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In case of inconsistency original version in Slovak language is applicable.*



MINISTRY OF TRANSPORT, CONSTRUCTION AND REGIONAL DEVELOPMENT OF THE SLOVAK REPUBLIC

Aviation and Maritime Investigation Authority
Námestie slobody 6, P.O.BOX 100, 810 05 Bratislava 15



Reg. No.: SKS2013010

FINAL REPORT

on investigation of serious incident of

glider type **L-13SE Vivat**

Registration No **OM-7101**

Date: 01.07.2013

Place: Nová Dedinka

The investigation of occurrence has been conducted pursuant to Art. 18 of the Act No. 143/1998 on Civil Aviation (Civil Aviation Act) and on Amendment of Certain Acts and in accordance with the Regulation (EU) No. 996/2010 of the European Parliament and of the Council on investigation and prevention of civil aviation accidents and incidents, governing the investigation of civil aviation accidents and incidents.

The final report is issued in accordance with the Regulation L 13 that is the application of the provisions of ANNEX 13 Aircraft Accident and Incident Investigation to the Convention on International Civil Aviation.

The exclusive aim of investigation is to establish causes of accident, incident and to prevent their occurrence, but not to refer to any fault or liability of persons.

This final report, its individual parts or other documents related to the investigation of occurrence in question have an informative character and can only be used as recommendation for the implementation of measures to prevent occurrence of other accidents and incidents with similar causes.

A. INTRODUCTION

Type of aircraft:	L-13 SE Vivat
Registration No:	OM-7101
Operator / Owner:	SNA gen. M. R. Štefánika / Silentium Sanus s.r.o.
Type of operation:	general aviation / sport and recreational flying
Take-off site:	airport Očová / LZOC
Planned landing site:	airport Boleráz / LZTR
Flight phase:	navigation flight
Place of incident:	Nová Dedinka
Geographic coordinates of the place of incident:	N 48° 11' 29,70'' E 17° 22' 18,80''
Date and time of incident:	01.07.2013, 09:54

Note: All time data in this report are stated in the UTC time.

B. INFORMATIVE SUMMARY

On 01.07.2013 the pilot with a passenger was on the navigation flight with aircraft type L-13 SE Vivat, Registration No. OM-7101. After the entry into the terminal control area Štefánik (hereinafter "CTR Štefánik") the pilot was conducting local operations. After their termination he continued the flight from the point Most pri Bratislave to the output point Senec.

At 09:54:47 the pilot reported the failure of the driving unit and the emergency ground landing near the community Nová Dedinka.

The commission composed of the following members was appointed for investigation of the incident:

Ing. Igor BENEK
Ing. Juraj GYENES

The report is issued by:

Aviation and Maritime Investigation Authority
of the Ministry of Transport, Construction and Regional Development
of the Slovak Republic

C. MAIN PART OF REPORT

1. FACTUAL INFORMATION
2. ANALYSES
3. CONCLUSIONS
4. SAFETY RECOMMENDATIONS

1. FACTUAL INFORMATION

1.1 History of the flight

On 01.07.2013 the pilot with a passenger was on the navigation flight on the route LZOC – Vráble – Veľký Meder – Šamorín – Bratislava – Senec - LZTR.

At 08:00 the pilot established communication with the airport control tower Štefánik (hereinafter “TWR Štefánik”), reported the flight direction of Zlaté Klasy, requested for the permission for entry as VFR flight in CTR Štefánik in an altitude of 1000 ft AGL with performance of local operations in the position Šamorín, Veľká Paka and Bratislava – city. The non-radar tower controller Štefánik (hereinafter “PC TWR Štefánik”) permitted the local operations.

At 09:34:36 the pilot requested for the permission to cross the prolonged axis of RWY04 and to continue the flight to Most pri Bratislave. PC TWR Štefánik confirmed the request.

At 09:38:14 PC TWR Štefánik permitted the pilot to continue the flight directly to Senec. The pilot confirmed the message and requested for permission to continue the operations over the community Most pri Bratislave. PC TWR Štefánik permitted the operations.

At 09:44:54 the pilot requested for permission to continue the flight directly to Senec. The operating parameters showed standard values during the whole flight until the failure of engine.

At 09:54:47 the pilot reported the failure of the driving unit and the ground landing south of the city Senec.

After the failed attempt at the restart of the engine the pilot made an emergency landing at course 160° in the field with high crops in the cadastral area of community Nová Dedinka. The distance from the first contact point of the aircraft with the ground to the end point of the ground roll was approximately 60 m.

After the landing the aircraft remained standing damaged. The crew of the aircraft was not damaged in the incident.

Daytime: day

Flight rules: VFR

1.2 Injuries to persons

Injury	Crew	Passengers	Other persons
Fatal	-	-	-
Serious	-	-	-
Minor	-	-	-
None	1	1	

1.3 Damage to aircraft

The aircraft suffered minor damage.

Damage to aircraft:

- Pierced engine block
- Broken connecting rod
- Separated auxiliary wheel on the left wingtip
- Destroyed horizontal stabilizer and elevator.



1.4 Other damage

No circumstances with potential claims for compensation of other damage toward a third party were notified to the Aviation and Maritime Investigation Authority.

1.5 Personnel information

Pilot:

National of the Slovak Republic, male, aged of 22 years
Holder of the PPL(A) private glider licence No. SK 02110195 issued by the Civil Aviation Authority of the Slovak Republic on 23.11.2011 with marked validity until 01.08.2017.

Qualifications:

SEP(L) with marked validity until 30.11.2013
TMG with marked validity until 31.07.2014

Flying experience:

Total flight hours 163 h 39 min and 430 flights
For the last 90 days 31 h 55 min
For the last 30 days 20 h 10 min
With given type 32 h 45 min

Medical certificate of 2nd class with marked validity until 30.06.2016.

General radio telephonist licence No. VVR-41/2011.

Passenger:

National of the Slovak Republic, male, aged of 31 years.

1.6 Aircraft information

a) Airframe

Type: L-13 SE Vivat
Registration No: OM-7101
Serial No.: 870203
Year of manufacture: 1987
Manufacturer: Aerotechnik, Kunovice, Czech Republic

The certificate of airworthiness No. 0441-S, issued by the Civil Aviation Authority of the Slovak Republic on 08.04.2008.

The certificate of verification of airworthiness No. ARC 0441-S/16/13, issued by Slovácky aeroklub Kunovice, Czech Republic, as organization authorized for management of maintenance of airworthiness, with marked validity until 22.03.2014.

Total operating hours since manufacture: 2126 h 35 min and 6171 flights

Third-party insurance: Allianz Slovenská poisťovňa, č. 411 017 301.

b) Engine

Type: MIKRON IIIB
Serial No.: 36249
Manufacturer: Walter, Praha – Jinonice, Česká republika

In 1999 production, repairs and development of engines were transferred to the company PARMA - TECHNIK, s.r.o.

Operating hours since the last general overhaul: 1119 h 52 min

1.7 Meteorological situation

Meteorological conditions had no influence on the occurrence of the incident.

1.8 Aids to navigation

N/A.

1.9 Communication

The aircraft was equipped by radiocommunication equipment enabling two-way radio communication with all air stations at every moment of flight.

1.10 Information about airport

N/A.

1.11 Flight recorders

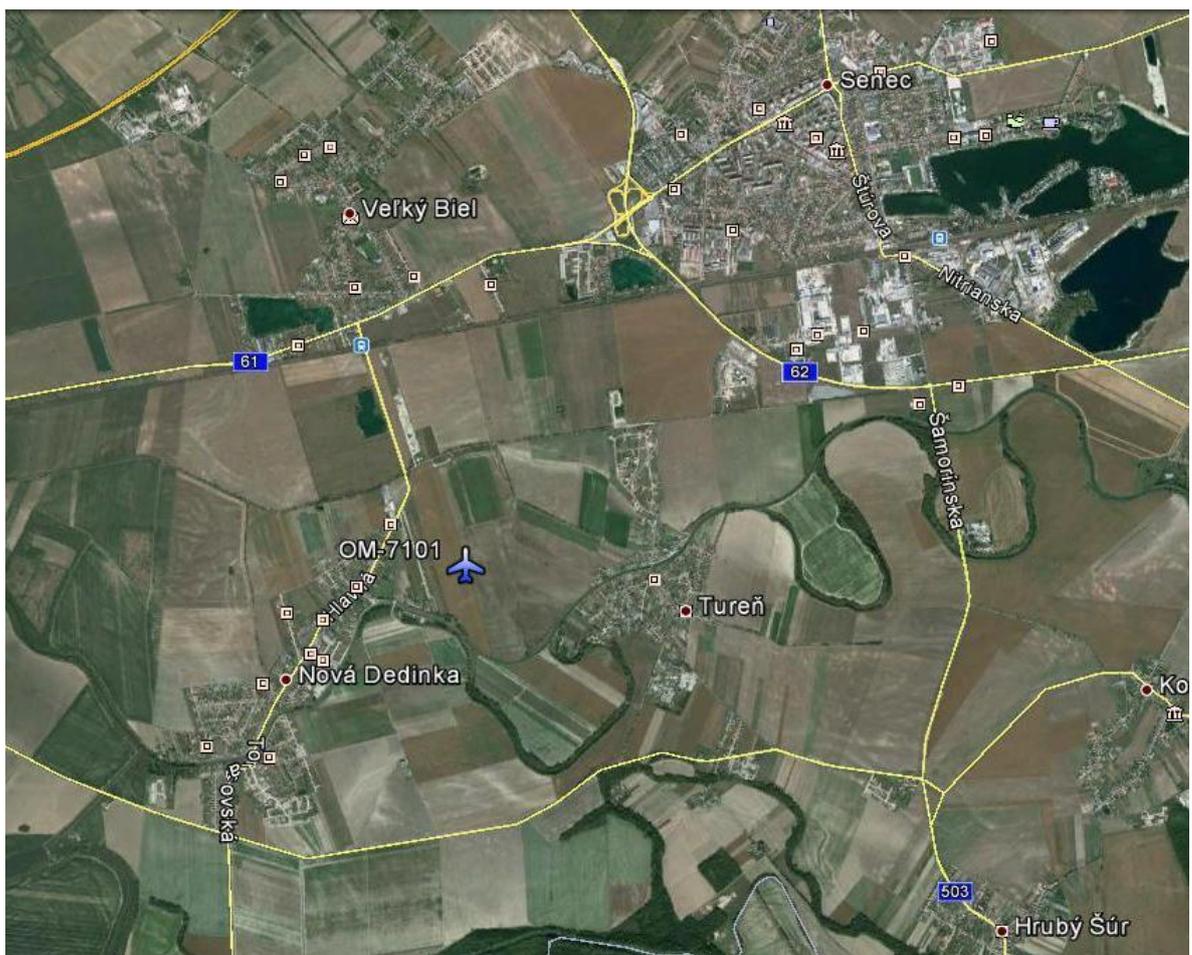
N/A.

1.12 Wreckage and impact information

Place of emergency ground landing:

N 48° 11' 29,70''

E 17° 22' 18,80''





1.13 Medical and pathological information

N/A.

1.14 Fire

No fire broke out.

1.15 Aspects of survival

The search and rescue operations with the use of SAR means were not required.

1.16 Tests and research

The sample of **gasoline** was sent for analysis to EUROFINs BEL/NOVAMANN s.r.o – accredited testing laboratory in Bratislava. The sample of gasoline BA 95N fulfilled the requirements of standard STN EN 228 in selected parameters.

The sample of **oil** was tested in the company for production, distribution and service of lubricants MOL-LUB s.r.o. - laboratory WEARCHECK. Based on the analysis, oil viscosity at temperature of 40°C was lower than the lower limit of the respective viscosity class.

The oil was contaminated by fuel. The drop of viscosity was probably caused by oil dilution with fuel. Moreover, the oil contained inadmissible amount of water (0.48%).

Engine was removed from the aircraft and sent to the company PARMA - TECHNIK, s.r.o. for analysis, where it was partially taken to pieces. After the dismantling of the engine starter and propeller carrier the experts detected bruised material in the key groove of the crankshaft and a broken tooth of the toothed rim. These faults were probably caused by the engine failure. The next step was the removal of the cover and broken connecting rod from cylinder No. 4. None of the bearings showed an excessive wear due to insufficient lubrication, as assumed on the basis of analysis of used oil, which detected a drop in viscosity caused by oil contamination with fuel. All the cylinders were in good working order without excessive wear. On piston no. 4 the upper ring was fully gummed, the second ring was half-gummed and the scraper ring was fully gummed. The piston No. 1 showed the same signs of wear: the upper ring was fully gummed, the second ring was free and the scraper ring was fully gummed. The remaining two pistons were in good order, carbon on all of them corresponded to the number of operating hours. The probable cause of oil contamination with fuel was the gummed rings of two cylinders, through which the mixture could leak out of the combustion chamber.

The damaged **connecting rod of the engine**, broken into several parts, was sent to the Institute of Criminology and Expertises of the Police Corps for analysis in order to detect the mechanism of damage to the connecting rod. For better transparency of investigation into causes of the damage to the connecting rod the individual ruptures were marked with alphabetic characters (photo No.1).

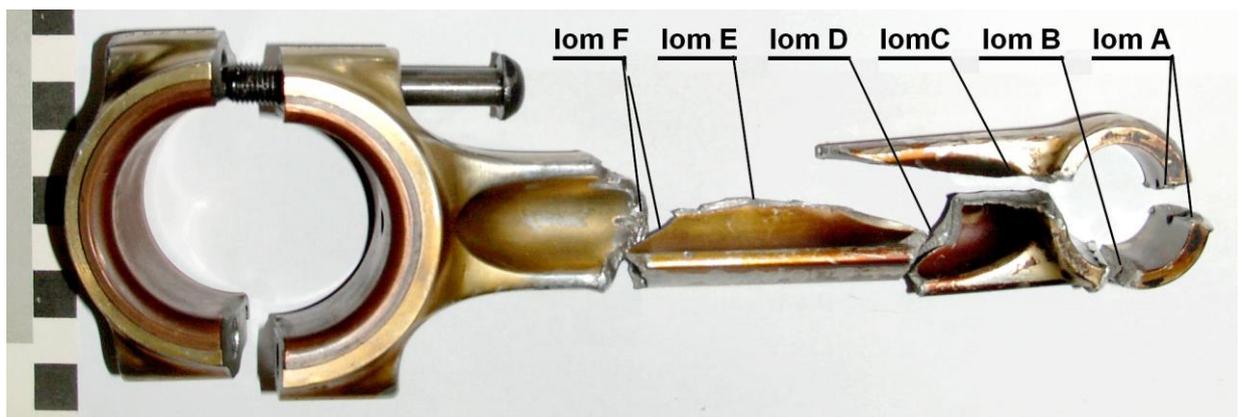


Photo No.1 Submitted parts of damaged connecting rod and ruptures marked with alphabetic characters

Rupture A situated in the upper section of the top connecting-rod eye and passing through the lubrication hole of the dudgeon pin shows signs of the fatigue mechanism of material damage with initiation area on the inner edge of the lubrication hole (photo No. 2).



Photo No. 2 Fatigue rupture in the upper section

Rupture B situated on the side of the top connecting-rod eye (photo No.1) did not show any signs of fatigue or other material damage by stages and was caused by secondary material overloading.

Rupture C showed an unusually straight line of growth and remarkable flatness of the rupture surface (photos No. 1 and 3). The rupture had a fragile or fission character (photo No. 4) without signs of fatigue material damage and was caused by application of dynamic pressure from the dudgeon pin on the internal wall of the eye secondarily, after the formation of rupture A in the upper section of the eye. The straight line of growth of the rupture in this case was related to the high dynamics of destructive load and to the high speed of fracture propagation.

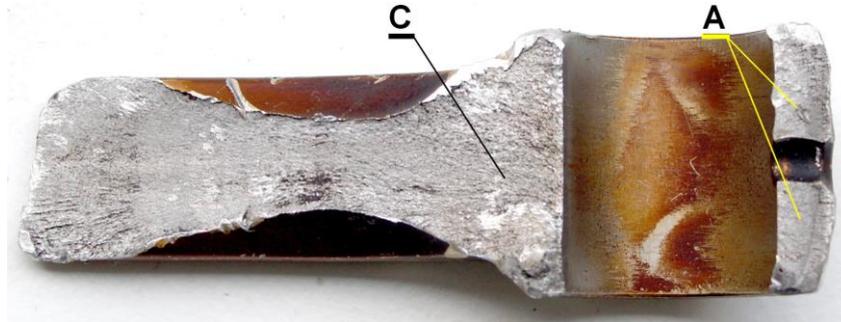


Photo No. 3 Rupture C and its straight line of growth

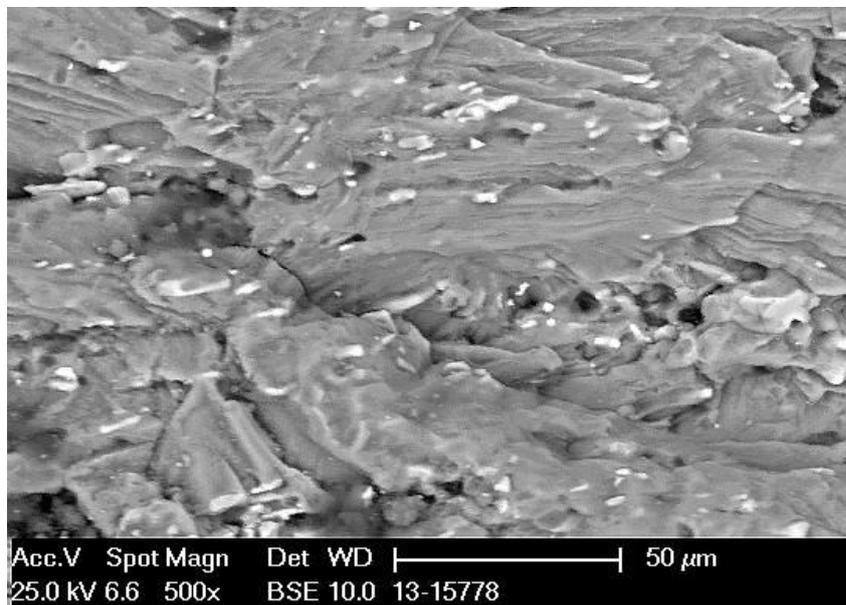


Photo No.4 Fission character of rupture C (SEM – picture from scanning electron microscope)

Ruptures D, E and F developed later and had no causal relation to the damage to the connecting (photo No.1).

The connecting rod was made from aluminium alloy with trace amounts of copper, manganese, nickel and iron (SEM/EDX – analysis based on the method of scanning electron microscopy using the device PHILLIPS, type XL-30, with energy-dispersive X-ray spectrometer of company EDAX).

Al-Cu-Mg alloys are normally used in aviation. The addition of nickel increases their strength at higher temperature, which fully corresponds to the detected composition of material of the connecting rod and to its use in the aircraft engine.

1.17 Organizational and management information

N/A.

1.18 Additional information

N/A.

1.19 Useful or effective investigation techniques

Standard investigation techniques were used.

2. ANALYSIS

After the failure of engine during the flight the pilot of aircraft correctly evaluated and solved the situation by making the emergency ground landing on selected surface.

The analysis of submitted parts of the damaged connecting rod showed that the connecting rod had been primarily damaged by fatigue rupture in the upper section of its top eye. The fatigue fracture was initiated on the lower edge of the lubrication hole, which acted at this point as a cut or tension concentrator.

3. CONCLUSIONS / CAUSE OF SERIOUS INCIDENT

3.1 Findings

- The pilot had valid qualifications for the critical flight,
- The aircraft had valid documentation and did not show any faults before the serious incident
- The aircraft fulfilled the conditions of airworthiness before the critical flight.

3.2 Causes of serious incident:

- Failure of engine caused by broken connecting rod of piston No. 4, which then pierced the engine block,
- The rupture of the connecting rod was caused by fatigue rupture in the upper section of the eye on the lower edge of the lubrication hole.

4. SAFETY RECOMMENDATIONS

On the basis of investigation of causes of serious incident that occurred on 1 July 2013

we recommend the manufacturer PARMA – TECHNIK, s.r.o.

to issue a binding TECHNICAL BULLETIN – to implement the check of connecting rods in the form of NDT RT - Nondestructive Testing Radiography Testing of engines of serial numbers 36xxx (engines from original production Walter), that have already undergone the second general overhaul, not later than 600 hours after the general overhaul.

Bratislava, 10.03.2014