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Number: 37200-8/2008/39-0010133
Date: 28 August 2009

FINAL REPORT

OF THE ACCIDENT INVESTIGATION COMMISSION INTO THE ACCIDENT OF ULTRA-LIGHT AIRCRAFT »WILD THING« REGISTERED D-MWTF ON 23 JUNE 2008 NEAR POSTOJNA CITY

CONTENTS

FOREWORD

This report sets out the technical conclusions reached by the Accident Investigation Commission concerning the circumstances and causes of this accident.

In accordance with Annex 13 to the Convention on International Civil Aviation and in compliance with the provisions of the fourth paragraph of Article 137 of the Aviation Act (Official Gazette of the Republic of Slovenia No. 113/2006 UPB-1), the analysis drawn up in this report do not aim to apportion blame or to assess individual or collective responsibility. Their sole objective is to derive from this occurrence the lessons necessary to prevent future accidents.

As a consequence, the use of this report for any purposes other than for the prevention of accidents could lead to erroneous interpretations.

In case of any divergence of interpretation of the text, the Slovene version shall prevail.

COMPOSITION OF THE ACCIDENT INVESTIGATION COMMISSION

By Order No. 37200-8/2008/1-0010133 dated 7 July 2008 and by Order No. 37200-8/2008/4-0010133 dated 16 July 2008 the Head of the Aircraft Accident and Incident Investigation Division (AAIID) established the Accident Investigation Commission to investigate the circumstances, research the causes and determine the lessons to be drawn from the accident of the ultra-light aircraft "WILD THING", registered D-MWTF.

The Commission comprised the following members:

- **Marko PETERNELJ**, Ministry of Transport, AAIID,
  Aircraft Accident and Incident Investigator, **Investigator In Charge**

- **Andrej RUPNIK,** Ministry of Interior, Police Directorate Postojna
  Criminal Police Inspector, **Member of the Commission**

- **Nebojša KRIČAK,** Certifying Staff in AMO 145,
  Flying Centre Maribor, **Member of the Commission**

According to ICAO Annex 13, Chapter 5.18. **Mr. Ulf KRAMER** from the Bundesstelle für Flugunfalluntersuchung Braunschweig, Germany, appointed as representative of Germany:

- **Mr. Roger KNOLL**, Bundesstelle für Flugunfalluntersuchung (BFU) Braunschweig, Investigator, **accredited representative of Germany** since 27 June 2008.

SYNOPSIS

1. Date of the accident: 23 June 2008 at 09.01 UTC *

2. Aircraft (ACFT): Ultra-light Aircraft "WILD THING", registration No. D-MWTF

3. Site off accident: Near Airport Postojna (LJPO)

4. Owner: Aero Light Club, Berlin, Germany

5. Type of flight: Private
VFR** cross country flight from Airport Postojna (LJPO) to Airport "Marco Polo" Venice (LIPZ), Italy

6. Consequences:

6.1 Injuries:

Injuries	*Crew*	*Passengers*	*Others*
Fatal	1	1	-
Serious	-	-	-
Minor/None	-	-	-

6.2 Aircraft: 100% destroyed

6.3 Equipment: 100% destroyed

(*) *Times referred to in this report are expressed in Coordinated Universal Time (UTC). Two hours should be added to give Slovenian local time on the day of the accident.*

(**) *VFR – Visual Flight Rules*

1. FACTUAL INFORMATION

1.1 History of the flight

Pilot (**P**ilot **i**n **C**ommand – PIC) planned VFR cross country flight from Airport Postojna (LJPO) to Airport "Marco Polo" Venice (LIPZ) in Italy.

Pilot took off at 09.01. After took-off the aircraft had a smaller rate of climb than in normal conditions. On Right Crosswind Leg at approx. 80m above airport level aircraft stalled and crashed to the ground.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	1	1	-
Serious	-	-	-
Minor/None	-	-	-

1.3 Damage to aircraft

Aircraft and equipment 100 % destroyed.

1.4 Other damage

There was no damage to other property.

1.5 Personnel information

1.5.1 Pilot (PIC)

Pilot, male, 51 years of age, holder of **P**rivate **P**ilot (Sport Pilot) **L**icence (ultra-light aircraft) valid until 31 October 2011. Sixteen month before fatal accident the pilot obtained his licence on 29 January 2007.

He had valid Medical Class II Certificate until 3 July 2008 and Restricted Flight Radiotelephone Operator's Certificate issued on 1 October 2006.

According to Pilot's Log Book issued on 20 June 2006 total flying time of the pilot was **113 hours 45 minutes** until 31 May 2008.

Last three month pilot's flying time was **12 h 48 minutes.**

Last month his flying time was **1h 43 minutes.**

According to Aero Light Club data base and Pilot's Log Book pilot in June didn't fly. Members of Aero Light Club said that the pilot performed one flight the day before accident with another type of ultra light aircraft as a "co-pilot".

Last flight on ultra-light aircraft type "WILD THING" before accident pilot performed on 13 January 2008 (six month before accident).

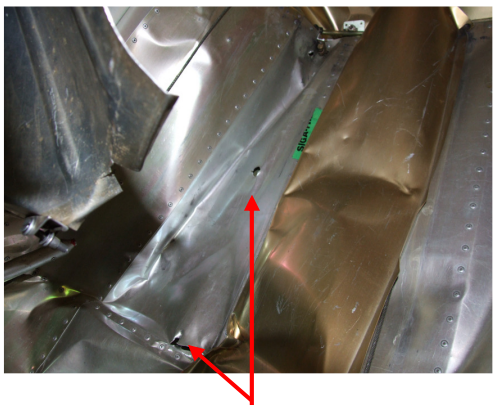
1.5.2 Passenger

Female, 53 years of age, disabled person.

1.6 Aircraft information

The obtained documentation and fact findings indicate the following:

- Ultra-light Aircraft Registration No. **D-MWTF**, type "**WILD THING**", **Serial No. 59** (S/N 59), year of manufacture **2000** was built in »**AIR light GmbH**«, Hassfurt, Germany.
- Aircraft had valid Permit to Fly issued on 6 July 2000.
- For cross country flight across Austria owner equiped aircraft and built in **E**mergency **L**ocator **T**ransmiter **(ELT)** according to Austrian Rules of the Air. ELT was fixed in the luggage compartment (See pictures below).



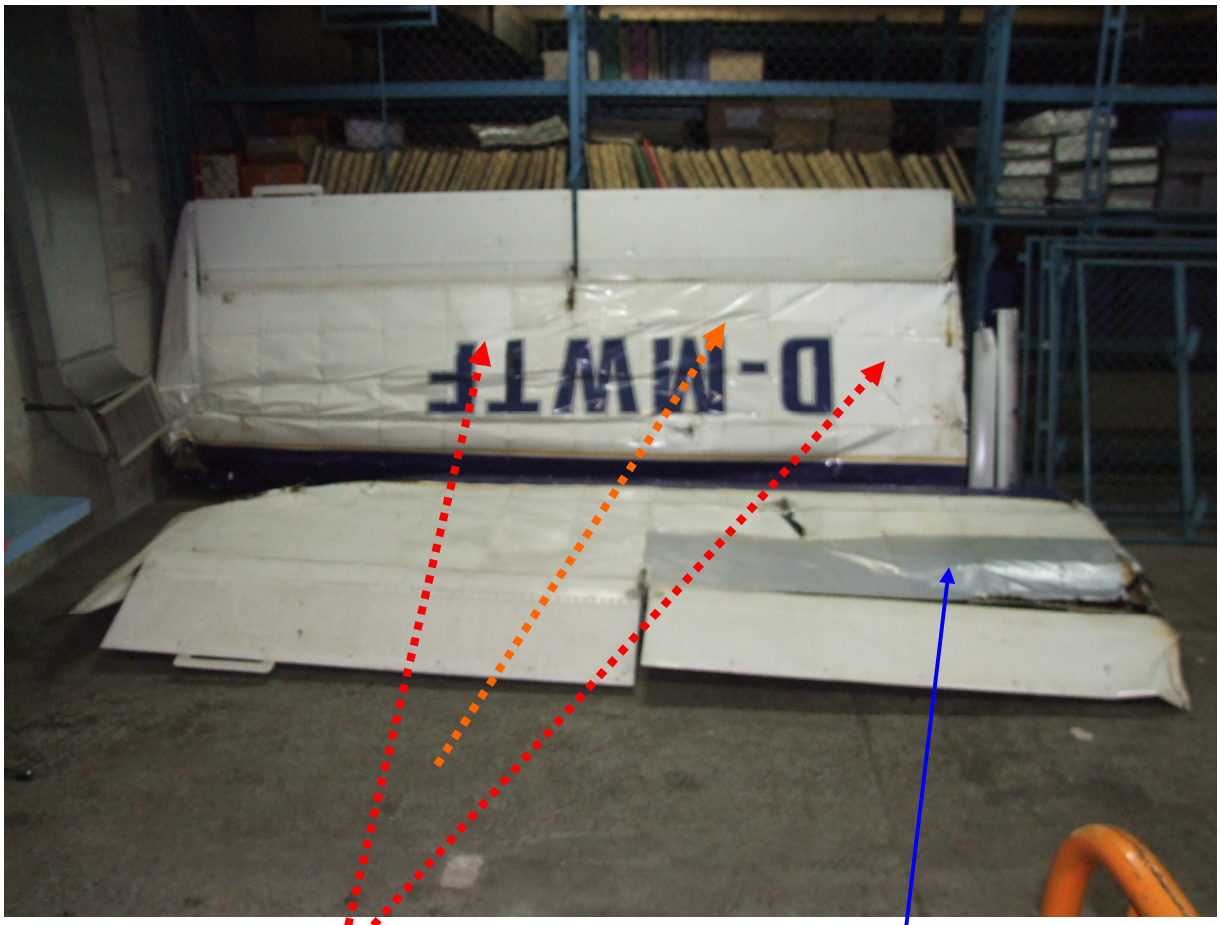
»ELT« FIX HOLES

ELT

- The last Annual Inspection was performed on 3 March 2008 – valid until March 2009.

- **About Unscheduled Maintenance and Major Repairs no data exist.**

- Probably two major repairs of the wing were performed in the past (See picture below).



DIFFERENT SHADES OF COLOR **UNCOLORED WING COVERING**

- Commission have got information that the ultra-light aircraft registered D-MWTF was crashed in the year 2001.

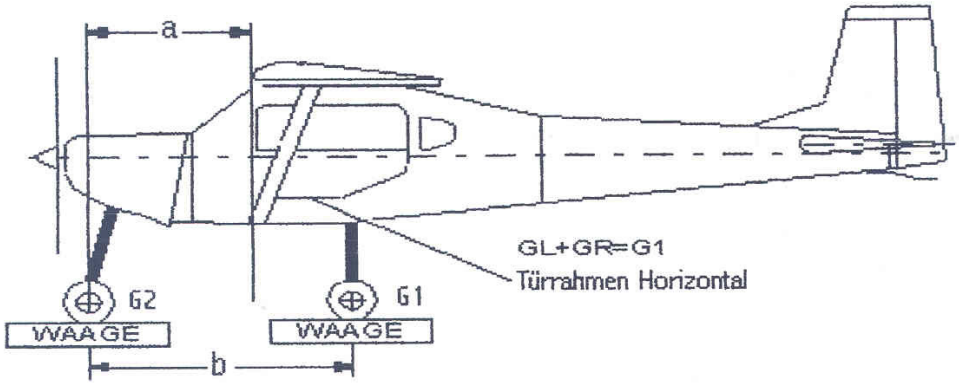
- The last maintenance 50 hours inspection was performed by the owner's personnel on 19 June 2008 at aircraft **T**otal **T**ime (**TT**) **4.852,9 hours.**

- Ultra-light Aircraft D-MWTF was registered for **M**aximum **T**ake **O**ff **M**ass (**MTOM**) **up to 450 kg.**

- Weight and Balance List was issued on 5 March 2006 (**Note: Maximum Load 151,4 kg –** See List on next page).

- Written visible warning about MTOM and loading was placed on instrument panel ("**max. Abflugmasse 450 kg**, **max. Zuladung 152 kg**").

Auftraggeber :	**Gewichtübersicht**	
	Datum: 05.03.2006	Auftrag :
Muster: Wild Thing 3300 Bugrad	Werknummer: 059	**D - M W T F**
Bezugspunkt BP : Flügelvorderkante , nähe Wurzelrippe		
Bezugslinie BL : Flugzeug horizontal (Wasserwaage auf Einstiegsrahmen)		



$$X_S = \frac{G_1 * b}{G} - a$$

Wägung und Leergewichts-Schwerpunktlage :

Auflage	Brutto [kg]	Tara [kg]	Netto [kg]
Links G_L	127,2		
Rechts G_R	127.9		
Summe G_1	255,1		255,1
Bugrad G_2	43,5		43,5
		G =	298,6

Hebelarm [mm]	Zuladung [kg]
a = 985	min. 65
b = 1630	max. 151,4

Leergewichts-Schwerpunktlage :

$$\frac{255{,}1 \times 1630}{298{,}6} - 985 = 407{,}5 \text{ mm}$$

Die Schwerpunktlage liegt im zulässigen Bereich.

Der Flug-Schwerpunktbereich liegt laut Handbuch von 350 mm bis 500 mm
Ausrüstung bei der Wägung siehe Ausrüstungsverzeichnis vom 05.03.2006
Im Cockpit ist ein Hinweisschild mit Daten aus dieser Gewichtsübersicht angebracht.

Halter
Hersteller
Prüfer
LSG

(Stempel) (Unterschrift Prüfer)

- On the day of accident the **TT** of the aircraft was **4.893,6 hours** (See picture below).

- According to Aero Light Club documentation aircraft **Flying Time (FT)** was **3.075 hours 05 minutes. Difference between TT and FT is 1.818 hours 31 minutes (37%).**

- Maintenance List entry dated 19 Jun 2008 point out that the aircraft had on the day of accident **40,7 h** after last 50 hours inspection.

- But according to the Aero Light Club Data Base aircraft had only**12 h 22 minutes** after inspection.

- Engine type **JABIRU 3300 A, S/N 33A 746**, 120 HP, year of manufacture 2005. On the day of accident the **TT** of the engine was **1.966,9 hours**.

- Last 50 hours inspection was performed jointly with annual aircraft inspection.

- Propeller type **HELIX**, two bladed.

1.7 Meteorological information

At 09.00 the official weather conditions at Airfield Postojna were:

- Visibility more than 10 km
- Wind direction 250^0
- Wind speed 4 knots (7km/h), gusting 10 knots (18 km/h)
- QNH* 1018 ± 1 mb
- Temperature 26^0 C
- Relative Humidity 54%

The statements of eyewitnesses were that there was no wind in the time of accident.

1.8 Aids to navigation - N/R

(*) *QNH is air pressure on see level - altimeter setting which will cause the altimeter to read altitude above mean see level (MSL) within a certain defined region*

1.9 Communications

Flight was performed in the airspace which is in the Republic of Slovenia classified as Uncontrolled Airspace of Class G and communication is not necessity. Pilot had radio contact on general frequency 123M500 probably only with another German ultra-light aircraft. Airport Postojna INFO was not active in the time of accident.

1.10 Airport Postojna (LJPO) information

- **Position: 45 45 13.616 N - 14 11 45.475 E**
- **RWY*: 020° - 200°; 747 x 50m** (grass)
- **Elevation: 1.738ft = 530m** (Calculated **Density Altitude**** was **3.399ft**)
- **Communication: Call Sign "POSTOJNA INFO"** on frequency **123M500**

1.11 Flight recorders (Pocket PC "hp IPAQ 314" data read-out)

Flight recorders were not installed in ultra-light aircraft.
The pilot was using pocket PC "**hp IPAQ 314**" S/N 3 CC8070 DGH (with 2 GB SD Card and GPS software installed) which was found loose in the cockpit and de-powered.
Read-out data was performed by BFU, Germany as follows:

a) Flight Book Data:

flugbuch.txt

```
0;27.04.2008 13:24;EDCM Kamenz;;
1;27.04.2008 14:14;EDCE Eggersdorf;;0:50
0;13.09.2007 08:44;EDCE Eggersdorf;;
1;13.09.2007 09:58;EDCP Peenemunde;;1:14
0;11.05.2008 13:52;EDCP Peenemunde;;
0;06.09.2007 13:03;45°45.67N 14°6.67E;;
1;06.09.2007 13:40;45°45.18N 14°11.77E;;0:37
0;06.09.2007 14:51;45°45.15N 14°11.70E;;
1;06.09.2007 15:27;45°45.15N 14°11.72E;;0:36
0;23.06.2008 09:01;45°45.19N 14°11.75E;;
```

b) Flight Data:

```
14.19585;45.75311;614;46;199
14.19561;45.75270;615;47;201
14.19535;45.75231;616;46;204
14.19507;45.75191;620;46;206
14.19482;45.75151;623;47;202
14.19456;45.75112;625;46;205
14.19432;45.75071;628;46;202
14.19408;45.75031;631;45;203
14.19380;45.74991;634;48;204
14.19351;45.74949;635;49;206
14.19318;45.74907;639;50;208
14.19287;45.74866;643;50;206
14.19259;45.74821;646;51;203
14.19232;45.74779;647;50;202
14.19205;45.74738;649;51;201
14.19176;45.74695;653;50;206
14.19148;45.74653;658;48;204
14.19120;45.74612;663;48;206
14.19092;45.74572;667;48;205
14.19065;45.74531;669;49;204
14.19036;45.74489;673;49;205
14.19001;45.74449;678;50;210
14.18957;45.74416;681;48;219
14.18907;45.74388;686;48;227
14.18854;45.74364;690;47;236
14.18800;45.74345;693;46;243
14.18741;45.74335;697;44;252
14.18677;45.74339;697;49;261
14.18619;45.74347;696;43;273
14.18565;45.74357;695;41;275
```

(*) *RWY – runway*
(**) *Density Altitude is the pressure altitude adjusted for non-standard temperature.*

1.12 Wreckage and impact information

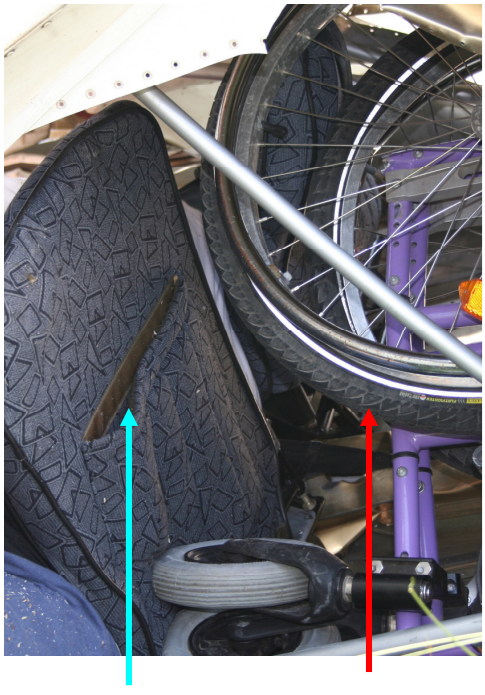
- Wreckage on Accident Site indicated that the aircraft was stalled (See pictures below). Aircraft impact to the ground first with right wing and after that with propeller, nose gear and engine (cowling).

- In cockpit were found Aircraft and Pilot's documents.

- 75 litres (54 kg) automotive unleaded gasoline were in left and right fuel tank.

- On board was found **F**light (Owners) **M**anual (Flug – und Betribschandbuch) not for subject aircraft but for ultra-light aircraft "**WILD THING**", registered **D-MWTE, S/N 50,** year of manufacture **1999**. (Last Revision was performed on 8 October 2002)
  Flight Manual for subject aircraft registered **D-MWTF was not accessible**.

- Behind the seats in luggage compartment was found unfixed wheelchair (See picture below). Under wheelchair was found small zipper bag with PAX medicines.



- **B**allistic **R**escue **S**ystem (**BRS**) key with red flag (REMOVE BEFORE FLIGHT) was found on instrument panel and BRS was ready for use before take off. (Junkers Profly – Magnum Speed BRS was built in aircraft)

- Magnetic Compass: broken – unreadable

- **A**ir-**S**peed **I**ndicator: 110km/h – broken

    - White Arc: from **58km/h** to 108km/h **(Vso = 58km/h)**
      (**Vso**: Stall speed – minimum flight speed in landing configuration)

    - Green Arc: from **58km/h** to 148km/h **(Vs_1 = 58km/h)**
      (**Vs_1**: Stall speed – minimum flight speed in clear configuration)

    - Yellow Arc: from 148km/h to 200km/h

    - Blue Line: **95km/h**

    - Yellow Line: 105km/h

    - Red Line: 200km/h

NOTE: Factually on Air-Speed Indicator Vso = Vs_1 (impossible equal status)

- **Alt**imeter: - 1.480ft (minus 1.480 feet was impact result), Pressure setting: 1022 mb

- **Emergency Fuel Valve: PUSH POSITION (NORMAL FUEL FLOW)**

- **V**ertical **S**peed **I**ndicator: broken – unreadable

- Yaw Indicator: Balance Ball – left position

- **M**aster Switch: **ON**

- Left Magneto Switch: **OFF**

- Right Magneto Switch: **ON**
- All circuit breakers: **OFF (impact result)**
- **C**ylinder **H**ead **T**emperature Selector: Selected Cylinder No. 2 (hottest Cylinder)
- Left Wing Fuel Valve: **ON**
- Right Wing Fuel Valve: **ON**
- Intercom: **ON**
- Radio: **ON**
- Tachometer: positioned on approx. **3.000 RPM (4.893,6 hours** – later read out data on examination)
- **C**ylinder **H**ead **T**emperature Indicator: **0^0 C**
- **O**il **T**emperature **I**ndicator: **0^0 C**
- Throttle Lever: **Full Power (Full foreword)**
- **Flaps Lever: DOWN POSITION –** FLAPS UP

- **Trim: NOSE UP POSITION** (See detail on picture)
- **E**mergency **L**ocator **T**ransmitter**: OFF**
- "Jeppesen" VFR Charts of different countries were also found in the cockpit.

1.13 Medical and pathological information

Pilot and Passenger post-mortem examination was performed.

Pilots and passenger severe injuries caused death as result of aircraft impact to the ground.
No alcohol was present in the blood or urine of the pilot.

1.14 Fire

There was no fire.

1.15 Survival aspects

In such aircraft accident survive probability was in fact impossible.

1.16 Test and research

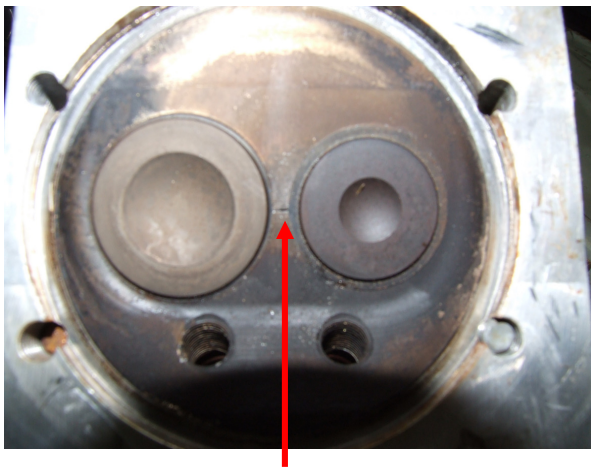
- On the 23 June 2008 the detailed investigation of the location of aircraft crash and wreckage was performed.
- During the followed activities the complete documentation of the pilot and aircraft was checked in details.
- The whole available documentation of the Aero Light Club, Berlin was checked in details as well.
- The last Flight Manual (FM) or Operation Manual (OM) issued by the manufacturer was checked.
- The wreckage was detailed inspected. Also the wreckage was additionally inspected with Mr. Roger Knoll from BFU, accredited representative of Germany – Aircraft Accident Investigator and with Mr. Alfred Kaiser, president of ULBI GmbH aircraft ultra-light manufacturer.
- On the 15 June 2009 First Draft Final Report was finished. Last comments on Draft Final Report were received on 14 August 2009.

Results of test and research:

No evidence of pre-impact aircraft malfunction was found.

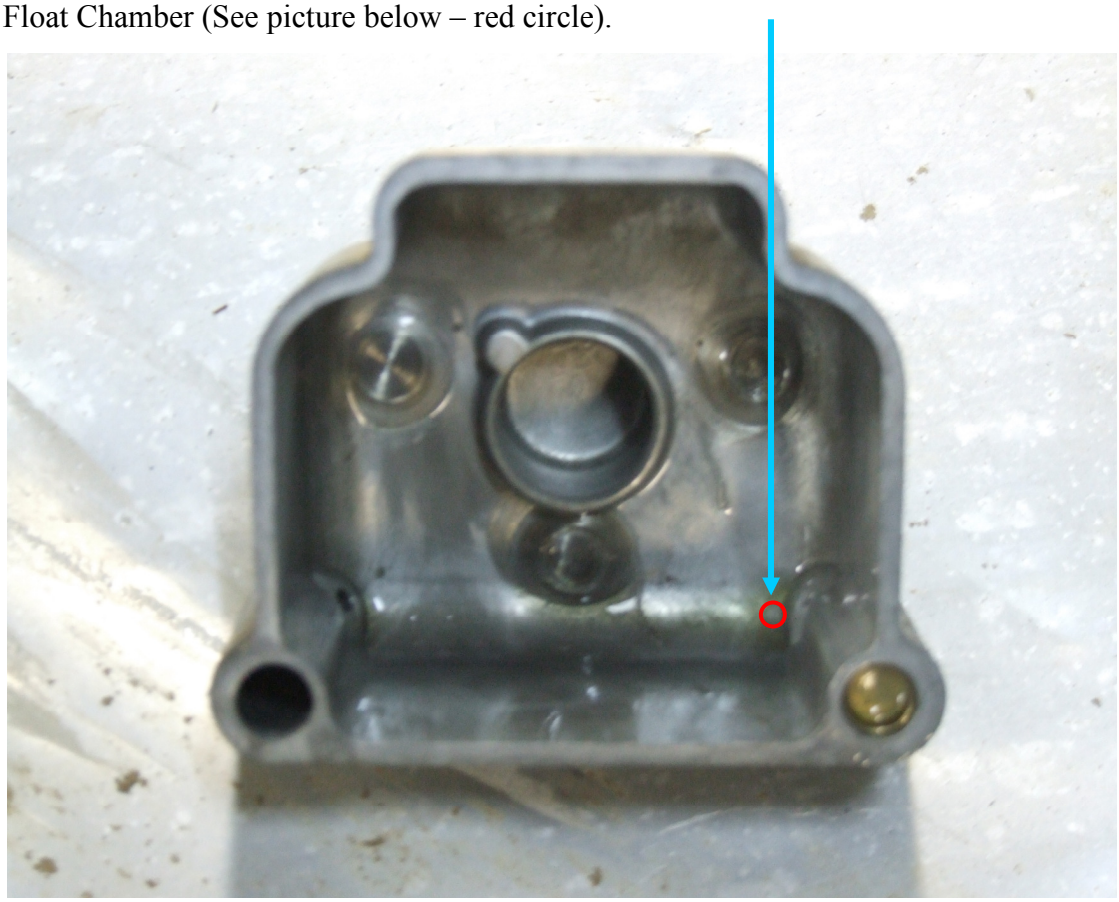
1.16.1 Engine Examination

- Engine was detailed inspected. Valve adjustment was correct. Only a small crack between exhaust valve and suction valve of the Cylinder Head No. 1 was found (See picture on next page).



CRACK ON THE CYLINDER HEAD No. 1 (WITH LARGEST TEMPERATURE CHANGES)

- Oil filter was in normal condition.
- Carburettor was clean and had no evidence of pre-impact malfunction.
- Carburettor float chamber was full of fuel. Only a **droplet of water** was found in the Float Chamber (See picture below – red circle).



- Ignition system had no evidence of pre-impact malfunction. It worked properly.

- No evidence of engine malfunction was found.

NOTE: According to Instruction and Maintenance Manual for Jabiru 3300 Aircraft Engine (Document No. JEM3301-3, Revision No. 3 Dated July 2008) Jabiru Aircraft Pty Ltd - Australia. **T**ime **B**etween **O**werhauls (**TBO**) for engines from S/N 33A 118 has been extended to 2.000 hours with **T**op **E**nd at 1.000, conditions apply. **About Top End for subject engine no data exist!**

1.16.2 Fuel System Examination

- Left and Right Fuel Tank were full of fuel. Fuel lines, fuel filter and mechanical fuel pump were clean, full of fuel and in function, without tracks of water.
- Left Wing Fuel Valve, Right Wing Fuel Valve and Emergency Fuel Valve were open and guaranteed normal fuel flow.
- Proper Unleaded Automotive Gasoline (Euro 95) was in use.
- Proper engine oil (AEROSHELL OIL W100 for outside air temperatures from 15^0C to 35^0C) was in use.
- No evidence of Fuel System malfunction was found.
- Fuel System, Engine Oil and Fuel were secure undisturbed run of engine.

1.16.3 Propeller Examination

- No evidence of pre-impact propeller malfunction was found.
- A crack of propeller blades indicates that the propeller rotated in the time of impact.

1.16.3 Flight Controls Examination

- No evidence of pre-impact Flight Controls malfunction was found.

- Elevator Trim setting**: full "NOSE UP" position.**

1.16.4 Pitot-static System Examination

- No evidence of pre-impact Pitot-static System malfunction was found.
- All air-pressure lines were clear and without tracks of water.
- Pitot-tube was clear and clean.
- Static holes were clear and clean.

1.17 Witnesses statements

- Passenger, pilot's wife, disliked flying.
- Pilot took-off with elevator trim in the landing position (full »nose up« position set on landing - flight before accident).
- After take-off at approximately 10m above airport level (on the end of the RWY) the pilot was looking to the right into the direction of his wife. (Note: In normal conditions, after take – off pilot is loking to the left).
- After took-off the aircraft had a smaller rate of climb than in normal conditions.
- At first, it looked like that the pilot had intention to turn back to the airport.

2. ANALYSIS

2.1 General

- First information from the member of Aero Light Club (who was shocked) on accident site was that the engine stops because the fuel was closed. He said that the **Emergency Fuel Valve was CLOSED (actually on PULL POSITION).**

- **Thrue the examination was found that the Emergency Fuel Valve was OPEN (actually on PUSH POSITION)**.

- **<u>Wrongly interpreting of the Emergency Fuel Valve position was caused because valve was displaced in the past, when owner build in BRS</u>**.

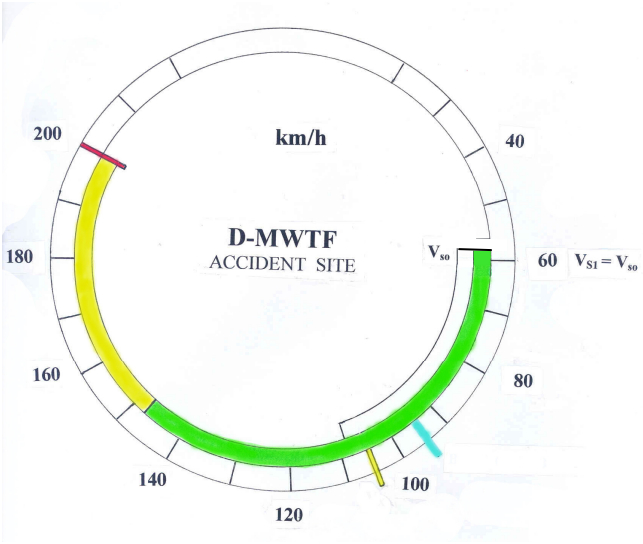
- As evidence (that the fuel was open) also see pictures below:

Subject aircraft on approach at Slovenian Airport Lesce-Bled (LJBL) in the year 2007

PUSH POSITION of Emergency Fuel Valve

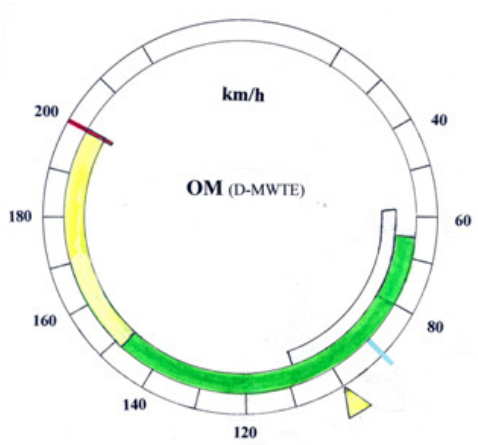
Position of Emergency Fuel Valve on accident site

- **<u>Important fact is</u> that Air Speed Indicator's White Arc and Green Arc start at speed of 58km/h** (See illustration and picture below)**.**

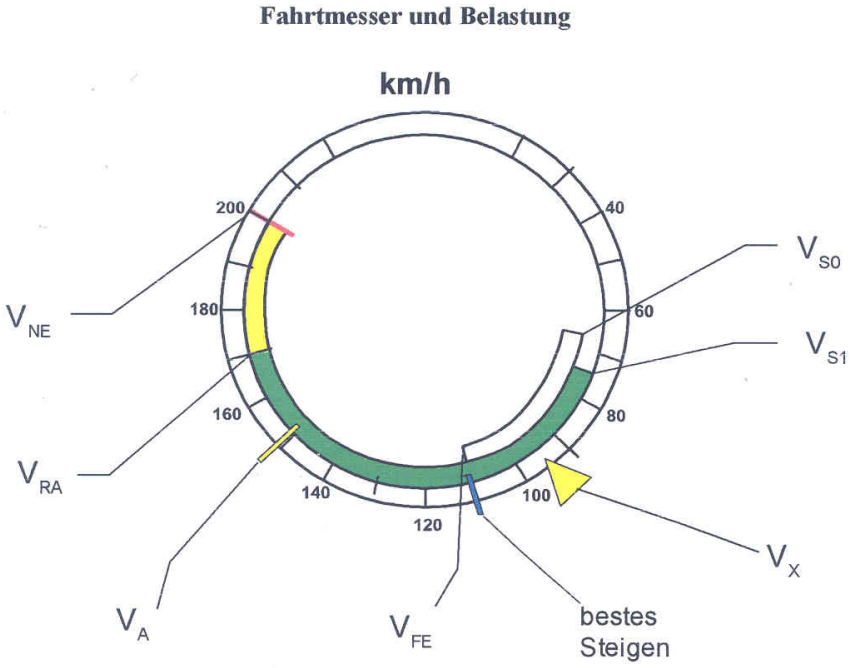


58km/h (White and Green Arc)

- **According to OM (FM) found on board (for ACFT registered D-MWTE) White Arc start at speed of 58km/h** and **Green Arc start at speed of 65km/h** (See illustration below)**.**



- **According to** »Ultra – Leicht – Bau – International, GmbH« (**ULBI**) Hassfurt (Germany) **OM (FM** issued on 5 March 2004**) White Arc start at speed of 65 km/h** and **Green Arc start at speed of 75 km/h** (See illustration below)**.**



NOTE: **According to the German regulations ultra-light aicraft with BRS have MTOM 472,5 kg.**

IMPORTANT: **In reality pilot probably think that the Indicated Air Speed (IAS) was approximately 5 - 15 km/h higher than stall speed.**
Wrong marks on Air Speed Indicator might lead the pilot to make errors.

2.2 Weight and Balance

- Weight find out data were:

	MASS (kg)	TOTAL (kg)
ACFT (Empty Weight)	298,60	**298,6**
PIC: Body Clothes ACFT documents	92,00 0,5 0,7	**93,2**
PAX: Body Clothes Life Jacket Binder	62,00 0,5 0,93 0,47	**63,9**
FUEL: 75 l (x 0,72 kg)	54,00	**54,0**
Luggage Compartment: Wheelchair Bag (PIC documents + 2 x headset) ELT	 16,40 2,80 1,40	**20,6**
TOTAL:	**530,30**	**530,3**
OVERLOAD:	**80,30**	**80,3**

NOTE: Wheelchair and Bag in Luggage Compartment were NOT FIXED.

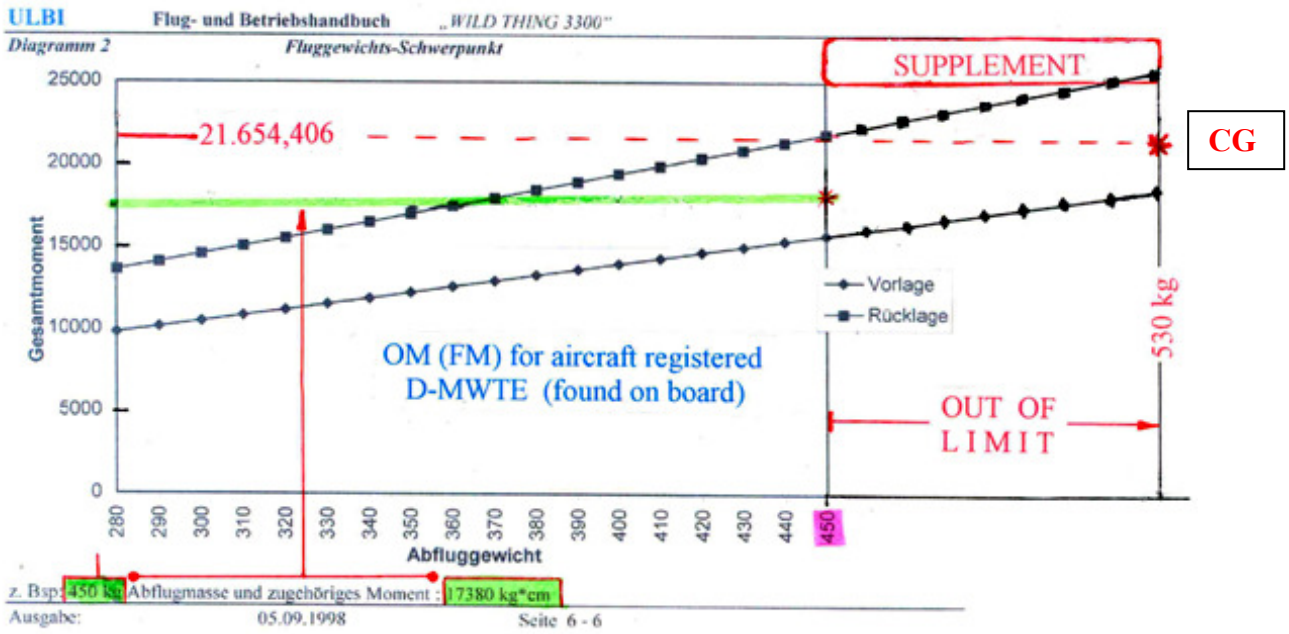
- Weight and Balance calculation:

MASS	TOTAL (kg)	Arm (cm)	Mass x Arm kg/cm
ACFT (Empty Weight)	**298,6**	**36,36**	**10.857,096**
PIC:	**93,2**	**38,10**	**3.550,920**
PAX:	**63,9**	**38,10**	**2.434,590**
FUEL: 75 l	**54,0**	**46,00**	**2.484,000**
Luggage Compartment	**20,6**	**113,0**	**2.327,800**
TOTAL:	**530,3**	**---**	**21.654,406**
OVERLOADED **According to "Gewichtübersicht"** on page number 8	**80,3**	**---**	**---**

WEIGHT & BALANCE

IMPORTANT: AIRCRAFT WAS OVERLOADED 80,3kg !

- According to Weight and Balance List and Flight Manual (OM – on board) was performed Flight Weight and Centre of Gravity Diagram with supplement:



FLIGHT WEIGHT and CENTRE of GRAVITY
DIAGRAM (CG)

From diagram it is obvious that the aircraft was overloaded but Centre of Gravity (CG) was in limits.

CONCLUSION: Permitted loading for subject aircraft was 151,4kg. 54kg (75 l) of fuel were in both reservoirs before flight. Only 97,4kg of load was left over, but pilot loaded the aircraft with 177,7kg.

INTENTIONALLY LEFT BLANC

2.3 Flight track and Profile

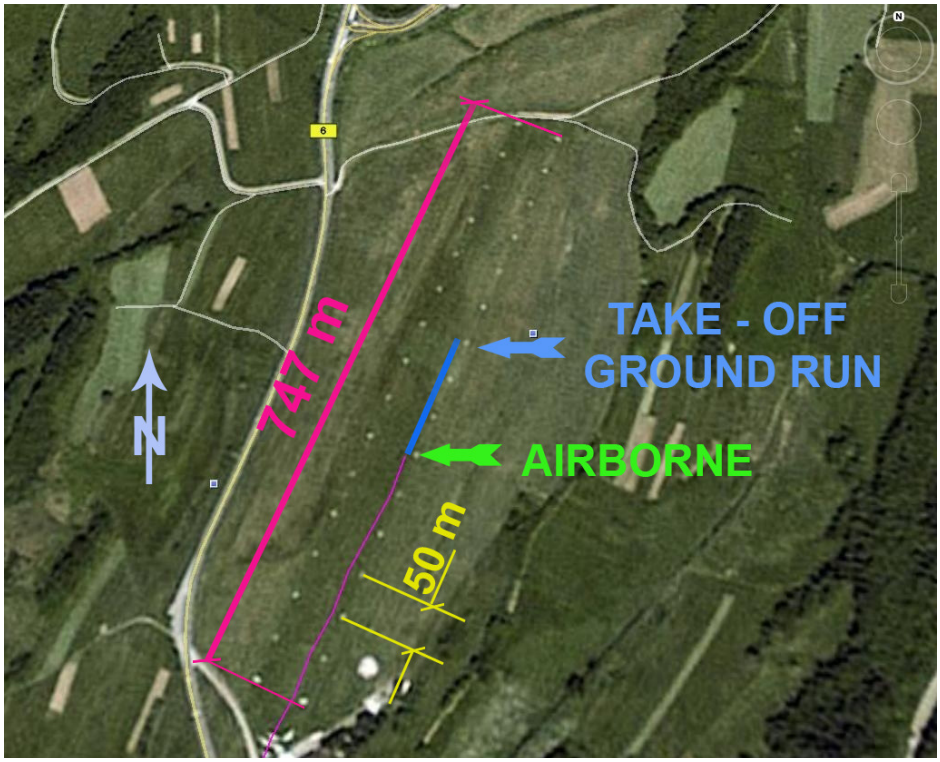
Flight track was defined according to pocket PC (GPS) data read-out and calculations. Aircraft took-off (airborne) on marked position (See illustration below).

Probable take-off ground run distance for overloaded aircraft on grass surface was approximately 150m (See illustration below).

After took-off aircraft had smaller rate of climb.

At the end of the RWY aircraft was at approximately 10m above airport level (See also table on page 28).

CONCLUSION: Pilot did not use available RWY distance. He used only a little more then half. In the case of emergency pilot lost in advance the available distance of approximately 350m.

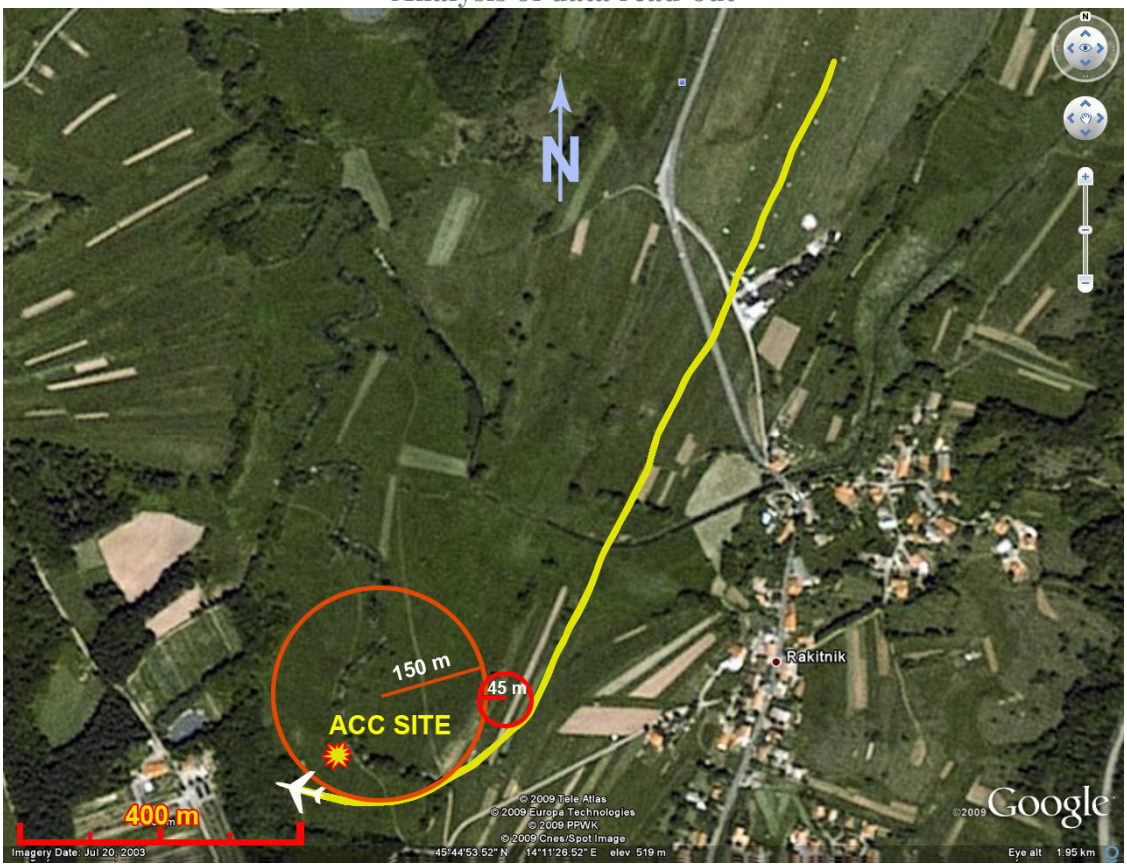


According to calculations the rate of climb was approximately 1,1 m/s at ground speed (GS) from 85,2km/h up to 94,5km/h. According to accessible informations the normal rate of climb is approximately 3 m/s.

After took-off, at 60m above airport level and approximately 700m from the end of RWY pilot probably decided to turn back to the airport. He performed right turn. At approximately 80m above airport level on Right Crosswind Leg aircraft stalled and crashed inside three seconds to the ground (See illustrations on next page).

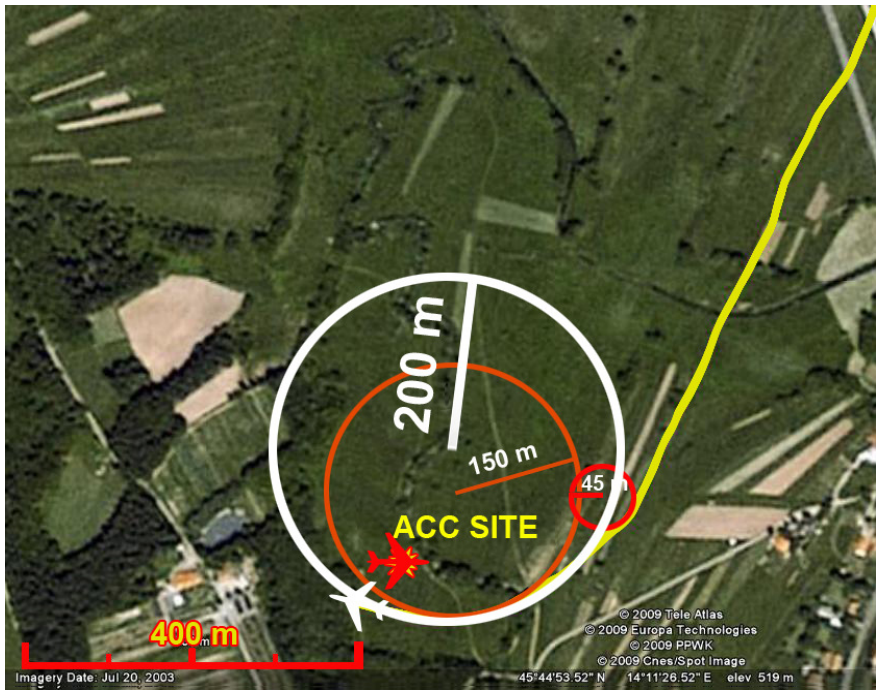
BFU read-out data

Analysis of data read-out



From illustrations is obvious that the flight track and profile were unstable and changeful.

Also Right Turn was unstable with dissimilar bank up to 23^0.



The right turn middle bank was approximately 18^0.

Above mentioned data of analyses were calculated and based on formulas below:

Turn radius:	**Turn stall speed:**
$r = \frac{v^2}{g \tan \theta}$	$V_{st} = V_s \sqrt{n}$
where:	where:
v = true airspeed r = radius of the turn g = gravitational acceleration θ = angle of bank	V_{st} = stall speed V_s = stall speed in straight, level flight n = load factor $n = \frac{1}{\cos \theta}$

CONCLUSION: Pilot flew very close to stall speeds.

Raw Data					Calculated	Calculated	Calculated	
Longitude [°]	Latitude [°]	Altitude above Geoid [m]	Ground Speed [kt]	Track [°]	Ground Speed [km/h]	Air Speed - [Wind Corr.]	Δ H [m]	NOTE:
14,19585	45,75311	614	46	199	85,2	48,6 kt = 90,0 km/h	-	
14,19561	45,75270	615	47	201	87,0	49,7 kt = 92,0 km/h	1	
14,19535	45,75231	616	46	204	85,2	48,9 kt = 90,5 km/h	2	
14,19507	45,75191	620	46	206	85,2	49,0 kt = 90,7 km/h	6	
14,19482	45,75151	623	47	202	87,0	49,8 kt = 92,2 km/h	9	
14,19456	45,75112	625	46	205	85,2	48,9 kt = 90,5 km/h	11	
14,19432	45,75071	628	46	202	85,2	48,8 kt = 90,4 km/h	14	
14,19408	45,75031	631	45	203	83,3	47,8 kt = 88,5 km/h	17	
14,19380	45,74991	634	48	204	88,9	50,9 kt = 94,3 km/h	20	
14,19351	45,74949	635	49	206	90,7	52,0 kt = 96,3 km/h	21	
14,19318	45,74907	639	50	208	92,6	53,0 kt = 98,1 km/h	25	
14,19287	45,74866	643	50	206	92,6	53,0 kt = 98,1 km/h	29	
14,19259	45,74821	646	51	203	94,5	53,8 kt = 99,6 km/h	32	
14,19232	45,74779	647	50	202	92,6	52,8 kt = 97,8 km/h	33	
14,19205	45,74738	649	51	201	94,5	53,7 kt = 99,4 km/h	35	
14,19176	45,74695	653	50	206	92,6	53,0 kt = 98,1 km/h	39	
14,19148	45,74653	658	48	204	88,9	50,9 kt = 94,3 km/h	44	
14,19120	45,74612	663	48	206	88,9	51,0 kt = 94,4 km/h	49	
14,19092	45,74572	667	48	205	88,9	50,9 kt = 94,3 km/h	53	
14,19065	45,74531	669	49	204	90,7	51,9 kt = 96,1 km/h	55	
14,19036	45,74489	673	49	205	90,7	51,9 kt = 96,1 km/h	59	
14,19001	45,74449	678	50	210	92,6	53,1 kt = 98,3 km/h	64	R/H TURN
14,18957	45,74416	681	48	219	88,9	51,5 kt = 95,4 km/h	67	
14,18907	45,74388	686	48	227	88,9	51,7 kt = 95,7 km/h	72	
14,18854	45,74364	690	47	236	87,0	50,9 kt = 94,3 km/h	76	
14,18800	45,74345	693	46	243	85,2	50,0 kt = 92,6 km/h	79	
14,18741	45,74335	697	44	252	81,5	48,0 kt = 88,9 km/h	83 ↔	
14,18677	45,74339	697	49	261	90,7	52,9 kt = 97,9 km/h	83	
14,18619	45,74347	696	43	273	79,6	46,7 kt = 86,5 km/h ↓	82 ↓	
14,18565	45,74357	695	41	275	75,9	44,7 kt = 82,8 km/h ↓	81 ↓	↓
								STALLING

Note 1: Calculated Air Speed according to Wind Direction 250° and Wind Speed: 4 kt

Note 2: Calculated Δ H [m] above Geoid Altitude

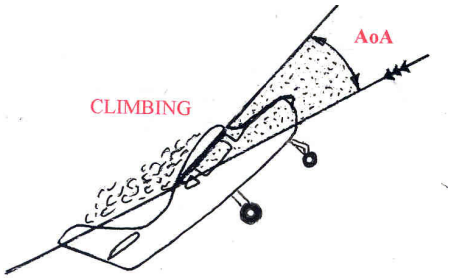
2.4 Stalling

Stalling occurs when a streamline flow becomes turbulent (See illustration below)**.**

Streamline flow over the wings brakes down and becomes turbulent when the critical angle of attack is exceeded. This causes:

- buffering (shaking and shuddering) of the airframe, felt through the controls;
- a marked decrease in Lift resulting in sinking;
- rearward movement of the Centre of Pressure (through which the Lift acts), resulting in the nose dropping;
- a marked Drag increase.

Stalling will occur whenever the Critical Angle of Attack (AoA) is exceeded, **irrespective of airspeed.**



The only way to recover is to decrease the Angle of Attack (relax the back pressure and/or move the control stick forward).

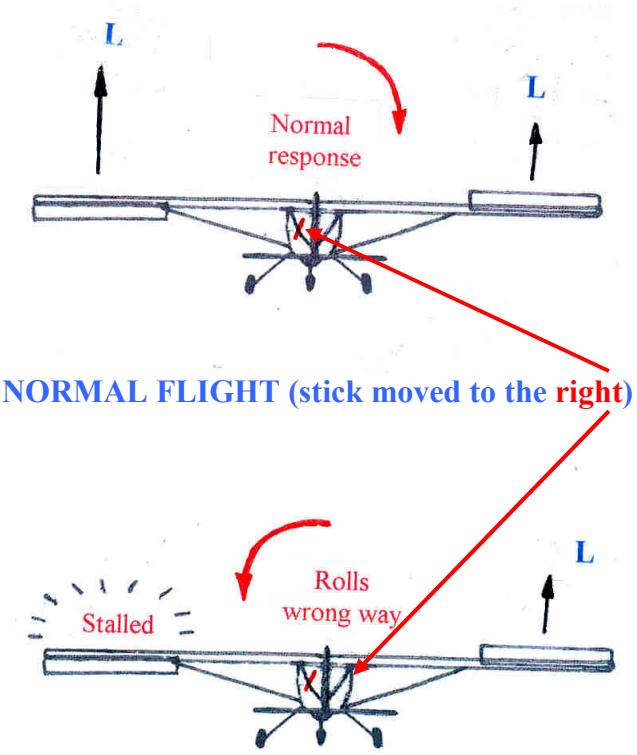
The Pilot can increase the Angle of Attack (and reduce Airspeed) by pulling the control stick back. This happens in many manoeuvres such as:

- **establishing slow flight**;
- **turning** (especially steep turns);
- **pulling out of a dive**; and
- landing.

Also, an upward gust of wind encountering the wing will increase its angle of attack.

Pilot must be careful using of ailerons near the stall speed!
A dropping wing can normally be "picked-up" by moving control stick in the opposite direction. This causes the aileron on the dropping wing to deflect downwards, increasing the Angle of Attack, and producing more Lift **(L)** on that wing. If the wing is near the stalling angle, the aileron deflection could cause the critical angle to be exceeded on that wing and, instead of rising, the loss of Lift would cause the wing to drop further.

For example see the illustration on next page.



SLOW FLIGHT NEAR STALL

Turning stall is a stall that occurs while the aircraft is turning (load factor is higher than 1g). Aircraft stalls at higher speed than the normal stall speed (which always refers to straight and level flight).

2.5 Probable Reconstruction of Flight

Pilot did not keep in mind that the aircraft was overloaded at Density Altitude of 3.399ft (1.036m). Also, he probably performed incomplete pre-flight and pre-take-off check (Left Magneto was switched off).

Pilot start from half of the runway with clear configuration (flaps up), elevator trim on full »nose up« position (he flews with wrong »force-feeling« on the stick), without max. power (engine remaining time to overhaul at 2.000 hours was only 33,1 hours).

From above mentioned reasons pilot probably performed take-off and initial climb near the Critical Angle of Attack (close to the stall speed).

During take-off pilot was looking to the right into the direction of his wife and he might been unconcentrated during the flight.

After took-off pilot notice that the rate of climb was smaller than normal. Because there was no changes of the Rate of Climb, use of Ballistic Rescue System was impossible (low

altitude) and also the landing straight ahead was impossible, pilot decided to turn back to the airport.

In right turn pilot stalled the aircraft and crashed. He probably stalled the aircraft because all the time he unknowingly flew near the stall speed because he was also mislead with wrong marks on Air Speed Indicator.

3. CONCLUSIONS

a) Findings:

- **No evidence of pre-impact aircraft or engine malfunction was found.**
- **Pilot was incompletely prepared for flight and he performed uncomplet pre-flight and pre – take-off check.**
- Pilot performed his last solo flight with this type of aircraft six month before accident.
- **Pilot overloaded the aircraft.**
- Pilot did not use available RWY distance (expecially because Density Altitude was 1.036m). **In the case of emergency pilot lost in advance 350m.**
- **Pilot did not keep in mind that the aircraft was overloaded.**
- Engine did not reach max. power because remaining time to overhaul was 33,1 hours.
- **Pilot's wrong decision was to turn back to the airport on low altitude on low speed.**
- **Pilot unknowingly performed turning stall.**

b) Probable cause:

Most probable cause was HUMAN FACTOR – Pilot's errors in pilotage technique on low speed with overloaded aircraft.

c) Contributory Factors:

- Probably the pilot's low level of knowledge and also low experience on the overloaded aircraft resulted in the aircraft being flown very close to the stall speed.
- Wrong marks on **A**ir **S**peed **I**ndicator might leaded the pilot to make errors in pilotage technique. **Result was stalled aircraft on low altitude.**

- Pilot did not understand what caused the small rate of climb. At altitude less than 60m pilot decided to turn back and perform forced landing (it was wrong decision).

- Pilot could not use Ballistic Rescue System because the aircraft was to low (approx. 80m above ground level).

- Eyewitness report that during take-off pilot was looking to the right into the direction of his wife. He might have been unconcentrated.

4. SAFETY RECOMMENDATIONS

This Investigation does not sustain any Safety Recommendations.

Marko PETERNELJ
Investigator in Charge

APPENDIX No. 1

AIRCRAFT OWNER COMMENT
ON THE DRAFT OF THIS FINAL REPORT
WITH SUPPLEMENTS IN GERMAN LANGUAGE

In accordance with seventh paragraph of Article 15 of the Decree on the Investigation of Aircraft Accidents, Serious Incidents and Incidents (Official Gazette of the Republic of Slovenia No. 72/03 and No. 110/05).

Everything is Ok. only on page 22 below Air Speed Indicator from the 472.5 kg execution.
The airspeed indicator is built of the 450 kg version.
Other data are for 450 kg version is not yet known.

Note: Incomprehensible clause

VERSION »MTOM« = 450 kg:

2.1 Einführung

Im zweiten Kapitel werden Betriebsgrenzen, Instrumentenmarkierungen und Hinweisschilder, die für den sicheren Betrieb des Luftfahrzeuges mit seinen zum Betrieb erforderlichen Anbauten notwendig sind beschrieben.
Es ist zu beachten, daß die angezeigte Geschwindigkeit mit zunehmender Höhe immer mehr abnimmt, obwohl die GS gleich bleibt. Der Grund ist die abnehmende Dichte der Luft mit zunehmender Höhe. Pro 1000 ft geht die Anzeige um ca. 2% zurück

2.2 Fluggeschwindigkeiten

	Geschwindigkeit	IAS (km/h)	Anmerkungen
V_{NE}	Zulässige Höchstgeschwindigkeit bei ruhigem Wind	200	Diese Geschwindigkeit darf nicht überschritten werden und der Ruderausschlag darf nicht mehr als 1/3 betragen.
V_{RA}	Höchste Geschwindigkeit bei Böen	170	Diese Geschwindigkeit darf bei starker Turbulenz nicht überschritten werden. Starke Turbulenz herrscht bei Gewitter, Leewellenrotoren usw. (Böen von max. 15m/s Auf oder Abwind)
V_A	Manövergeschwindigkeit	151	Oberhalb dieser Geschwindigkeit dürfen keine abrupten Ruderausschläge mehr gegeben werden.
V_{FE}	Höchstgeschwindigkeit zum Fahren der Klappen	110	Diese Geschwindigkeit darf beim Fahren der Klappen nicht überschritten werden.

2.3 *Fahrtmessermarkierungen*

Markierung	Wert oder Bereich (km/h)	Bedeutung
Grüner Bogen	**75 – 170**	Normaler Betriebsbereich.
Gelber Bogen	**170 – 200**	In diesem Bereich darf bei starker Turbulenz nicht geflogen und Manöver dürfen nur mit Vorsicht durchgeführt werden.
Roter radialer Strich	**200**	Zulässige Höchstgeschwindigkeit für alle Betriebsarten.
Blauer radialer Strich	**90**	Geschwindigkeit des besten Steigens.
Weißer Bogen	**65 – 110**	Geschwindigkeit zum Fahren der Klappen.
Gelbes Dreieck	**95**	Vom Hersteller empfohlene geringste Landeflugeschwindigkeit.
Gelber radialer Strich	**151**	Oberhalb dieser Geschwindigkeit dürfen keine abrupten Ruderausschläge mehr gegeben werden.

Ausgabe : 05.03.2004 **Seite 2 – 1**

VERSION »MTOM« = 472,5 kg:

2.1 Einführung

Innerhalb des zweiten Kapitels werden Betriebsgrenzen, Instrumentenmarkierungen und Hinweisschilder die für den sicheren Betrieb des ULF mit seinen zum Betrieb erforderlichen Anbauten notwendig sind beschrieben.

2.2 Fluggeschwindigkeiten

	Geschwindigkeit	IAS [km/h]	Anmerkungen
V_{NE}	zulässige Höchstgeschwindigkeit bei ruhigem Wetter	200	diese Geschwindigkeit darf nicht überschritten werden, und der Ruderausschlag darf nicht mehr als 1/3 betragen
V_C	Höchste Geschwindigkeit bei Böen	160	diese Geschwindigkeit darf bei starker Turbulenz nicht überschritten werden. Starke Turbulenz herrscht bei Gewitter, Leewellenrotoren, ect. (Böen max. 15m/s Auf- oder Abwind)
V_A	Manövergeschwindigkeit	147	oberhalb dieser Geschwindigkeit dürfen keine abrupten Ruderausschläge mehr gegeben werden
V_{DF}	Geschwindigkeit zum Fahren der Klappen	108	diese Geschwindigkeit darf beim Fahren der Klappen nicht überschritten werden

2.3 Fahrtmessermarkierungen

Markierung	Wert oder Bereich	Bedeutung
grüner Bogen	65 - 147	normaler Betriebsbereich
gelber Bogen	147-200	in diesem Bereich darf bei starker Turbulenz nicht geflogen und Manöver dürfen nur mit Vorsicht durchgeführt werden
roter Strich	200	zulässige Höchstgeschwindigkeit für alle Betriebsarten
blauer Strich	90	Geschwindigkeit des bestens Steigens
weißer Bogen	58 - 108	Geschwindigkeit zum Fahren der Klappen
gelbes Dreieck	100	vom Hersteller empfohlene geringste Landeanfluggeschwindigkeit