



Statens haverikommission
Swedish Accident Investigation Board

ISSN 1400-5719

Report RL 2005:27e

Accident involving aircraft SE-LTP in Värnamo, F county, Sweden, on 16 November 2004

Case Dnr L-48/04

SHK investigates accidents and incidents with regard to safety. The objective of the investigations is the prevention of similar occurrences in the future. It is not the purpose of the Board's activities to apportion blame or liability.

The material in this report may be reproduced free of charge for publication or other purpose provided due acknowledgement is made.

The report is also available on our website: www.havkom.se.

Translated by Tim Crosfield, M.A., from the original Swedish at the request of the Swedish Accident Investigation Board.

In case of discrepancies between the English and the Swedish texts, the Swedish text is to be considered the authoritative version.

Statens haverikommission (SHK) Swedish Accident Investigation Board

Postadress/Postal address
P.O. Box 12538
SE-102 29 Stockholm Sweden

Besöksadress/Visitors
Teknologgatan 8 C
Stockholm

Telefon/Phone
Nat 08-441 38 20
Int +46 8 441 38 20

Fax/Facsimile
Nat 08 441 38 21
Int +46 8 441 38 21

E-mail Internet
info@havkom.se
www.havkom.se

2005-11-30

L-48/04

Swedish Civil Aviation Authority

SE-601 73 NORRKÖPING

Sweden

Report RL 2005:27e

The Swedish Accident Investigation Board (Statens haverikommission) has investigated an accident that occurred on 16 November 2004, in Värnamo, F County, Sweden, involving an aircraft with registration number SE-LTP.

In accordance with section 14 of the Ordinance on the Investigation of Accidents (1990:717), the Board submits herewith a report on its investigation.

Carin Hellner

Dan Åkerman

Appendices

- 1 Excerpt from certificate of registration regarding the pilot (Civil Aviation Authority only)
- 2 Thielert Service Bulletin TAE 125-0002

Report RL 2005:27e

L-48/04
Report finalised 30-11-2005.

<i>Aircraft: registration, type</i>	SE-LTP, Diamond DA 40 D
<i>Class, airworthiness</i>	Normal, valid certificate of airworthiness
<i>Owner/operator</i>	Hagshult Flyg AB/Värnamo Flying Club
<i>Time of event</i>	16-11-2004, 23.59 hrs in darkness <i>Note.:</i> All times are given in Swedish normal time (UTC + 1 hour)
<i>Place</i>	Värnamo, F county (pos 5710.58N 01400.03E; approx 170 m above sea level)
<i>Type of flight</i>	Instructional flight
<i>Weather</i>	According to SMHI analysis: westerly wind 5 knots, good visibility, no cloud, temp./dew point -3/-5 °C, QNH 1012 hPa
<i>Persons on board:</i>	
<i>crew members</i>	2
<i>passengers</i>	1
<i>Injuries to persons</i>	None
<i>Damage to aircraft</i>	Limited
<i>Other damage</i>	None
<i>Instructor:</i>	
<i>Sex, age, licence</i>	Man, 32 yrs, CPL
<i>Total flying time</i>	477 hours, of which 29 on type
<i>Flying hours, latest 90 days</i>	33 hours, of which 16 on type
<i>Number of landings, previous 90 days</i>	85, of which 58 on type
<i>Pupil:</i>	
<i>Sex, age, licence</i>	Man, 26 yrs, PPL
<i>Total flying time</i>	71 hours, of which 16 on type
<i>Flying hours, latest 90 days</i>	8, all on type
<i>Number of landings, previous 90 days</i>	21, all on type

The Swedish Accident Investigation Board (SHK) was informed on 17 November 2004 that an accident involving an aircraft with registration SE-LTP had occurred in Värnamo, F County, Sweden, on 16 November at 23.59 hrs.

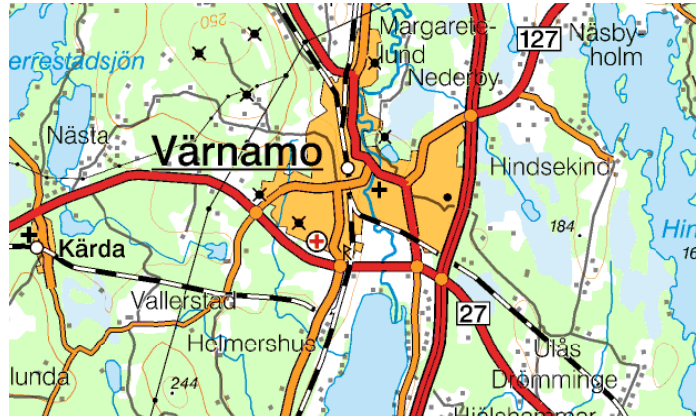
The accident has been investigated by SHK represented by Carin Hellner, chairman, Mats Öfverstedt, chief operational investigator until and including 11 February 2005, and Dan Åkerman, chief technical investigator.

The investigation was followed by Magnus Axelsson, Swedish Civil Aviation Authority.

History of the flight, etc

An instructor with a student and a passenger were performing a navigation flight from Växjö/Kronoberg airport, intending to land at Värnamo airport. When they were approaching Värnamo the engine revolutions suddenly increased and at the same time oil pressure fell, whereupon it went to zero. Shortly thereafter, the oil pressure increased above the normal value and then disappeared. After a brief period the engine stopped. The crew followed the steps given in the checklist for engine failure and got the engine running for about 10 seconds before it stopped again.

When the engine stopped smoke penetrated the cabin and sparks and flames were seen under the engine cowling. These went out after a few seconds. The instructor took over control of the aircraft from the student and initiated a forced landing on a plot on an industrial estate. The landing was successful and the aircraft sustained only negligible damage. The crew and the passenger left the aircraft unharmed. There was no fire, nor any leakage of fuel; nor was there any effect on the environment.



After the landing it was found that the underside of the fuselage was covered with engine oil. In addition a connection rod had failed and made a hole in the crankcase.

The Diamond DA-40 D is a low-winged, four-seater composite aircraft driven by a turbocharged Thielert diesel engine. Originally intended for vehicle use, the engine produces its power at an r.p.m. that is too high to drive a propeller directly. For this reason a reduction gearbox is fitted between engine and propeller. Mounted on, and driven by, this gearbox there is a double oil pump. One part of this is a return oil pump from the turbocharger while the other supplies the propeller with oil pressure for varying the pitch.

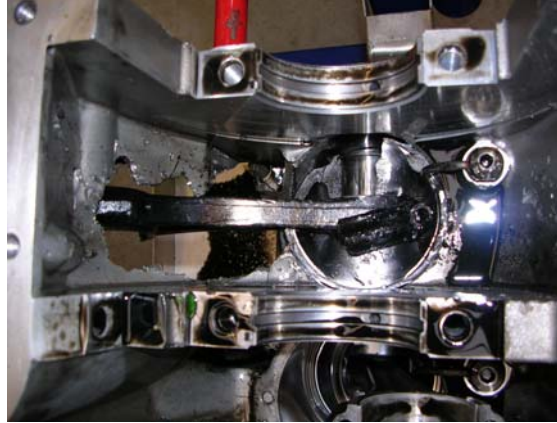


Engine output and revolutions are governed by two parallel computers, termed Full Authority Digital Engine Controls. These receive commands from the throttle control at the pilot's position and affect both the fuel injection system and the variable-pitch propeller. Simply expressed, the function is that the pitch of the propeller blades controls the engine revolutions while the quantity of injected fuel determines power output. The computer saves operational data, which can be downloaded to a PC for analysis.

Operational data from the flight in question, together with the engine, were sent to the engine manufacturer shortly after the event. Using the data, and even before inspecting the engine, the manufacturer was able to

form the opinion that there had probably been a problem with the double oil pump mentioned above.

Following arrival at the factory the engine was dismantled by Thielert and SHK staff. It was found that it contained very little oil, that the rear connecting rod bearing had seized and that the connecting rod was broken off. Also, the connecting rod had made a hole in the crankcase, as shown in the illustration below.



The double oil pump proved to have an extremely worn input shaft, see illustration:



(To the left, a new pump and shaft.)

The input shaft is driven by a driving plate, see illustration, pressed into the splined end of the gearbox intermediate drive. No visible damage to the driving plate was noted. The connection between the driving plate and the oil pump input shaft is designed to have a small but noticeable play.



At the time of the event the operating time of the engine and reduction gearbox was 449 hours.

The Thielert TAE 125-01 is an engine newly developed for aviation, and it is not uncommon for the manufacturer of a new product to need a little time to overcome teething troubles. This may mean that certain components must initially have considerably shorter operating times between overhauls. Part of the work involved in gathering operating experience may for example be to take oil samples to assess wear levels, or simply to replace whole components to carry out maintenance and modifications.

One example of this is Thielert's Service Bulletin TAE 125-0002 (Category 5 – only for information). Under the heading "Life time extension program, inspection" this bulletin includes the following:

- "Actions: Inspection/Replacement of the gearbox according to Repair Manual /.../.
 Inspection of gearbox oil and filter.
 Inspection of engine oil and filter.
 For the reason of data sampling, the replaced gearbox as well as the engine oil and the gearbox oil and their filters have to be sent to Thielert Aircraft Engines GmbH.
- Remarks: The gearbox of the engine TAE 125-01 has to be inspected after each 300 flying hours.
 For further information please contact Thielert Aircraft Engines GmbH."

The whole bulletin is attached as Appendix 2.

The firm's intention in the bulletin is that the operator of the aircraft should dismount the gearbox after 300 flying hours and send it to the factory for inspection.

The engine in question was installed in SE-LTP on 5 July 2004. It had been supplied by Thielert as a replacement engine and had an operating time of 195 hours, as shown in the accompanying documents, i.e. its logbook and EASA Form 1. This operating time was not entered in the Swedish engine daybook.

Conclusions

The engine failure was probably caused by the input shaft of the double oil pump having become so worn that the pump was no longer being driven. When this occurs there are two consequences. One is that the propeller is no longer supplied with oil pressure for varying blade pitch. It moves to fine pitch, whereupon engine revolutions increase. The other consequence is that oil is no longer emptied from the turbocharger but, since the engine pressure oil pump is still functioning and delivering oil to the turbocharger, the latter's oil sump overflows. The oil makes its way out of the supercharger wherever it can: out onto the underside of the aircraft instead of into the engine oil sump. After a minute or so the latter is empty and a bearing in the engine overheats and seizes up because of lack of oil.

This course of events is supported by the operating data log read by the manufacturer.

At the time, the engine had an approximately 50 % longer operating time than the 300 hours given in the service bulletin above.

The engineer responsible has stated in discussion with the Board that he did not see removal and replacement of the gearbox as obligatory.

The Board of Accident Investigation has some understanding for this view.

In the Board's opinion the phrasing of the bulletin is unfortunate: it is classed as "Category 5, Information only", which does not make it appear as a condition for airworthiness.

Nor does the heading "Actions" give the information that the gearbox must be removed and sent to the factory. The impression is given, rather, that this can be a consequence of an inspection that can be done without removal.

In addition, the Board considers that the design of the oil pump drive is doubtful at several points. For one thing the carrier, as mentioned earlier, is only pressed into its shaft with no secure locking arrangement. Secondly, the play between the carrier and the oil pump shaft, together with unavoidable changes in radial position between the two, entails wear.

After the event the German civil aviation authority, on 7 April 2005 issued an airworthiness directive, D-2005-152. This directive refers to the factory's service bulletin TM TAE 125-0010 in which a number of maintenance items, including replacement of gearbox/oil pump, are made compulsory.

The factory has also redesigned the oil pump drive.

The accident was caused by the fact that the oil pump drive was not suitably designed for its purpose.

Following the event the oil pump drive has been redesigned and the original pumps will be replaced successively, whereafter operators will meet the requirements of the airworthiness directive mentioned above. The Swedish Board of Accident Investigation makes no recommendations.



Thielert Aircraft Engines GmbH

Platanenstraße 14
D - 09350 Lichtenstein, Germany

Tel. +49-(0)37204/ 696-90
Fax +49-(0)37204/ 696-50
www.centurion-engines.com
info@centurion-engines.com

Technische Mitteilung / Service Bulletin

Technische Mitteilung Nr. / Datum: TM TAE 125-0002, Revision3 / 29.10.2004
Service Bulletin No. / Date TM TAE 125-0002, revision 3 / October 29th, 2004

Betrifft: Lebensdauererweiterungsprogramm, Inspektion
Subject: life time extension program, inspection

Betroffenes Luftfahrtgerät: gesamter Flugmotor TAE 125-01
Type affected: entire aircraft engine TAE 125-01

Betroffene Geräte-Nr.: alle
Models affected: all

Einstufung: Kategorie 5 – nur zur Information
Compliance: Category 5 – for information only

Dringlichkeit: alle 300 Flugstunden
Accomplishment: each 300 flight hours

Grund: Der Flugmotor TAE 125-01 befindet sich in einem Lebensdauererweiterungsprogramm.
Reason: The aircraft engine TAE 125-01 is subject of a life extension program.

Maßnahmen: Inspektion / Austausch des Getriebes entsprechend Reparaturhandbuch RM 02-01 Abschnitt 03.0.
Analyse des Getriebeöl und des -filters
Analyse des Motoröl und des -filters
Zum Zwecke der Datensammlung sind das ausgetauschte Getriebe sowie die Motor- und Getriebeölproben und deren Filter an die Thielert Aircraft Engines GmbH zurückzusenden.

Actions: Inspection / replacement of the gearbox according to Repair Manual RM 02-01 Chapter 03.0.
Inspection of gearbox oil and filter
Inspection of engine oil and filter
For the reason of data sampling, the replaced gearbox as well as the engine oil and the gearbox oil and their oil filters have to be sent to Thielert Aircraft Engines GmbH.



Thielert Aircraft Engines GmbH

Platanenstraße 14
D - 09350 Lichtenstein, Germany

Tel. +49-(0)37204/ 696-90
Fax +49-(0)37204/ 696-50
www.centurion-engines.com
info@centurion-engines.com

Technische Mitteilung / Service Bulletin

Technische Mitteilung Nr. / Datum: TM TAE 125-0002, Revision3 / 29.10.2004
Service Bulletin No. / Date TM TAE 125-0002, revision 3 / October 29th, 2004

Hinweise: / Remarks:

Das Getriebe der Flugmotoren TAE 125-01 ist nach jeweils 300 Flugstunden zu inspizieren.
The gearbox of the engines TAE 125-01 has to be inspected after each 300 flying hours.

Für weitere Informationen wenden Sie sich bitte an die Thielert Aircraft Engines GmbH.
For further information, please contact Thielert Aircraft Engines GmbH.

Zulassung: Die technischen Informationen, die in diesem Dokument enthalten sind, wurden im Rahmen der Befugnisse der EASA- Genehmigung als Entwicklungsbetrieb Nr. EASA.21J.010 genehmigt.

Approval: *The technical information contained in this document has been approved under the authority of EASA Design Organisation Approval no. EASA.21J.010.*