



Federale Overheidsdienst Mobiliteit en Vervoer
Service public fédéral Mobilité et Transports
Luchtvaart-Transport aérien

Air Accident Investigation Unit

-

CCN

Rue du Progrès 80 Bte 5
1030 Brussels

**FINAL REPORT ON THE ACCIDENT
OCCURRED ON 12/08/2006
AT KEIHEUVEL
ON A FOKKER S-11 REGISTERED
PH-HTC**

Ref. AAIU-2006-01
Issue date: 18 October 2007
Status: Final

Table of Content.

Foreword.....3

Synopsis.....4

1. Factual information.....5

1.1. Chronology of the events.....5

1.2. Injuries to persons.....10

1.3. Damage to aircraft.....10

1.4. Other damage.....10

1.5. Personnel information.....11

1.6. Aircraft information.....12

1.7. Meteorological information.....13

1.8. Aids to Navigation.....13

1.9. Communication.....13

1.10. Airfield information.....14

1.11. Flight Recorder.....14

1.12. Wreckage and Impact information.....14

1.13. Medical and Pathological information.....16

1.14. Fire.....16

1.15. Survival Aspects.....16

1.16. Test and Research.....16

2. Analysis.....23

3. Conclusions.....24

4. Safety recommendations.....25

FOREWORD

This report is a technical document that reflects the views of the investigation team on the circumstances that led to the accident,

In accordance with Annex 13 of the Convention on International Civil Aviation, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the determination of the causes, and define recommendations in order to prevent future accidents and incidents.

Unless otherwise indicated, recommendations in this report are addressed to the Regulatory Authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those Authorities to decide what action is taken.

Synopsis.

Date and hour of the accident.

Saturday, 12 August 2006, around 14.30 UTC (*) (16.30 Local)

Aircraft

Type: Fokker S-11

Registration: PH-HTC

Accident location

On the Keiheuvel airfield (EBKH).

Aircraft Owner.

DELLEVOET J.W.F.M.

Type of flight

Demonstration/ aerobatics

Persons on board

1 pilot

Abstract.

The aeroclub Keiheuvel organized a Fly-In exhibition, for its 50 years of existence.

Amongst the participants was a Fokker S-11.

The pilot flew aerobatics with its aircraft, and, at the conclusion of the exhibition, came in at low speed above the airfield, with the purpose of greeting the crowd.

This presentation was done at a very low altitude, estimated to be 30m above ground, with aircraft slipping; with rudder fully deflected left.

The pilot had opened the canopy, and waved the crowd. The engine was rotating at low revs, When the pilot wanted to increase the engine power, the engine choked.

The aircraft was turning to the left, stalled, and came into an incipient spin. The aircraft bore into the ground with nose first.

The pilot sustained heavy injuries, and died the day after arrival at the hospital.

(*) For the purpose of this report, time will be indicated in UTC, unless otherwise specified.

1. Factual information.

1.1 Chronology of the events.

The airplane came from Eindhoven airport (EBEH), and landed on Keiheuvel airfield on 12 August 2006 at 13:15.

The pilot took off with his airplane for a demonstration flight, at 14.25, from runway 25.

The aerobatics included;

- Looping
- Stall turn
- Barrell Roll
- Wing Over
- Reverse half Cuban Eight
- ¼ Clover Leaf
- Russian Break
- Aileron Roll
- 360° Competition Turn

The figures were performed south of the runway.

The presentation intended to end with a slow pass, followed by a 180 degree turn, before landing.

Around 14.35, the airplane came in low, slipping; with rudder deflected left, nose of the aircraft to the left. The pilot had opened the canopy and was waving to the crowd. The altitude was estimated around 30 to 40 meters.

When the pilot wanted to increase the engine power, the engine choked, as reported by witnesses (including the presentator). During these attempts, the aircraft banked to the left, stalled, and the aircraft came into a spin to the left.

The aircraft bore into the ground, nose first.

The first persons who came to the rescue of the pilot were crew members of a B.Def A109 helicopter, shortly followed by the fire brigade and medics. The pilot was stuck behind the engine.

The pilot was brought to the intensive care AZ St Dimpna Hospital in Geel, where he died from his wounds on 13 August 2006.



Aircraft presentation



Pilot is waving



Aircraft slipping



Right wing low



Correction with rudder



Banking turn

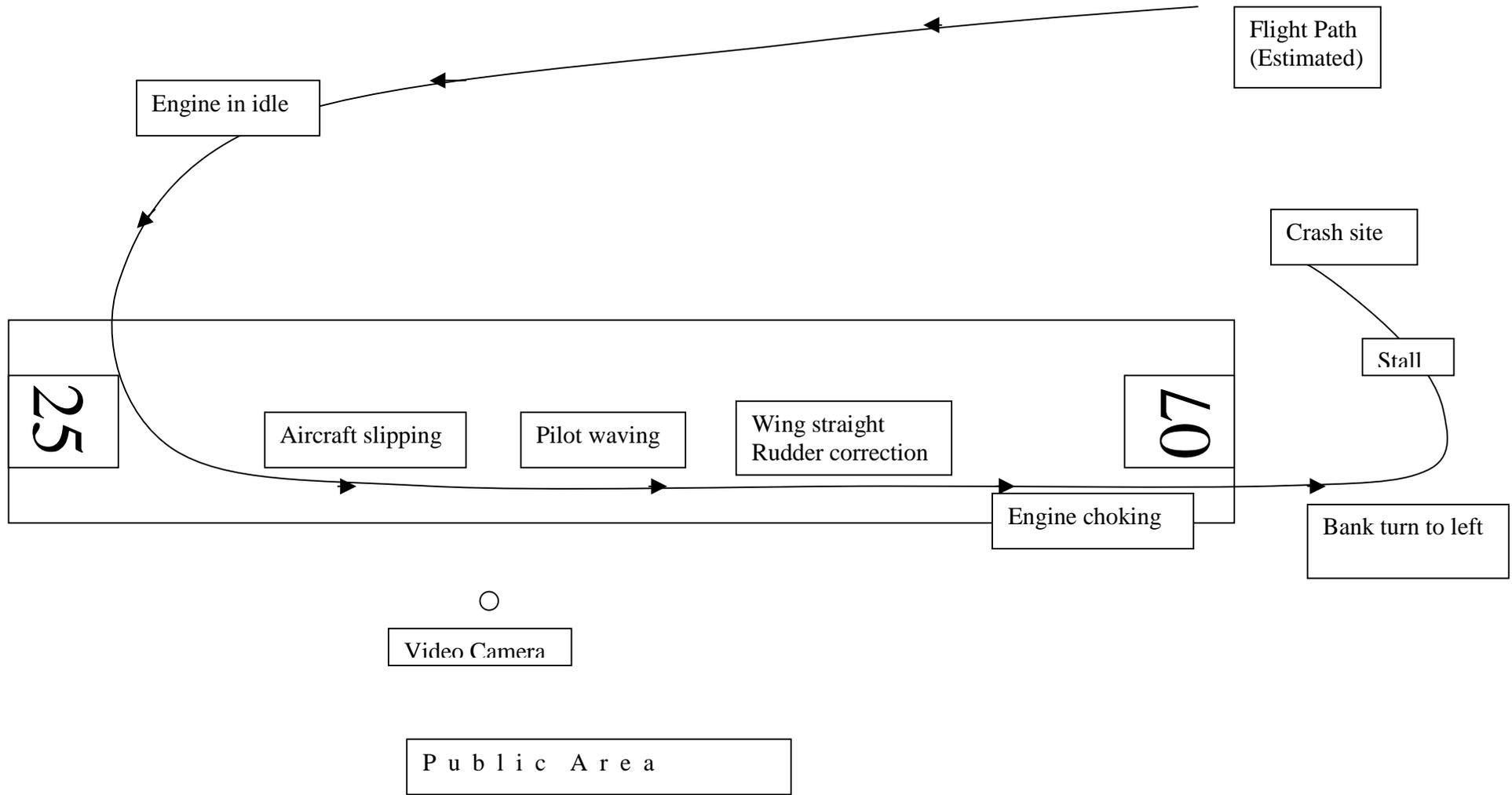


Incipient Spin



Crash





1.2 Injuries to persons.

Injuries	Crew	Passengers	Others	Total
Fatal	1	0	0	1
Serious	0	0	0	0
Minor	0	0	0	0
Total	1	0	0	1

The pilot was national to the Netherlands.

1.3. Damage to the Aircraft

The aircraft was destroyed by impact forces.



1.4. Other damages

No other damages.

1.5. Personnel Information.

Sex: Male

Age: 41 years-old

Nationality: Dutch

Licence: ATPL (A) issued 25 February 2000, converted to a JAA licence on 27 September 2005; validity unlimited.

CPL (A) issued 23 July 1993, validity unlimited.

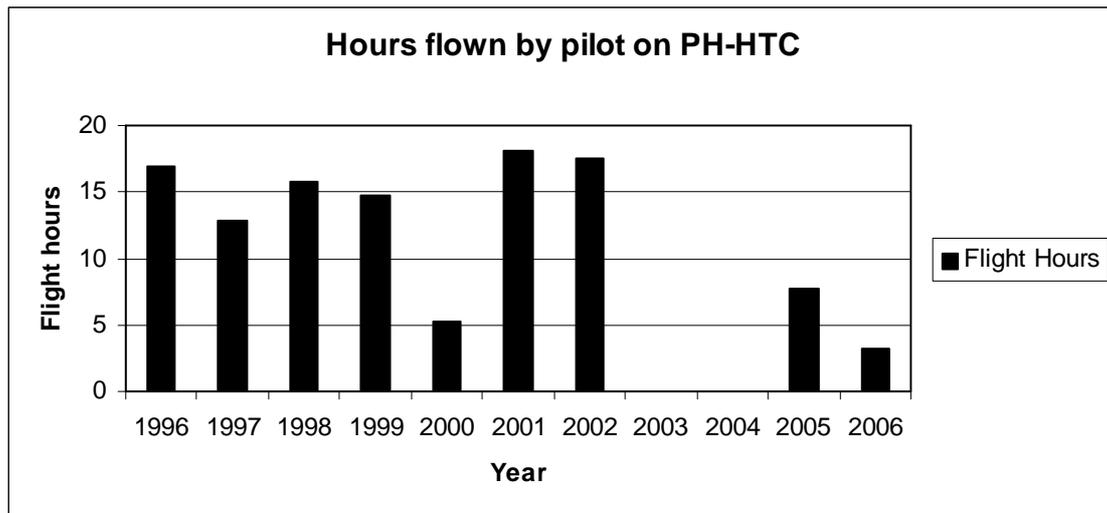
Qualifications: B737-300 / 900 (Pilot-in-command, VFR/IFR), issued 16 December 2005, expiring 1 July 2007.

SEP (land) (PIC, -), issued 17 June 1992, expiring 1 July 2007.

IR-ME (A), issued 8 January 1993, expiring 1 July 2007.

RT, issued 2 April 1992, validity unlimited.

The pilot had a total of 112,25 FH experience on PH-HTC, amongst which 3,25 in 2006.



1.6. Aircraft Information.

The Fokker S-11 Instructor is a low wing, metallic, single engine, two seater propeller aircraft with fixed undercarriage. The aircraft was designed by the former Dutch aircraft manufacturer Fokker . It was designed as a primary trainer aircraft. This aircraft was first used by the Dutch Air Force, and registered E-18.

This aircraft certification (TCDS N°F.1, issued by RLD, The Netherlands) is based upon the Netherlands Airworthiness Requirements 1940, Category IIIa, class h and semi-acrobatic flight, class i.

The aircraft is approved for operation as a normal category aircraft, and the following acrobatic maneuvers are permitted:

- Looping
- Slow Roll
- Spin
- Roll of the top
- Inverted flight
- Stall

Flights under icing condition are prohibited.

1.6.1. Airframe

Manufacturer: Koninklijke Nederlandse Vliegtuigen Fokker
Type: S-11.1 Instructor
Serial Number: 6209
Built year: 1953
Registration: PH-HTC
Certificate of Registration: N°3351, first issue 1 June 1984.
Certificate of Airworthiness: N°54934, valid until 12 February 2007.
Total Flight Hours: 3538:15 FH
Time Since Overhaul: 1120:10 FH

1.6.2. Engine

Manufacturer: Lycoming
Type: O-435-A
Serial Number: 399-17A
Total Flight Hours: 2224:50 FH
Time Since Overhaul: 1147:37 FH

1.6.3. Propeller

Manufacturer: Hoffman
Type: Wooden composite HO. 51-214-126
Serial Number: 78851
Total Flight Hours: 156:10 FH.

1.7. Meteorological information

Metar reports from Brussels (EBBR) and Antwerp (EBAW) at 14.20Z

Antwerp.

Wind direction: 310°
Wind speed: 7 kts
Visibility: unlimited
Banks of clouds at 3500ft
Temperature: 18°C
Wet Bulb Temperature: 11°C
Atmospheric pressure: 1007 mb

Temporary changes
Visibility: 3000m
Rain showers, Thunderstorm.
Bank of clouds at 1500ft – Cumulonimbus.

Brussels.

Wind direction: 360° with variations between 310° and 40°
Wind speed: 5 kts
Visibility: unlimited
Banks of clouds at 3100ft
Temperature: 17°C
Wet Bulb Temperature: 10°C
Atmospheric pressure: 1007 mb

Temporary changes
Visibility: 4000m
Rain showers
Scattered clouds at 2500ft – Cumulonimbus.

The meteorological conditions did not influence the accident.

1.8. Aids to Navigation

Not applicable.

1.9. Communication

Not applicable

1.10. Airfield Information

Location Indicator and Name: EBKH – BALEN/ Keiheuvel

Coordinates:	51°10'42"N - 005°13'15"E
Elevation (m/ft):	40 / 131
QFU:	067° / 247°
Dimensions (m):	690 x 18
Slope :	none
Surface :	Grass
Strenght:	5700 kg
OPR:	Aeroclub Keiheuvel Lichtvliegwezenlaan, 8 B - 2490 Balen
OPR HR:	HJ
AFIS:	"Balen Radio" - 119.200 MHz (motorized ACFT) / 123.500 MHz (GLD) - INFO only, no ATC

Remarks:

- AD prohibited for DPM.
- AD prohibited for ULM not equipped with four-stroke engine.
- The use of the AD is subject to prior permission from the operator.
- Mixed activity (airplanes and gliders)
- Due to glider activity, winch and air-tow until 2 000 ft AGL.
- Customs: PN 2 HR

1.11. Flight Recorders.

Not applicable.

1.12. Wreckage and Impact information

The wreckage lies at 215 m from the front end of Runway 07, and 50 m south of the runway axis. The nose of the aircraft is pointing NNE. The airplane crashed vertically on the engine, and then fell backwards.

The propeller broke on impact, and the two blades, severed at the hub, were found separated by a distance of ca 10 meters, indicating that the engine was not delivering high power upon impact.

The pilot was sitting on the left seat, but due to the force of the impact, was found between the 2 seats.



Position of the control levers:

Left Console:

Throttle control lever: Forward (full throttle)
Mixture control lever: Forward (lean)

Central Pedestal (severely damaged)

Throttle control lever: Mid position
Carburetor heater: Cold
Fuel Hand Pump: (torn) Mid Position.
Trim: Neutral.

Flaps Control Lever: Full extension

Fuel left on board.

There was 90 liters of Fuel left on the aircraft.

1.13. Medical and pathological information

The pilot suffered from injuries consequent to the impact of the aircraft with the ground.

1.14. Fire.

There was no fire.

1.15. Survival aspects.

The safety teams were immediately present to rescue the pilot, but owing to the impact, chances to survive to this accident were slim.

1.16. Test and Research

1.16.1 Aircraft Design; engine controls.

The engine throttle control lever is duplicated. One is located left in the cockpit and the other on the central pedestal. The mixture control lever, however, is not duplicated, and is located on the left, together with the throttle control lever.

This location is in contradiction with CS 23.777 and 14 CFR 23.777

(c) Powerplant controls must be located—

(2) For single and tandem seated single-engine airplanes, on the left side console or instrument panel;

(3) For other single-engine airplanes at or near the center of the cockpit, on the pedestal, instrument panel, or overhead; and

(4) For airplanes, with side-by-side pilot seats and with two sets of powerplant controls, on left and right consoles.

The movement of the mixture control lever is uncommon, as the “lean” position is forward. This is in contradiction with CS 23.779.

CS 23.779 Motion and effect of cockpit controls.

1) <i>Powerplant controls:</i>	
Power (thrust) lever	Forward to increase forward thrust and rearward to increase rearward thrust.
Propellers	Forward to increase rpm.
Mixture	Forward or upward for rich.

→ Forward



Idle, mixture rich

→ Forward



Full throttle, mixture rich

The type certificate of the Fokker S-11 (reference F-1) was issued by the Department of Civil Aviation of the Netherlands on 24-9-1952 is based upon the compliance with the Netherlands Airworthiness Requirements 1940, Category IIIa, class h and semi-acrobatic flight, class i.

The throttle control lever and the mixture control lever were both found forward in the wreckage of PH-HTC.



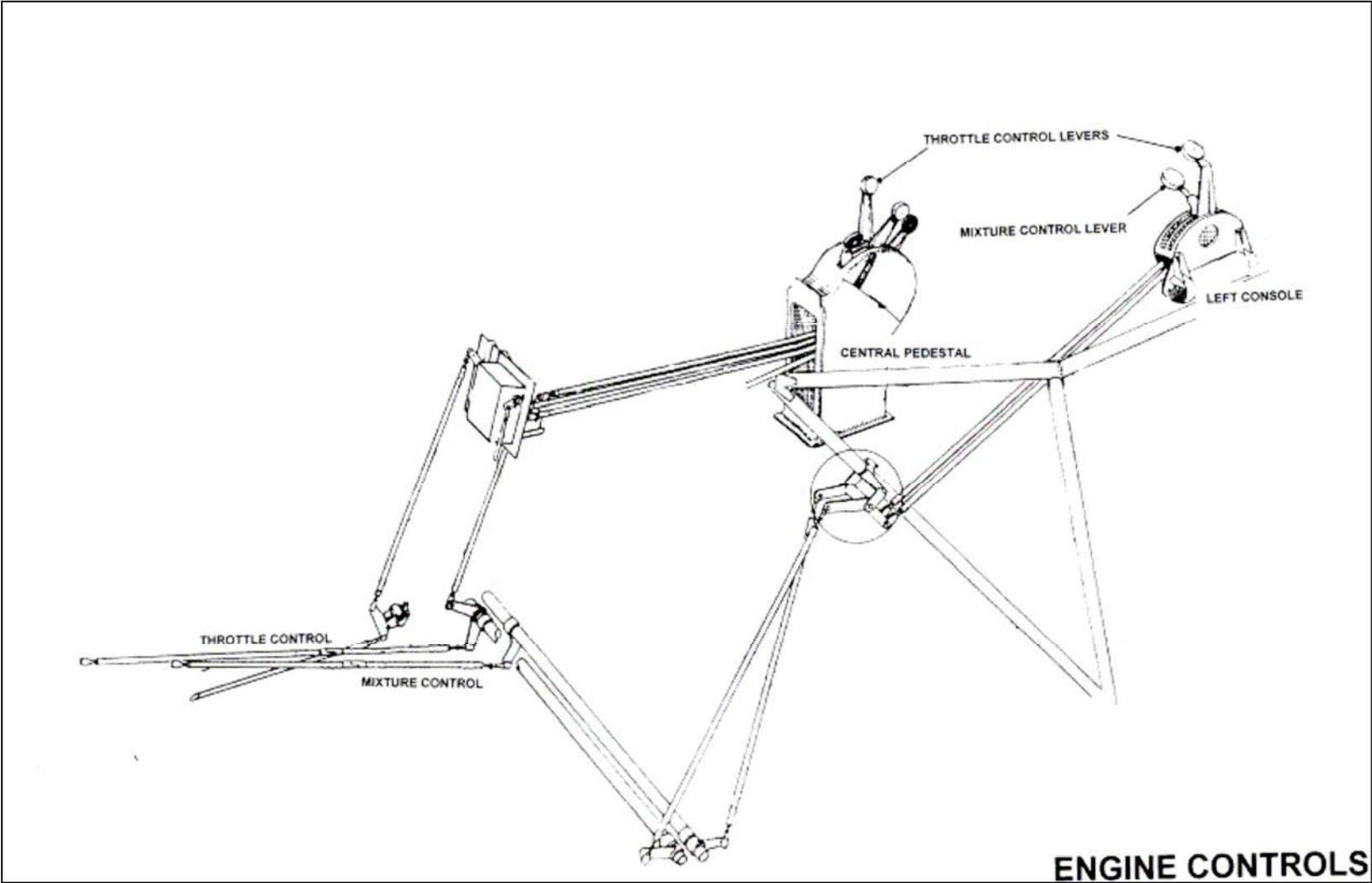
Position of the control unit, as found in the wreckage.

The Fuel mixture valve inside the carburettor was found 2/3 open. There was no other anomalies found in the carburettor. The spark plugs showed a “chocolate” brown colour, signs that the mixture air/fuel was correct.

The fact that the Control lever was found in a forward position doesn't give an absolute certainty that it reflects the actual position of the lever, as set by the pilot.

The connection between the control lever in the cockpit and the command lever on the engine is made through rigid rods. The control rods, attached to the control lever, showed evidences of buckling; thus compression, that would – normally- push the control lever to the 'rich' position.

However, the impact of the aircraft with the ground caused initially a crushing of the structure and this movement of the engine (towards the rear) may have resulted in a forward movement of the mixture control lever.



1.16.2. Maintenance.

The Maintenance Program of PH-HTC is based upon the Fokker recommendations, and is as follows:

- Daily Check (before flight);
- 50 Hours-inspection (50FH);
- 100 Hours-inspection (100FH);

In addition, some components are subjected to specific maintenance intervals:

- Magneto's: 500 FH – inspection of the breakers contact points;
- Exhaust Valve Guides – 400 FH – Inspection on play.

Further, the engine has a 'on-condition' program, based on the following inspection:

- Inspection of cylinders for leaks (50FH);
- Oil servicing (50FH).
- Inspection on exhaust valve guide per EASA AD 2005-0023.

The aircraft was maintained in accordance with this maintenance programme;

- 100-Hours (and 50-Hours) inspection performed on 6-2-2006, by a licensed mechanic (NL-7672) at 3517FH (aircraft), and 2204FH (engine).
- The previous 100-Hours inspection was performed on 28-1-2005, by a licensed mechanic (NL-7672), at 3417FH (aircraft), and 2157FH (engine).

An annual inspection for the renewal of the CofA (BvL-V inspection) was performed on 8-2-2006 by an approved Maintenance Organisation (NL.145.1155). This report stated the inspection was satisfactory, and a recommendation was issued to extend the validity of the CofA for another year.

Engine.

The engine was tested at the KUL University.

The findings are:

- The engine rotated freely, it was not blocked.
- The fuel pump worked correctly.
- Spark Plugs were tested satisfactorily, and shows no abnormal signs;
- Ignition cables were tested, and found ok;
- Fan air rotated freely,

Magneto's

The magneto's were inspected after the accident and the following findings were made:

- Carbon deposit found on the contacts;
- Both magneto's give ignition on the 3 contacts;
- One magneto shows a loss of insulation.

The maintenance data on the magneto's show;

- RH magneto;
 - Make: Bendix
 - Part Number: 10-22580-3
 - Serial Number: 173656 A
 - Last test performed: 19-4-1989; installed at 3066FH (aircraft), next due 3566FH.
 - Next due for Overhaul; 3566 FH (aircraft)

- LH magneto;
 - Part Number: 10-22580-3
 - Serial Number: 180304
 - Last test performed: 19-4-1989; installed at 3066FH (aircraft), next due 3566FH.
 - Next due for Overhaul; 3566 FH (aircraft)

The Bendix magneto's are subjected to 2 Airworthiness Directives;
BLA 1994-039, complied with on 8/11/1997.
BLA 1994-053, complied with on 8/11/1997.

The routine maintenance program covers the following items;

Nr	Description	50-Hours	100-Hours
16	Inspect cooling ducts of generator and magneto's for deformation and damage	x	x
23	Inspect the greasing points of the breaker mechanism		x
24	Adjust the magneto (timing and break point)		x

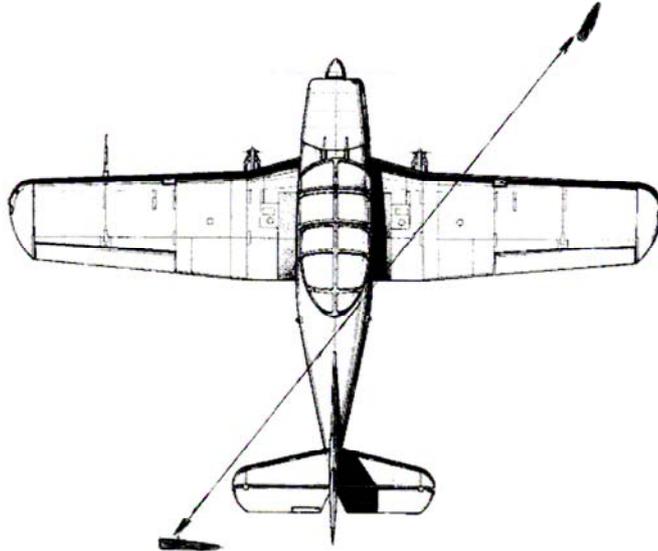
Note: In Belgium, Commercial aviation, the magneto's are on a 500FH, 4-years (wof) overhaul program.

Engine Controls.

The mixture lever showed some play, and was adjusted on 6/2/2004.

1.16.3. Propeller

The propeller broke upon impact, and were severed at the hub. The two blades were found at 10 m distance, more or less symmetrically from the impact point.



2. Analysis.

No elements were found that would positively confirm the origin of the loss of power of the engine.

After the pilot experienced the engine trouble, he pilot leveled his aircraft, by giving a short input on the rudder, and engaged in a bank turn to the left. We assume that the intention of the pilot was to steer 180°, and land the aircraft on Runway 07. This decision caused the stall of the aircraft, with the incipient spin as a consequence.

To support the interpretation of the pilot's intention, we found on the ground, after the crash, the flap control lever in the full extend position, and the flaps extended; the extension of the flaps is not visible on the video of the crash, but it could have happened during the last turn. However, It could also be a consequence of the crash itself.

Mixture Lever Theory

The only indication that would explain an engine trouble would be the mixture control lever, that was found in forward position, i.e. in 'lean'. Should this position be the position as set by the pilot, then the following could have possibly occur;

The engine was at idle power, when the aircraft came in for a low pass, and either as a result of an engine problem of an unknown origin, or just resulting from the will of the pilot to increase power, in order to go into his intended landing pattern, the pilot would push both levers (throttle and mixture) forward, resulting in choking the engine, what was heard from the crowd, and confirmed by 3 out of the 4 witnesses.

To support this, we must also consider that the pilot, since 2003, had only a limited experience on this type of aircraft; the majority of his flight hours experience on that aircraft were gained prior to that year. In the mean time, the pilot got a qualification on B737. The forward movement towards the 'lean' mixture of the mixture control lever is not common; all current aircraft, this movement complies with FARs and JAR/CS-23; and show a reverse movement. In addition, there is no locking device that would prevent the traveling of the mixture control lever to the forward position; the only safety device is a friction braking device that would notify the pilot that he's moving the 2 levers together. A test was performed on 2 other Fokker S11 aircraft, and showed that the friction braking system is not efficient.

3. Conclusions.

Known facts

The pilot had a valid License.

The aircraft had a valid Certificate of Airworthiness.

The pilot decided to perform aerobatics, including a low pass at low speed, at an altitude of 30-40m, well below the normal heights.

The airfield is bordered by trees, and the surrounding of the airfield would have made the decision of a crash landing a difficult one.

The pilot had no recent experience with the aircraft.

The engine controls (mixture control lever) have an uncommon feature.

Causes of the accident.

During a bank turn, performed at low speed and low altitude, the aircraft stalled, entered in an incipient spin, and crashed to the ground.

4. **Recommendations.**

1. To BCAA:

Stall/spin at low altitude accidents tend to be more deadly than other types of accidents occurring in General Aviation. In the last 10 years in Belgium, 30 percent of the mortal accidents in fixed-wing, general aviation-type of aircraft were due to stall / spin at low altitude.

Common cases encountered ranged from freshly certified pilots wanting to show relatives their piloting skills, to experienced pilot wanting to land their airplane having experienced an engine failure shortly after take-off.

A sensibilization campaign by BCAA towards pilots is recommended, in order to identify the dangers of stall / spin at low altitude.

The means could be the issue of a safety article to be put on the internet site of BCAA, a folder to be distributed to all pilots, and finally a request to all instructors to include that topic in the courses.

2. To IVW,

Considering this aircraft is included in the EASA list of exclusions, the Authority of Certification for this aircraft is IVW, The Netherlands.

The Fokker S11 was designed in accordance with certification specifications prior to EASA CS-25. One of the controls (Mixture Control lever) has a reverse movement with respect to the condition defined in CS23-779.

For this aircraft in particular, and any other vintage aircraft operated without restrictions in General Aviation having a similar characteristics on one or more essential Cockpit Control, we recommend to evaluate the possibility to introduce a modification to such aircraft as to either:

- Have their movement made conform to CS23-779, or
- Introduce a locking mechanism that would prevent the inadvertent movement of the controls, when adequate for the type of controls, or
- Have a warning placard placed in the cockpit.

3. To BCAA

To introduce a calendar time limit for the maintenance of magneto's also for Private Aviation. This in order to avoid magneto's to remain installed for a very long period, especially for aircraft with a low utilization rate.

4. To BCAA.

The exhibition that took place in Keiheuvel was not declared as an airshow, and therefore no special request was made to BCAA. The event was defined as a "Fly-in", for which the Rules of Air Navigation do apply.

The performance of aerobatics during the Fly-in exhibition by this aircraft, (and possibly others), at altitude lower than 300m (the low pass, with aircraft slipping could be considered an aerobatic manoeuvre) without the required authorization of BCAA is in violation with the Rules of Air Navigation (KB/AR 15.09.1994).

We recommend that BCAA sensibilises aeroclubs and airfields to notify BCAA of the organization of all such events (Fly-in, or any special event), even though the original intend would fall outside the scope of an air show. This would enable BCAA to take preventive measures, such as a briefing with the managers of the event, the air traffic controller, and possibly the pilots, in order to remind them about the basics of the Rule, in addition to attending the event and checking the respect of the Rules.