CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

# Report A-046/2013

Accident on 20 December 2013, involving a Bell 212 aircraft, registration EC-IFA, operated by INAER, in Chera (Valencia, Spain)

GOBIERNO DE ESPAÑA
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.º 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.

# Table of contents

# Abbreviations

| | |
|---|---|
| 00° 00' 00" | Sexagesimal degrees, minutes and seconds |
| 00 °C | Degrees centigrade |
| AEMET | National Weather Agency |
| AESA | National Aviation Safety Agency |
| CAMO | Continuing Airworthiness Management Organization |
| CIAIAC | Civil Aviation Accident and Incident Investigation Commission |
| ft | Feet(s) |
| ft/min | Feet per minute |
| GPS | Global positioning system |
| h | Hour(s) |
| HP | Horsepower |
| KIAS | Indicated airspeed in knots |
| kt | Knot(s) |
| lb | Pound(s) |
| m | Meter(s) |
| N1 | Compressor RPMs (in percent) |
| N2 | Power turbine stage RPMs (in percent) |
| NR | Rotor RPMs (in percent) |
| RPM | Revolutions per minute |
| TMA | Terminal control area |
| TSB | Canada's Transportation Safety Board |

# Synopsis

| | |
|---|---|
| Owner and operator: | INAER |
| Aircraft: | Bell 212, registration EC-IFA |
| Date and time of accident: | Friday, 20 December 2013; at 13:42 h[1] |
| Site of accident: | Chera (Valencia, Spain) |
| Persons onboard: | 1; crew member, uninjured |
| Type of flight: | General aviation – Other |
| Phase of flight: | En route – Cruise |
| **Date of approval:** | 26 October 2015 |

## Summary of accident

On Friday 20 December 2013, a Bell 212 aircraft, registration EC-IFA and operated by Inaer, was preparing to make a positioning flight from INAER's heliport in Albacete to the Castellón Airport. The pilot was the only occupant onboard.

During the flight, the fire warning light turned on for the no. 2 engine lever. After pulling on the lever for the engine, the pilot decided to make an emergency landing. While making the approach to the area he had selected for the landing, he was unable to maintain altitude and he was forced to land in a place different from the one he had selected.

During the landing, the aircraft's fuselage and main rotor blades impacted the trees present in the area, and the aircraft fell over on its right side.

The aircraft was destroyed.

The pilot was uninjured and exited the aircraft under his own power.

[1] All times in this report are local.

# 1. FACTUAL INFORMATION

## 1.1. History of the flight

Prior to the accident flight, the pilot had made a test flight on the same accident helicopter. The test included a check of the engine power, the result of which was satisfactory.

The aircraft took off at 13:10, with 1,145 lb of fuel, from the operator's heliport in Albacete, to Castellón on a positioning flight.

Thirty-five minutes into the flight, the engine fire light turned on for the number 2 engine. The pilot started the engine fire procedure, lowering the airspeed and, in an effort to check if there really was a fire in the number 2 engine, he started a turn to the right to ascertain whether he could see smoke, which he could not. During this time, he selected a landing area.

The engine fire light (FIRE PULL 2) remained on even after the affected engine was stopped.

While making the approach to the chosen landing area, the pilot was unable to stay on course and he was forced to land in a different spot, where the helicopter impacted the ground.

## 1.2. Injuries to persons

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

## 1.3. Damage to aircraft

The helicopter was destroyed. The nose was heavily damaged, as were the main rotor blades. Part of the tail cone had detached, along with the tail rotor.

Figure 1. Helicopter after the accident

## 1.4. Other damage

The main rotor cut the branches from several almond trees.

## 1.5. Personnel information

The pilot held a commercial pilot license (helicopter), issued by AESA, that was valid and in force until 09 April 2017. The license had a type rating for the helicopter involved in the accident, the Bell 212/412, which was valid until 28 February 2014. He also had a class 1 medical certificate, valid until 22 October 2014.

He had a total of 5,010 flight hours in a helicopter, of which 1,182 had been on the type.

From 01 January 2013 until the day of the accident, he had flown 16:26 h in the model of helicopter involved in the accident, of which 3:16 h had been in the last month.

The pilot had satisfactorily completed training on a flight simulation device for the type of helicopter involved in the accident on 22 February 2013. That training included landings on a single engine and actions to take in the event of an engine fire, an exercise in which he scored 4 out of 6 points.

## 1.6. Aircraft information

### 1.6.1. *Overview*

The Bell 212 helicopter, with serial number 30689, had been built by Bell Helicopter Textron, Inc. in 1975. It had a Certificate of Airworthiness issued by the Civil Aviation General Directorate on 12 September 2005. It also had an Airworthiness Review Certificate issued by AESA, which was valid until 20 May 2014.

Two Pratt & Whitney engines supplied the power. These engines were of the PT6T-3 type, with serial numbers CP-PS 62790 for the number 1 (left) engine, and CP-PS TB0259 for the number 2 (right) engine. The two engines had a fire detection and suppression system. The helicopter had two rotors in a conventional arrangement, a main rotor that rotated counter-clockwise as seen from above and that provided lift, and a tail anti-torque rotor for directional control.

The landing gear consisted of two longitudinal skids and the two crossbars that attached them. This assembly supported the fuselage.

The helicopter was maintained in accordance with the approved maintenance program for the CAMO of the operator, INAER, reference INAER-PM-B212 Ed. 3, dated 9 March 2012, and Rev. 00k dated 22 November 2012.

The checks described below, included in the aforementioned maintenance program, were the last to be carried out, all satisfactorily.

Total flight hours and checks conducted:

| | Inspection type | Date | Total hours |
|---|---|---|---|
| Airframe | 25 h/30 days | 20-12-2013 | 10,909:05 |
| Engine | | | |
| No. 1 (serial no. CP-PS-62790) | 25 h | 20-12-2013 | 10,124:05 |
| | 100 h/6 months | 20-12-2013 | 10,124:05 |
| No. 2 (serial no. CP-PS-TB0259) | 25 h | 20-12-2013 | 11,088:35 |
| | 100 h/6 months | 20-12-2013 | 11,088:35 |

The check of the engines included an inspection and a power test of the engines, which had to be conducted in flight.

In keeping with the maintenance program, just before the accident flight, the pilot later involved in the accident carried out a test flight on the accident helicopter.

The test included an inspection and check of the power in both engines. The results of the inspection and the test were satisfactory.

### 1.6.2. *Engine fire detection and suppression system*

**Detection system.** The helicopter had a fire detection system installed in the engine bay. This system consists of a set of heat detecting elements mounted on the cowling

and on the firewall on each engine bay. A fire or overheating condition in an engine bay causes the associated fire detection grip (FIRE PULL 1 or 2) to light up. Pulling the grip on the affected engine closes the fuel valves to that engine and readies the two fire suppression bottles for activation.

**Suppression system.** On either side at the rear of the fuselage there are two fire suppression bottles, one in each engine bay. These bottles are connected such that both can be discharged on either engine as commanded by the pilot.

**Discharge system.** There is a bottle selector to discharge the principal and reserve bottles individually. To extinguish a fire in the engine bays, two actions are required:

First, pull the FIRE PULL lever to ready the bottles for activation and so the fire retardant can be directed to either engine bay. Second, the FIRE EXT switch must be selected to either the PRINCIPAL or RESERVE position, thus discharging the corresponding bottle. About ten seconds are needed for the agent to extinguish the fire and for the warning light to go out. If one bottle does not completely extinguish the fire, the warning light remains on. In this case, ten seconds following the activation of the bottle, the other bottle must be discharged.

### 1.6.3. *Fuel system*

The helicopter's fuel system includes switches for the fuel valves and the fuel pumps for both engines.

**Fuel valve switch.** When selected to ON, this two-position switch supplies energy to the fuel valve, allowing it to supply fuel to the associated engine. This fuel supply is interrupted when the valve is selected to OFF.

**Fuel pump switch.** When selected to ON, it supplies fuel to the corresponding engine. The fuel supply is shut off when selected to OFF.

Furthermore, as described in the previous point, pulling on the fire detection grip closes the fuel valve, which makes the engine stop.

#### Twist-grip throttle

There are two twist-grip throttles on the collective control stick. Each grip controls fuel flow to its respective engine.

To avoid turning them accidentally, the two grips have independent friction settings that are used to determine how easy it is to twist the grips. The two throttle grips are on the same shaft, one above the other, and can be moved together with just one hand.

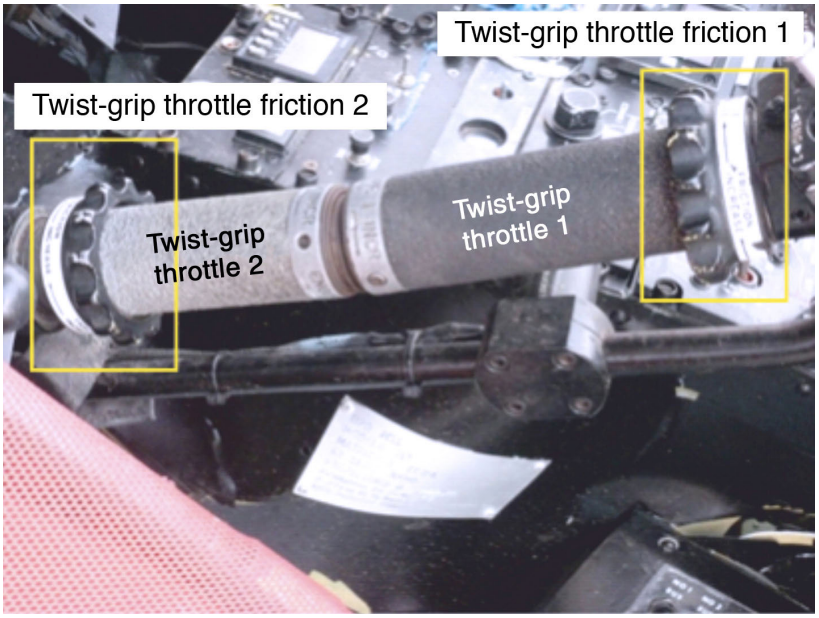


**Figure 2.** Collective stick and grip throttles

With the engine running, if the associated grip throttle is twisted from the maximum position to any lower position, the RPM limit (N1) for the compressor on that engine decreases approximately 10%. When this happens, since N1 is now limited to about 90% of its rating, if more thrust were requested by pulling on the collective control, this N1 limit would be reached first. Since the limit cannot be exceeded, the power turbine RPMs (N2) will decrease, and with it the rotor RPMs (NR) and the lift produced by the main rotor.

### 1.6.4. *Flight performance*

Prior to the time of the accident, the helicopter was at an altitude of 2,353 ft. The temperature was likely 11 °C. Considering the graph in the Flight Manual titled "Climb rate on a single PT6-3 engine at maximum continuous thrust at a speed of 58 KIAS and a weight of 8,000 lb", if flying on a single engine had been required, a climb rate of approximately 800 ft/min would have been sustainable. This calculation assumes that the weight of the helicopter in the flight condition present during the event was about 7,600 lb.

## 1.7. Meteorological information

Based on the information provided by Spain's National Weather Agency, the weather conditions in the vicinity of Chera (Valencia) at the approximate time of the accident were: wind from 290° at around 19 kt and a temperature of about 11 °C. Visibility conditions were not limiting for the flight in question.

## 1.8. Aids to navigation

Not applicable.

## 1.9. Communications

Not applicable.

## 1.10. Aerodrome information

Not applicable.

## 1.11. Flight recorders

The helicopter was outfitted with a GPS fleet tracking unit. There was also a handheld GPS unit onboard. The data obtained from these two recorders were consistent.

## 1.12. Wreckage and impact information

The area was mountainous, with steep slopes and barely any suitable landing spots. The flat parts were primarily planted with almond trees.

The aircraft wreckage was mostly confined to an area measuring about 150 square meters.

The helicopter was resting on its right side. There was significant damage to the front of the cabin. The front part of the tail cone was partially detached in the area where it joins the cabin. The aft segment of the tail cone, along with the tail rotor, had detached at the horizontal stabilizer.

The main rotor blades showed signs of having struck the almond trees that were present at the impact site.

An inspection of the engine bay did not reveal any signs of fire and the engines' outward appearance was normal. The fire bottles had also not been discharged.

During the inspection of the cockpit, it was noted that the fire detection lever for the number 2 engine had been pulled, that the fuel valve and pump switches were OFF and that the engine's instrument readings were at zero. It was also noted that the fire detection lever for the number 1 engine had been pulled and that the instrument readings for that engine indicative values above zero.

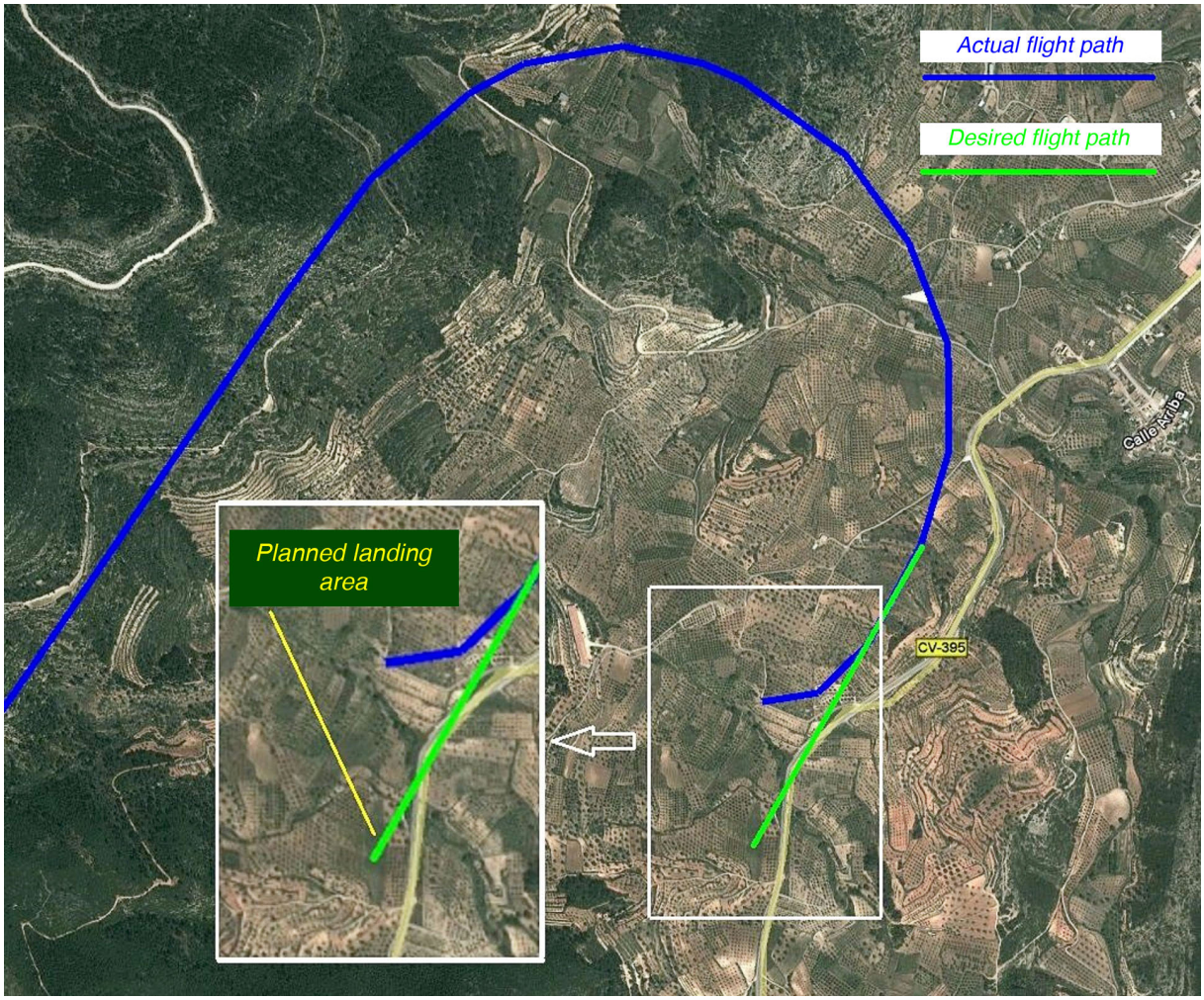


**Figure 3.** Close up of final flight path

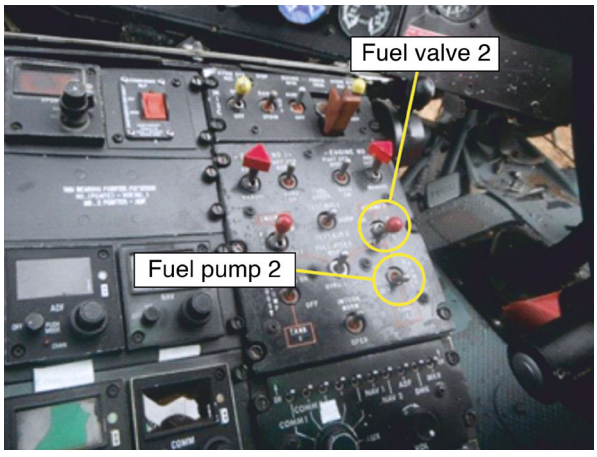


**Figure 4.** Fuel panel

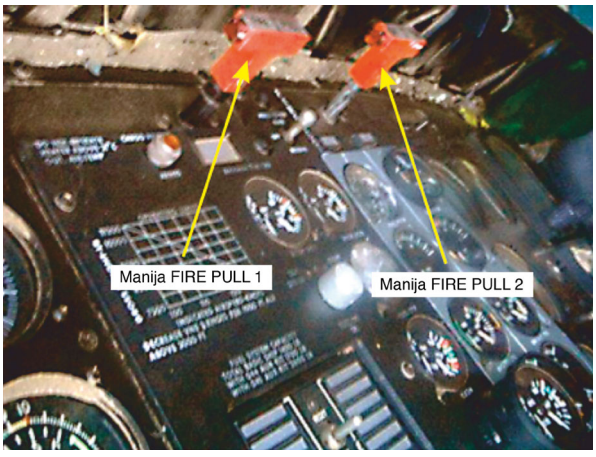


**Figure 5.** Fire detection levers

The fuel reading showed that there was a little over 1,000 lb of fuel onboard after the impact.

## 1.13. Medical and pathological information

Not applicable.

## 1.14. Fire

Not applicable.

## 1.15. Survival aspects

The pilot exited the helicopter under his own power.

## 1.16. Tests and research

### 1.16.1. *Pilot's statement*

In his statement the pilot commented that after conducting an engine power test, he left Albacete at around 13:00 en route to Castellón, and that he circled the Valencia TMA upon reaching it.

He also added that in the moments prior to the emergency, he was flying at a speed of 110-120 kt with a slight tailwind on an approximate heading of 40°.

He continued by saying that at one point, the fire light for the number 2 engine turned on, as a result of which he pulled the fire detection lever, but the light remained on. He then decelerated to 65-70 kt and started a turn to the right to see if there was smoke issuing from the engine on that side (number 2 engine). He did not see any smoke. He thought the light had turned on due to a fault in the fire detection system and he did not discharge the fire suppressant.

He picked a landing spot and started the approach. He was flying low and the helicopter was sinking. Thinking he would be unable to reach the landing spot, he turned more to the right toward the flattest area available. During this segment he shut the fuel valve and disconnected the pump for the number 2 engine. As he himself stated, he was more mindful of the exterior than of what was happening in the cockpit, and he did not see lights or hear any alarms. As he was flaring the landing, on pulling back on the collective stick the RPM warning light turned on and the low RPM horn went on.

He added that he seemed to recall cutting the fuel to the number 2 engine by turning the twist throttle and that he released the friction on both throttles.

After the landing the number 1 engine was still running, and he decided to pull the fire detection lever for the number 1 engine in order to stop it.

### 1.16.2. *Engine inspection*

The two engines were subjected to a detailed inspection at the facilities of the engine manufacturer in Canada, under the supervision of Canada TSB personnel approved by the CIAIAC. The engines were also bench tested.

The functional test revealed that both engines performed correctly in both normal conditions (645 HP) and maximum power emergency conditions (910 HP). No faults or anomalies were found in either engine.

## 1.17. Organizational and management information

Not applicable.

## 1.18. Additional information

### Flight Manual

Section 3 of the Flight Manual (3-4-A-3), on Emergency Procedures, contains the "In-flight engine fire" procedure, which details the steps to take in the event of a fire in an engine. This procedure specifies:

INDICATIONS

FIRE PULL 1 and/or FIRE PULL 2 –lit.

PROCEDURE

If possible, immediately start an emergency descent.

Stop the affected engine (1 or 2) as follows:

| | |
|---|---|
| FIRE PULL lever | pull |
| FIRE EXT switch | select MAIN |
| Throttle twist grip | close |
| Fuel crossfeed switch | select Override Close |
| Fuel interconnect switch | select OPEN |
| Engine BOOST PUMP | select OFF |

Verify that the FIRE lever light, the FUEL BOOST warning light and the FUEL switch on the affected engine are all off.

If the FIRE warning light remains on more than 10 seconds:

| | |
|---|---|
| Interruptor FIRE EXT | select RESERVE |
| ENG RPM N2 on running engine | set to 100% |

Land as soon as possible.

If no suitable landing area is available, proceed as follows:

| | |
|---|---|
| FIRE PULL lever | in |
| GEN switch (1 or 2) | select OFF |

If engine 2 was stopped:

| | |
|---|---|
| INV 3 switch | if installed select DC BUS 1 |
| BATTERY BUS 2 switch | select OFF |
| BATTERY BUS 1 switch | select ON |

While not mentioned in the Flight Manual, it is an unwritten rule that the pilot make a turn toward the side that the affected engine is on so as to check for the presence of smoke.

## 1.19. Useful or effective investigation techniques

To determine if this was an isolated event or not, two searches were initiated, one within the operator to analyze its records and another involving the database of AESA's Event Notification System.

According to the operator's information, from late 2007 there had only been one report of a faulty fire detection system in its Bell 212 and Bell 412 fleets, resulting in a false in-flight engine fire indication that cleared itself within 10 minutes.

The check of AESA's Event Notification System database did not reveal any reports of faulty fire detection events related to the helicopter model involved in this accident.

## 2. ANALYSIS

The pilot was properly qualified and the aircraft had a valid Airworthiness Review Certificate.

The weather conditions were not limiting for the flight in question.

While the fire detection light for the number 2 engine turned on during the flight, a subsequent inspection of the engine bay did not show any signs that a fire had broken out in either engine bay.

The engines had been inspected prior to the flight, as per the maintenance program. Both engines were deemed to be in good condition and suitable for flight.

In addition, in light of the results of the field inspection and of the operational test conducted later in Canada, it can be stated that both engines were in good condition to make the flight.

Based on calculations carried out using the Flight Manual, and adapted to the conditions present at the time of the event, the aircraft was capable of climbing at a rate of 800 ft/min with one engine in operation. According to the pilot's account, however, the helicopter was unable to maintain level flight.

One explanation for the loss of power that the running engine should have been able to provide is the pilot's possible and unintentional input to the grip throttle for said engine. The pilot stated that he released the friction on both grips, meaning that when he later closed the throttle for the number 2 engine, he might have moved the one for the number 1 engine as well.

The fact that the grip throttle for the running engine might have been accidentally twisted while closing off the throttle for the number 2 engine means that the operating limits for the number 1 engine would have been lowered. As a result, any subsequent movement of the collective lever to demand more power would not achieve its objective, as its N1 would have been limited to 90% of its rated value.

This would explain the inability to reach the initially selected landing spot and the need to make an emergency landing.

# 3. CONCLUSIONS

## 3.1. Findings

- The pilot was properly qualified and the aircraft had a valid Airworthiness Review Certificate.
- Weather conditions were not limiting for the flight in question.
- The fire warning light for the number 2 engine turned on in flight, even though no evidence was found of a fire in the associated engine bay.
- Both engines were in good condition for the flight.
- The aircraft had enough power to climb on a single engine at continuous maximum thrust.
- The flight path could not be maintained due to the lower operating limits of the engine still in operation.
- The pilot's handling of the emergency was not adequate.

## 3.2. Causes/Contributing factors

The accident was caused by an improperly executed emergency landing in a very difficult area after a false fire alarm in the number 2 engine and the resulting loss of power.

## 4. SAFETY RECOMMENDATIONS

No safety recommendations are issued.