



Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2007:05e

**Incident involving aircraft SE-LIP
at Stockholm/Arlanda airport, AB county,
on 1 June 2006**

Case L-11/06

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Report RL 2007:05e

The Swedish Accident Investigation Board (Statens haverikommission) has investigated an aircraft incident that occurred on 1 June 2006 at Arlanda airport, O county, involving an aircraft with registration SE-LIP.

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

Åsa Kastman Heuman

Henrik Elinder

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1	Extract from Register of Licences regarding the pilot (to the Swedish Civil Aviation Authority only)	
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L-11/06

Report finalised 9 February 2007

<i>Aircraft; registration and type</i>	SE-LIP, Fokker F27 MK050
<i>Class/airworthiness</i>	Normal, valid Certificate of Airworthiness
<i>Owner/Operator</i>	Largus Aviation AB, Box 14237 SE-104 40 Stockholm/Skyways Express AB, Box 915, SE-195 86 Arlandastad, Sweden
<i>Time of occurrence</i>	2006-06-01, time 07:15 in daylight <i>Note.</i> : All times are given in Swedish daylight saving time (UTC + 2 hours)
<i>Location</i>	In airspace Northeast of Arlanda airport, AB county
<i>Type of flight</i>	Commercial passenger transport
<i>Weather</i>	According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis in respect of Arlanda airport: Wind 010°/18 knots, good visibility, 2/8 cirrocumulus cloud with base at 1500 feet, 7/8 with base at 1700 feet, temp./dewpoint +9/+5 °C, QNH 1010 hPa
<i>Persons on board:</i>	
<i>crew members</i>	3
<i>passengers</i>	17
<i>Injuries to persons</i>	None
<i>Damage to the aircraft</i>	Limited
<i>Other damage</i>	None
<i>Commander:</i>	
<i>Gender, age, licence</i>	Male, 54 years, ATPL
<i>Total flying time</i>	12200 hours, of which 2700 hours on type
<i>Flying hours previous 90 days</i>	44 hours, all on type
<i>Number of landings previous 90 days</i>	38
<i>Co-pilot:</i>	
<i>Gender, age, licence</i>	Male, 55 years, ATPL
<i>Total flying time</i>	16000 hours, of which 3600 hours on type
<i>Flying hours previous 90 days</i>	200 hours, all on type
<i>Number of landings previous 90 days</i>	197
<i>Cabin crew members</i>	One female

The Swedish Accident Investigation Board (SHK) was notified on 1 June 2006 that an aircraft with registration SE-LIP had an incident Northeast of Arlanda airport, AB county, that same day at 07:15.

The incident has been investigated by SHK represented by Åsa Kastman Heuman, Chairperson, Henrik Elinder, Chief technical investigator aviation, and Stefan Christensen, operations investigator

The investigation was followed by Max Danielsson, representing the Swedish Civil Aviation Authority.

Summary

The aircraft took off from Stockholm/Arlanda to undertake a flight to Wasa in Finland with the commander as PF (Pilot Flying). About 15 minutes after take-off, a red warning flag was activated on the commander's altimeter and at the same time the information on the Altitude Select instrument disappeared. The pilot simultaneously saw that faint smoke was seeping out from the central control console between the pilots' seats and there was a smell of electrical burning.

The commander then called out "Electrical fire" and transmitted an emergency message to Stockholm control. The pilots then put on their oxygen masks and began to perform the checklist operations.

The amount of smoke in the cockpit decreased after a few minutes. Approach and landing took place with a tailwind component on runway 19R without difficulty. After landing, the aircraft taxied to the ramp where the passengers disembarked in the normal manner.

The technical investigation has shown that an internal short circuit arose in the left side altimeter of type THOMSON-CSF with P/N 60121-001-1, S/N 256. This fault caused smoke to be generated and faults to occur in the aircraft's flight data and navigation system. The short circuit in the altimeter was considered to be a one-off event.

A local procedure among pilots was to switch off the oxygen mask audio connection due to noise interference, which meant that communication between air traffic control and the aircraft was interrupted for about five minutes.

The incident was caused by a short circuit in the left side altimeter.

Recommendations

None.

1 FACTUAL INFORMATION

1.1 History of the flight

1.1.1 *Take-off and departure*

After the normal preparations for starting, the pilots took off in the aircraft from Stockholm/Arlanda airport to undertake a flight to Wasa in Finland, flight number BLS470. The commander was PF (Pilot Flying) on this particular segment. The take-off was to the north and climb-out began in accordance with normal practice, towards the planned cruise altitude of FL 210 (21000 feet).

About 15 minutes after take-off, while the aircraft was climbing through FL 140, a red warning flag was activated on the commander's altimeter and at the same time the information on the Altitude Select instrument disappeared. The pilot simultaneously saw that faint smoke was creeping out from the central control console between the pilots' seats. In connection with this the pilots also smelled electrical burning.

The commander then called out "Electrical fire" and transmitted an emergency message to Stockholm control, with a request to turn back and land at Arlanda airport. The pilots then put on their oxygen masks and began to perform the checklist operations. In connection with this the commander handed over control to the co-pilot, who became PF for the remainder of the flight.

The request was accepted by air traffic control, which vectored¹ the aircraft for an approach to Arlanda. Due to the serious situation, with smoke coming from an unknown source in the cockpit, the commander decided to land to the south, with a straight in approach to runway 19R at Arlanda. This meant landing downwind, but also meant that the time in the air was considerably shortened, since the aircraft was north of the airport.

1.1.2 *Approach and landing*

After the aircraft had been given clearance direct to Arlanda, there followed a period of almost five minutes without any radio transmission from the aircraft.

The lack of transmissions from the aircraft was due to the fact that the commander's oxygen mask did not have its audio connections connected (see 1.6.3).

Since the technical failure in the aircraft's altimeter system also resulted in the loss of the transponder's height reporting information, the period of lost communication with the aircraft was a further cause of concern to air traffic control.

The smoke in the cockpit thinned out after several minutes, and had virtually stopped being emitted after five minutes. The pilots then took off their oxygen masks and put their normal headsets back on, thus restoring normal communication with air traffic control.

The remainder of the approach and landing took place with no problems. The tailwind component of runway 19R on landing was 10-15 knots. The maximum permitted tailwind in normal conditions is, according to the company operating manual, 10 knots. After landing, the aircraft taxied to the ramp where the passengers disembarked in the normal manner.

The incident occurred in airspace Northeast of Arlanda airport at about flight level 140.

¹ Vectoring = Steering a course in association with radar control.

1.2 Injuries to persons

	<i>Crew members</i>	<i>Passengers</i>	<i>Other:</i>	<i>Total</i>
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	–	–	–	–
None	3	17	–	20
Total	3	17	–	20

1.3 Damage to the aircraft

Limited

1.4 Other damage

None.

1.5 Personnel information

1.5.1 Commander

The commander, male, was 54 years old at the time and had a valid Airline Transport Pilot Licence.

<i>Flying hours</i>			
<i>latest</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	-	44	12200
This type	-	44	2700

Number of landings this type previous 90 days: 38.

Flight training on type concluded in 2005.

Latest PC (Proficiency Check) carried out on 5 May 2005 on the type.

1.5.2 Co-pilot

The co-pilot, male, was 55 years old at the time and had a valid Airline Transport Pilot Licence.

<i>Flying hours</i>			
<i>latest</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	4	200	16000
This type	4	200	3600

Number of landings this type previous 90 days: 197.

Flight training on type concluded in 2000.

Latest PC (Proficiency Check) carried out on 19 May 2006 on the type.

1.5.3 Cabin crew members

A female, with valid training for cabin service on this aircraft type.

1.5.4 The crew members' duty schedule

On that particular day the pilots had checked in the morning to fly that particular sector. The pilots had flown with each other on several occasions

and stated in interviews that their mutual co-operation worked well. In both the planned period of duty and the actual period, they were within the permitted limits. The requirements for rest periods and breaks from duty were met in accordance with the applicable regulations. That actual day was day four for the commander on a five day roster, in which certain days were spent on office duty at the company's flight operations department. The co-pilot was also on day four of a five day duty roster. The pilots had not flown with each other during the current five day roster.

The accumulated weekly duty points at the time of the incident were 193 for the commander and 172 for the co-pilot. The maximum permitted number of points planned for any week was 270.

1.6 The aircraft

1.6.1 General

The aircraft

<i>Manufacturer</i>	Fokker
<i>Type</i>	F27 MK050
<i>Serial number</i>	20147
<i>Year of manufacture</i>	1989
<i>Gross mass</i>	Max. authorised start mass 20820 kg, actual 17000 kg
<i>Centre of mass</i>	MAC 29
<i>Total flying time</i>	25513 hours
<i>Number of cycles</i>	30559
<i>Flying time since latest inspection</i>	180 hours
<i>Fuel loaded before event</i>	Jet A1

ENGINE

<i>Motor manufacturer</i>	Pratt & Whitney	
<i>Model</i>	PW125B	
<i>Number of engines</i>	2	
<i>Engine</i>	<i>No. 1</i>	<i>No. 2</i>
<i>Total operating time, hrs</i>	25304	22407
<i>Operating time since overhaul</i>	2511	6361
<i>Cycles after overhaul</i>	2745	7247

Propeller

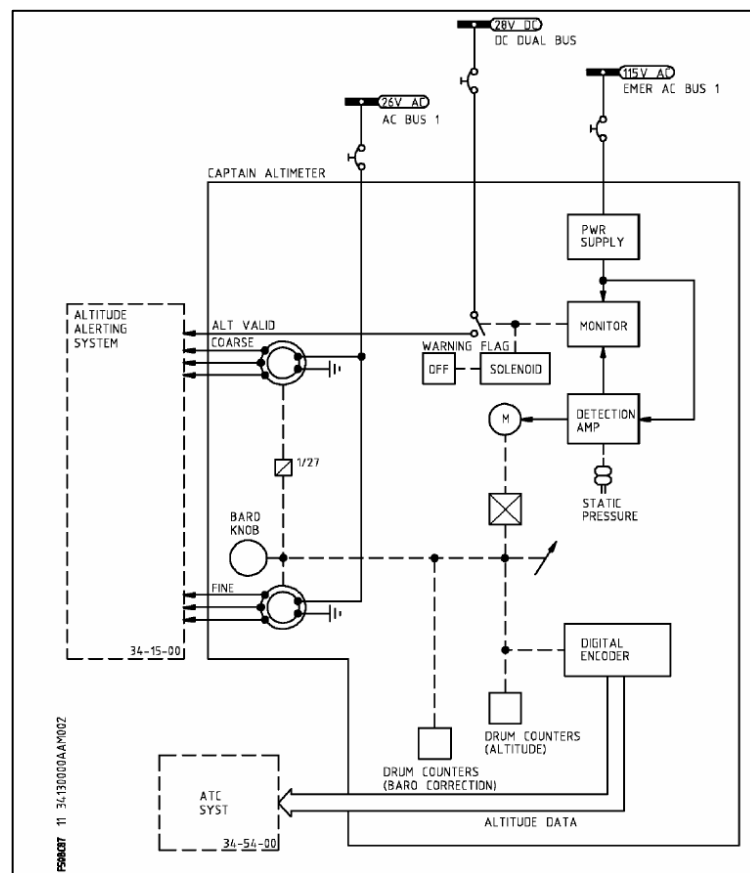
<i>Propeller manufacturer</i>	Dowty
<i>Propeller running time since basic inspection</i>	
<i>Propeller 1</i>	2513 hours
<i>Propeller 2</i>	3578 hours

The aircraft had a valid Certificate of Airworthiness

1.6.2 Left pilot's seat altimeter

The standard altimeter for the left pilot's seat is of an electromechanical type with both analogue and digital presentation, manufactured by THOMSON-CSF with P/N 60121-001-1, S/N 256. Apart from presenting the height to the commander, the instrument provides digital height

information to the aircraft's control and navigation systems. These include the transponder, TCAS²- and TAWS³-systems along with the autopilot.



Schematic diagram of the standard left altimeter

1.6.3 Procedure for the use of oxygen masks

When the need arises to use the oxygen masks, for example in the presence of smoke, gases or a loss of cabin pressure, the respective checklists always commence with the following items:

- Don oxygen mask
- Establish communication

Communication in the Fokker 50, both between the pilots and externally with air traffic control, is normally via headsets consisting of headphones and a microphone. In situations where the oxygen masks are being used, a switch must be set to on, to activate the loudspeaker system in the cockpit. The procedure in this company is that the pilot non flying (PNF) resets the communications on both the pilots' audio panels.

1.6.4 Normal practice in respect of oxygen masks

In interviews with the company chief pilot it became apparent that the oxygen masks generate a certain amount of background noise, even under normal operation when the masks are not in use. The reason for this is that the microphones in the masks are always activated, so that noise is generated which can sometimes be experienced as disturbing, especially in connection with take-off and landing. A local procedure has therefore evolved in the case of certain pilots, who switch off the audio connections to

¹ TCAS = Traffic Collision and Avoidance System

² TAWS = Terrain Awareness Warning System

the masks so as to avoid this “noise”. The mask audio connections are then switched on at a later stage of the flight, when the noise is perceived as less disturbing. This procedure is not written into either the manufacturer’s or airline manuals.

Some of the airline’s aircraft have been modified in order to eliminate these disturbances. According to the interviews this took place several years ago, and further modifications to the system had not been planned at the time of the incident. The checklist did not contain any item for checking that the oxygen mask audio connections were switched on.

1.7 Meteorological information

According to the SMHI (Swedish Meteorological and Hydrological Institute) analysis in respect of Arlanda airport: Wind 010°/18 knots, good visibility, cloud 2/8 cirrocumulus cloud with base at 1500 feet, 7/8 with base at 1700 feet, temp./dewpoint +9/+5 °C, QNH 1010 hPa

1.8 Aids to navigation

Not applicable.

1.9 Communications

Radio communications were normal during the initial phase of the flight. When the emergency message from BSL 470 was transmitted, with the request to turn back and land as soon as possible, the aircraft was given a vector for a direct approach to runway 19R. All other affected traffic in the area was redirected so as to clear the way.

1.10 Aerodrome information

Arlanda airport status was in accordance with AIP⁴-Sverige/Sweden.

1.11 Flight and voice recorders

1.11.1 Digital Flight Data Recorder (DFDR)

The aircraft was equipped with a flight data recorder. Relevant parameters from the event have been printed out in diagram format and show normal values for that particular flight.

1.11.2 Cockpit Voice Recorder (CVR)

SHK initially determined that there was no need to print out and analyse the data recorded by the CVR.

1.12 Location of occurrence

1.12.1 Location of the incident

The incident occurred in airspace northeast of Stockholm/Arlanda airport.

⁴ AIP – Aeronautical Information Publication

1.12.2 *The aircraft*

Apart from damage to the left side standard altimeter, which is described in section 1.16, there was no damage to the aircraft.

1.13 **Medical information**

Nothing was discovered to indicate that the psychological or physical condition of the pilots was degraded before or during the flight.

1.14 **Fire**

Localised overheating or fire occurred in a metal-encapsulated instrument.

1.15 **Survival aspects**

1.15.1 *General*

As can be seen from section 1.16, overheating or a localised fire took place in the left side standard altimeter. The possible fire was enclosed in the instrument, which had a metal casing, and there was therefore little risk of it spreading.

Because the pilots quickly donned their oxygen masks, the smoke and fumes that developed did not affect their performance. The fault in the altimeter caused other flight and navigation systems to fail, which under other less favourable circumstances could have led to serious consequences from a flight safety viewpoint.

1.15.2 *Actions by the rescue services*

As the pilots declared an emergency and requested landing priority, the airport rescue services were alerted and ready on the runway before the landing. The smoke spontaneously ceased and an emergency rescue effort was not required.

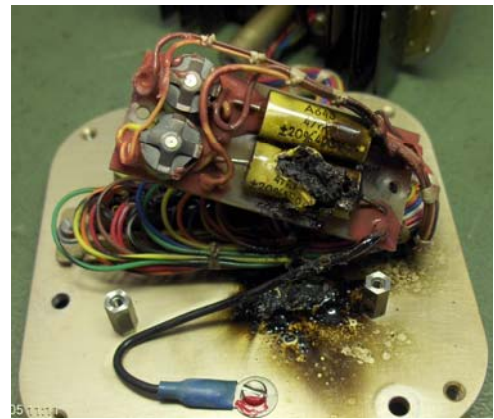
1.16 **Tests and research**

1.16.1 *Examination of the altimeter*

The altimeter, a Thomson P/N 60121-001-1, S/N 256 manufactured in November 1988, has been examined at the instrument workshop. The examination showed that overheating and possibly fire occurred in a capacitor forming part of the electronics part of the instrument. A short circuit had probably taken place due to an electrical wire, that had been trapped between the capacitor and a metal base plate, after long use in a vibrating environment, gradually causing mechanical damage to the capacitor. According to the airline and the instrument workshop there was no knowledge of a previous case of the same type of fault.



Soot deposits



Burned capacitor and wiring

On checking after the incident it could also be determined that all the affected systems had correct fuse protection.

1.17 Organisational and management information

The company is based in Stockholm and operates national and international commercial flight operations, primarily with RJ-100, Fokker 50 and Saab 2000 aircraft types.

1.18 Other

1.18.1 Equal opportunities aspects

This event has also been examined from the point of view of equal opportunities, i.e. against the background that there are circumstances to indicate that the actual event or its effects were caused by or influenced by the women and men concerned not having the same possibilities, rights or obligations in various respects. Such circumstances were however not found.

1.18.2 Environmental aspects

Not applicable.

1.18.3 Measures taken

After the incident the company took the following measures:

- The checklist has been changed so that the oxygen mask audio connections are checked.
- The company is discussing whether to modify the oxygen mask audio system, with the aim of eliminating background noise.

2 ANALYSIS

2.1 The incident

The smoke was caused by overheating or fire in an altimeter, as a result of an internal short circuit. The smoke and smell of an “electrical fire” on board an aircraft is a very powerful warning to a pilot. The source is often difficult to diagnose, locate and isolate, while it is known that a fire on

board an aircraft can develop and spread very quickly, in itself creating increased stress in the cockpit.

As described in section 1.6.2 several other systems depend on digital height information from the left side altimeter. Several of the aircraft's flight control and navigation systems were thereby put out of operation, which condition further worsened the situation for the pilots and indicated that there was a serious technical problem.

The conditions for a successful emergency landing were on this occasion good, but in other less favourable conditions the fault could have led to serious consequences from a flight safety viewpoint.

Everything points to the altimeter fault being a one-off occurrence and SHK sees therefore no reason to issue any recommendation in this respect.

2.2 *Emergency landing*

The decision of the crew to declare an emergency and return immediately to Arlanda was probably hastened by the pilots quickly realising the seriousness of a suspected fire in one or several of the aircraft systems.

In connection with declaring an emergency and the aircraft receiving clearance to return to Arlanda, the pilots donned their oxygen masks and carried out procedures in accordance with the emergency checklist. At this time the commander also handed over control of the aircraft to the co-pilot. SHK considers that it is probable that the stress engendered by the situation, with fire suspected in the electrical and instrument systems, contributed to the commander not checking the audio connections for his oxygen mask. Normal radio communications were therefore only resumed when the pilots removed their oxygen masks.

SHK also finds it understandable that the decision was taken to exceed the company's permitted tailwind component in order to land straight in on runway 19R at Arlanda. An approach pattern to be able to land from the south would probably have taken 5-10 minutes longer flying time, which in the case of a different development of the fire could have had serious consequences. When the decision was made to land with the shortest approach, the crew was not aware of either the localisation or the extent of the suspected fire.

3 **CONCLUSIONS**

3.1 **Findings**

- a) The pilots were qualified to perform the flight.
- b) The aircraft had a valid Certificate of Airworthiness.
- c) A short circuit took place in the left side altimeter.
- d) The fault caused smoke to be generated and faults to arise in the aircraft flight control and navigation systems.
- e) It was local practice for the pilots to disconnect the oxygen mask audio connections because of disturbing noise.
- f) Communication between air traffic control and the aircraft was interrupted for about five minutes.
- g) Normal radio communications were only resumed when the pilots removed their oxygen masks.
- h) On landing the operator's maximum permitted tailwind component was exceeded.

3.2 Causes of the incident

The incident was caused by a short circuit in the left side altimeter.

4 RECOMMENDATIONS

None