Engines

| | |
|----------------|--|
| Type and model | TELEDYNE CONTINENTAL TSIO-520-E |
| Number | 2 |

Crew

| | Pilot in command | Copilot |
|--------------------------|---------------------------------|---------------------------------|
| Age | 28 years | 36 years |
| Licence | Commercial Pilot (Airp.) | Commercial Pilot (Airp.) |
| Total flight hours | 1,147 h | 1,100 h |
| Flight hours on the type | 627 h | 200 h |

INJURIES

| | Fatal | Serious | Minor/None |
|---------------|-------|---------|------------|
| Crew | | | 2 |
| Passengers | | | |
| Third persons | | | |

DAMAGES

| | |
|---------------|------------------|
| Aircraft | Important |
| Third parties | None |

FLIGHT DATA

| | |
|-----------------|--|
| Operation | Commercial Air Transport – Non scheduled domestic – Cargo |
| Phase of flight | Taxiing to runway |

REPORT

| | |
|------------------|---------------------|
| Date of approval | 26 July 2006 |
|------------------|---------------------|

1. FACTUAL INFORMATION

1.1. Event description

The airplane had arrived to Valencia Airport from Palma de Mallorca, and it was going to initiate the flight back to Palma with 300 kg of newspapers. There were two flight crew members on board. The pilot in command was the pilot flying (PF). When it was ready to enter runway 12 for takeoff, the pilot released the brakes, increased the power of the engines, and started taxiing. A few meters afterwards the left main landing gear leg collapsed, the LH wing and the LH horizontal stabilizer touched the ground and the tip of the LH propeller blades also hit the runway pavement.

The failure of the leg was caused by the shearing of the bellcrank pivot bolt.

1.2. Injuries to persons

Both occupants were uninjured.

1.3. Damage to aircraft

During a first visual inspection of the aircraft it was noticed that it had suffered major damage on the LH wing that was deformed, on the LH horizontal tail, left landing gear well and doors, and left propeller that had the blades totally deformed. Although the left engine did not show obvious exterior damage, the possibility existed that it could have been affected by the shock caused by the propeller impact against the ground.

1.4. Personnel information

The following table shows the most relevant data on licensing and experience of the piloto in command:

| Information on the pilot in command | |
|-------------------------------------|--------------------------------------|
| Age | 28 years |
| Nationality | Spanish |
| Licence | Commercial Pilot (Airplane) |
| <i>Type rating (validity)</i> | Single engine (land) (21-06-2005) |
| | Multiengine (land) (15-02-2005) |
| | Instrumental (15-02-2005) |
| | Flight instructor (09-10-2004) |
| | Class rating instructor (01-07-2006) |

| Information on the pilot in command (<i>continue</i>) | | |
|---|-------------------------|--------------------|
| <i>Flight experience</i> | Total | 1,147 h |
| | On type | 627 h |
| | Last 90 days | 125 h |
| | Last 30 days | 52:05 h |
| <i>Duty period</i> | Start of current period | 01:45 h local time |
| | Previous rest | 19:45 h |

1.5. Aircraft information

1.5.1. General information

| General information | | |
|-------------------------------------|---------------------|---|
| Registration | EC-FCC | |
| Make | Cessna Aircraft Co. | |
| Model | 402-B | |
| Serial number | 402B1013 | |
| Year of manufacture | 1976 | |
| <i>Engine</i> | Make | Teledyne Continental |
| | Model | TSIO-520-E |
| | Serial number | 812552-R y 812660-R |
| <i>Hélice</i> | Make | McCauley |
| | Model | 3AF32C87 |
| <i>Certificate of airworthiness</i> | Class | Restricted |
| | <i>Empleo</i> | Categoría: TPP TPM |
| | | Prestación: Normal. Aeronave idónea para vuelo instrumental CAT 1 |
| | Number | 3178 |
| | Issued | 20-02-2003 |
| | Expiry date | 04-12-2004 |
| Latest renewal date | 05-12-2003 | |

| Technical specifications | | |
|--------------------------|---------------------|------------|
| <i>Dimensions</i> | Span | 14.50 m |
| | Height | 2.99 m |
| | Length | 11.00 m |
| <i>Limitations</i> | MTOW | 2,857.7 kg |
| | Minimum flight crew | One pilot |

1.5.2. *Maintenance records*

The first element that broke and started the sequence of the left landing gear collapse was the bellcrank pivot bolt. The «Cessna Supplemental Inspection Document» (SID) 32-10-03 dated 1-09-2002 establishes the need of an initial inspection with 1,000 landings or 3 years and then repetitive inspections every 500 landings or 3 years to detect possible shear failures on the bolt.

The latest maintenance check carried out on the aircraft on 7 July 2004 was a 100-hour inspection with several special items.

On 14 August 2003 they had performed a structural inspection in which, among other tasks, the bellcrank pivot bolts of both legs of the main landing gear had been replaced with brand new bolts.

During the next 11 months elapsed between the replacement and the accident, the aircraft had been flown for 352 h and completed 384 landings.

Therefore, the left bolt had still a potencial service life of 616 landings or 25 months before the next required inspection.

1.6. **Meteorological information**

The information provided by the National Institute of Meteorology for Valencia Airport was as follows:

- Wind: 100°/4 kt.
- Cavok.
- Temperature: 23 °C.
- Dew point: 17 °C.
- QNH: 1,020 hPa.
- No significant changes expected.

1.7. Tests and research

1.7.1. Inspection of the landing gear

After the aircraft was moved to a hangar of the company that owned the aircraft, it was put on jacks and it was carried out a visual inspection of the landing gear related mechanisms, and of the other aircraft damages on propeller, left wing and horizontal stabilizer.

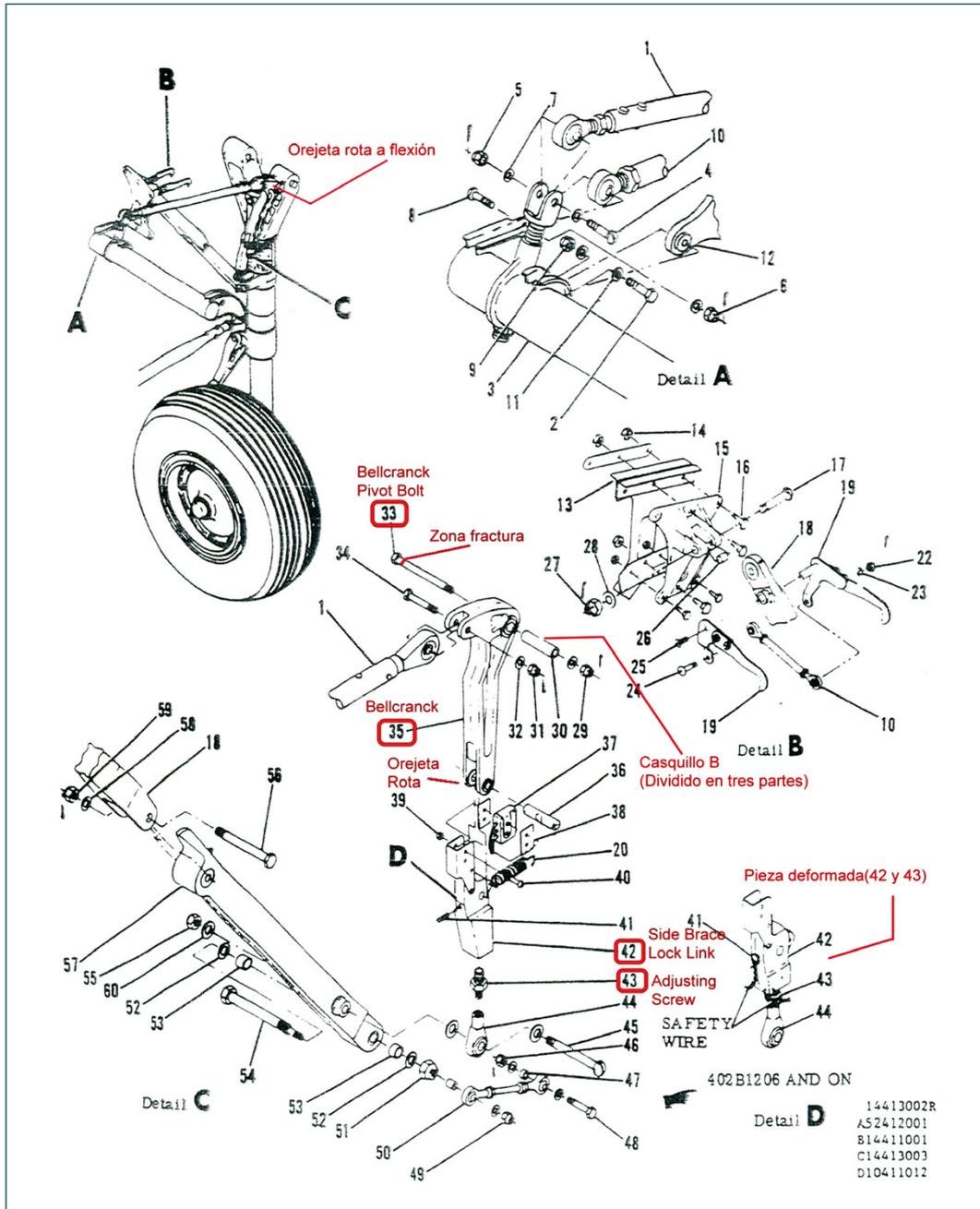


Figure 1. Schematics of the breakdown of the main landing gear leg

It was noticed the breakage of the bellcrank pivot bolt (see attached Drawing 1, item 33) that fits the bellcrank (35) to the leg of the gear through two fittings welded to that leg. One of those fittings (the rearmost when looking in the sense of the flight) was still attached to the leg together with the head of the broken bolt. The forward fitting was broken due to bending and remained partially held by the nut of the bolt (33).

Additionally, one of the two lower fittings of the bellcrank (35) was torn by bending.

The adjusting screw (43) was also deformed.

Several severed and/or deformed parts of the collapsed gear leg were reserved for further detailed inspections.

As a precautionary measure, it was checked whether the other leg was also damaged (which could have indicated a possible common misrigging of the mechanisms of both legs during their maintenance). The counterparts of the parts damaged on the left leg were disassembled from the right leg and no crack or noticeable deformation was observed, especially on the bellcrank pivot bolt, and therefore such possibility was discarded.

1.7.2. *Inspection of the bolt*

The severed bolt, called bellcrank pivot bolt, P/N NAS 464P4-26, was sent to a laboratory to determine the causes of its failure.



Photo 1. Macroscopic view of the fracture surface

The fractographic evaluation carried out on the fracture surface of the bolt concluded, at a macrofractographic level, that there had been a static failure mainly due to shear loads, which was later confirmed at microfractographic level when domes were detected representing the fracture effects of shear loads.

The chemical composition is conformed the specification NAS464 and the associated technical specification NAS498.

By means of optical emission spectrometry it was determined that the chemical composition of the bolt corresponded to a low-alloy steel of type AISI 8740, with a medium level of strength as obtained by Rockwell-C hardness measures of 142 KSI (kilo pounds per square inch).

The specification NAS464 establishes that the strength level must be between 160 KSI and 180 KSI.

The bolt evaluated had an actual strength of 142 KSI, which is a 11,25% lower than the minimum required by that specification.

1.7.3. *Records of the bolt*

It was intended to obtain the history of the broken bolt since the moment of its manufacture, and the following findings were established:

Honeywell TPG/Tristar sent the bolt to Cessna Aircraft Company, located in Wichita (Kansas, USA) in March 2003.

Cessna Aircraft Company sent later on the bolt to Hill Aircraft, located in Atlanta (Georgia, USA).

It is possible, although it was not definitely determined, that this company sent the subject bolt to «Nortavia-Transportes Aéreos, S. A.», an aircraft maintenance center located in Portugal, where they installed it on the accident aircraft on 14 August 2003.

1.8. Additional information

Cessna was asked regarding the quality control procedures applied to these bolts, and they answered that their purchasing agreements with all of their vendors require that any parts shipped to use meet the specifications applicable to the part. The parts are tested by the bendor before release and are generally shipped with a conformity report stating the parts meet specification. Their purchasing agreements also state that even if a conformity report is not send with the parts, by sending the parts to Cessna the vendor is stating the parts conform to the specification applicable to the parts.

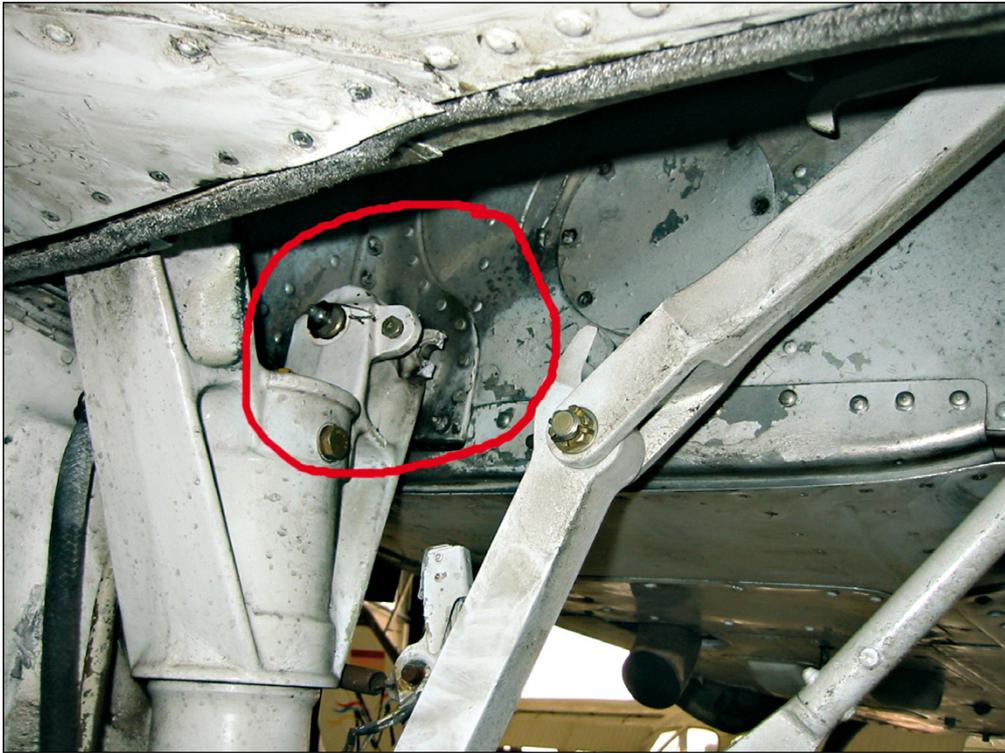


Photo 2. Detail of the broken fitting

Regarding the possibility that other defective bolts would have been installed on other aircraft, Cessna informed that they were not aware of any other previous case in which this bolt had failed.

2. ANALYSIS

From the data obtained, it can be concluded that the collapse of the LH landing gear was due to the following process:

- a) The sequence of the breakages started with the fracture of the bellcrank pivot bolt (item 33 of Drawing 1 above) because, otherwise, the rear fitting (when looking in the sense of flight) of the left leg of the main landing gear would not have remained undamaged with the head of the bolt still inside.
- b) The front fitting then bent and broke due to bending moments, as happened to one of the lower fittings of the bellcrank (35) that was joined to the side brace lock link (42). The adjusting screw (43) was also deformed.
- c) From that moment on, the geometry of the mechanical assembly of the overcenter (that maintains locked the landing gear) was disturbed, and the leg retracted on its door and produced a series of breaks and deformations in several components of the left landing gear.

In view of the normal state of the mechanical components of the other leg of the main landing gear, especially the bellcrank pivot bolt, it cannot be concluded that it is necessary to recommend to lower the period of 500 landings or three years required by the Cessna Supplemental Inspection Document (SID) 32-10-03 dated 1-09-2002.

3. CONCLUSION

3.1. Findings

The fact that the counterpart components of the right MLG leg did not show any abnormality discards the possibility of a common misrigging of both legs.

The collapse of the left leg MLG leg was due to the fracture of the bellcrank pivot bolt (33) due to the fact that its strength was lower than the minimum established in the applicable specifications, NAS464 and in the related technical specification NAS498.

According to the information provided by the operator, the maintenance of this element had been carried out following the instructions of the manufacturer of the aircraft, and at the moment of the accident it still had a potential service life of 616 landings or 25 months before the next scheduled inspection.

3.2. Cause

This incident was caused by the shearing of the bellcrank pivot bolt of the left main landing gear leg. This failure was probably due to the fact that the strength of the bolt was lower than the minimum required by the specification.

4. SAFETY RECOMMENDATIONS

REC 11/06. It is recommended that Cessna Aircraft Company requires Honeywell TPG/Tristar to review their quality control systems of the elements and components provided as spare parts to be assembled in aircraft manufactured by Cessna Aircraft Company to further ensure that those parts comply with the specifications of the type design.