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E **I**NCIDENTES DE
AVIACIÓN **C**IVIL

Report A–046/2018

Accident involving a Cessna 310-R aircraft, registration EC-EQK, at the Cuatro Vientos Airport on 30 November 2018

GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Transportes, Movilidad y Agenda Urbana ©

NIPO: 796-20-093-1

Diseño, maquetación e impresión: Centro de Publicaciones

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Foreword

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the accident object of the investigation, and its probable causes and consequences.

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1., 4. and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only

Contents

Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees centigrade
AD	Airworthiness directive
AESA	Spain's National Aviation Safety Agency
CPL	Commercial pilot license
CRI	Class rating instructor
ELT	Emergency locator transmitter
ETSIAE	Advanced School of Aeronautical and Space Engineering
h	Hours
hPa	Hectopascals
ICAO	International Civil Aviation Organization
IR	Instrument rating
km	Kilometers
kt	Knots
LECU	Madrid-Cuatro Vientos Airport
LEVS	Madrid/Cuatro Vientos (military)
m	Meters
MEP	Multi-engine piston rating
METAR	Aviation routine weather report
NE	Northeast
NW	Northwest
P/N	Part number
PPL	Private pilot license
S/N	Serial number
SEP	Single-engine piston rating
TAF	Aerodrome forecast
UPM	Universidad Politécnica de Madrid
UTC	Coordinated universal time
VFR	Visual flight rules
W	West

Synopsis

Owner:	Servicios Politécnicos Aéreos
Operator:	Servicios Politécnicos Aéreos
Aircraft:	Cessna 310-R
Persons on board:	2 crew, uninjured
Type of flight:	General Aviation – Private
Phase of flight:	Landing – Landing run
Type of operation:	VFR
Date and time of incident:	30 November 2018 at 16:55[1]
Site of incident:	Cuatro Vientos Airport
Date of approval:	27 November 2019

Summary of the event

On Friday, 30 November 2018, the aircraft took off from the Cuatro Vientos Airport on a local training flight, including landings and takeoffs, to familiarize one of the pilots with the handling of the aircraft.

After flying for 35 minutes, they executed a touch and go. Upon reaching an altitude of 700 ft, they attempted to raise the landing gear and some 25 seconds later, according to the pilot, they heard a loud mechanical sound and smelled smoke. The aircraft has a mirror, which allowed them to see that the front landing gear leg was not fully lowered.

They noticed they were unable to move the landing gear either electrically (standard procedure) or manually (emergency procedure).

After declaring an emergency, the pilot landed at the Cuatro Vientos Airport using only the main landing gear. The photograph below shows the position of the landing gear on the aircraft seconds before landing.

[1] All times in this report are local. To obtain UTC, subtract one hour from local time.

Figure 1: View of the aircraft's landing gear seconds before landing at the Cuatro Vientos Airport

The image below shows how the aircraft performed the emergency landing.

Figure 2: Aircraft landing at the Cuatro Vientos Airport

The pilots were not injured.

The aircraft sustained significant damage.

The investigation has determined that this accident was caused by a broken component in the mechanism that lowers the landing gear, which prevented the gear from being fully extended.

The component, a tube, broke due to an instantaneous overload along its longitudinal axis, likely caused by a misalignment of the tubes in the extension and retraction system while attempting to retract the landing gear.

This supposed misalignment of the tubes in the extension and retraction system would also explain the failure of the electric landing gear motor during the retraction process, as it exceeded its operating time.

1. FACTUAL INFORMATION

1.1. History of the flight

On Friday, 30 November 2018, the aircraft took off from the Cuatro Vientos Airport on a local training flight, including landings and takeoffs, to familiarize one of the pilots with the handling of the aircraft.

They had been flying for about 35 minutes when they executed a touch and go. Upon reaching an altitude of 700 ft, they attempted to raise the landing gear and some 25 seconds later, according to the pilot, they heard a loud mechanical sound and smelled smoke. The aircraft has a mirror, which allowed them to see that the front landing gear leg was not fully lowered.

They noticed they were unable to move the landing gear either electrically (standard procedure) or manually (emergency procedure).

After declaring an emergency, the pilot landed at the Cuatro Vientos Airport using only the main landing gear.

The pilots were not injured.

The aircraft sustained significant damage.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Other
Fatal				
Serious				
Minor				N/A
None	2		2	N/A
TOTAL	2		2	

1.3. Damage to aircraft

As a result of landing with the front landing gear leg not being locked, the propellers and the underside of the fuselage were damaged.

The photograph below shows the damage to the fuselage and one of the propellers.

Figure 3: Close-up of the damage to the underside of the fuselage and one of the propellers

1.4. Other damage

There was no other damage.

1.5. Personnel information

The pilot, a 43-year-old Spanish national, had the following licenses, issued by AESA:

- commercial pilot license (CPL(A)), first issued on 23 August 2001, and
- private pilot license (PPL(A)), first issued on 1 April 1996

And the following ratings:

- MEP (land), valid until 30 November 2018[2]

[2] Even though the license provided by the pilot showed the MEP rating expiring on 30 November 2018, this rating had been renewed on the day before, according to AESA's records, and was valid until 30 November 2019.

- SEP (land), valid until 31 May 2019,
- A320 and IR(A), valid until 31 January 2018[3]

He also had a class rating instructor (CRI) rating for MEP (land) that was valid until 31 August 2020.

The pilot had, among others, a Class-1 medical certificate that was valid until 8 August 2019.

The pilot worked for a commercial air transport operator, and occasionally for the operator of the aircraft, Servicios Politécnicos Aéreos S.A. He had a total of 62:27 flight hours on the accident aircraft. His last flight before the accident had been on 30 September 2018.

1.6. Aircraft information

The aircraft, a Cessna 310-R with registration EC-EQK and serial number 310R-1610, was manufactured in 1979 and listed in the AESA aircraft registry on 10 May 2004, under the name of the current owner.

It has a certificate of airworthiness issued by Spain's Civil Aviation General Directorate on 4 June 2005, and an airworthiness review certificate that was valid until 12 August 2019.

The last flight made with this aircraft before the accident had been on 5 October 2018.

The last maintenance activity had been performed on 11 October 2018, and consisted of:

- 50- and 100-hour checks (inspection operations 1 and 2)
- Inspection operations 14 and 41
- Check of the ELT and the suction pumps on both engines
- Airworthiness directives AD 2000-01-16b and AD 2016-17-08 were implemented
- The cockpit heater was replaced

The aircraft had a total of 6229:57 hours and the engine had 3798:08 hours on the day of the accident.

[3] Likewise, even though the license showed that this rating expired on 31 January 2018, according to AESA's records, the rating was renewed on 31 January 2018.

The image below shows a photograph of the aircraft's cockpit.

Figure 4: Photograph of the cockpit

Close-up of the crank for manually actuating the landing gear.

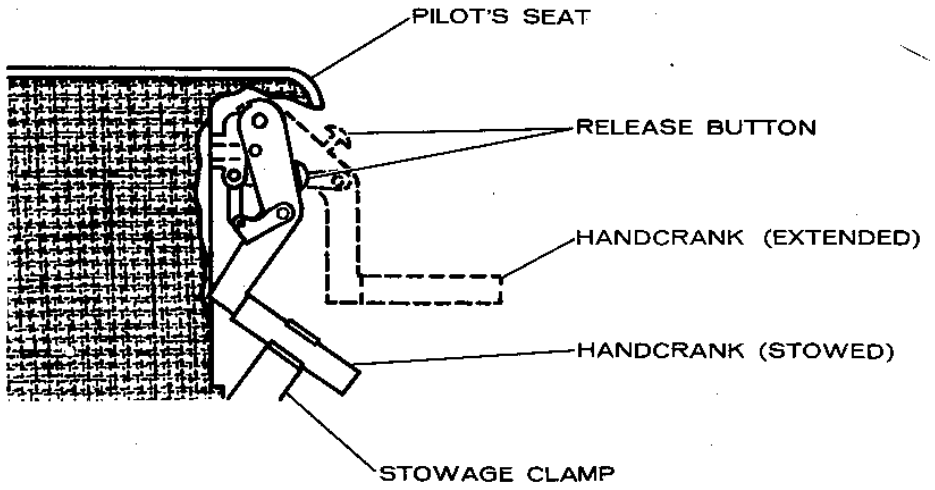


Figure 5: Crank for manually actuating the landing gear

1.6.1. Description of the landing gear.

The aircraft has a retractable tricycle landing gear. It has a main gear located in each wing and a front leg housed in the fuselage. The landing gear legs are connected mechanically to a single actuator located behind the pilot's seat. This actuator is normally moved by an electric motor that is connected to it. The electric motor is controlled using the landing gear switch located on the pilot's instrument panel. During ground operations, the accidental retraction of the landing gear, regardless of the position of the switch, is prevented by way of a safety switch located in the left main gear strut. When the weight of the airplane is on the landing gear, the strut compresses, opening the safety switch, which keeps electricity from reaching the landing gear motor.

The landing gear doors are mechanically attached to their respective legs, going down and up in unison with the legs.

The landing gear is operated using a wheel-shaped switch that has UP, OFF and DOWN positions. To operate the landing gear, the switch is pulled out and moved into the desired position. This movement of the switch causes the electric motor to energize and raise or lower the landing gear, as selected. The motion of the electric motor is controlled by two switches (up limit switch and down limit switch) that cut off the supply of electricity to the motor once the desired position is reached.

There is also a crank that can be used to manually lower the landing gear. It is situated below the right edge of the pilot's seat. This crank is normally folded and stowed. To use it, the pilot's seat has to be moved back. The crank is then pulled out from its storage clip and unfolded, as shown in "Figure 5: Crank for manually actuating the landing gear". Once in this position, the crank is turned clockwise four times until the gear down lights turn on. Once the gear is down, the crank is folded and stowed.

The crank must be gripped firmly while manually lowering the landing gear. The crank must never be allowed to turn uncontrollably by itself. If the handle is accidentally released, it must not be gripped again until it stops moving.

The crank must be folded in its storage clip before the landing gear is actuated electrically. This is because when the crank is placed in its operating position, the landing gear motor is disengaged.

The crank cannot be used to manually retract the landing gear.

The figure below shows a diagram of the landing gear on the accident aircraft.

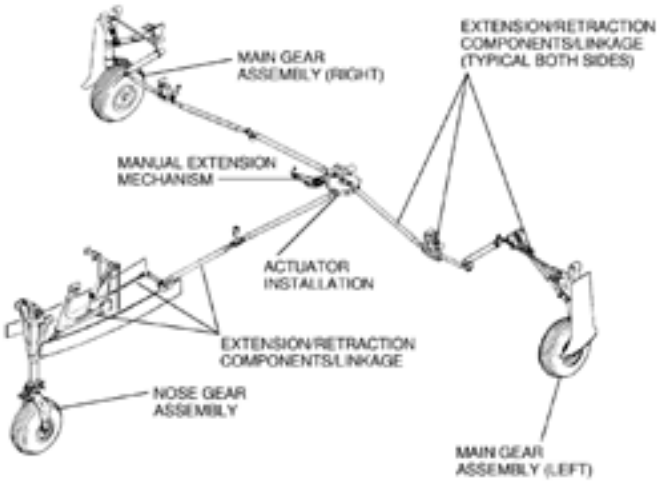


Figure 6: Diagram of the landing gear on the accident aircraft

1.6.2. System for lowering and raising the nose gear.

The system for lowering and raising the nose gear consists of the following components.

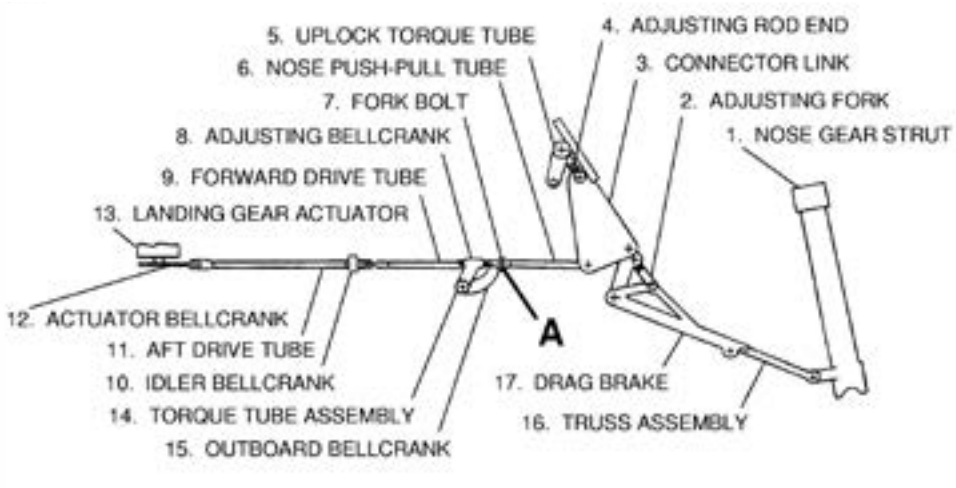


Figure 7: System for lowering and raising the nose leg

The system works as follows:

- When the electric motor is engaged, the nose leg drive tubes move longitudinally, compressing when the nose leg is retracting and expanding when the leg is extending. The drive tubes are linked through the idler bellcrank, whose function is to adjust and align the tubes to ensure that the longitudinal motion is in a straight line.
- The forward drive tube turns the adjusting bellcrank, which causes the push-pull tube to move.
- The motion of the push-pull tube makes the drag brake and the connector link

reach their overcenter position, which locks the leg in place when the gear is extended. The system has a spring as an additional safety measure, which applies tension to the system in the locked position.

- The nose leg is locked in the retracted position using a mechanical hook. The nose gear retraction system also operates the gear doors.

1.6.3. Landing gear actuator

The landing gear actuator consists of an electric motor, a reduction unit and a worm and sector gear assembly. The top end of the actuator shaft is attached to a bellcrank, which acts on the drive tubes of the main landing gear. The bottom end is attached to another bellcrank which acts on the drive tube for the nose leg. There are up limit and down limit switches that restrict the motion of the gear to ensure its proper operation. The actuator motor features a brake to prevent excess travel of the landing gear.

The actuator is normally powered by the electric motor; however, the motor-driven reduction unit can be uncoupled, and a manual extension system can be engaged.

The image below shows the parts that make up the landing gear actuator.

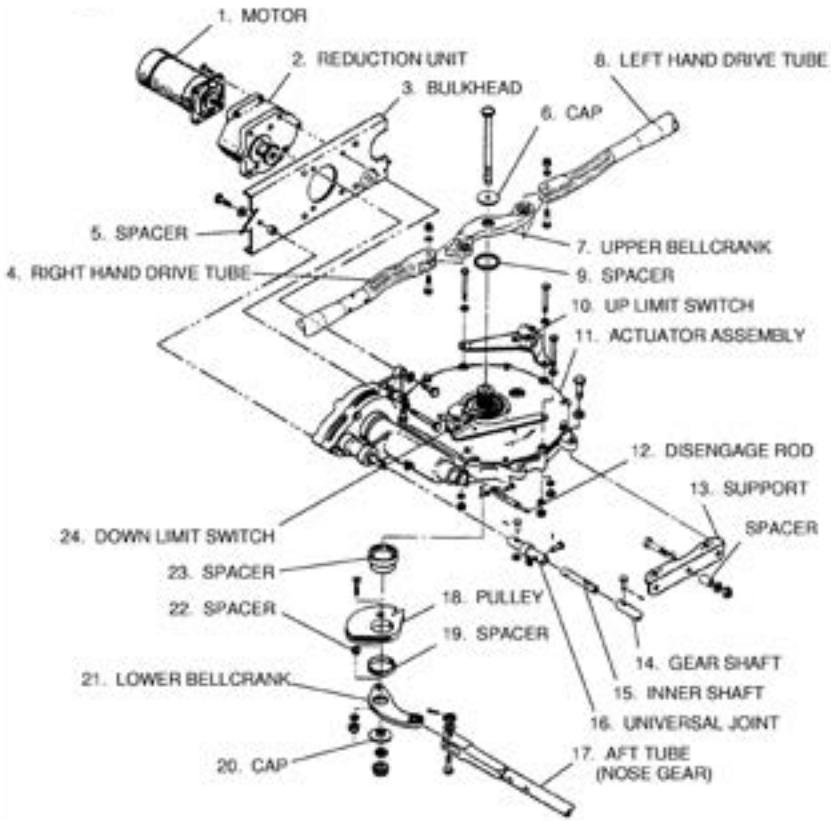


Figure 8: Landing gear actuator

1.6.4. Manual extension system

The manual extension system has a crank that is connected to the landing gear actuator with a chain and toothed wheels, bellcranks, conical gears and retraction-extension tubes.

According to the *Maintenance Manual*, the manual extension system is inspected every 200 hours or 12 months using task 32-30-00.

The following image shows the components that make up the manual landing gear extension system.

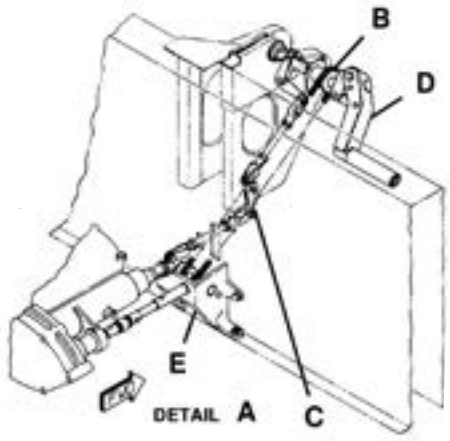


Figure 9: Manual extension system

1.6.5. Solving problems with the landing gear

The manufacturer's Maintenance Manual states that if one of the landing gear legs does not fully retract or extend, the cause could be that:

- The components in the nose gear extension and retraction system are out of service, or
- the components in the nose gear extension and retraction system are misaligned.

1.7. Meteorological information

The METAR for the Madrid-Cuatro Vientos Airport at around the time of the accident is as follows:

METAR LEVS 301630Z 29005KT 250V320 9999 FEW045 10/02 Q1022=

The wind was at 5 knots from 290º, variable between 250º and 320º. Visibility was 10 km. There were few clouds at 4500 feet. The temperature was 10º C and the dewpoint was 2º C. QNH was 1022 Hpa.

The TAF forecast was:

TAF LEVS 301400Z 3015/3024 VRB03KT 9999 FEW035 PROB30 TEMPO 3015/3017 34008KT=

The TAF forecast was valid from 15:00 UTC until 24:00 UTC:

- Variable wind at 3 knots.
- Visibility 10 km or more.
- Few clouds at 3500 feet.
- Moderate probability (30%) from 15:00 to 17:00 UTC, with wind from 340º at 8 knots.

In light of the above and of the weather data and remote images, it can be concluded that no meteorological phenomenon could have contributed to the accident.

1.8. Aids to navigation

No navaids were used.

1.9. Communications

The communications between the crew and the air traffic controllers in the control tower at the Madrid-Cuatro Vientos Airport were focused on making a safe landing, given the inability to lock the nose landing gear leg.

1.10. Aerodrome information

The aircraft had taken off from the Madrid-Cuatro Vientos Airport (ICAO: LECU) to go on a local flight.

The Madrid-Cuatro Vientos Airport is 8.5 km southwest of the city of Madrid, at an elevation of 892 meters. It has one asphalt runway, 09/27, that is 1,500 m long and 30 m wide. There is another, natural soil runway parallel to the first that is closed to civil traffic and is 1,127 m long and 45 m wide.

Ground-air communications are on the tower frequency of 118.50 MHz. A ground frequency of 121.80 MHz is also used.

1.11. Flight recorders

The aircraft did not have a flight recorder as it was not required for this type of aircraft.

1.12. Wreckage and impact information

The propellers and underside of the fuselage were damaged during the landing run due to the failure of the front landing gear leg to lock.

The photograph below shows the final position of the aircraft after coming to a stop.

Figure 10: Final position of the aircraft after stopping

1.13. Medical and pathological information

There were no signs that the pilot was incapacitated or that his actions were affected by any physiological factors.

1.14. Fire

There was no fire in the aircraft or in the surroundings.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

1.16.1. Pilot's statement

He was on a training flight that included landings and take offs in order to familiarize another pilot on the handling of that aircraft.

They had been flying for about 35 minutes when they did the first touch and go. At an altitude of 700 feet, they attempted to raise the landing gear. They heard a loud mechanical sound and smelled something burning. About 25 seconds elapsed between

commanding the gear up until he heard the sound, which is longer than it takes to retract the landing gear. He thought that something must have blocked the motion of the gear, preventing it from retracting correctly, eventually breaking one of the tubes on the front gear leg.

The aircraft has a mirror that they used to see that the wheel on the front landing gear leg was not locked. The landing gear did not move.

The proceeded to point W to perform the emergency gear extension procedure. They could not lower it manually. They considered the possibility of landing on the grass runway at the Cuatro Vientos Airport, but ruled it out because it had rained recently. They also considered landing at the aerodrome of Casarrubios so as not to affect traffic at Cuatro Vientos, but they thought it was safer to land at the asphalt runway in Cuatro Vientos.

They communicated with the control tower at the Cuatro Vientos Airport and requested to land last in the sequence, since they had enough fuel to wait for all the other traffic to land.

Although he adhered to the emergency procedure at all times, he admits that the landing maneuver was not entirely perfect.

He added that he does not usually verify that the emergency landing gear extension method works correctly, and thought it would be a good practice to verify its proper operation.

1.16.2. Inspection of the front landing gear leg

After the accident, the front landing gear leg was disassembled. This revealed that one of the tubes that moves to actuate the front leg was broken. The red arrow in the image below indicates the tube that was found broken when the front landing gear leg was disassembled.

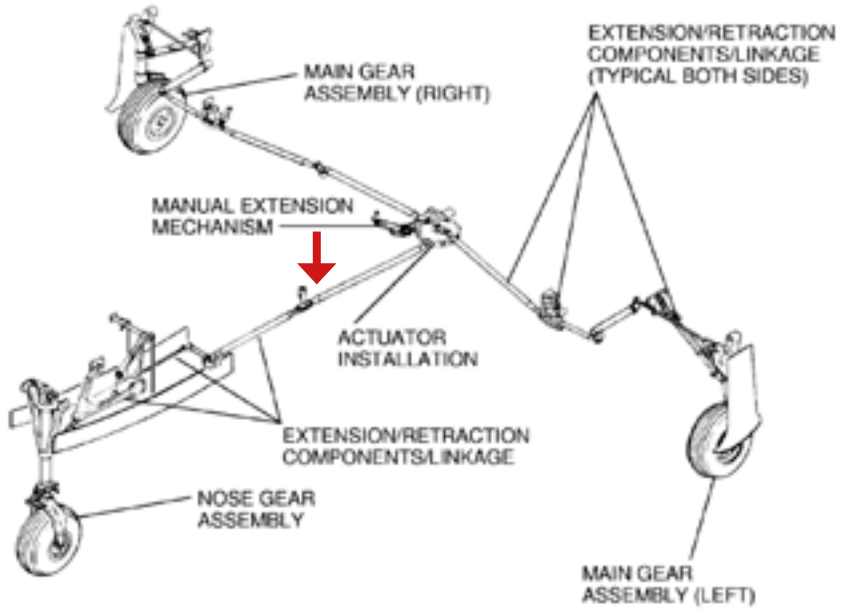
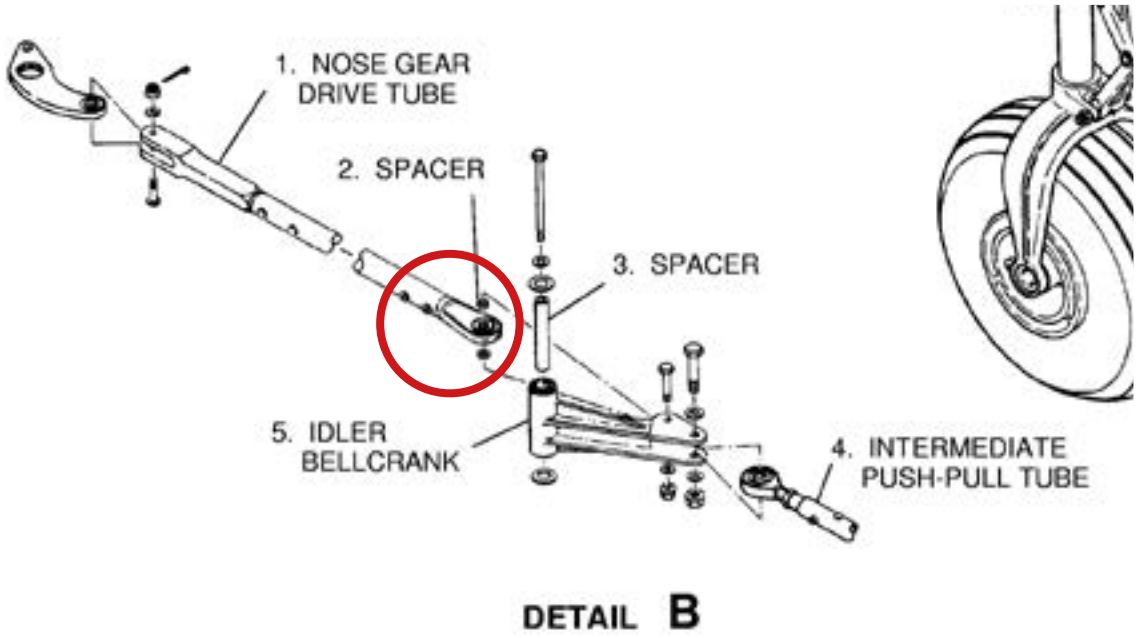


Figure 11: Identification of the broken tube

Detail of the tube that was found broken.



And the photographs below show a close-up of the fracture found on the tube.

Figure 12: Close-up of the fracture on the drive tube in the front landing gear leg

During this inspection, the up and down limit switches that restrict the motion of the electric landing gear motor were verified to be working correctly.

However, the electric motor that extends and retracts the landing gear did not rotate in the up direction. It did work in the down direction.

The photographs below show the electric motor installed on the accident aircraft. It was manufactured by Electro:Mech in 1973, with P/N 9910002-3 and S/N 1917. It is a 28-volt, 22-amp, DC motor that turns at 6500 RPMs to provide 0.31 HP. Its duty cycle is 20 seconds on followed by 10 minutes off.

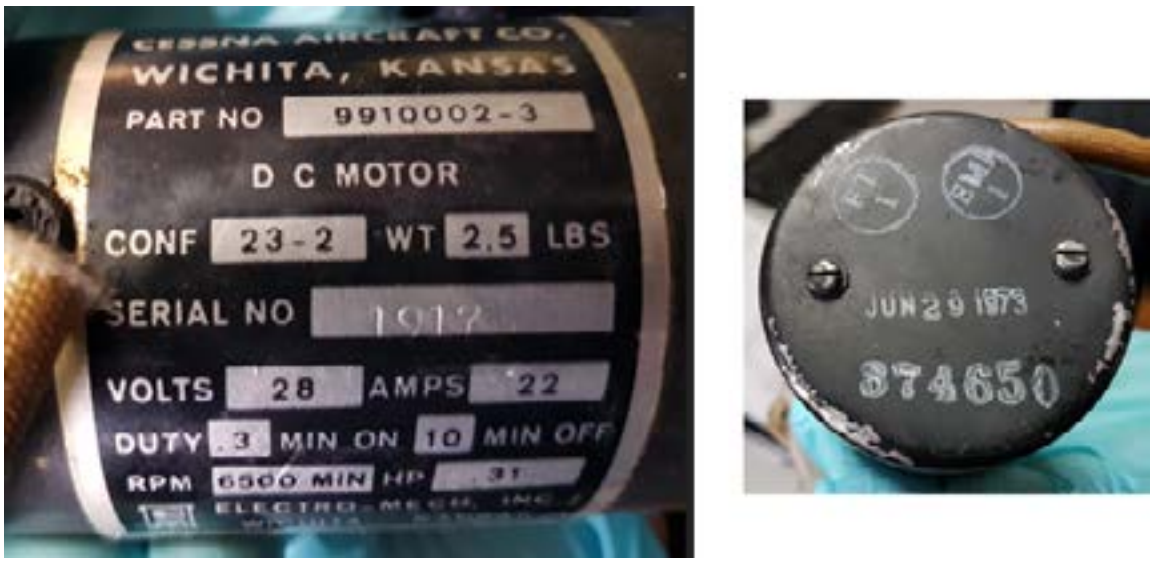


Figure 13: Views of the electric landing gear motor on the accident aircraft

1.16.3. Analysis of the fracture in the drive tube of the front landing gear leg

The fracture of the drive tube in the extension and retraction system for the front landing gear leg was analyzed in the Materials Testing Laboratory at the Universidad Politécnica de Madrid's (UPM) Advanced School of Aeronautical and Space Engineering (ETSIAE).

This laboratory concluded that the tube exhibited a complete fracture of a lug located at one of its ends. The visual inspection conducted revealed that the inner diameter of the lug had very noticeably deformed and elongated during the failure process. It also showed that the parts of the lug close to the fracture had undergone significant thinning due to plastic deformation.

An analysis of the two fractures in the lug conducted using a scanning electron microscope showed that the entire fracture surface exhibited the same microfractographic dome-shaped features, in various sizes and stages of growth, generally transcrystalline, but located on grain faces in some areas.

All the findings point to an in-service fracture process of the lug that was instantaneous and caused by a ductile overload.

There were no indications of fatigue or corrosion that could have weakened this part.

1.16.4. Analysis of the electric landing gear motor

The electric landing gear motor was removed and tested on a test bench. It was verified to rotate correctly in the down direction, but not in the up direction.

1.16.5. Consultation with the aircraft manufacturer, Textron Aviation, involving the in-service failures of the electric motor and tube

The aircraft manufacturer was asked if it had any statistics on the in-service failures of the tubes that link the aircraft's landing gear or of the electric motor.

The manufacturer replied that it did not record either the hours of operation or replacements of components and their causes in legacy piston aircraft for the purpose of calculating in-service failure rates. However, using reports from customers and records from the sale of spare parts as an alternative, it did state that:

- There were no Field Condition Reports in its service database on these components (or P/N) that included events involving similar or related failures.
- As for the 9910002-3RX electric motor (inspected spare motors), it sells between 6 to 8 every year. Some of these motors may also be repaired or checked by repair shops, for which they have no data. In any case, it is not aware of any systematic problems with the motors beyond the normal wear and tear that is to be expected of an electric motor.

1.16.6. Maintenance of the front landing gear leg

The aircraft manufacturer specifies the following tasks and intervals in its Maintenance Manual for the front landing gear leg extension and retraction system. The right column in the table below also indicates the date on which said task was last performed on the accident aircraft:

Task	Interval	Date
Nose and Main Landing Gear Extension and Retraction System Check - Inspect condition, operation and specification compliance.	Every 200 h or 12 months	03/08/2018
Nose and Main Landing Gear Extension and Retraction Linkage - Check condition of linkage.	Every 200 h or 12 months	03/08/2018
Main/Nose Gear Retraction System Teardown Check. Purpose: check cracks for fatigue, excessive wear in the mechanisms, hubs, bearings, structural attachment points and clamping accessories that could hamper the proper movement and cause failures in the gear position or structural failures.	After 10,000 landings or 20 years, repeat every 5,000 landings or 10 years.	27/05/2016
Nose Gear Retraction System. Make sure you examine these areas: mechanisms, bushings, bearings, structural attachments. NOTE: Corrosion Prevention and Control Program Inspection item.	Every 36 months	06/06/2017

With regard to the electric motor in the landing gear, the aircraft manufacturer does not specify any maintenance tasks. The year 1973 was stamped on the electric motor. The motor was supposedly installed on the aircraft when it was manufactured in 1979. It is not known how the motor was used between 1973 and 1979.

1.17. Organizational and management information

The aircraft operator, Servicios Politécnicos Aéreos S.A., engages in aerial photography and reconnaissance flights, including aerial cartography and pollution monitoring operations. The aircraft was based at the Cuatro Vientos Airport.

These activities are considered specialized operations[4], the performance of which requires a statement of responsibility.

According to the records of the National Aviation Safety Agency, the operator had filed such a statement, pursuant to the stipulations of ORO.DEC.100 of Annex III of Regulation (EU) 965/2012 of the Commission.

[4] European regulation defines a specialized operation as any operation other than commercial air transport in where the aircraft is used for specialized activities such as: agriculture, construction, photography, surveying, observation and patrol, aerial advertising, etc.

1.18. Additional information

There are several accidents and incidents in the CIAIAC database involving fractures of components in the main landing gear extension-retraction system of Cessna aircraft that have the same landing gear design as EC-EQK. None of them exhibited problems with the materials in extension-retraction mechanism. The cause of the accidents/incidents was identified as a misalignment of the landing gear extension-retraction mechanism:

A-071/2002 – Cessna 402-B, 25 September 2002. The incident was caused by an improperly adjusted extension-retraction and locking mechanism for the right main gear leg.

IN-017/2006 – Cessna 421-B, 12 June 2008. The incident was caused when the left landing gear leg folded due to a break in its locking mechanism. The fractures in the mechanism were caused when the affected components were overloaded. The overload of the mechanism resulted from shifting stresses during landing, probably due to changes in the clearances that are amplified by the geometry of the locking mechanism itself, and that make the geometric configuration of the gear assembly differ from its design.

On 12 June 2008, safety recommendation REC 11/08 was issued to CESSNA to have it improve the description for adjusting the retraction-extension system for the main landing gear, and to inform the operators and maintenance centers of this type of Cessna aircraft so they could implement it. On 10 September 2015, in light of Cessna's failure to respond to this recommendation, it was classified as "open, action not acceptable". A copy of this decision was sent to the NTSB. Subsequently, on 16 April 2018, the recommendation was classified as "closed, action not acceptable", since there was still no response from Cessna. This decision was reported to Cessna and the NTSB. There is no indication that the description for adjusting the retraction-extension system for the main landing gear has been improved.

IN-036/2006 – Cessna 402-B, 3 July 2006. The incident was caused by shifting loads during landing, probably due to an incorrect assembly or to a change in the assembly adjustments of the extension-retraction and locking mechanism for the right leg caused by clearances that are amplified by the geometry of the locking mechanism itself.

1.19. Useful or effective investigation techniques

No special investigation techniques were used.

2. ANALYSIS

On Friday, 30 November 2018, the aircraft took off from the Cuatro Vientos Airport on a local training flight that included takeoffs and landings in order to familiarize one of the pilots of the aircraft's operator, Servicios Politécnicos Aéreos, on the handling of the aircraft.

While doing a touch and go, the pilot attempted to electrically retract the landing gear. The landing gear actuator activated the drive tubes on the nose gear to retract it; however, the landing gear was mechanically blocked and could not function correctly, meaning the nose gear drive tubes were unable to move it.

The investigators resorted to the manufacturer's Maintenance Manual to determine what caused the nose gear to malfunction. Two causes can explain what happened in this accident, in which one of the landing gear legs did not fully retract or extend:

- The components in the nose leg extension and retraction system were out of service, or,
- the components in the nose leg extension and retraction system were misaligned.

The possibility that the components in the nose leg extension and retraction system were out of service can be ruled out since the analysis of the drive tube fracture in the nose leg extension and retraction system revealed that it had been caused by an instantaneous overload, there being no signs of existing corrosion or fatigue.

The most likely cause is that a slight misalignment in the tubes of the extension and retraction system mechanically obstructed the retraction of the landing gear. The attempt to retract a slightly misaligned landing gear could have created overloads that ended up breaking said tube. Once this happened, the nose leg could not be moved either electrically or mechanically.

The electric landing gear motor had been working correctly until that point, but its operating time was exceeded during this accident. As noted above, the landing gear actuator was mechanically obstructed, which prevented its proper operation, and the up-limit switch that signals that the gear is up never activated, and thus the electric motor was not deenergized. The duty cycle of the motor is 20 seconds on followed by 10 minutes off, even though, according to the manufacturer's Maintenance Manual, only 10 to 14 seconds is needed to raise the gear. According to the pilot's statement, he heard a loud mechanical noise some 25 seconds after commanding the gear up. This means that the motor must have been damaged after it exceeded its duty time, at which point it stopped turning in the up direction. The burning odor smelled by the pilot undoubtedly originated in the electric motor.

It is not known what caused the tubes in the nose gear extension and retraction system to become misaligned.

In any case, if the wheel on the nose leg is misaligned, then it cannot retract into its housing, which results in excessive stresses in the extension and retraction system.

In light of this situation, the pilot had no other option than to declare an emergency and landing using only the main gear.

3. CONCLUSIONS

3.1. Findings

- The pilot had a valid license and medical certificate.
- The aircraft's documentation was valid and the aircraft was airworthy.
- Weather conditions were not limiting for the type of flight.
- The drive tube on the system for lowering and raising the front landing gear leg broke due to an instantaneous overload.
- The electric motor for the landing gear did not turn in the up direction, but it did turn in the direction to lower the landing gear.

3.2. Causes/Contributing factors

The investigation has determined that this accident was caused by a broken component in the mechanism that lowers the landing gear, which prevented the gear from being fully extended.

The component, a tube, broke due to an instantaneous overload along its longitudinal axis, likely caused by a misalignment of the tubes in the extension and retraction system upon attempting to retract the landing gear.

This supposed misalignment of the tubes in the extension and retraction system would also explain the failure of the electric landing gear motor during the retraction process, as it exceeded its operating time.

4. SAFETY RECOMMENDATIONS

No safety recommendations are issued because the slight misalignment of the nose gear extension and retraction system could have resulted from the improper operation of the aircraft. We note, however, that the adjustment of the landing gear extension and retraction system on these aircraft is quite delicate, something that should be taken into consideration during operation and maintenance.