CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report A-044/2007

Accident involving a Britten-Norman Islander BN2A-21 aircraft, registration G-CHES, in Guadalcanal (Seville), on 17 October 2007

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MINISTERIO DE FOMENTO

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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) n° 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.

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Abbreviations

00°	Sexagesimal degrees
00 °C	Degrees centigrade
AESA	Agencia Estatal de Seguridad Aérea (Spanish Aviation Safety Agency)
CAVOK	Clear skies and horizontal visibility in excess of 10,000 m
DGAC	Dirección General de Aviación Civil (Spanish Civil Aviation General Directorate)
ELT	Emergency Locator Transmitter
ft	Feet
h	Hours
hh:mm	Time expressed in hours and minutes
Hg	Mercury
kt	Knot(s) – Nautical miles per hour
kg	Kilogram(s)
km	Kilometer(s)
lb	Pound(s)
LH	Left-Hand
LT	Local Time
m	Meter(s)
mb	Millibar(s)
ME	Multi-Engine rating
MTOW	Maximum TakeOff Weight
NW	Northwest
P/N	Part Number
psi	Pounds per square inch
RH	Right-Hand
rpm	Revolutions Per Minute
S/N	Serial Number
SE	Single-Engine rating
SW	Southwest
UTC	Universal Time Coordinated

Synopsis

Owner:	Private
Operator:	Private
Aircraft:	Britten-Norman BN2A-21 "Islander"
Date and time of accident:	17 October 2007; at 19:30 (LT)
Accident site:	Los Tomillares Ranch, Guadalcanal (Seville)
Persons onboard and injuries:	2 pilots, one deceased and the other seriously injured
Type of flight:	General aviation – Ferry flight
Date of approval:	23 March 2011

Summary of accident

The aircraft, with two pilots onboard, was going to make a short positioning flight from a temporary private strip on which it had landed by mistake, to another public runway in the same town of Guadalcanal.

The aircraft had been prepared for the flight by filling the main fuel tanks with 250 liters of fuel. Prior to takeoff, both pilots walked the length of the strip to check its condition and, by counting steps, to ensure that it was long enough to accommodate the takeoff. The flight started half an hour before sunset.

The aircraft accelerated normally during the takeoff run and became airborne before the end of the runway, achieving a positive rate of climb. After clearing the end of the runway, there was a partial failure of the right engine that resulted in a temporary drop in power. Full engine power was recovered shortly thereafter, but over the seconds that the fault lasted, the aircraft lost its ability to climb. It started descending gradually, experiencing lateral control problems caused by the changing asymmetric thrust. The aircraft eventually impacted the ground, first with the left wing, followed by the fuselage.

The investigation concluded that the aircraft's impact against the ground resulted from a loss of lateral control at low altitude after a partial and transitory loss of power during takeoff, possibly as a consequence of water contamination in the fuel.

1. FACTUAL INFORMATION

1.1. History of the flight

The Britten Norman "Islander" aircraft, registration G-CHES, had flown on the morning of 17 October 2007 over various points of the Sierra Morena and the north part of the province of Seville. Its mission had been to scout the various flight fields which would be available to the aircraft in future operations. The purpose of that day's flight was to land at a temporary runway in the town of Guadalcanal, in the province of Seville on the border with the province of Badajoz. This runway, used by airplanes on agricultural flights, is some five kilometers SW of the town. The pilot, however, mistakenly landed at another temporary field, with the same bearing and approximately halfway between the town and the other runway on Guadalcanal. The runway on which it landed, called Los Tomillares (after the name of the ranch on which it is located), is considerably shorter. The distance available was sufficient for the airplane's sole pilot to land normally.

In order to be able to depart from that strip, which measured only 400 m in length, the pilot telephoned for help and guidance in order to make the short four-kilometer flight from that strip to the runway in Guadalcanal, his original destination.

In response to his call for help, a pilot with experience on that type of airplane reported to the strip early in the afternoon and joined the pilot as a crew advisor on the aircraft in order to aid the pilot in command. Two other persons on the ground provided assistance loading fuel in the main tanks. The gasoline was taken to the aerodrome in 50-liter plastic drums, which were placed inside the aircraft once emptied, since they were operating between runways in which there was no refueling service. A total of 250 liters of AV100LL fuel was deposited in the main tanks.

Both pilots walked the length of the field at Los Tomillares to check its condition and dimensions. They determined its length by counting their steps. They also determined its gradient. Although the surface was made of uncompacted dirt, they calculated that it was sufficient for takeoff, which they decided to do toward the southeast to take advantage of the favorable negative slope. Specifically, they planned to depart on a SE heading, turn 90° right, and continue flying south until they were lined up with the Guadalcanal runway. They planned to land on a NW course. They postponed the operation until late in the afternoon, before sunset, so as to avoid glare from the setting sun while landing at Guadalcanal.

According to eyewitness accounts, the pilot in command did the pre-flight check and dismissed the ground assistants, who left before the airplane took off.

A few minutes later, at 19:30[1], half an hour prior to sunset, the aircraft headed for the runway threshold. Shortly thereafter it started its takeoff, gaining speed and

[1] All times in this report are in local time (LT), which at this time of year corresponded to UTC+2 hours.

becoming airborne prior to reaching the opposite threshold. The right engine then started to fail partially, causing the airplane to yaw hard to the right. The pilot in command, seated to the left, was flying the airplane. According to the statement of the accompanying pilot, who was seated in the RH seat, when the engine failed, the pilot asked him to take the flight controls while he attempted to restore power to the right engine.

After lowering the nose, they started to descend slightly, managing to correct the right yaw by applying left rudder. They had practically managed to regain directional control of the aircraft when the right engine started to run at full power once more, propelling the aircraft, which caused it to veer left, toward higher ground. They were unable to avoid the impact.

The aircraft's left wingtip impacted first, hitting some bushes on the hillside. A few meters later the left gear wheel made contact. After crossing a small river bed, the aircraft's left wing and forward fuselage impacted, with the airplane coming to a stop after traveling along the ground for a few meters.

The impact site was on the runway centerline extension and some 400 m from the southeast threshold, which they had overflown a few seconds earlier when taking off.

The aircraft was seriously damaged and was essentially destroyed. There was no fire after the impact.

Figure 1. Aircraft wreckage

The pilot in command suffered severe injuries that resulted in his death approximately 30 minutes after the impact.

Although the second pilot also suffered serious injuries, which initially caused him to lose consciousness, he regained consciousness shortly after the accident and was able to report the accident and call for help using his cellular phone. He was rescued and taken to a hospital in Seville.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	1		1	
Serious	1		1	
Minor				Not applicable
None				Not applicable
TOTAL	2		2	

1.3. Damage to aircraft

The aircraft was destroyed.

1.4. Other damage

There was no additional damage, with the exception of a few bushes that were run over by the aircraft during the impact trajectory.

1.5. Personnel information

1.5.1. *Pilot in command*

Age: 28

Nationality: Spanish

License: Commercial Pilot License (A)

Ratings in effect:
- Initial issue date: 02-02-2007
- Expiration date: 02-02-2012
- Radiotelephony in English

	• SE piston since 07-11-2005 • ME piston and IR (A) since 02-02-2007
Flight hours:	No reliable data was available regarding his flying experience
Rest prior to flight:	More than 8 h

1.5.2. *Accompanying pilot*

Age:	34
Nationality:	Spanish
License:	Airline Transport Pilot License • Initial issue date: 21-03-2002 • Expiration date: 19-06-2008
Ratings in effect:	• Radiotelephony in English • SE piston since 18-06-2005 • Agricultural since 18-11-2005 • ME piston and IR (A) since 31-01-2007
Flight hours:	2,400 h
Rest prior to flight:	More than 12 h

At the time of the accident, the medical certificate of the accompanying pilot had expired and he had no intention to renew it, since he was now involved in other activities.

Previously, that pilot had been the operations advisor and a pilot at the company that owned the aircraft. He had taken a course specific to that aircraft type and had acted on the company's behalf to purchase the accident airplane, prepare it for flight and move it.

On this flight his mission was to accompany and advise the pilot in command.

1.6. Aircraft information

The airplane, a Britten-Norman BN2A-21 "Islander", is a twin-engine plane with a capacity for up to nine passengers and certified for one- or two-pilot operations. It has reciprocating engines and a conventional landing gear with two wheels on each main leg.

The accident aircraft had been recently purchased by the company and was still registered in the United Kingdom, where it had been purchased, while arrangements were made to transfer the registration to Spain, according to information gathered from the owner.

The last maintenance checks of the structure, engines and radio equipment had been made at an authorized workshop in the United Kingdom following the purchase of the aircraft by the new owner. There were no entries in the hold item list.

1.6.1. *Airframe*

Manufacturer:	Fairey Britten-Norman LTD
Model:	BN2A-21 Islander
Production number:	2011
Registration:	G-CHES
MTOW:	2,980 kg (6,600 lb)
Owner:	AUXILIAR DE ACTIVIDADES AEREAS, S.L.
Operator:	Private
Estimated takeoff weight:	Below 2,800 kg (6,170 lb)[2]

1.6.2. *Airworthiness certificate*

Number:	United Kingdom 007268/009
Class:	Normal category airplane
Issue date:	30 July 2007
Expiration date:	29 July 2008

1.6.3. *Maintenance record*

Total flight hours:	8,500 h
Total cycles:	8,900

[2] The takeoff weight was estimated taking the empty weight (Sec. 1.6.3), the weight of the occupants with little baggage and full main gas tanks (255 liters per tank) and wingtip tanks (160 liters per tank), assuming a density for 100LL fuel of 0.715 kg/l.

Last annual/150-h inspection:	29-07-2007
Hours on last annual inspection:	8,489:45 h / 8,855 cycles
Last weighing – Empty weight:	2,022 kg (4,458 lb)

1.6.4. *Engines and propellers*

Manufacturer:	Lycoming
Model:	IO-540-K1B5
Power:	300 HP
Serial numbers:	L-13851-48A / RL-21728-48A
Last inspection:	29-07-2007
Propellers:	Hartzell HC-C2YK-2CUF
Serial numbers:	AV 1197B / AU 1196B

The aircraft was not equipped with an emergency locator transmitter, ELT, nor was it required to by law except for flights over desert areas or over sea far from the coast.

1.6.5. *Fuel tanks*

The list of items to check on the wings during the pre-flight inspection includes:

- Ensure that the ventilation intakes on the underside of the wing are clear.
- Check the wing tanks for fuel losses, ensure the ventilation intakes are clear and secure the closing plugs.
- Check the wingtip tanks (if installed).

The following items are included on a type-A (50-hour) inspection:

- Engine items – drain any water present in the mesh filter (gascolator).
- Wing items – drain the wing tank sumps (including the wingtip tanks if installed) to extract any water present. Check the ventilation of these tanks.

No records were found indicating that either the pre-flight or type-A inspection tasks were made, though this is normal; these items, when done, are carried out by following a quick checklist on which no entries are made.

1.7. Meteorological information

The information obtained from eyewitnesses and the surviving pilot indicates that the weather conditions were CAVOK with a slight breeze from the northwest. The air temperature was around 20 °C.

There were no wind meters or indicators either at the private strip where the flight originated or at the destination aerodrome.

On 17 October 2007, the sun set over the town of Guadalcanal at 19:42 local time with an azimut 261°. The official time for twilight (elevation of sun 5° below the horizon) was approximately 20:05 local time.

The moon was in the first quarter and would set shortly after 23:00.

1.8. Aids to navigation

Not applicable.

1.9. Communications

The aircraft's crew did not make any radio communications with any control station or with other aircraft on aviation frequencies.

1.10. Aerodrome information

The temporary runway used by the aircraft is in the Los Tomillares Ranch, which is within the municipality of Guadalcanal in the province of Seville. It had been built less than a year earlier on an elongated hill running from northwest to southeast. The runway surface is made of uncompacted dirt and measures 15 × 400 m. Its elevation is approximately 610 m and it has a convex longitudinal profile with a notable gradient, rising in one half and falling in the other. The runway is some 2 km SW of the town. The area around the runway features low-lying hills, with peaks to the north rising to an elevation of up to 800 m, and river beds to the south that fall some 150 m in elevation to the level of the other aerodrome. The terrain along the extension of the SE runway is at an elevation of 610 m, with only slight variations of ± 15 m.

The temporary runway that was the intended destination is also within the municipality of Guadalcanal, southwest of the first at a straight-line distance of 2,600 m. It is some 4.6 km away from the town. This runway is located atop an old cattle track. The terrain in this area is at an elevation of 465 m. The runway has a compacted dirt surface

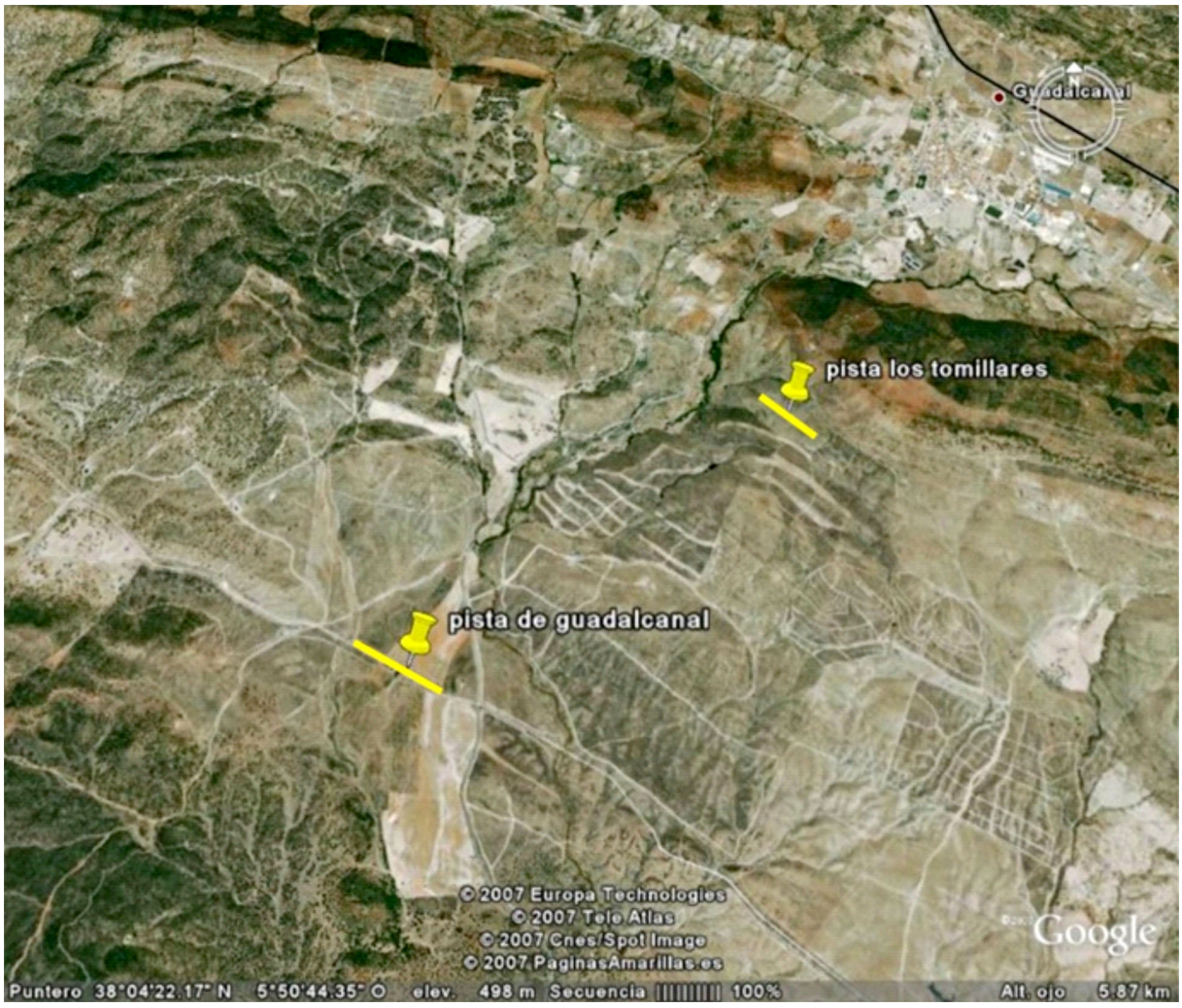

Figure 2. Location of town and of runways of Guadalcanal and Los Tomillares

measuring 20 × 560 m and a very slight longitudinal gradient. The runway is oriented on a true bearing of approximately 300°-120°.

1.11. Flight recorders

The aircraft was not equipped with flight recorders. Such equipment was not required on this aircraft type.

1.12. Wreckage and impact information

1.12.1. *Marks on the ground*

The aircraft left marks on its path prior to impact, along the extension of the runway, starting fewer than 400 m from the end of the runway. The first signs of its low-level

flight were sheared bush branches that had been cut by the left wing and propeller. Contact marks were then found on the ground along the runway extension, made by the left leg. These were at an elevation slightly below that of the runway at its SE end. The ground slopes down to the right in that location in relation to the aircraft's flight path and it slopes up to the left.

The first impact point, made by the left main gear wheels, was found 20 m away from the first marks. The aircraft then crossed a small stream, after which its left side impacted an upsloping hillside that was at a 30° angle to its flight path. The aircraft then moved a further 10 m up the hill. There were deep impact marks on the ground made by the left wingtip, left engine and the front part of the fuselage.

1.12.2. *Condition of the aircraft wreckage*

The wreckage was resting on its right side at a left 60° angle in relation to its impact trajectory. There was considerable damage to the lower front part, particularly on the left side, where the holes in the fuselage penetrated to the cockpit.

The entire wing detached from its root in the upper part of the fuselage. The middle part of the wing, where the engines and main landing gear legs are attached, had its

Figure 3. Left propeller

Figure 4. Right propeller and engine

lower side facing up and the trailing edge facing forward. The left wing had suffered strong distorsion and its elevator was detached. The end of the right wing had detached, along with the auxiliary wingtip fuel tank.

The blades on both propellers, especially those on the left engine, were twisted and bent by the impact against the ground. The engines partially detached from their mounts and exhibited general damage as a result of the impact.

The left main landing gear leg detached following the initial impact. The nose gear wheel was bent backwards. The right main landing gear leg, however, was intact.

1.12.3. *Position of levers and controls in the cockpit*

Below is a summary of the positions of the cockpit throttles, controls and instruments deemed most significant to ascertain the status of the flight and the operation of the engines in the moments prior to impact:

- Altimeter 1,920 ft (585 m), set to 30.18 inches of Hg (1,020 mb).
- The flaps indicator read zero, though the flaps themselves were lowered to 25°, corresponding to an intermediate takeoff position. (Since the flaps indicator is electrically powered, its indication reverts to zero when it is deenergized, regardless of the actual position of the flaps.)
- Engine throttles at their forward stop, propeller pitch and fuel mix at the half point.
- Engine intake pressure: 30 inches of mercury in the left (No. 1) and 25 inches in the right (No. 2).
- Fuel indicator switches selected to the same side main tank.
- Left engine fuel selector valve set to the left tank, right engine fuel selector valve set to an intermediate position between the left and right tanks.
- Fuel pumps ON.
- Magnetos and alternators energized.

1.13. Medical and pathological information

There is no reason to believe that either crewmember's performance was affected by an illness or was hampered by any medications or physiological condition or disability.

No information was available from the autopsy performed on the dead pilot or from any toxicological screens that may have been performed.

1.14. Fire

There was no fire.

1.15. Survival aspects

There were no eyewitnesses of the takeoff of the accident aircraft or of its impact against the ground. The ground personnel at the departure airport had left minutes before takeoff.

According to the surviving pilot's account, once he regained consciousness after the accident he saw that the pilot in command was still alive. Though he tried to encourage him while they waited to be rescued, he fell silent after about 10 minutes.

The surviving pilot called one of the two ground assistants to ask for help. The assistant, in turn, alerted emergency services. As he recalled, it was already dark by the time he regained consciousness and made the call.

He was unable to provide clear indications regarding his whereabouts due to being in a state of shock, but he recalled that there was a flashlight with the emergency equipment located on the seatback. He was able to use it to signal rescuers to their location.

By the time rescuers reached the wreckage site, some 40 to 60 minutes after the initial call for help, the pilot in command no longer showed any signs of life.

Both pilots were wearing their safety harnesses. The aircraft did not have an emergency locator transmitter.

1.16. Tests and research

1.16.1. *Analysis of engines and propellers*

The engines and fuel supply system were subjected to a detailed analysis.

Initial external analysis

Both engines were inspected visually and found to be in good overall condition. The engines themselves and their accessories appeared to have been well maintained and exhibited no mounting abnormalities or any outward signs of a malfunction.

The positions of the engine controls as found after the accident were as follows:

- Throttle for the fuel injector on the no. 1 engine was broken and detached. On the no. 2 engine it was at its maximum power setting.

- Mixture control also for the fuel injector on the no. 1 engine set at a rich mixture position (upper stop). On the no. 2 engine it was set to cut-off (lower stop), though the connecting rod was broken.
- Propeller pitch control for the governor in the no. 1 engine set to near maximum rpm's (forward pitch); on the no. 2 engine, set at the forward pitch stop.

No discontinuities were found in the cables from the throttle, mixture and propeller controls.

The propeller blades had been bent as a result of the impact against the ground. The blades on the left propeller turned with the hub, due to the fracture of the fixing bolts and the reduction gear for the pitch control. Both the fractures at the junction of the blades as well as the type of twisting and bending they evidenced were consistent with an impact at high rpm's. The left showed more damage, possibly because it was the first to impact the terrain.

Internal analysis of the engine and accessories

The ignition system did not exhibit any defects existing prior to the accident. The magnetos were properly synchronized with the engine, spark plugs were installed in the cylinders and energized. There were normal amounts of soot and combustion deposits at the spark plug ignition tips.

The main engine-driven fuel pumps were disassembled. No abnormalities were found in either the blades or in the pressure regulating diaphragms. They turned freely and showed no signs of fuel leaks.

The Bendix 10ED1 servo fuel injectors, P/N 2524556-9, S/N 78568 (LH) and 80281 (RH), were visually inspected. No defects were found in the regulating diaphragms. There were no signs of leaks between the air and fuel chambers or damage to the seat of the fuel control valve. The fuel filters installed in the servo-injectors were clean and had no foreign deposits. The membranes in the flow dividers were in good condition and did not exhibit any signs of friction or improper operation. The ventilation holes were clear. The supply piping from the flow divider to the injection nozzles was in good condition and its ends securely attached. The injection nozzles did not show any signs of obstruction.

Lastly, the integrity of the cylinders was checked using a differential compression method, which is valid for determining the conditions of the segments and of the intake and exhaust valves. The average reading obtained was 70 psi out of a standard value of 80. The test was performed three months after the accident, and the cylinders with the lowest readings were on the left engine.

1.16.2. *Fuel analysis*

During the on-site inspection of the aircraft wreckage, two fuel samples were taken from the tanks that had retained their integrity, the tank on the right wingtip (sample A, about 7 liters) and the left main tank (sample B, about 15 liters). The samples were placed in two of the plastic 50-liter jugs found inside the aircraft in good condition and that had been used to transport fuel.

No samples were taken from the other tanks because they were empty. The auxiliary tank on the left wingtip had drained after being punctured during the impact. The right main tank had gravity drained its fuel to the left side tank and to the outside via broken lines in the wing root area.

Only sample B taken from the main tank was analyzed after it was determined that both engines had been supplied by the main tanks only, and also because during the last refueling performed at the runway in Los Tomillares, only the main tanks were refilled to their maximum capacity of 255 liters each.

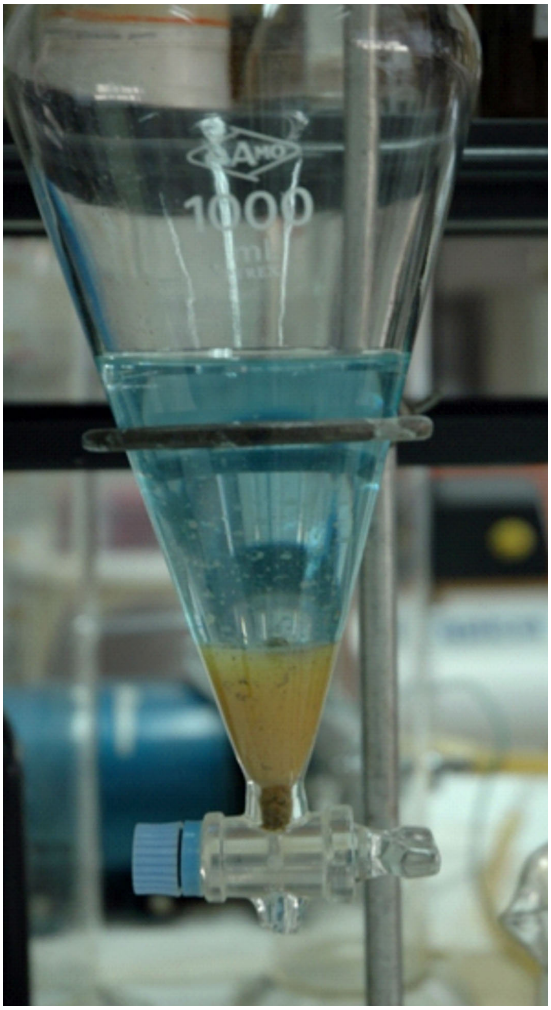

Figure 5. Fuel analysis

The analysis showed that the fuel taken from the tank complied with the ASTM D 910 specification for AVGAS 100LL aviation fuel, with some exceptions.

An examination of its appearance revealed small amounts of cloudy water (15 ml). It was dark brown and had abundant suspended solids (see Fig. 5). It is possible that this water present in the samples could have affected the performance of the engines.

Other small discrepancies in the fuel analysis versus specifications involved its volatility and lead content.

1.16.3. *Inspection of the fuel system*

The fuel supply and transfer lines between the tanks and from the tanks to the engines were inspected. The fuel tank selector and cross-feed valves were disassembled and the main fuel filters were inspected. Nothing was found in any of these components that

Figure 6. Fuel selector valve controls in their as-found positions

could have resulted in an obstruction or in an anomaly in the fuel supply to either engine.

It was noted during the on-site inspection that the selector valve for the right engine (green in color) was in an intermediate position. While testing the valve in the workshop, it was noted that in any of its intermediate positions, whether supplied from the same-side tank or in the cross-feed position (arc between the 6 o'clock position for same-side feed and 9 o'clock for cross-feed), fuel always flowed out the discharge line without any reduction to or interruption in the flow. The only variation was in the source of the fuel, the same-side or opposite tank.

1.17. Organizational and management information

The company that owned the aircraft, Auxiliar de Actividades Aéreas S.L., was not devoted to commercial air operations; they have limited their operations to aircraft renting. Initially it had smaller aircraft, a single-engine Piper PA-28 and a twin-engine Cessna 337. Three months before the accident, the size of the fleet was expanded with the acquisition of the twin-engine Britten-Norman Islander.

The pilot in command was considering leasing the aircraft, which he had borrowed for a few days to evaluate its suitability for his needs in preparation for a possible future rental agreement.

Investigators learned that the activity the pilot was planning to engage in with this aircraft was to shuttle hunters and bullfighters to and from temporary fields. The

purpose of the flights on those days was to familiarize himself with the aircraft and with possible fields from which to operate.

1.18. Additional information

1.18.1. *Information in the Flight Manual*

Safe takeoff distance and speed

With the information in the performance chapter of the Flight Manual, the distance and speed required for takeoff were calculated using the graphs for takeoff distance with the following assumptions:

- Aircraft weight: approx. 2,800 kg
- Runway elevation: 610 m
- Compensated runway gradient: zero
- Wind: none
- Temperature: 20 °C

Using these data yields a minimum takeoff distance of 487 m (1,600 ft). The distance traveled in the takeoff run until the wheels lift was calculated to be 365 m (1,200 ft).

The safe takeoff speed for the aircraft weight was found to be 54 kt.

Failure for engine failure on takeoff

The Flight Manual describes the flight procedures to be followed in the event of an engine failure on takeoff, distinguishing between two cases, depending on when the engine failure occurs:

a) *Engine failure on takeoff*, that is, before reaching the safe takeoff speed. In this case, it instructs closing the throttle levers and decelerating to a full stop.
b) *Engine failure after takeoff* is that which occurs once the safe takeoff speed is reached or while the airplane is climbing.

In this case the climb must be continued and the following procedure applied:

1. Make sure that the throttle control levers on both engines are set to full power and the mixture control levers are set to fully rich.
2. Determine which engine is operating.
3. Set the mixture control lever on the failed engine to idle cut-off.

Feather the propeller on the failed engine.

4. Make sure the generator on the operating engine is on.
5. Allow indicated airspeed to increase to 65 kts (75 mph).
6. Raise the flaps and compensate for the resulting forces on the control stick.
7. Adjust the rudder trim as required to climb.
8. Close the throttle lever on the failed engine.
9. Close the fuel valve for the affected engine.
10. Turn the magnetos off.
11. Set the corresponding auxiliary fuel pump to off.
12. Set the corresponding generator switch to off.

    A note warns that it is "essential to raise the flaps to their fully up position in order to achieve the optimal climb gradient".

As for the single-engine flight characteristics, it states that, in general, the aircraft is smooth and responsive on a single engine.

2. ANALYSIS

2.1. Airplane and flight preparations

The data gathered indicate that the accident flight involved making preparations to take off from a very short (400 m) temporary runway built over uncompacted dirt. The airplane, a Britten Norman Islander, registration G-CHES, had landed on that runway, called Los Tomillares, by mistake at the end of the previous flight made on the morning of the same day, 17 October 2007.

The plan was to take off from the runway, at an elevation of 610 m, to the SE so as to take advantage of the favorable gradient in that direction, followed by a descending flight profile to the south over negatively sloping terrain, down to the 465-m elevation of the destination airfield. The uncompacted condition of the terrain must not have concerned the crewmembers since the airplane had landed on it, which had given them an idea of the load-bearing capacity of the surface.

The crew took into account the expected position of the sun, whose glare could give them problems upon landing on the runway in Guadalcanal. As a result, they deliberately postponed the takeoff until sunset so that they could land before the official twilight but with the sun already below the horizon. The time of the operation could probably have been moved up since a comparison of the runway heading, about 300° true, with the positions of the sun that day, with a maximum azimuth of 261° at twilight, revealed that the sun would have been 40° left of the runway heading.

The main tanks were fully refueled with 250 liters for a flight expected to last 5 or 6 minutes. The weight taken on could have been limited to make the aircraft lighter. The estimated takeoff weight of 2,800 kg is not considered excessive for the prevailing conditions and the aircraft's performance. It is true that the data obtained from the aircraft's performance tables indicate a takeoff run (365 m) very close to the length of runway available (400 m), meaning that a degradation in any of the variables influencing the length of the takeoff run could have placed the crew in an extreme situation that would have required them to rotate before the aircraft had gained enough energy and speed to continue the takeoff safely to an altitude of 50 ft.

Little information is available regarding the quality of the maintenance and services performed on the aircraft. Based on the analysis of the wreckage, the aircraft had been properly maintained. It is also known that the pilot in command himself had personally conducted the pre-flight checks required by the procedures. It is not known, however, what actions the operator had put in place to ensure that the water that could foul the airplane's fuel tanks was drained, or how often they were performed. As is well known, under certain ambient humidity and changing temperature conditions, water can condense on the inside walls of the tanks and mix with the fuel. At rest, this water can be drained through the low point taps on the tanks. It is also known that humid

conditions often exist in autumn in the Iberian peninsula. This humidity can enter the tanks via air intake and ventilation points. The water vapor condenses at night when aircraft are left outdoors.

It is also not known for sure whether special measures were taken to transport the fuel in containers that were also susceptible to contamination during handling if adequate precautions were not taken.

2.2. Timeline of the flight and accident

Shortly after twilight, the aircraft proceeded to the NW threshold the runway and initiated the takeoff run. With the engines at full power, it picked up speed and upon reaching 55 kt, went airborne within the runway limits.

As it climbed, the aircraft most likely suffered a partial and transitory failure of the right engine that had a decisive effect on the controllability and performance of the airplane. The actions taken with the fuel selector valve and the mixture control corroborate the account of the surviving pilot who, as he stated, took control of the airplane at the request of the pilot in command while the latter attempted to regain takeoff power. His efforts were successful, since the engine was restored. The impact marks left on the ground confirm that both engines were turning at power.

With a partial failure, the engine, though operating, does not deliver sufficient power. The unfeathered engine can greatly increase the asymmetric drag, resulting in a loss of climb performance and accentuating the aircraft's lateral control problems.

It may be assumed that, in this case, with the failure of the right engine, the rudder was fully deflected to compensate, as stated by the surviving pilot. In the moments that followed, once power was fully restored to the right engine, the left yaw commanded by the depressed left pedal took on full effect, causing the aircraft to turn into the elevated terrain to the left before the pilots could correct the flight path.

The pilot in command apparently sensed that they were having a problem with the fuel, which is why he was manipulating the system's valves. In the meantime, the pilot flying attempted to stabilize the flight. In a way, the degree of coordination between the two pilots may have had a decisive effect on the accident. The valve manipulations caused sudden increases in thrust that, coupled with the commands being given to the rudder, served to destabilize the airplane once and for all. The pilot flying was unable to anticipate the sudden increase in power.

Having lost lateral control, the aircraft approached the hill that rose gradually to their left without being able to avoid colliding into it. The altimeter needle was locked at a reading of 1920 ft, or 585 m, representing the elevation of the terrain, assuming the

instrument sub-scale setting of 30.18 inches of Hg (1020 mb) shown on the window was correct.

The event took place very quickly. At the takeoff speed of 55 kt (27 m/s), it is estimated that they traveled the 400 m from the end of the runway to the impact site in some 15 seconds. The impacts with the wingtip, the left landing gear wheels and the nosewheel suggest that the airplane was fairly level and was maintaining course and speed. It seems unlikely, then, that it stalled.

Since the flight was fairly level, there was a series of impacts and contact with the ground over some 20 to 30 m that dissipated the airplane's kinetic energy, allowing for a less violent final impact and aiding in one occupant's survival. The more severe extent of the damage to the left side, however, proved fatal to that side's occupant.

The conditions and positions of the controls, levers and control surfaces, even that of the flaps in takeoff condition, indicate that at no time did the crew consider the need to stop the engine and feather the right propeller.

In the event of a total engine failure, the after-takeoff single engine failure procedure (see 1.17.1.2) states to feather the propeller. The airplane's certification guarantees that with the propeller on the failed engine feathered, the airplane is able to climb and be laterally controlled. On this flight, it was not even necessary that the airplane climb. It would have sufficed to have maintained separation with the downsloping terrain. Under these conditions, the airplane could probably have reached the destination runway, which was at a lower elevation.

In the accident at hand, immediately stopping the engine that was behaving erratically would probably have facilitated the control of the aircraft until the completion of the flight. Any discussion, however, regarding the general or specific operating rules to follow involving the feathering of an engine at the slightest hint of a problem in the corresponding engine is problematic.

2.3. Inquiry into a possible material failure causing the transitory fault of the right engine

As noted earlier, the visual inspection of the aircraft wreckage revealed the airplane to be in satisfactory cleanliness and maintenance conditions. This observation was confirmed during the detailed analysis of the engines and fuel supply system. There were no indications of improper maintenance or operating practices involving those systems or any of their associated components. The investigation confirmed the absence of any mechanical abnormalities or faults in said components, or of any electrical faults, that could have upset the normal operation of either engine.

The analysis of the fuel selector valves (green and red in Figure 6) and the presence of large amounts of fuel in both main wing tanks imply that the right engine was not starved of fuel. Any possible explanation regarding the origin of the fault, then, is reduced to the presence of water or other contaminants in the fuel, or to an inadvertent manipulation of an engine control lever.

Despite the ample evidence pointing to a transitory failure of the right engine, there is no clear cause to explain it.

No material defects were found, nor any anomalies in the operation of either engine or their accessories, that could explain a drop from takeoff power. Everything indicates that the airplane was properly maintained. It may be stated, then, that the loss of power was not the result of a hypothetical mechanical failure of the aircraft, including its systems and engines.

The ignition system, including the magnetos and spark plugs, was verified to be functioning properly, creating a good spark. The soot indicated that the combustion had been normal in the final hours of operation. The fuel system was supplying the engines correctly in the as-found condition —intermediate position of the fuel selector valves— as well as in any of the other possible intermediate positions, as detailed in 1.16.3.

2.4. Analysis of the fuel as the probable cause of the failure

The only anomaly found that could have caused the abnormal operation of the engine was contamination by water and suspended particulate matter found in the left main fuel tank. The laboratory analyses of the fuel, however, are not absolutely conclusive since no traces of these contaminants could be found in the filters, the fuel lines or the injectors. There is also the possibility, however, that small amounts of water could have been supplied to the engine, leaving no trace of said contamination once the water was replaced with a steady flow of uncontaminated fuel following the fuel system manipulations made by the pilot in command.

The fuel samples could also have been contaminated in the instants following the accident. Both the left and right main tanks spilled fuel internally and externally via gaps and cracks in the piping. Contaminants could have found their way into the system through those same openings. The other contaminant, the water, could have been present in the container prior to the sample being taken, or it could have condensed afterward in the sample container, which was not full.

Regardless, even though the indications are inconclusive, it is likely that water condensation in the tanks, aided by the autumn weather, or the contamination of the fuel in the drums and bottles, in the absence of other indicators, caused the failure and abnormal operation of the aircraft's right engine.

3. CONCLUSION

3.1. Findings

The crew of the aircraft had planned to take off from a temporary agricultural field located at an elevation of 610 m, and to land at another temporary field parallel to it and located 2.6 km to the south at a lower elevation of 465 m.

During the takeoff, after reaching a safe takeoff speed and initiating the climb, there was a partial loss of power in the right engine and, consequently, of thrust on that side.

Believing that the engine failure was not complete and that a high-power regimen could be re-established, the crew attempted to regain the engine by transferring the fuel supply. They did so by selecting the cross-feed to the left main engine, after which the engine recovered its maximum takeoff power.

When the fault and abnormal operation of the engine occurred, the airplane yawed hard to the right, a motion that was offset by fully depressing the left rudder pedal. At the same time the airplane started to descend gradually.

When power was recovered to the right engine, the flight path deviated to the left and the aircraft impacted the terrain at an altitude that was slightly below that of the runway threshold that it had flown over.

During the emergency, as the asymmetric thrust oscillated, the airplane's flight path was maintained along the extension of the runway at a low altitude above ground.

It is believed that the partial and transitory drop in power in the right engine was probably due to water contamination in the fuel.

The airplane impacted with the left wing first, then the left main gear leg, followed by the nose wheel and forward fuselage, after which it traveled along the ground for some 20 or 30 m.

The two crewmembers, who were trapped in their seats, were seriously injured in the accident.

The pilot who was seated in the RH seat lost consciousness, regaining it some 30 minutes later. The pilot seated in the RH seat perished about ten minutes later.

There were no witnesses to the accident. The first call for help was made by the pilot in the RH seat, who survived, on his cellular phone.

3.2. Causes

It is believed that the fault and abnormal operation of the right engine was probably caused by the presence of water in the fuel being supplied to it. This water could have come from condensation inside the tanks that was not properly drained when the airplane was serviced. Alternatively, the water could have come from the jugs that were used to transport the fuel prior to the refueling in the field.

The cause behind the airplane's loss of lateral control and its ability to climb was probably the result of the oscillating condition of the high asymmetric drag as the stationary propeller, and the counteracting forces being applied by the rudder, were suddenly and immediately replaced by a condition of high symmetric thrust with the left rudder pedal still fully depressed.

4. SAFETY RECOMMENDATIONS

None.