

# CIAIAC

Comisión de Investigación  
de Accidentes e Incidentes  
de Aviación Civil

## **TECHNICAL REPORT**

**A-030/2002**

Accident of the  
aircraft Air Tractor-802,  
registration EC-GOO,  
on June 12, 2000  
in Barxeta (Valencia)



MINISTERIO  
DE FOMENTO

# Technical report

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registration EC-GOO, on June 14, 2002,  
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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 in which happened the event being investigated, with its causes and its consequences.

In accordance with the provisions of Law 21/2003 and Annex 13 to the Convention on International Civil Aviation, the investigation has exclusively a technical nature, without having been targeted at the declaration or assignment of blame or liability. The investigation has been carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents.

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

This report has originally been issued in Spanish language. This English translation is provided for information purposes only.

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## **Abbreviations**

00 °C	Degrees centigrade
00° 00' 00"	Degrees, minutes and seconds
cm	Centimetres
DGAC	Dirección General de Aviación Civil (Civil Aviation Authority of Spain)
FAA	Federal Aviation Administration (Aeronautical Authority of the United States of America)
gr	Grams
kg	Kilograms
km	Kilometres
l	Litres
MTOW	Maximum Take-Off Weight
No.	Number
SHp	Shaft horse power

## Synopsis

The accident was notified to the Civil Aviation Accidents and Incidents Investigation Commission, as the body responsible for the investigation. The Commission sent a notification to its counterparts in Canada (TSB) and the U.S.A. (NTSB), as established in Appendix 13, in their capacity as the bodies representing the States of design and manufacture of the engine and of the aircraft, respectively.

The aircraft, an AT-802, registration EC-GOO, was carrying out fire fighting operations. It was the second flight of the day. The other flight finished shortly before.

On coming out of water bombing on the first flight, the aircraft carried out a «hammer head», an acrobatic manoeuvre that is forbidden in this type of aircraft, as established in the Flight Manual.

On the second flight the water was dropped and at the end of this manoeuvre the aircraft reached a pitch angle of 90° nose up, and then crashed into the ground. Both the pilot and the motor pump operator, who was also on board, died as a result of the impact.

The results of the toxicological examinations carried out subsequently showed that the level of ethyl alcohol in the pilot's blood was 2.07 gr/l and that the level in the motor-pump operator's blood was 1.13 gr/l.



## 1. FACTUAL INFORMATION

### 1.1. History of the flight

On June 14, 2002 the aircraft took off from the temporary runway at Siete Aguas in the direction of Venta del Moro where there was a fire, having previously carried out one water bombing operation. Whilst en route to their destination, they were told to go to Barxeta where there was a fire, already under control, that had to be put out. Once there, the aircraft carried out a pass to survey the area and then turned 360°. Unloading was at a low altitude and at great speed and then the aircraft ascended until gaining a vertical attitude at an altitude of 150-200 metres, according to the statement of some eye witnesses, after which it plummeted and crashed into the ground. The accident took place at approximately 21.30 hours local time.

On the day of the accident, the pilot and motor pump operator were on duty in Siete Aguas but did not make any flights during the morning. In the afternoon they received an alert to proceed to Venta del Moro, where there was a fire. This same alert was received by another aircraft located in Enguera.

The distance between Enguera and Venta del Moro is 80 km whereas the distance between Siete Aguas and Venta del Moro is half that, i.e. 40 km. In spite of this difference, the aircraft located in Enguera reached the fire in Venta del Moro first and when it was proceeding to Siete Aguas, to reload, it crossed the aircraft involved in the accident and communication was established to discuss the fire's characteristics and how to attack it.

Unloading in Venta del Moro was at great speed and a low altitude, with some pine trees with a thickness of 30 cm being broken. The aircraft then ascended until it gained the vertical and carried out a hammer head manoeuvre to the right. The pilot and the motor pump operator were on board this flight.

The aircraft returned to Siete Aguas, where it reloaded water and fuel before returning to the scene of the fire. The motor pump operator also went in the aircraft.

It took off again and en route they were instructed to proceed to Barxeta where there was another fire.

According to the statement of an eye witness, when they reached the fire area, the aircraft made a survey and then it unloaded the water at such a low height that it contacted the top of some pine trees breaking some branches. Afterwards, it climbed in an almost vertical trajectory until it lost its airspeed and it fell from that position, crashing into the ground.

## 1.2. Injuries to persons

Injuries	Fatal	Serious	Minor/None
Crew	1		
Passengers	1		
Others			

## 1.3. Damage to the aircraft

The aircraft was completely destroyed.

## 1.4. Other damage

The aircraft plunged into a field of orange trees. The impact was almost vertical and the aircraft fell into an orange tree which broke at the base of the trunk. The other orange trees round about suffered minor damage to their branches.

## 1.5. Personnel information

### 1.5.1. Pilot

Age: 29 years  
Licence: Commercial aircraft pilot  
Date of issuance: 20-10-1993  
Qualifications: AT502, AT802, multi-engine landplanes, single-engine landplanes, instrument flying  
Renewal date: 23-04-2001  
Expiry date: 02-04-2006  
Date of last medical examination: 09-01-2002  
Total flight hours: 663 hours (according to DGAC)  
Hours in aircraft type: 176:47 hours  
Hours in last 90 days: 22:22 hours  
Hours in last 30 days: 13:56 hours  
Hours in last 48 hours: 1:06 hours

The day prior to the accident, the pilot was on duty in Siete Aguas but did not make any flights, nor did he make any on the morning of the accident.

On June 12, the pilot was not on duty and on June 11 he was on duty based in Castellon. That day, he flew a total of 25 minutes.

On March 8, 2001 the pilot requested from the Dirección General de Aviación Civil the annotation of Agro-Forestry Applicator in his flight licence, before the deadline established by the first temporary provision of Royal Decree 1684/2000. According to the requirements of that regulation, he was qualified to perform the type of operation that he was carrying out at the moment of the accident.

### 1.5.2. *Motor pump operator*

As reflected in the company's operational documentation, the task of the motor pump operator is to load the aircraft on land in order to speed up the operation.

## 1.6. Aircraft information

### 1.6.1. *Airframe*

Make:	Air Tractor
Model:	AT-802
Serial No.:	802-0047
Registration:	EC-GOO
MTOW:	7,264 kg
Owner:	AVIALSA T-35, S. L.
Operator:	AVIALSA T-35, S. L.

This model of aircraft is used for agricultural work (fertilizer spraying, fumigation, etc.) and fire fighting. Of its type, it is the model with the largest capacity.

### 1.6.2. *Airworthiness certificate*

Class:	Special. Restricted
Type:	Aerial Work
Technical Data:	Normal. Aircraft to be used only for visual flight
Date issued:	02-06-1997
Expiry date:	23-04-2003

### 1.6.3. *Maintenance log*

Total flight hours: 992:30 hours  
Last annual inspection: 10-01-2002  
Hours at last annual inspect.: 985:21 hours

### 1.6.4. *Engine*

Make: Pratt & Whitney  
Model: PT6A-67AG  
Power: 1.350 SHP  
Serial No.: PCE-RD0002  
Total hours: 992:30 hours  
Last inspection: 10-01-2002  
Hours at last inspection: 985:21 hours

The PT6 is a light turbine engine that uses a propeller through a two-stage reduction gearbox.

Two main rotating assemblies make up the engine's core. One assembly consists of the compressor's turbine and the compressor. The other consists of the power turbines and the power turbine spindle. The two rotating assemblies are not connected and rotate at different speeds and in opposite directions. This design is known as the «Free Turbine Engine». This configuration allows the pilot to vary the propeller's speed irrespective of the compressor's speed. The starter motor torque is also lower, due to the fact that during start-up initially only the compressor is made to turn. The engine starts up via connection with the starter motor mounted in the accessory box.

## 1.7. **Meteorological information**

According to some witnesses, the meteorological conditions were adequate for visual flight, without clouds or winds of any significance, and the temperature was 30 °C.

The accident occurred approximately at sunset, 21:30 hours local time.

## 1.8. **Aids to navigation**

Not applicable.

### **1.9. Communications**

In connection with the flight involved in the accident, radio communications made by the aircraft were those described below.

After carrying out the first unloading in the fire that broke out in Venta del Moro, the aircraft landed on the temporary runway of Siete Aguas, reloaded water and took off again to carry out another unloading operation on the fire. However, after take-off, the aircraft received a call informing it of the existence of a second fire in Barxeta where its presence was necessary.

According to information from the operating company, during the flight to Barxeta the aircraft received a call from the company instructing the pilot to put the motor pump operator down as it was not necessary for him to be on the flight. The pilot answered in the affirmative, indicating that he would put him down as soon as he could. Once at the site of the fire, he contacted the firemen to ask for permission to carry out the unloading operation. The firemen agreed and proceeded to clear the area so that he could unload.

### **1.10. Aerodrome information**

Not applicable.

### **1.11. Flight recorders**

The aircraft was not carrying flight recorders, which are not required for aircraft of this type.

### **1.12. Wreckage and impact information**

The aircraft crashed in a field of orange trees, very near Barxeta. This area is devoted to the cultivation of fruit trees and the most important geographical features are gently rolling low hills. To be specific, the orange grove was situated at the base of the hill where the fire had broken out, an area of pine trees. The aircraft crashed 19 metres from the road to Barxeta, at the coordinates 39° 01.67' N 00° 25.74' W.

The fall had a strong vertical acceleration component and the aircraft had a level attitude and only damaged one orange tree and some branches of the nearby trees. The aircraft's nose was facing south, in line with the trajectory followed initially.

There was no sign on the ground of lengthwise travel by the aircraft after the impact.

All the remains were distributed in a radius of 3 metres round the aircraft, indicating that it had mainly vertical speed.

The rudder bar and elevator control column had broken away from the vertical tail fin and horizontal stabilizer, respectively. The wings were broken at their restraints with the fuselage and throughout their length.

The main undercarriage had buckled and was found under the aircraft's wing.

The most damaged part was the nose area. The engine had broken away, although it was close to the aircraft and of the 5 propeller blades, 2 were buried, 2 did not suffer any damage and 1 of them was bent.

The hopper had been cut into several pieces.

### **1.13. Medical and pathological information**

Both the pilot and motor pump operator were so badly injured that it was impossible for them to survive. The injuries showed that both occupants were wearing their harnesses and protective helmets correctly.

Blood and vitreous humor samples were taken for a toxicological analysis. The results were as follows:

— Pilot:

- 2.07 gr/l of ethyl alcohol in the blood.
- 2.67 gr/l of ethyl alcohol in vitreous humor.

— Motor pump operator:

- 1.13 gr/l ethyl alcohol in the blood.
- 1.67 gr/l ethyl alcohol in vitreous humor

### **1.14. Fire**

The aircraft did not catch fire.

### **1.15. Survival aspects**

Members of the Civil Guard, who were in the area because of the fire that had broken out, saw how the accident occurred and immediately went to the place where the air-

craft had crashed. They saw that the pilot had died and that the motor pump operator was severely injured.

The injured man was moved out of the orange grove to receive medical assistance from the emergency services and died moments later.

A crew of firemen who were carrying out fire extinguishing activities sprayed the aircraft with foam to prevent the aircraft's fuel from catching fire.

Both the pilot and the motor pump operator were wearing helmets at the moment of the accident and remained in their positions, held fast by their harnesses, in spite of the impact.

The motor pump operator's seat broke in two with the impact.

## **1.16. Tests and research**

### **1.16.1. *Trajectory of the aircraft***

Appendix A contains an estimation of the aircraft's trajectory. First it approached the fire area via a small valley. Then it made a reconnaissance pass to locate the fire and study the terrain. Then it turned 360° before immediately unloading.

Once it had unloaded, the aircraft ascended until it reached a vertical attitude with a pitching angle of 90° and almost came to a standstill at an altitude of between 150 and 200 metres. From this position it descended out of control and crashed into the ground.

### **1.16.2. *Analysis of the power plant***

A detailed inspection of the power plant was carried out in the engine manufacturer's installations. The inspection revealed that the engine had moderate damage due to the impact.

Marks round the circumference of the compressor turbine, power turbine guide, the first stage of the turbine, the second stage of the turbine and the power turbine spindle's housing were detected, caused by contact between the components on being subjected to impact load and the deformation of the engine's external structure.

The ring of the compressor's first stage, the ring of the compressor's turbine and the ring of the first power stage were scored and material had come away due to contact

with the rotors under external loads and structural deformation. The connecting shaft to the propeller's reduction gearbox suffered a torsion fracture due to the power absorbed in the impact.

In the analysis, no signs of abnormal working of the engine's components, controls or accessories under examination were observed.

Consequently, the conclusion was reached that the engine's internal components showed signs that are typical of an engine that is producing considerable power at the moment of the impact.

At the same time, there were no signs of engine abnormalities or malfunction prior to the impact that could lead to the belief that the engine was operating abnormally prior to the impact.

### 1.16.3. *Aircraft control continuity analysis*

Continuity between the controls and aerodynamic surfaces was checked at the site of the accident. It was noted that no discontinuity or obstruction existed. The breakages that appeared came about as a result of the impact suffered by the aircraft. This check was repeated in a hangar after transferring the wreckage and the same conclusions were reached as at the site of the accident.

The engine controls did not show continuity due to the control cables having been fractured in the impact.

It was verified that in the co-pilot's position, where the motor pump operator was seated, there were no fuel, elevator or lateral controls; therefore, the idea that he might have been able to interfere in the manoeuvre from that position was rejected.

### 1.16.4. *Testimony of witnesses*

#### 1.16.4.1. *Witness who saw the unloading in Venta del Moro*

A helicopter pilot who saw the unloading operation that preceded that of the accident and which the aircraft carried out in Venta del Moro declared that the manoeuvre occurred at a very low altitude and that the aircraft broke several pine trees with a 30 cm diameter. He informed the pilot by radio that he had again broken some pine trees. The aircraft then made a vertical ascent before carrying out a hammer head manoeuvre to the right.



#### 1.16.4.2. Witness who spoke to the pilot in Siete Aguas, after the first unloading in Venta del Moro

A person, also a motor pump operator from the operator company, who was in Siete Aguas when aircraft EC-GOO arrived to reload after having been in Venta del Moro, declared that he indicated to the motor pump operator in the aircraft that he should come down and help him as that was his job and not to fly. According to this testimony, the pilot intervened between the motor pump operators and dismissed these indications. Both the motor pump operator and the pilot affected by the accident ignored these instructions and took off in the aircraft.

Then the pump operator who was on the ground informed the company of this situation so that it could be corrected.

#### 1.16.4.3. Witness who saw unloading in Barxeta

A witness who saw the water bombing operation carried out by the aircraft in Barxeta declared that first the aircraft made a reconnaissance pass of the area and then carried out the unloading operation at a low altitude, breaking some pine trees. Then it made a vertical ascent before plunging to the ground.

### 1.17. Organizational Fand management information

According to the company's Operational Circular 4-2000:

«Motor pump operators must remain on the ground whilst aircraft carry out successive unloading operations in fires from the same water loading runway. They will only travel in the aircraft in forestry surveillance routes and fire-fighting water loading runway positioning flights and on the return flight to the base where the aircraft is recovered.»

In the accident, the aircraft's base was Siete Aguas, which was also the nearest to the fire area; therefore, according to Operational Circular 4-2000 of AVIALSA T-35, S.L., the motor pump operator ought to have remained on the ground.

This circular coincides with the regulations that were published subsequent to the accident, in particular, Resolution of July 5, 2002, issued by the Dirección General de Aviación Civil, establishing specific procedures for aerial and agro-forestry work operations, section 4 of which determines:

«In agricultural-forestry fire extinguishing operations and crop spraying applications, to prohibit the participation, on board the aircraft, of persons other than the members required for the operation and the flight crew.»

## 1.18. Additional information

### 1.18.1. *Fire fighting operations as per the Flight Manual*

According to the aircraft's Flight Manual, when fire fighting operations are being carried out:

- The aircraft must approach the target at a speed of between 109 and 113 knots and 10° of flaps.
- The hydraulic pressure must be guaranteed to be sufficient and the on/off switch must be in the ON position. The computer must be configured to control the quantity to be unloaded, the area to be covered and the speed.
- The aircraft must be aligned to carry out unloading.
- It must be borne in mind that during unloading the aircraft's nose will suddenly go up. Use of the control stick to compensate this must be initiated as soon as the button to release the load has been activated.
- The aircraft must be kept level and at a constant altitude during the unloading phase.
- Once unloading has been completed, the door will close automatically.
- Power must be applied gently to take the aircraft up and away from the area of fire and smoke.
- Flaps must be retracted and trimmings adjusted for a normal flight.

At the same time, the company's Operational Circular 4-2000 specifies that:

«The aircraft's passes for water bombing in fires must be carried out with an obstacle clearance altitude margin that guarantees a safe manoeuvre and efficient unloading. The minimum altitude margin will be 15 metres above the highest part of the terrain flown over in the pass.

Unloading passes in the flight trajectory with difficult departure from the fire after unloading must not be undertaken. Departure from the fire area must always be possible with the aircraft loaded (taking into consideration a launching system fault).»

### 1.18.2. *Hammer head manoeuvre*

Witnesses to the accident and the prior unloading carried out by the aircraft in Venta del Moro describe the manoeuvre after unloading as a hammer head.

The hammer head, as it is known colloquially, is an acrobatic manoeuvre consisting of following a vertical upward path, gradually reducing engine thrust, until the upward speed is practically nil. At that moment, rudder control is applied and the engine power

is cut off, producing the aircraft's turn in the vertical plane described in the ascent and at a turning point situated very close to the tip of the right or left wing, depending on the direction rudder applied. The length of time that rudder control must be applied varies according to the type of aircraft.

After the turn, the aircraft adopts a 90° dive attitude, that is, it starts a vertical descent and finally recovers horizontal flight in the opposite direction to that of its entry into the manoeuvre. A diagram of this manoeuvre is given in Appendix C.

The Flight Manual indicates that acrobatic manoeuvres, including stalls, are not authorized. In fact, this warning should appear on one of the placards situated in front of the pilot.

### **1.18.3. *Regulations on the consumption of alcohol in agricultural/forestry operations***

No references have been found in the civil aviation regulations in force in Spain at the date of the accident to the permitted alcohol levels or periods of consumption in aerial agricultural and forestry activities.

Point B.2 of the Resolution dated July 5, 2002, issued by the Dirección General de Aviación Civil, establishing specific operational procedures for aerial and agricultural/forestry work operations, which was approved subsequent to the accident, specifies that:

«Pilots who have to carry out the activities contemplated in this Directive (including fire fighting) at the moment of starting each operation must be in perfect health, they must not have consumed alcohol during the twelve hours immediately prior to the flight and must not be users of addictive substances.»

The JAR-OPS 1 regulation applicable to commercial air transport operations using aeroplanes indicates that crew members must not consume alcohol during the 8 hours prior to presentation time for the start of the aerial activity, nor must they start a period of aerial activity with an alcohol level in the blood of more than 0.2 per thousand.

For comparative purposes, Spanish legislation establishes alcohol blood-level limits for automobile drivers of 0.5 gr/l, 0.3 gr/l for professional drivers and 0.3 gr/l for new drivers (up to 2 years after obtaining the driving licence).

### **1.18.4. *Effects of consuming alcohol***

Response to the intake of alcohol can vary, as demonstrated in scientific publications in which it has been recorded that blood-levels of alcohol as low as 0.25 gr/l can lead

to a significant number of errors in set procedures carried out in a simulator as well as inducing disorientation and loss of awareness phenomena.

Publication AM-400-94/2 issued by the Federal Aviation Administration (FAA) on alcohol and flying, available for public distribution to North American general aviation, specifies that as from a blood-level of 0.3-0.5 gr/l, the symptoms that can be described are as follows:

- 0.3-1.20 gr/l: euphoria, lack of inhibition, deterioration of concentration and the capacity to reason, increased reaction time.
- 0.9-2.50 gr/l: emotional instability, loss of critical reasoning capacity, memory loss, reduction in sensorial response and moderate muscular incoordination.
- 1.8-3.00 gr/l: confusion, dizziness, exaggerated emotional conduct, loss of visual perception, alterations in equilibrium, muscular incoordination, speech limitations.
- 2.70-4.00 gr/l: apathy, deterioration of the state of awareness, absence of a coordinated response to stimuli, muscular incoordination, lack of stability when walking, and possible incontinence.

The organs most affected by alcohol are the central nervous system and the visual and vestibular apparatuses, which are essential for carrying out the functions of a pilot.

## 2. ANALYSIS

### 2.1. Analysis of flights made by the aircraft on the date of the accident

During the morning of the day of the accident, the operator's personnel located in Siete Aguas received no alerts to provide support in any fire fighting tasks.

In the afternoon a fire occurred in Venta del Moro and the assistance of the aircraft in the bases of Engera and Siete Aguas was requested. In spite of the fact that Siete Aguas is half the distance away from Venta del Moro than Engera, the first aircraft to reach the fire was the one from the base in Engera. This probably means that the personnel of Siete Aguas were not in the base when the alert was received.

For this first intervention, the pilot and motor pump operator embarked in Siete Aguas, thus infringing the contents of the company's in-house Circular 4-2000, which states that the motor pump operator must remain on ground whilst the aircraft carries out successive unloadings from the same loading runway and, given the fact that Siete Aguas was the closest to the fire, this should have been the loading runway.

When they approached the fire in Venta del Moro, they crossed the aircraft from Engera, which was going to Siete Aguas to reload. On crossing each other they made contact to discuss the fire and the most effective way of attacking it.

In Venta del Moro the aircraft unloaded at a low altitude, breaking several pine trees, and on coming out it ascended to the vertical, carrying out a hammer head manoeuvre. In this case the pilot did not follow the procedure indicated in the Flight Manual for after unloading, which establishes that it is advisable to come out gently, gaining height gradually. But the pilot had no difficulty in recovering the aircraft after the hammer head and then went to Siete Aguas to reload again.

Once in Siete Aguas, the pilot and motor pump operator ignored the indications of another pump operator who was on the ground, and again infringed the company's Circular 4-2000 and took off.

During the flight a fire alert was transmitted to them by radio and they proceeded to Barxeta where the fire had broken out. They also received a call from the company's Operations Manager to inform them that the motor pump operator ought to remain on the ground. They replied affirmatively to this call and indicated that he would be put down as soon as this was possible.

Once in Barxeta, the aircraft made a reconnaissance pass before unloading, during which the pilot located the fire and studied the surrounding area. After unloading, the pilot did not follow the Flight Manual's indications, allowing the aircraft to make a vertical ascent and reducing its climbing speed to zero. From that position and at that

height it is very difficult to regain control of the aircraft. The aircraft then crashed into the ground.

## 2.2. Influence on the operation of the use of alcohol

During the operations carried out on the day of the accident, several irregularities were observed in the actions of the pilot and motor pump operator:

- It is probable that they were not in the base when they were alerted of the existence of a fire in Venta del Moro.
- Both of them went in the aircraft when this was not necessary as the loading runway was going to be Siete Aguas and, consequently, the motor pump operator should have remained on the ground.
- The manoeuvre carried out after unloading in Venta del Moro was incorrect and not the one that appears in the Flight Manual neither did the aircraft maintain the distance from obstacles established in the operating company's Circular 4-2000.
- After recharging in Siete Aguas, the pilot and the motor pump operator again left in the aircraft together.
- The manoeuvre carried out in Barxeta did not comply with what is established in the Flight Manual.

All these are signs of abnormal behaviour on the part of both the pilot and the motor pump operator.

In the toxicological examination made of the pilot and motor pump operator, levels of alcohol in the blood that amply exceeded those permitted for commercial air transport operations with aircraft and for driving automobiles were discovered. This intake of alcohol could explain a behaviour that does not comply with what is adequate for carrying out flight operations.

It is very probable that the ingestion of alcohol influenced the pilot's behaviour when coming out of the water bombing operations in both fires, Venta del Moro and Barxeta.

### **3. CONCLUSIONS**

#### **3.1. Findings**

- The aircraft had a valid and current Airworthiness Certificate.
- The pilot had a valid and current licence.
- The aircraft's maintenance had been carried out in accordance with the scheduled maintenance.
- Inspections of the aircraft and the engine did not reveal any abnormalities in their working prior to the accident.
- The motor pump operator flew in the aircraft instead of remaining in the Siete Aguas base, as required by the Operator's Operational Circular 4-2000.
- The manoeuvres on coming out of water bombing first in Venta del Moro and later in Barxeta infringed the limitations contained in the Flight Manual.
- The toxicological examination revealed that the pilot had an ethyl alcohol level in the blood of 2.07 gr/l and the motor pump operator 1.13 gr/l.

#### **3.2. Causes**

The probable cause of the accident was the acrobatic manoeuvre carried out after water bombing a fire, which precipitated loss of control of the aircraft at an altitude that was insufficient to permit its recovery.

As a contributing factor, it must be taken into account the presence of alcohol in the pilot's blood, which probably led to adverse effects on his behaviour and reduced his physical faculties, increasing the risks of the operation that he was carrying out.

#### **4. SAFETY RECOMMENDATIONS**

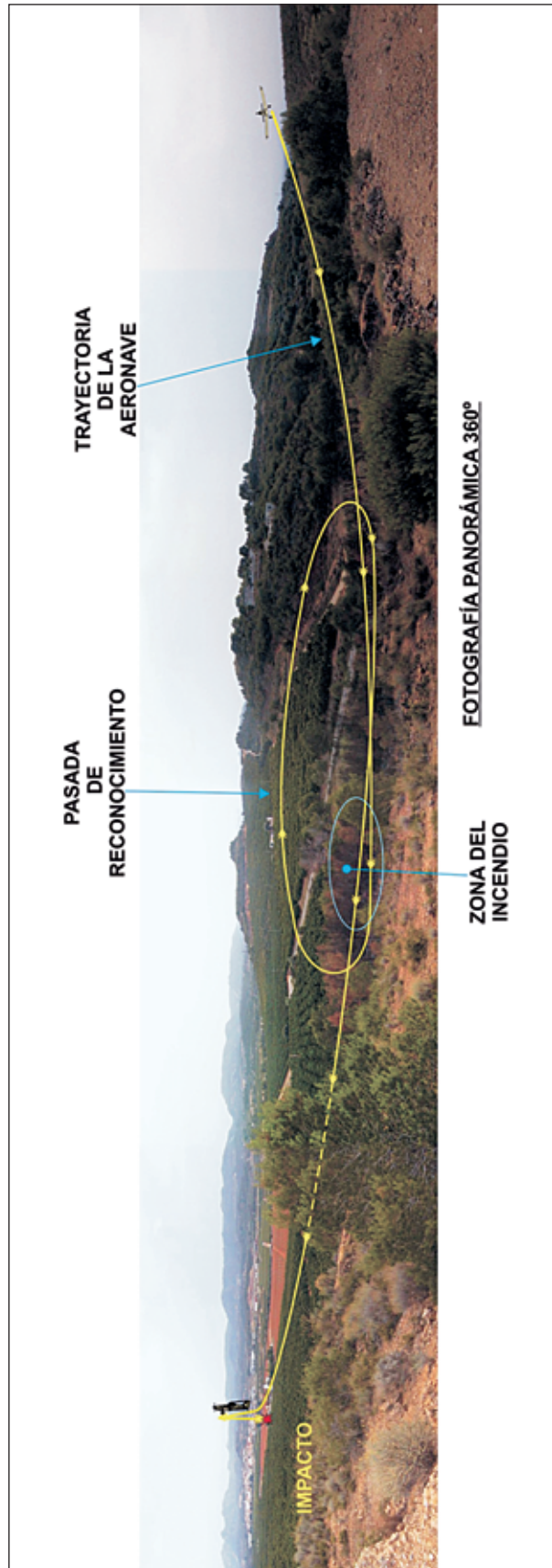
None.



# APPENDICES

# **APPENDIX A**

## **Trajectory followed by the aircraft**



## **APPENDIX B**

### **Photographs**



Photo 1. *Aircraft involved in the accident*



Photo 2. *Motor pump operator's seat*



Photo 3. *Rudder and elevator broken off*

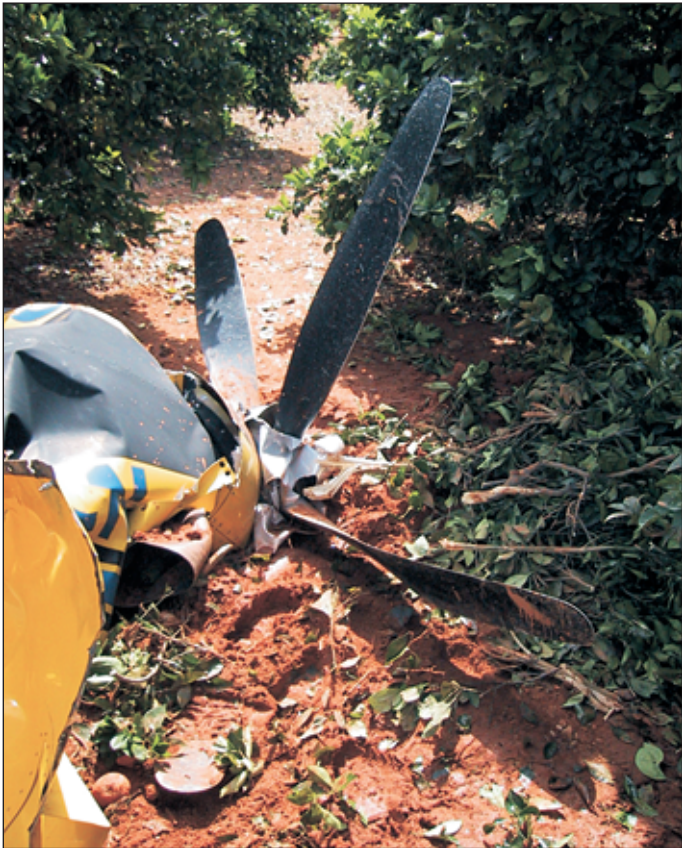


Photo 4. *Detail of the propeller*

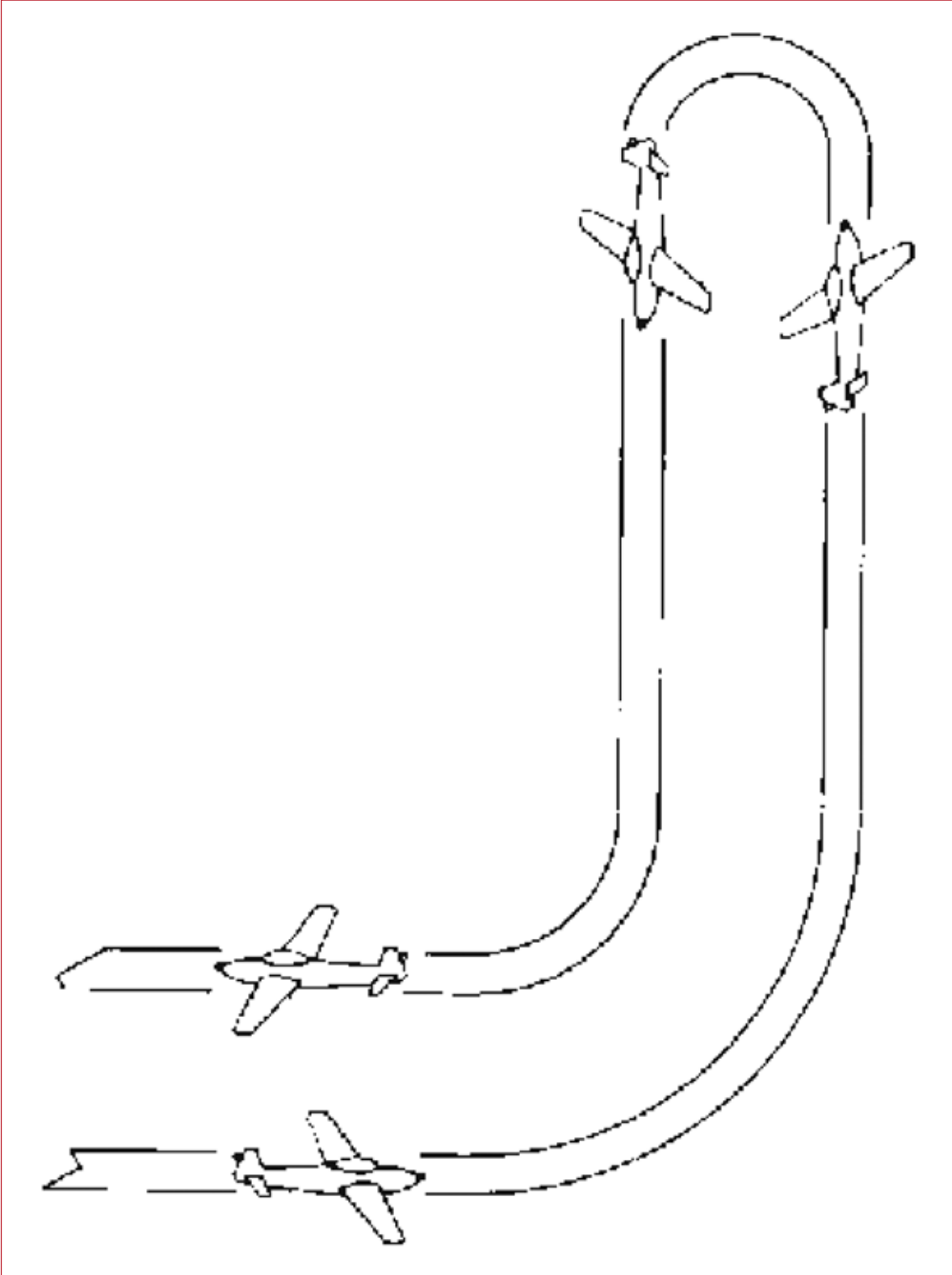


Photo 5. *Front part of aircraft (hopper)*

## **APPENDIX C**

### **Hammer head manoeuvre**





*Hammer head manoeuvre*