



COPY

MINISTÉRIO DA ECONOMIA E DO EMPREGO
GABINETE DE PREVENÇÃO E INVESTIGAÇÃO DE ACIDENTES COM AERONAVES

FINAL ACCIDENT REPORT

PRIVATE
CESSNA 182P

D-ENEW

“Cortes de Cima” Farm
Vidigueira

16th of October, 2010

GPIAA

**Homologo, nos termos do nº 3
do artº 26º do D. L. 318/99,
de 11 de Agosto de 1999**

24.AGO.2011

O Director,

Fernando Ferreira dos Reis

FINAL ACCIDENT REPORT Nr. 15/ACCID/2010

NOTE

The only aim of this technical report is to collect lessons which may help to prevent future accidents.

Safety investigation is a technical process aiming to accident's prevention and comprises the gathering and analysis of evidences, in order to determine the causes and, when appropriate, to issue safety recommendations

In accordance with Annex 13 to the International Civil Aviation Organisation Convention, Chicago 1944, EU Regulation Nr. 996/2010, from European Parliament and Council, 20th OCT 2010 and article 11th n° 3 of Decree-Law n° 318/99, 11th AUG 1999, the sole purpose of this investigation is to prevent aviation accidents. It is not the purpose of any such investigation process and the associated investigation report to apportion blame or liability.

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SYNOPSIS

On the 16th of October 2010, in the afternoon, the owner of Cessna 182P aircraft, with German registration D-ENEW, decided to perform an observation flight over his farm of “Cortes de Cima”, Vidigueira, where he built a runway and a hangar to operate and store the aircraft.

By 16:35 UTC¹ he took off on a North-westerly direction and made a 450° right turn, overflying residential zone at low altitude, preparing to start a photographic recording session of the farmland.

By then, engine started losing power and stopped, with propeller becoming stuck, unable to turn. While the pilot tried to restart the engine, looking inside, the aircraft collided with a tree and crashed on the ground.

The aircraft was destroyed but the pilot managed to leave the cockpit by himself, with some scratches on his face and serious injuries on his spine, being taken to hospital.

GPIAA was informed, at 17:00, by ANPC² and GNR³. A team was sent to the site next morning, in order to start the investigation.

***This report has been released in Portuguese and English Languages.
In case of conflict, Portuguese version will take precedence.***

¹ - All timings referred in this report, unless stated differently, are UTC (Universal Coordinated Time) timings. That day, local time in Portugal mainland was equal to UTC+1 hour.

² - Civil Defense National Authority.

³ - Republican National Guard.

1. FACTUAL INFORMATION

1.1 History of the Flight

The Cessna 182P, s/n 182-62589, German registration D-ENEW, aircraft used to be stationed at “Cortes de Cima” private farm, near Vidigueira, both being property of the same owner, who used to fly regularly the aircraft around his farmland for patrol and monitoring of his crops.

On the 16th of October, 2010, the farmer decided to perform a local flight, for farmland observation and picture taking. At 16:30, after taking the aircraft out of the hangar and preparing it for the flight, engine was started and the aircraft took-off a few minutes later (16:34) on runway 31.



Picture Nr 1

After take-off, the pilot started a 450° right turn, keeping low altitude ($\leq 900'$ /275m), overflow part of its property and proceeded to Northeast, for starting picture taking (*picture nr 1*).

After passing overhead the artificial dam, belonging to his farm, he turned left, back to residential area, heading Southwest, keeping low altitude ($\approx 600'$ /185m).

By that moment, the pilot noticed the engine was losing power and soon it stopped completely, with the propeller becoming motionless.

Pilot checked fuel selector position and, as the propeller had stopped turning, tried to restart the engine with electric starter assistance. When performing these actions, the pilot looked inside the cockpit and lost situational awareness, didn't care for altitude keeping and outside

obstacles and the aircraft collided with a tree, crashing on the ground, afterwards (16:40), having flown for nine minutes only.

1.2 Injuries

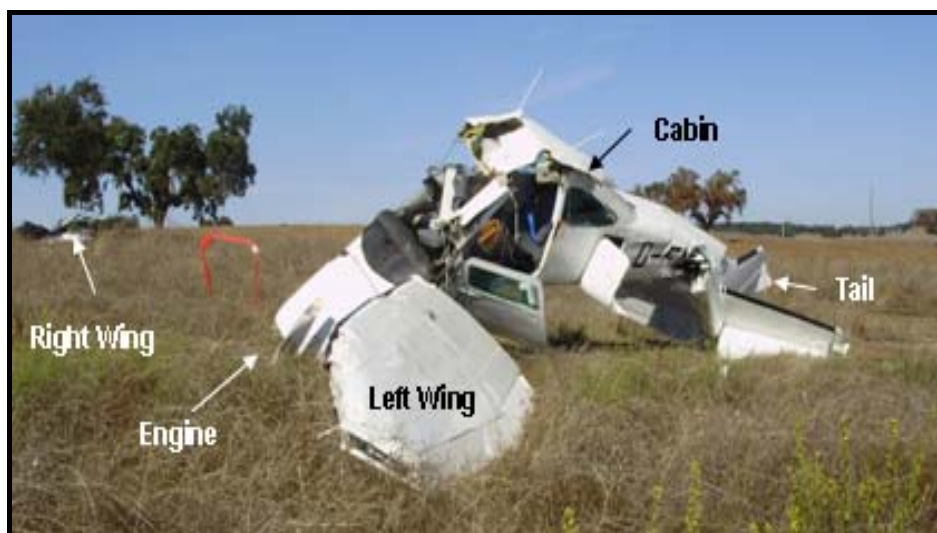
Even if he left the aircraft by himself, the pilot suffered light scratches on his face and serious injuries on his spinal column (*table nr 1*).

Injuries	Crew	Passengers	Others
Fatal:	0	0	0
Serious:	1	0	0
Minor/None:	0	0	0
Total:	1	0	0

Table Nr 1

1.3 Aircraft Damage

The aircraft suffered heavy damage (*picture nr 2*), with separation of both wings and big deformations of fuselage and tail, cabin roof destroyed, nose gear fracture with wheel detachment and bending & abrasions on engine cowlings and propeller blades. After removing engine upper cowlings it was found a hole on engine block and left magnet out of its seating. It was considered as a total loss.



Picture Nr 2

1.4 Other Damage

Third party damage was restricted to some pulled out branches from the tree where the aircraft right wing impacted.

1.5 Pilot

Male, Danish nationality, 70 years old, the pilot had the following flight qualifications and experience (*table nr 2*):

Flight License:	Type: Validity: Qualifications: Last Medical Examination: Restrictions / Limitations:	PPL(A) 07-07-2013 SEP; Radiotelephony 28-05-2010 VDL	
Flight Experience:		Total	On Type
Total:		3 466:00	210:00
Last 90 days:		30:00	30:00
Last 30 days:		N/D	N/D
Last week:		N/D	N/D
Last 24 hours:		00:10	00:10

Table Nr 2

1.6 Aircraft

1.6.1 General

Single engine, monoplane high wing, fixed tricycle landing gear, metallic construction, with capacity for four people and a Maximum Take-Off Mass (MTOM) of 1338kg, the aircraft Cessna 182P, s/n 182-62589, showing a German registration (D-ENEW), had an Airworthy Certificate (valid till 04-06-2011), issued by Germany Civil Aviation Authority (LBA) on 05-06-2010.



Picture Nr 3

Being registered in the name of present owner on the 31st of March, 2006, at accident date, the aircraft presented the following characteristics and flying hours (*table nr 3*):

Reference	Airframe	Engine	Propeller
Manufacturer:	Cessna Aircraft Company	Teledyne Continental	Mc Cauley
Model:	C-182P <i>Skylane</i>	O-470-R25B	2 ^a 34C203C/90DCA8
Serial Nr.:	182-62589	288285-R	373877
Year of Manufacture:	1974	N/D	N/D
Flight Time*:			
Since New:	2 280	1084	1084
Since Overhaul:	2 280	232	232
Last Inspection:	06-04-2010	17-03-2010	17-03-2010

* - Times provided by owner/pilot due timers to be unserviceable and no official document or Technical Logbook shown.

Table Nr 3

During its stay in Portugal, all programmed inspections, every 50, 100, 200 hours and annual, used to be performed by a certified Aircraft Maintenance and Repair Organization (AMRO), in accordance with EASA Part 145 requirements.

The last inspection was performed during March/April of 2010, with Certificate of Release to Service (picture nr 4) issued on the 06th of April, which supported Airworthiness Certificate revalidation.

On that inspection all manufacturer's and Aeronautical Authorities' recommended and effective "Service Bulletins" were incorporated, together with the correction and fixing of all reported defects or anomalies.

After maintenance works, a test flight was performed and, according with results, the aircraft was released to service, without restrictions or limitations.

CERTIFICADO DE APTIDÃO PARA O SERVIÇO
 AIRCRAFT CERTIFICATE OF RELEASE TO SERVICE AND MAINTENANCE STATEMENT

PT.145.010

Organização PART-145 PART-145 Organization Name Agroar - Trabalhos Aéreos, Lda	Código de Aprovação da Organização PART-145 PART-145 Organization Approval Reference PT.145.010	Processo de Manutenção Work Order N.º 21/010
Matrícula Registação MAN D-ENEW	Fabricante Modelo CESSNA	Modelo 182P
N.º do Série 182P-62589		
Trabalho Realizado: Alert Cancelled		
* 200 HRS/ANNUAL INSPECTION AS PER CESSNA MAINTENANCE MANUAL # 22006-3-13 DATES 15TH SEPT. 72, PLUS LAST TEMPORARY REVISION #4, DATED 15TH JAN 2008. * AD'S AS PER MAINTENANCE STATUS REPORT * FAR 91.411 - BALANCE TEST * FAR 91.211 - ENCLOSURE SYMMETRY TEST (EASA AD 2006-0265) * STATIC PRESSURE TEST		
Local onde a Inspeção foi efectuada: Location where check was accomplished EVOGA		
Total de Horas/Ciclos após Trabalho Efectuado: Total Time/Cycles after work completed		Horas: 2224:12
A Próxima Inspeção Programada a ser Efectuada ás: The next scheduled maintenance check is due at		
Horas de Célula: Time since new	Data: Date	Ciclos de Aeronave: Aircraft cycles
2294:12	06-04-2011	
De Componentes a substituir ou Inspeções Não Programadas antes da Próxima Inspeção Programada acima mencionada são: The following set of parts, inspections/operations, checks are due before the next scheduled maintenance check after this date		
* BOTH PILOT SIDE SEAT RAILS P/N: 0710658-2 WITH CRACKS. NEW PARTS ON ORDER. * PLUNGER ASSEMBLY - DRAWN P/N: 0756010-1 GETTING TOO WORN. NEW PART ON ORDER.		
Certificação que o Trabalho acima descrito, salvo abaixo descrito, foi efectuado de acordo com o preceituado na PART 145, pelo que a aeronave é dada como apta para o uso relativamente ao trabalho efectuado. Certification that the work specified above except as otherwise specified below was carried out in accordance with PART 145, and in respect of that work the aircraft is considered fit for service.		
Demarcações: Remarks:		
Assinatura: Signature [Signature]		
Nome por estender do Assinante: Print name of person signing [Signature]		Data: Date 06-04-2010
Código de Autorização da Assinatura: Aircraft person reference or person signing I		Estado: Status

AGR-MDO-22 MP 8, 11, 20, 23, 24 e 25

Picture Nr 4

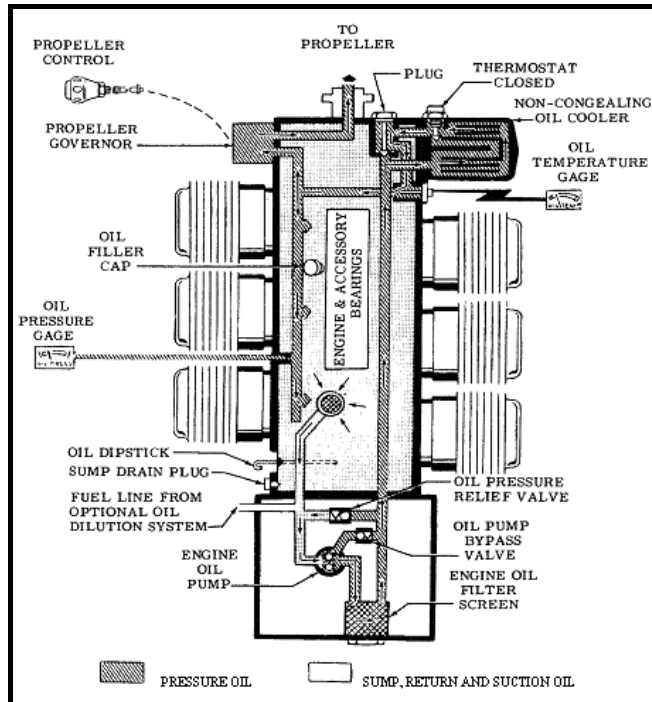
1.6.2 Engine

The engine installed on the aircraft was a Teledyne Continental engine, model O-470-R25B; a reciprocating four strokes engine, with six horizontally opposed cylinders, air refrigerated, carburettor fed, producing 230HP at 2600RPM at sea level standard conditions.

It was overhauled on January, 2006, accumulating, after that, 232 hours of work, being subjected to all programmed inspections. The last one (200h/annual) was on 17-03-2010.

1.6.3 Engine Lubrication System

Engine lubrication was performed by oil, under pressure, circulating through pipes and cavities, as illustrated bellow (picture nr 5):



Picture Nr 5

The oil, accumulated in lower engine part (sump) was sucked by the scavenge pump, which sent it under pressure to propeller governor and all engine & accessories bearings and pistons, through an oil filter and an oil cooler. Once its lubrication mission fulfilled, the oil returned to the sump, from where it was sucked again and sent to lubrication circuit.

Pressure and temperature control were performed by bypass & relief valves and a thermostat, with pressure and temperature values presented on instrument panel, in the cockpit.

Oil system normal capacity was 11litres (12quarts) and it should be changed every 100 hours, with oil filter change every 50 hours. As an annual inspection had been performed 56 hours before, engine oil was inside its timeframe, but oil filter should have been changed about six hours before the accident. In fact, on 12-10-2010, four days before the event, aircraft owner called maintenance organization and bought a new oil filter kit, which was installed on the aircraft by himself. Having no torque wrench available, the recommended torque was not applied to hollow stud, in oil filter assembly. After oil filter change no engine run-up was performed, to detect possible oil leaks.

1.7 Meteorology

That day, the weather was dry but the sky was partially clouded, with few clouds at 3000ft, the wind blowing weak, from Northeast, variable from 260° to 320°, speed 6kt (11km/h), the outside temperature around 21°C and QNH 1012hPa, as meteo reports from nearby Beja airport (LPBJ) showed:

METAR LPBJ 161600Z 29006KT 260V320 9999 FEW030 21/09 Q1012
METAR LPBJ 161700Z 33006KT 9999 FEW030 21/10 Q1012

1.8 Navigation Aids

Not applicable.

1.9 Communications

The aircraft didn't establish radio communication with any aeronautical station.

1.10 Accident Site

The accident took place on a farmland, with an average altitude of 500ft AMSL (150m), about 900m far from Cortes de Cima house compound (to Northeast), about 9km from Vidigueira, near national road N258 (*picture nr 6*). This land was undeveloped and was covered by grass and shrub. A medium intensity power line ran across the field, almost parallel with the road, and there were only a few, sparse and medium size cork trees as obstacles, making it a suitable place for an emergency land.



Picture Nr 6

As the pilot had not taken the decision to make an emergency landing, still trying to restart the engine, he disregarded the outside looking, lost his height awareness and collided with one of those few trees (*pointed by arrow*), present in the field.

1.11 Flight Recorders

The aircraft was not equipped with flight recorders, as they were not mandatory for that kind of aircraft and operation.

There was a satellite navigation equipment aboard, from which it was possible to recover some flight information and reconstruct horizontal and vertical track of the aircraft, as shown on picture nr 1.

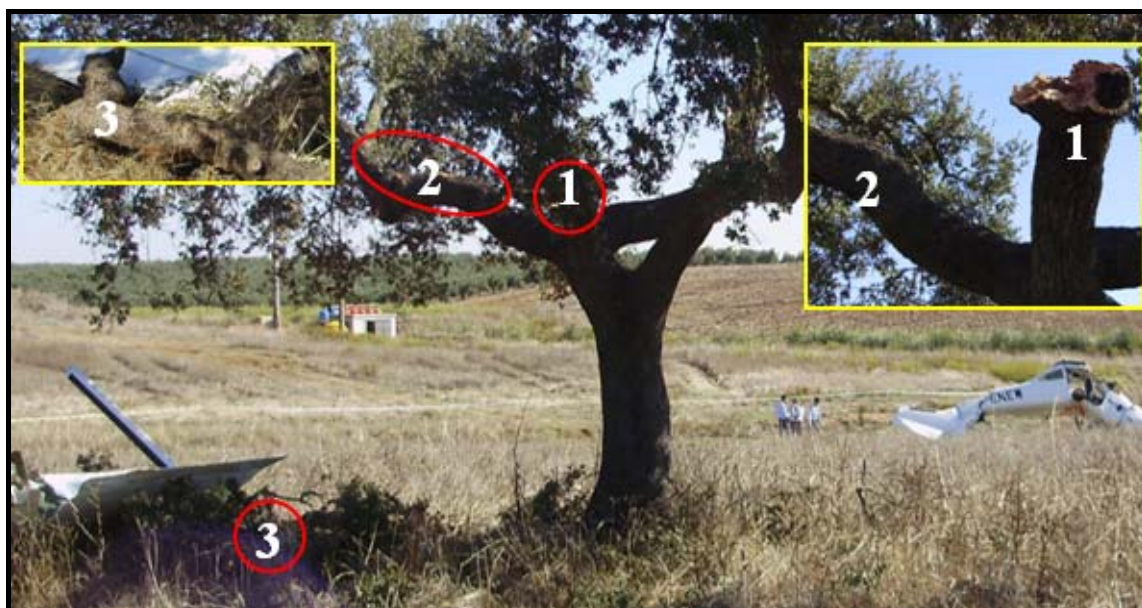
1.12 Wreckage & Impact

1.12.1 Impact

First impact occurred at a speed of 115km/h, when right wing collided with a cork tree branch (picture nr 7), being both (*wing & branch*) separated by their roots (1) and lying together on the ground (3), while the aircraft progressed over the tree (2) and impacted the ground a few metres ahead.

This ground first impact occurred at a speed of 52km/h, in a pronounced nose down attitude, causing the nose gear leg to break, propeller blades to bend and the fuselage and tail to crease and buckle, destroying cabin roof and windscreen, with left wing separating.

This distortion was increased with subsequent impacts along the track, with parts separating until final stop, approximately 15m away from the tree.



Picture Nr 7

The trail, along the light slope, confirmed there was not a continuous sliding movement but a jumping progress with the consequences of greater damage to the aircraft.

1.12.2 Structures

The cracks found on aircraft structures (Picture nr 8) were well elucidative of impact violence. Within five seconds the aircraft had its speed reduced from 115km/h to 0.2km/h, with right wing (A) being the first to collide and absorbing the utmost energy, the aircraft still flying. The

ground impact occurred at 52km/h, enough to cause fuselage break by cabin top and wind-screen, bending by main gear station line (C), with rear fuselage tearing and folding and tail suffering heavy damage (E, F).



Picture Nr 8

Left wing (B) became separated from fuselage but remained connected by flight control cables, being the wing tip the most damaged part, due ground contact.

Nose gear leg strut broke below torque link assembly (D), when it impacted the ground with an angle presumably greater than 45°.

Propeller blades (D) were bent backwards, signalling the engine was not running or producing power, the moment of impact.

1.12.3 Cockpit

Inside the cockpit it could be seen all circuit breakers pushed "IN" and essential exterior lights switched "ON" (picture 9).



Picture Nr 9

Engine controls (*picture nr 10A*) were positioned for a restart attempt, with carburettor heat (*A-1*) selected “COLD”, throttle (*A-2*) to “IDLE”, propeller pitch control (*A-3*) selected “FINE PITCH”, mixture control (*A-4*) positioned to “RICH” and magnet switches (*picture 10B-2*) set to “BOTH” (*default position for the key to revert when released from “START” spring loaded position*). Alternator and Battery switches were selected “ON” (*picture 10B-1*).



Picture Nr 10

Fuel selector (*picture nr 10C*) was positioned for right tank as fuel feeding source.

Wing flaps were selected “UP” (*picture nr 10D*) and flight control surfaces’ trims were out of neutral, with elevator trim 1/4 below “Take-Off” mark (*nose up*) and ruder trim set 1/3 to the right (*picture 10A-5*).

1.13 Medical or Pathological

The pilot, due impact forces, suffered some light scratches on his face and heavy injuries on his spinal column, which forced him to a long hospital and domiciliary care.

1.14 Fire

Even if there was a fuel tank rupture, with fuel leakage, there was no fire in the aircraft or its surroundings.

1.15 Survival Aspects

The use of seat belts and the quick response of emergency services, called by police force and present in the scene in a few minutes, were responsible for a timely care and to minimize the consequences.

1.16 Tests & Research

During evidence collecting, in site, it was noticed that right hand side lower engine cowlings and adjacent fuselage showed large dirty oil stains (*picture nr 11*).



Picture Nr 11

Checking under the wreckage and along the impact trail no oil marks were seen.

A decision was taken in order to inspect carefully the engine, as soon as the wreckage was removed from the field to an appropriate storage place, in this case to owner's hangar.

Afterwards, the investigator's attention was called for a large pool of oil (*picture nr 12*) in front of the hangar for aircraft storage, the place where the aircraft engine has been started, inside farm housing complex, a few metres to runway threshold.



Picture Nr 12

The oil stain extension denounced there has been a total leak of engine oil, apparently in pressure line, immediately after engine start, which reinforced the need to proceed with a thorough inspection of the engine, paying particular attention to engine oil system, in order to find the origin of such oil leak.

With the wreckage moved into the hangar, at owner premises, it was called on a maintenance technician, from a certified maintenance provider, to help with engine dismounting and research for leaking source.

When trying to rotate the engine, through the propeller, it was notice that it was impossible to move it manually, denouncing there was a mechanical failure.

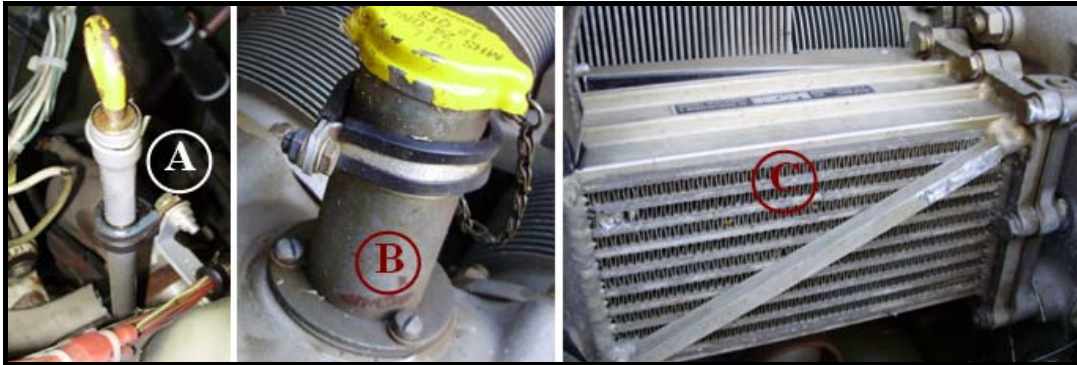
During initial inspection, as engine cowls were removed, it was found a big dirty oil concentration on the right side of the engine, especially on engine cowl flap inner side and fire-wall area (picture nr 13).



Picture Nr 13

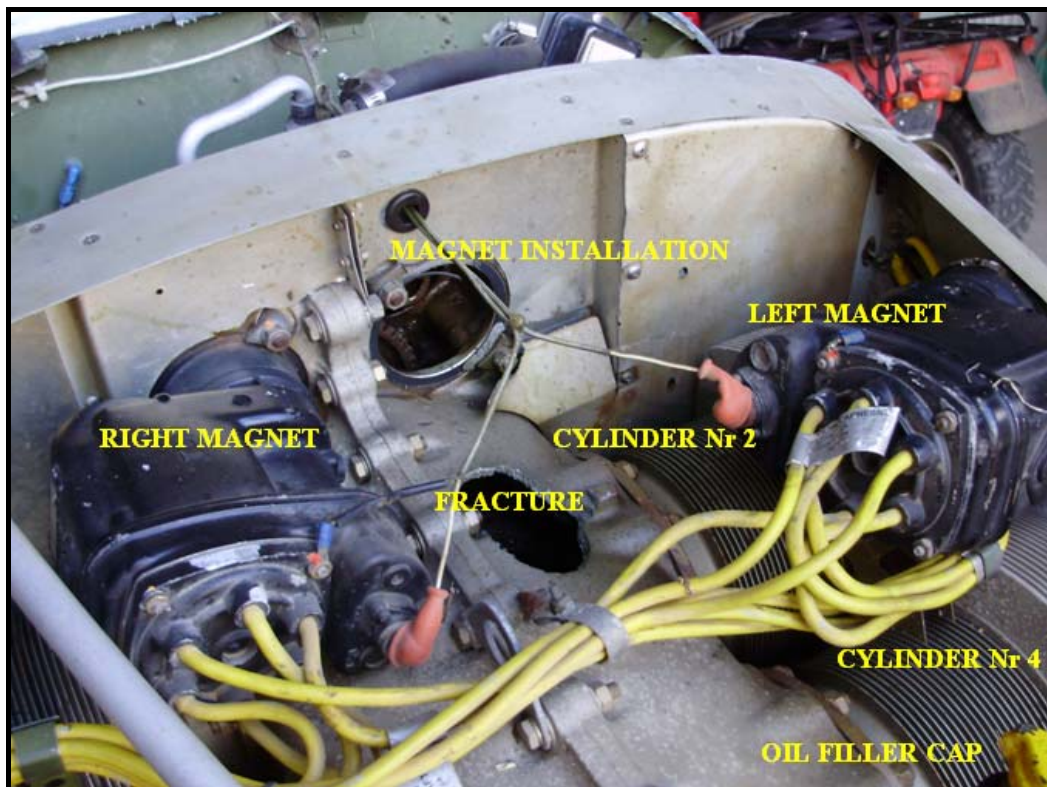
Chiffre

On left hand side engine cowl flap, fire-wall left hand side and other engine areas, namely oil quantity indicator dipstick (A), oil filler cap (B), oil heat exchanger (C) and drain plug were absolutely clean (*picture nr 14*).



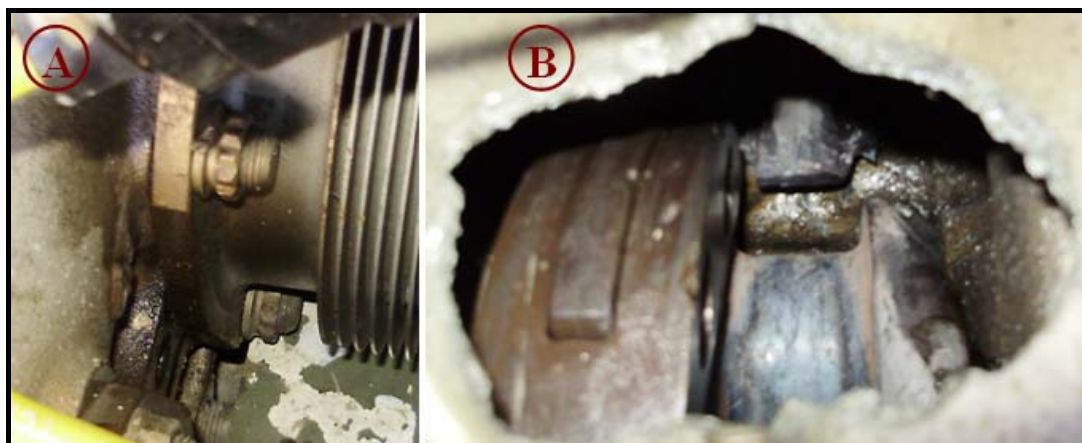
Picture Nr 14

After removing engine upper cowlings, a big hole on engine block, near cylinder nr 2, came to sight, together with left magnet dislodged from its installation and only connected through electric cables (*picture nr 15*).



Picture Nr 15

Oil loss and consequent lack of cooling caused the engine to become flodded. Cylinder nr 2, being the one situated on the rearmost position and having less exposition to cooling air flow, reached the highest temperature (*picture nr 16A*) and led the connecting rod (*picture nr 16B*) to break, causing the fracture of engine block. The engine block fragment was expelled violently and forced left magnet out of its seating.



Picture Nr 16

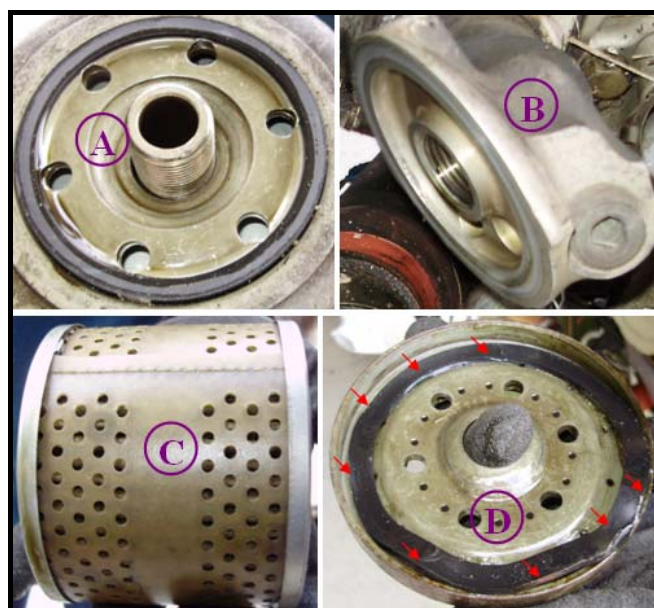
Continuing the search for probable location of engine oil leak, exterior clues guided us to exterior engine oil filter assembly, situated at an engine rear right position, in front of fire-wall (*picture nr 17*).

Externally it looked clean, glossy and viscous, signalling the filter can had been washed by leaking oil, expelled through the top mounting and flowing downwards.



Picture Nr 17

Proceeding with filter assembly dismounting, it was noted that hollow stud was wire locked but the correct torque, as recommended by manufacturer's Aircraft Maintenance Manual, was not applied.



Picture Nr 18

The filter can was removed and an attentive examination carried out.

- The filter element (*picture nr 18C*) was in good condition.
- Adapter seating (*picture nr 18B*) was clean, without irregularities and upper gasket (*picture nr 18A*) in good condition, but lower gasket (*picture nr 18D*) had been incorrectly mounted and tightening forces caused its deformation, preventing it to fulfil its job, avoid engine oil from flowing outside filter assembly.

1.17 Organizational & Management

Being it a private aircraft, used by its owner for other than commercial flights, he was not entitled with an Air Operator Certificate (AOC) or Air Work Operator Certificate (AWOC) and the existence of an Operations Manual was not required. The only requirement was to keep updated the aircraft Airworthiness Certificate, for which he used to contract maintenance services to a Portuguese Civil Aviation National Authority certified AMRO and recognized by Germany Civil Aviation Authority, entity issuing such Airworthiness Certificate.

Last inspection was performed at 2224 hours and was considered for the last Airworthiness Certificate renewal.

1.18 Additional Information

There's no other relevant information to refer.

1.19 Special Investigation Techniques

No special investigation techniques were used during this investigation. All evidence was gathered by the investigator on site and from official documentation available.

2. ANÁLISIS

2.1 Maintenance

2.1.1 Programmed Inspections

According aeronautical regulations in force and manufacturer's recommendations, all aircraft, to keep valid their Airworthiness Certificates, must be subject to regular inspections and other required maintenance actions, at specified regular intervals, be them amount flight time or calendar time.

As specified by "Pilot Operating Handbook" and "Aircraft Service Manual", both issued by the manufacturer, the aircraft should comply with a maintenance programme of inspections every 50, 100, 200 hours and annually.

Between 16-03-2010 and 06-04-2010, the aircraft was subject to a 200 hours / annual maintenance check, carried out by a certified maintenance organization, when all recommended Service Bulletins (SB), in force, were incorporated. By then, the aircraft had accumulated 2224 flying hours and should be checked again 50 hours later, at 2274 hours.

The approved maintenance programme for the 50 hours check included several items covering all aircraft systems. Related to the engine, the following checks should be performed:

ENGINE COMPARTMENT

Check for evidence of oil and fuel leaks, then clean entire engine and compartment, if needed, prior to inspection.

1. Engine oil screen filler cap, dipstick, drain Plug and external filter element;
2. Induction air filter;
3. Engine baffles;
4. Hoses, metal lines and fittings;
5. Intake and exhaust systems;
6. Engine controls and linkage;
7. Engine cowl flaps and controls;
8. Carburettor throttle arm attachment

According regulations in force, these works should be performed by qualified technician, following EASA Part 66 requirements.

There was no confirmation if the pilot was qualified by Germany Authority to perform such 50 hours checks, which included external filter element change.

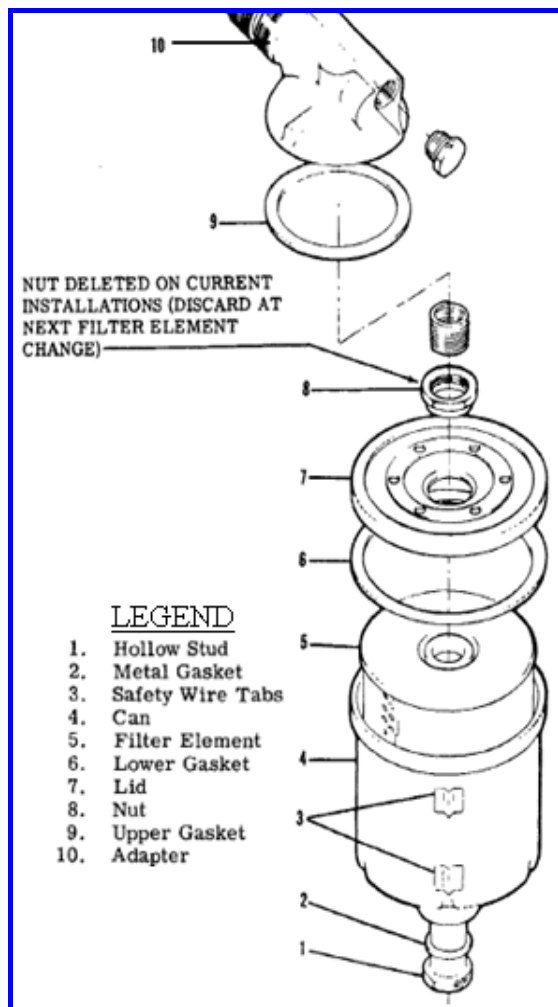
2.1.2 Full-Flow Oil Filter Change

This operation (filter element change) was duly described on "Aircraft Service Manual" (chap. 11-38), issued by the manufacturer.

All those procedures and notes were intended to make easy oil filter change operation and prevent some common errors that might jeopardize aircraft operation, damage the engine or injury personnel.

- FULL-FLOW OIL FILTER -

NOTE – Filter element replacement kits are available from the Cessna Service Parts Centre.



Picture Nr 19

11-38. Removal & Installation

- Remove engine cowling in accordance with paragraph 11-3;
- Remove both safety wires from filter can and unscrew hollow stud (1) to detach filter assembly from adapter (10) as a unit. Remove filter assembly from aircraft and discard gasket (9). Oil will drain from filter as assembly is removed from adapter;
- Press downward on hollow stud (1) to remove from filter element (5) and can (4). Discard metal gasket (2) on stud (1);
- Lift lid (7) off filter can (4) and discard lower gasket (6);
- Pull filter element (5), out of filter can (4);

NOTE

Before discarding remove the outer perforated paper cover; using a sharp knife, cut through the folds of the filter element at both ends. Then, carefully unfold the pleated element and examine the material trapped in the element for evidence of internal engine damage, such as chips or particles from bearings. In new or newly overhauled engines, some small particles or metallic shavings might be found, these are generally of no consequence and should not be confused with particles produced by impacting, abrasion or pressure. Evidence of internal damage found in the oil filter element justifies further examination to determine the cause;

- Wash lid (7), hollow stud (1) and filter can (4) in solvent and dry with compressed air;

NOTES

- When installing a new filter element (5), it is important that all gaskets are clean, lubricated and positioned properly, and that the correct amount of torque is applied to the hollow stud (1). If the stud is under-torqued, oil leakage will occur. If the stud is over-torqued, the filter can might possibly be deformed, again causing leakage;*
 - Lubricate all rubber grommets in the new filter element, lid gaskets and metal gasket with clean engine oil or general purpose grease before installation. Dry gaskets may cause false torque readings, again resulting in oil leakage;*
 - Before assembly, place a straightedge across bottom of filter can. Check for distortion or out-of-flat condition greater than 0.010inch. Install a new filter can if either of these conditions exist;*
 - After installing a new gasket on lid, turn lid over. If gasket falls, try a different gasket and repeat test. If this gasket falls off, install a new lid.*
- Inspect the adapter gasket seat for gouges, deep scratches, wrench marks and mutilation. If any of these conditions are found, install a new adapter;
 - Place a new filter element (5) in can (4) and insert the hollow stud (1) with a new metal gasket (2) in place, through the filter can and element;
 - Position a new gasket (6) inside flange of lid (7) and place lid in position on filter can;

- j. With new gasket (9) on face of lid, install filter can assembly on adapter (10). While holding filter can to prevent turning, tighten hollow stud (1) and torque to 20-25lb/ft (240-300lb/in), using a torque wrench;
- k. Install all parts removed for access and service the engine with the proper grade and quantity of engine oil. One additional quart of oil is required each time the filter element is changed;
- l. Start engine and check for proper oil pressure. Check for oil leakage after warming up the engine;
- m. Again check for oil leakage after engine has been run at high power setting (preferably a flight around the field);
- n. Check to make sure filter can has not been making contact with any adjacent parts due to engine torque;
- o. While engine is still warm, recheck torque on hollow stud (1) then safety stud to lower tab (3) on filter can and safety adapter (10) to upper tab on filter can.

However, when changing filter element, aircraft pilot/owner didn't follow exactly manufacturer recommended procedures. In fact he never used a torque wrench, to apply recommended torque to hollow stud (*paragraph j.*) and skipped engine run-up, after filter change, for leak detection and check for normal pressure values (*paragraph l.*).

2.2 Flight Preparation

Gathered information about the flight didn't refer any particular flight preparation procedures and ground assistance for departure, but aircraft towing out of the hangar. Once outside, the pilot got no assistance for start and taxi out till take-off position.

It's supposed the pilot didn't wait for the engine to warm and he skipped before take-off power checks. The way engine oil has been expelled during start phase (*there were no oil drops along taxi route*), oil pressure at take-off should be under normal readings, or no reading at all, which could be easily detected with a glimpse to the pressure indicator. Detection of such anomaly should be reason enough to abort take-off.

2.3 Flight Progress

During the few minutes of the flight, the pilot never made a comprehensive instrument's reading, otherwise he would notice engine abnormal indications.

When he became faced with engine failure, with propeller standing still, he tried to restart the engine, making use of electric starter motor. For that, he looked inside the cockpit and lost exterior references, including aircraft height above the ground and obstacles around. Having a suitable field for an emergency landing, without serious consequences, the aircraft finished to collide with a medium size tree and crashed on the ground.

3. CONCLUSIONS

3.1 Findings

- 1st The pilot was entitled with a valid pilot license, which allowed him to fly that aircraft;
- 2nd The aircraft had a valid Airworthiness Certificate, it complied with an annual (200 hours) inspection and accumulated 56 hours since that;
- 3rd The pilot, himself, proceeded to oil filter change, but didn't follow exactly manufacturer recommended procedures, missing to apply required torque on hollow stud and engine run-up after the work was done and before next flight;
- 4th During start, before flight begun, engine oil was totally expelled and spread on the floor, under the aircraft;
- 5th Pilot never noticed any abnormality on engine operation, before take-off and first nine minutes of flight;
- 6th About nine minutes, after take-off, engine stopped and propeller stood still;
- 7th Pilot tried to restart the engine, using electric starter motor, concentrating his attention inside the cockpit and neglecting outside surveillance;
- 8th The aircraft collided violently with a tree and precipitated on ground;
- 9th The pilot suffered serious spine injuries and light face scratches;
- 10th The aircraft was considered a total loss and written-off.

3.2 Causes of the Accident

3.2.1 Primary Cause

Engine failure, due total oil leakage, was considered primary cause of the accident.

3.2.2 Contributory Factors

The following were considered as contributory factors:

- 1st The use of an inaccurate procedure for oil filter change;
- 2nd The omission of recommended procedures for static check of engine parameters, before take-off;
- 3rd Pilot loss of situational awareness, when he concentrated his attention inside the cockpit, instead of looking outside for a suitable place for an emergency landing, which was available and reachable.



4. SAFETY RECOMMENDATIONS

Considering that the real source of the accident, which caused engine stoppage, was the inaccurate procedure followed for oil filter change, either for not use the right tools or for skipping engine run-up, in order to detect any malfunction;

Recognizing the pilot didn't hold a professional license or technical qualification, entitling him to practise as a certified maintenance technician;

It's recommended:

To Aircraft Operator:

"To provide that all aircraft maintenance and repair works be performed by certified Aircraft Maintenance and Repair Organization, complying with all Aeronautical Authority requirements and manufacturer recommended practices". (SR Nr 07/2011)

Lisbon, 23rd of August 2011

The Investigator In Charge,



António A. Alves