Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2005:07e

Aircraft accident to SE-LNT at Luleå/Kallax Airport, Norrbotten County, Sweden, on 17 September 2003

Case L-49/03

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

The report is also available on our web site: 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

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2005-02-25 L-49/03

Swedish Civil Aviation Authority

601 73 NORRKÖPING

Report RL 2005:07e

The Swedish Accident Investigation Board (Statens haverikommission, SHK) has investigated an aircraft accident that occurred on 17 September 2003 at Luleå/Kallax Airport, Norrbotten County, involving an aircraft with registration SE-LNT.

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.

The Board will be grateful to receive, by 25 August 2005 at the latest, particulars of how the recommendations included in this report are being followed up.

Göran Rosvall Henrik Elinder

Contents

Appendices

Rapport RL 2005:07e

L-49/03
Report finalised 25-02-2005

Aircraft; registration, type	SE-LNT, BAe Jetstream 32
Class, airworthiness	Normal, valid certificate of airworthiness
Owner/operator	TageHus AB, Frejgatan 87, 113 26 Stockholm/European Executive Express AB, Box 1073, SE-721 27 Västerås
Time of occurrence	17/09/2003, 18.28 hrs in daylight. Note: all times are given in Swedish daylight saving time (UTC + 2hrs)
Place	Luleå/Kallax Airport, Norrbotten county, Sweden (pos. 6532N 02207E; 20 m above sea level)
Type of flight	Scheduled
Weather	According to SMHI analysis: wind 260°, 5 knots, good visibility, no clouds, temp./dp +13/+2C°, QNH 1009 hPa
Persons on board:	
Crew members	2
Passengers	0
Injuries to persons	Minor
Damage to aircraft	Substantial
Other damage	None
Commander:	
Sex, age, licence	Male, 64 år, ATPL(A), British
Total flying time	31 000 hours, of which 2 000 on type
Flying hours latest 90 days	50 hours, of which 45 on type
Number of landings previous 90 days	53
Co-pilot	
Sex, age, licence	Male, 29 år, CPL(A)
Total flying time	660 hours, of which 237 on type
Flying hours latest 90 days	114 hours, of which 108 on type
Number of landings previous 90 days	165
Cabin crew members	0

The Swedish Accident Investigation Board (SHK) was notified on 17 September 2003 that an accident involving a BAe Jetstream 32 with registration SE-LNT had occurred at Luleå/Kallax Airport, Norrbotten County, Sweden, on that day at 18.28 hrs.

The accident has been investigated by SHK represented by Lena Svenaeus up to and including 31 January 2004 and subsequently Göran Rosvall, Chair, Mats Öfverstedt, Chief Investigator Flight Operations and Henrik Elinder, Chief Technical Investigator, Aviation.

The accredited representative from the UK Air Accident Investigation Branch was Richard James, with experts from BAE SYSTEMS.

The investigation was followed by Max Danielsson, Swedish Civil Aviation Administration.

Summary

During a scheduled flight from Pajala to Luleå, which happened to take place with no passengers on board, the opportunity was taken to have the co-pilot train flying with simulated loss of thrust on one engine.

During the approach to Luleå/Kallax Airport the commander reduced thrust on the right engine by moving the throttle to its aft stop. He understood this to represent “simulated feather”.

The co-pilot’s understanding was that the whole landing, including touchdown on the runway, would be effected with one engine off. However, the commander’s intention was to restore normal thrust to the idling engine. As the aircraft approached the runway threshold, thrust on the right engine was approximately 7 %.

Owing to the asymmetrical thrust, the approach took place with applied rudder and opposite banking. Shortly after the aircraft had crossed the runway threshold and was approximately 5 metres above the runway both the co-pilot and the commander felt a sudden veer and roll to the right.

Even though the pilots applied both full aileron and full rudder they were unable to stop the aircraft’s uncontrollable motion. This continued until the right wingtip struck the ground. The fuselage then struck the ground, and the aircraft slid on its belly for about 50 metres before coming to a standstill. The pilots were not seriously injured and left the aircraft unaided.

The accident was caused by shortcomings in the company’s quality control system, operative routines and regulations. This contributed to:

- the commander considering he could serve as a flight instructor on an aircraft type and in a flight situation for which he was neither qualified nor authorized,
- the pilots lacking necessary knowledge of the particular flight characteristics of this aircraft type in unsymmetrical thrust, and
- the pilots being unfamiliar with the rules in force for flight training.

Recommendations

It is recommended that the Swedish Civil Aviation Authority ensure that the Authority’s routines are such that:

- aviation companies that are unable to maintain flight safety standards and meet official requirements in force are brought to book *(RL 2005:07e R1)*

- necessary steps are taken against aviation companies that neglect, or are unable, to remedy shortcomings in flight safety within the required time *(RL 2005:07e R2)*

1 FACTUAL INFORMATION

1.1 History of the flight

The pilots were scheduled to fly the aircraft, a BAe Jetstream 32, on scheduled flight EXC 403 from Pajala Airport to Luleå/Kallax Airport. This was the third flight together for the day. Before takeoff they noted that the flight was planned without passengers. Since the co-pilot was shortly to undergo an Operator's Proficiency Check and the commander had long flying experience, including as an instructor, the commander decided to take the opportunity to have the co-pilot train flying with simulated engine failure.

The takeoff from Pajala was at 17.57 hrs with the co-pilot as Pilot Flying. During the climb the commander reduced thrust on the right engine to simulate engine failure. This was done by moving the engine control lever to its rear stop. The commander understood this to represent what is termed "simulated feather" in which an engine generates no drag and causes the least possible resistance.

The exercise passed off without problem and the co-pilot had no difficulties in handling the aircraft. It was decided to practise flying with simulated engine failure during the landing as well. During the approach to Luleå/Kallax Airport when the aircraft was at an altitude of about 3500 feet the commander accordingly reduced thrust on the right engine once again.

The co-pilot understood that the whole landing, including touchdown, would be with one engine on reduced thrust. However, the commander's intention was to restore normal thrust on the right engine before touchdown.

Prior to landing the reference speed (Vref[1]) had been calculated at 107 knots IAS[2] and the flaps lowered 20°, based on the calculated landing mass of 5 640 kg.

During the approach when the aircraft was at about 3500 feet, the commander reduced right engine thrust. According to the FDR recording thrust was reduced initially to just over 19 % and subsequently, for six minutes, further to just under 11% at the same time as altitude decreased to 900 feet.

The co-pilot flew the aircraft in a right turn to runway 32 and started his final 2 nautical miles from the runway threshold at a height of 900 feet. The final was entered with a somewhat higher glide angle than normal.

As the aircraft approached the runway threshold the thrust on the right engine had decreased to approximately 7 %.

The approach took place with applied rudder and opposite banking to counteract the lateral forces generated by the asymmetrical thrust. During the approach the co-pilot experienced an inertia in the ailerons that he had never experienced previously.

Shortly after the aircraft had crossed the runway threshold and was about 5 metres above the runway, both the co-pilot and the commander felt how the aircraft suddenly yawed and rolled to the right. Neither pilot remembers hearing the stall warning sounding.

Despite application of full aileron and rudder the pilots were unable to stop the aircraft's uncontrolled motion. This continued until the right wing tip hit the ground. The fuselage then struck the ground.

The aircraft slid on its belly about 50 metres alongside the runway before stopping. The pilots hastily evacuated the aircraft. The accident was observed by the air traffic controller who immediately alarmed the airport rescue service, which arrived at the accident scene within a minute or so. After its arrival the commander boarded the aircraft and turned off the fuel

[1] Vref – Speed on crossing runway threshold
[2] IAS – Indicated Air Speed

supply and the main electricity, whereafter the rescue service covered the aircraft with foam.

The accident occurred on 17 September 2003 at 18.28 hrs in position 6532N 02207E; 20 m above sea level in daylight.

1.2 Injuries to persons

	Crew members	*Passengers*	*Others*	*Total*
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	1	–	–	–
None	1	–	–	–
Total	2	–	–	2

The co-pilot sustained injury to one leg.

1.3 Damage to aircraft

Substantially damaged.

1.4 Other damage

None.

1.5 Personnel information

1.5.1 The Commander

The commander, a man, was at the time 64 years old and had a valid British ATPL(A).

Flying time (hours)			
Previous	*24 hours*	*90 days*	*Total*
All types	2.4	50	31 000
This type	2.4	45	2 000

Number of landings this type previous 90 days: 53.

Flight training on type concluded 2003.

Latest Proficiency Check carried out on 23 April 2003 at BAe Systems, England.

The commander had instructor certification for certain aircraft types but lacked certification for the type in question.

The commander was not listed as an instructor in the company's Operational Manual Part D.

1.5.2 The Co-pilot

The co-pilot, a man, was at the time 29 years old and had a valid CPL(A)

Flying time (hours)			
Previous	*24 hours*	*90 days*	*Total*
All types	2.4	108	660
This type	2.4	114	237

Number of landings this type previous 90 days: 165.

Flight training on class concluded on 10 April 2003.

Latest Proficiency Check carried out on 10 April 2003 at BAe Systems, England.

The next OPC was planned for the near future.

1.5.3 Cabin crew members

The flight was carried out without a cabin crew, and such was not a requirement.

1.5.4 The crew members' duty schedule

The pilots' scheduled hours were within the requirements in force according to BCL-D. The crew had flown together during the previous week with Pajala as base.

According to the pilots' own statements they had developed a good relationship. The commander was glad to share his experience with the less experienced co-pilot.

The relaxed relationship between commander and co-pilot is reflected in the audio recording in the cockpit during the flight preceding the accident.

1.6 Aircraft information

1.6.1 General

The aircraft type is a twin-engined passenger aircraft with space for nineteen passengers. It has turboprop engines and a pressurised cabin.

AIRCRAFT	
Manufacturer	British Aerospace
Type	Jetstream 32
Serial number	948
Year of manufacture	1991
Gross mass	Max take off/landing mass 7 350/7 080 kg, actual 5 820/5 640 kg
Centre of mass	48 loaded index take off mass
Total flying time	13 494 hours
Flying time since latest inspection	23 hours
Fuel loaded before event	Jet A1/2 000 kg

ENGINES		
Manufacture	Garret	
Model	TPE 331-12UAR-704M	
Number of engines	2	
	Nr 1	Nr 2
Operating time since overhaul	795	4 579
Cycles after overhaul	1 007	6 298

PROPELLERS	
Manufacture	Mc Cauley 4 HFR34C
Operating time since latest overhaul:	
Propeller 1	3 268 hours
Propeller 2	4 228 hours

Values at 20 degrees flap, undercarriage down, according to flight manual:

- Minimum Control Speed (Vmcl[3]) =98 knots IAS
- Stall Warning Sped (Vsw[4]) =93 knots IAS
- Stall Speed (Vs[5]) =84 knots IAS

The engines operate largely at constant revolutions during flying. Thrust is varied by adjusting propeller blade pitch. Thrust is measured as propeller shaft torque, TQ. In the case of an engine failure during flight, the propeller blades can feathered, that is, adjusted so that the pitch is theoretically zero degrees and the propeller's drag is hence minimal.

The aircraft had a valid certificate of airworthiness.

1.6.2 Manufacturer's Operating Manual (MOM)

The MOM Jetstream 31/32 and the Aircraft Flight Manual (AFM) are produced by the manufacturer, BAe. MOM and AFM form the basis for the company's Operations Manual (OM) which must be authorised by the Swedish Civil Aviation Authority (formerly the Swedish Civil Aviation Inspectorate).

In consequence of an accident at Prestwick in 1992 the UK Aircraft Accident Investigation Board recommended BAe in Safety Recommendations 93-55 to revise MOM, AFM and the associated training manuals in respect of training in single-engine flying, to the effect that throttling back may not be performed in such a way as to cause abnormal drag. The information was to be disseminated so that all pilots became aware of the effect of an incorrectly set thrust value. The recommendation was aimed particularly at operators of Jetstream 32s equipped with McCauley propellers.

1.6.3 Advance Amendment Bulletin No 6

On 4 June 1993 the manufacturer published Advance Amendment Bulletin No 6 for Jetstream 32 equipped with McCauley propellers. In May 1994 AAB 6 was incorporated in the Aircraft Flight Manual (AFM) on page 6-8-4 with the following text:

[3] Vmcl – Lowest speed with maintained control
[4] Vsw – Speed at which stall warning is activated
[5] Vs – Stalling speed

Warning: An abnormal yaw, control difficulty and reduced climb performance may be experienced if the torque value of the simulated failed engine is reduced below 10 %.

...During simulated one-engine-inoperative handling exercises or demonstrations the torque value of the simulated-failed engine must be adjusted to 12% or greater."

The information was entered in the company's OM Part D which is available to the company's instructors.

1.6.4 Notice to Aircrew (NTA)

As a consequence of the present case the aircraft manufacturer intends to publish an information letter to pilots, a Notice to Aircrew (NTA). The purpose of the letter is to supplement the information in the AFM regarding training simulated engine failure so that it also includes deliberate reduction of thrust on one engine for some reason according to the emergency checklist.

1.6.5 JAR-OPS[6] 1.370

JAR-OPS 1.370, which covers simulation of abnormal situations during flight, states:
"An operator shall draw up rules to ensure that abnormal situations or emergency situations that wholly or partly require the adoption of procedures for abnormal situations or emergency situations, are not simulated during commercial transport flights."

1.6.6 The aircraft company's operating handbook, Operations Manual (OM)

The company's OM is arranged according to JAR-OPS 1.

Regarding the arrangement of the operations manual, it is laid down in *JAR-OPS 1.1040 f)* that*:*
"The operator must ensure that all operational personnel have readily available a copy of the parts of the operations manual that are relevant for their work tasks. In addition the operator must provide crew members with a personal copy of, or excerpts from, parts A and B of the operations manual that are relevant for personal study."

JAR-OPS 1.1040 g) provides that:
"The operator must ensure that the operations manual is amended or revised so that the instructions and information it contains are kept up to date. The operator must ensure that all operational personnel are made aware of modifications that are relevant to their work tasks."

OM Part A, General/Basic must cover all non-type-related operational policy, instructions and procedures that are required for safe operation. In the company's OM Part A at the time of the accident there were no restrictions regarding simulated emergency situations during commercial transport flying.

OM Part B, Aircraft Operating Matters must contain operational aircraft issues. This part must cover all type-related instructions and procedures required for safe operation. OM Part B must be available for all crew members serving with the aircraft company. This was in fact the case.

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[6] JAR-OPS – Joint Aviation Regulations - Operations (European operational aviation regulations)

AFM page 6-8-4 was not entered in the company's OM Part B at the time of the accident. Moreover, there was no description of the aircraft's stall characteristics or limitations in connection with single-engine flying, which are described in AFM.

OM Part D, Training Requirements and Instructions, must cover all personnel training instructions required for safe operation. OM Part D need be available only to instructors in the company. The restrictions on simulating abnormal situations were entered in OM Part D and were available only to the company's instructors.

1.7 Meteorological information

According to the SMHI analysis: Wind 260/5 knots, visibility good, no clouds, temp./dp +13/+2°C, QNH 1009 hPa.

1.8 Navigational aids

The airport status was according to AIP[7] Sweden.

1.9 Radio communications

Radio communication between the aircraft and air traffic control was normal. The air-traffic controller at Luleå/Kallax Airport was not informed that the landing was to take place without thrust on one engine.

1.10 Aerodrome information

The airport status was according to AIP Sweden.

1.11 Flight recorders

1.11.1 Flight Data Recorder, FDR

The aircraft's FDR was sent after the accident to the AAIB in England for reading and analysis. Relevant parameters have been compiled and are presented in diagram form in Appendix 2. From the FDR recording the following can be read, among other things:

- When propeller speed was increased to 100 % RPM, thrust on both engines decreased by approximately 11 %. The thrust on the left engine regained its previous value almost immediately while the thrust on the right engine, 30 seconds later and approximately one minute before the crash, had been reduced to approximately 7 %.
- Twelve seconds before the fuselage struck the ground the indicated air speed (IAS) was approximately 107 knots and thrust on the left and right engines was approx 61 % and 7 % respectively.
- About half a second later the attitude (the aircraft's nose position) started to increase successively (rose) from 5 degrees to 15 degrees at the same time as the speed decreased.

[7] AIP –Aeronautical information publication

- About six seconds before the impact, when the speed had sunk to 96 knots, a right roll started. This continued for just over four seconds until the right wing-tip hit the ground.
- When the right wing-tip hit the ground, indicated air speed was approximately 80 knots.

1.11.2 Cockpit Voice Recorder, CVR

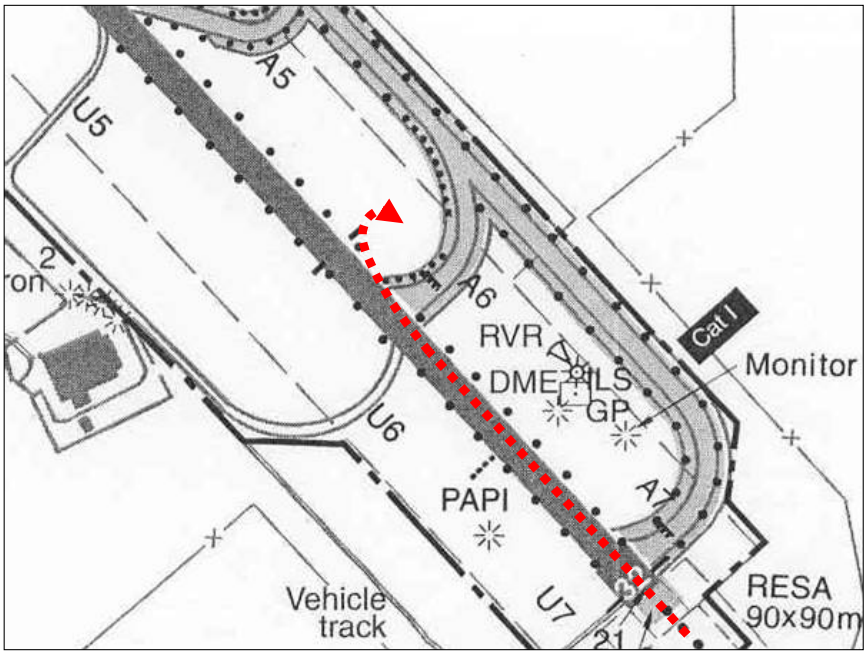
The aircraft's CVR was sent after the accident to the AAIB in England for reading. A transcript of the sound recorded on the flight deck is given in Appendix 3.

From the transcript it can be read, among other things, that communication on the flight deck was normal and relaxed during the whole approach until about five seconds before impact, when the commander exclaimed "Keep it straight!" Shortly after this the stall warning and the "BANK ANGLE!" warning started to sound.

1.12 Accident site and aircraft wreckage

1.12.1 Accident site

The aircraft hit the ground first with its right wing-tip which struck on the right verge of runway 32 just over 500 metres from the threshold. About 50 metres further on in the direction of travel, in the area of grass between the main runway and the taxiway, the fuselage struck the ground hard, nose first. The aircraft then slid on its belly, describing a right swerve, for another 50 metres or so before coming to a standstill the right way up. The aircraft was then approximately 60 metres from the runway verge with the nose pointing largely in the direction of its approach. (See sketch below.)



The site of the crash

1.12.2 Aircraft wreckage

The aircraft was severely damaged. The nose section was pushed in and the rear of the fuselage was cracked. All the landing gear and the left wing main spar were fractured. All the propeller blades were deformed

The wrecked aircraft

1.13 Medical information

Nothing indicates that the mental or physical condition of the crew members had been impaired before or during the flight.

1.14 Fire

There was no fire.

1.15 Survival aspects

The emergency locator transmitter was activated on impact and deactivated by rescue personnel. The aircraft hit the ground at a relatively high rate of descend. The injuries the co-pilot sustained and the major material damage to the aircraft were probably a consequence of vertical G forces. The horizontal G forces were fairly moderate since while sliding along the ground the aircraft was braked with relatively little retardation.

The safety belts in the aircraft did not rupture on impact and the crew were able to free themselves from these and evacuate the wrecked aircraft.

1.16 Tests and research

1.16.1 Technical inspection of the aircraft

The aircraft's position and appearance were documented at the site of the crash and it was transported to a hangar at the airport for technical inspection. A technical inspection was then undertaken by an authorised aircraft workshop under SHK's supervision and in consultation with the British Aircraft Accident Investigation Branch, the aircraft manufacturer (BAe) and the aircraft company. The inspection covered only those systems whose function was judged to have been able to affect the course of the accident.

The control system

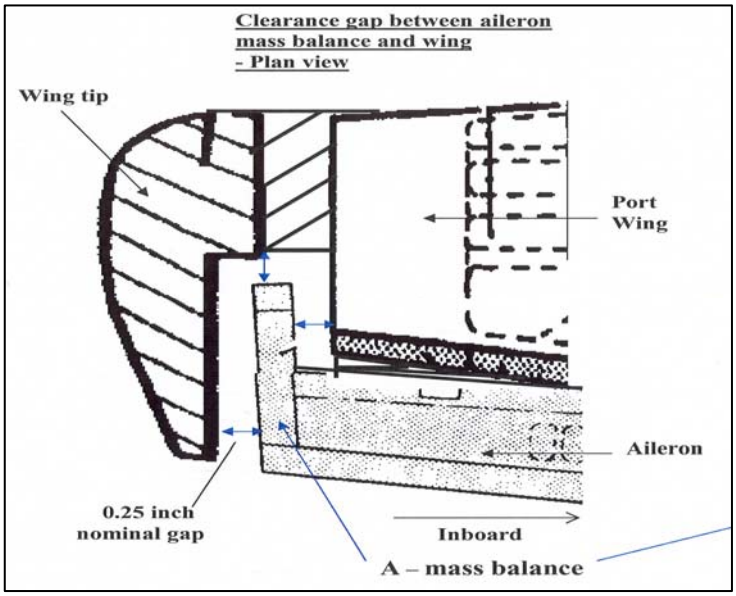
The control system was checked as far as practically possibly. Apart from damage to the left aileron, treated below, it has been impossible to find anything wrong or abnormal.

Flight and engine instruments
The aircraft's static and dynamic systems were pressure-tested. Relevant air data instruments and engine instruments were checked in specialist workshops. No faults or abnormalities were discovered.

Stall warning system
The aircraft's stall warning system was checked and found to function according to the specification in force.

1.16.2 Investigation of left aileron

The aircraft's ailerons are balanced using counterweights in the outer tip of the aileron. The weights are fixed in holders with two bolts. The counterweight holders are let into the wings with a clearance of 0.25 inches (6.4 mm). (See illustration below.)



Aileron balance

The counterweight holder on the left aileron was partly broken off when the left wing hit the ground. Closer inspection of the counterweight mounting showed that one of the two fastening bolts for the weights had failed and the castle nut was missing.


Broken fixing bolt for balance weights

In addition, damage to the metal shell plating on the underside of the wing opposite the balance-weight fastening bolts was noted. The damage was in the form of "stamping" from some object with a threaded profile and

also ”wear damage” judged to have arisen through repeated metallic contact.

Damage to shell plating on underside of wing

Metallurgical examination of the fracture surface of the failed fixing bolt showed that the fracture was caused by shearing.

A check measurement of the dimensions of the balance weights and the undamaged fastening bolt in the broken-off weight holder showed that the balance weights were not correctly installed, in that the threaded ends of the fastening bolts projected from the plating of the balance weight holder by 0.1 inches (2.5 mm).

SHK has not found in the technical documentation for the aircraft any note of inertia or resistance in the aileron system.

1.16.3 Simulator trial

To gain further knowledge of the aircraft's flight characteristics at low speeds and with simulated loss of thrust in one engine, SHK conducted practical flight tests in the BAe flight simulator for the Jetstream 32. Of special interest was verification of the given Vmcl value for asymmetrical thrust corresponding to that obtaining at the time of the accident. The following tests were carried out:

1. Normal landing with two engines.
2. Single-engine landing with normal thrust on left engine and reduced thrust on right engine (TQ=12 % and TQ<12 % respectively).
3. Verification of Vmcl at normal engine thrust on left engine and reduced thrust on right engine (TQ=12 % and TQ<12 %, respectively).
4. Aborted landing and full throttle from low altitude (“Single engine go-around”).
5. Simulation of the actual flight situation at the time of the crash with a 10-15-degree attitude position and flare just before touchdown.
6. Simulation of the actual flight situation at the time of the crash and with locked ailerons.

As reference values in the trial, recorded FDR parameters from the flight in question were used. According to the manufacturer the tests and manoeuvres carried out were within the performance envelope where the simulator gives reliable information about the behaviour of this aircraft type.

It was not possible in the simulator to reduce engine thrust below about 1o % in connection with landings. It was thus impossible recreate exactly the accident flight in which the right engine thrust was momentarily down to about 6 %.

The tests showed the following:

- Landings with asymmetrical thrust corresponding to TQ=60 % on the left engine and TQ down to 10 % on the right engine were performed with full control.
- Landings with asymmetrical thrust and speeds close to Vmcl were performed with full control.
- At speeds close to Vmcl the speed margin to stall and an uncontrollable situation was small.
- The aircraft's manoeuvrability was not appreciably affected by asymmetrical thrust down to 12 % on one engine.
- Single-engine go-around was performed with no problem from an altitude of 100 feet.
- The aircraft was manoeuvrable at speeds down to 95-9o knots.
- When the accident flight was simulated with a 10–15 degree attitude position during the flare, the aircraft got into an uncontrollable yaw and roll motion and "crashed".
- In simulation of the accident flight but without marked flare, the aircraft landed normally.
- Landing without marked flare was also carried out with simulated locked ailerons.
- With asymmetrical thrust at speeds near Vmcl, speed reduction was rapid and the margin to the point at which the aircraft became uncontrollable was small.

1.17 Organisational and management information

(At the time of the accident)

1.17.1 Operations

The airline European Executive Express AB (EEE) was formed on 12 May 2000 as a further development of the CNA International airline, formed in 1987. In the company's Air Operator Certificate, which was authorised in accordance with JAR-OPS 1 by the Swedish Civil Aviation Inspectorate on 23 May 2000, authorisation is given to conduct air transport for profit with passengers, using aircraft with a takeoff mass of under 10 tonnes and/or with fewer than 20 passenger seats.

The company operated six aircraft type Jetstream 32 on 7 routes with varying postings for the pilots. Of the pilots, all had fixed appointments except for two who were employed on contract.

1.17.2 Organisation

The organisation of the management group underwent several changes during 2003. The company met minimal requirements according to JAR-OPS1.

The quality manager worked part-time and was on duty in the company only about one day a week.

The technical manager was also technical manager of another company.

1.17.3 Recruitment of pilots

The company perceived its pilot turnover to be high. The company had a high work load with training of new pilots. After amassing a certain number of flying hours, many pilots left the company for larger ones.

1.17.4 In-house training

Pilots are trained according to the company's OM Part D. The course of training is described in accordance with JAR-FCL. Conversion training

takes place at approved flying schools in England and the USA. The pilots then undergo an in-house course where they learn the company's manual systems, emergency situation procedures, and other procedures.

The pilots in the present accident cannot remember ever having been made aware of the contents of Aircraft Flight Manual page 6-8-4 or the existence of restrictions in simulation of abnormal situations.

1.17.5 Previous air accident

On 30 November 2001 the company suffered an air accident in connection with landing at Skien Airport in Norway. In that accident there were no personal injuries but the aircraft, also a Jetstream 32, was a total wreck. The accident was investigated by the Norwegian Accident Investigation Board, HSLB. No final report has yet been published but the Board has been informed by HSLB that the report will treat issues concerning shortcomings in the company's operational routines and quality assurance systems at the time of that accident.

1.17.6 Action taken

Following the Skien accident and the present one, the following changes, among others, have taken place:

- The company's management group has been reorganised to avoid double appointments among managers (Accountable Manager) and responsible appointees (Nominated Postholders),
- the company's quality assurance system has been improved and the quality assurance manager has been linked more closely to the company,
- the company has increased its CRM training,
- the company has moved its head office to Arlanda, the company's main operational base and
- the company's technical operations have been revised.

1.18 Additional information

1.18.1 Supervision by the Swedish Civil Aviation Inspectorate, now the Swedish Civil Aviation Authority

For an airline to obtain an AOC according to JAR-OPS 1,[8] specified requirements are placed upon, among other things, the company's organisation, quality assurance system, technical maintenance, personnel recruitment, documentation of operations, etc.

Before an AOC can be issued the company's overall operation must be approved by the Civil Aviation Authority. This is done in connection with the initial audit. Through regular audits, the Authority must then ensure that the company is running its operations according to regulations in force.

At the audits conducted by the Inspectorate, the company's operational and technical activity was normally checked on the same occasion. The audits normally started with Inspectorate staff, together with the company's operational and technical management, going through the relevant manuals, reports received, meeting minutes, action taken, etc. The inspectors subsequently, in different ways checked that operational and technical practice was in fact conducted in accordance with company regulations.

SHK has been informed by the Civil Aviation Inspectorate's inspectors that their workload was experienced as high, and available time was insuffi-

[8] JAR – Joint Aviation Authorities

cient for conducting initial and regular audits as thoroughly as could be desired. Concerning cases not directly related to flight safety, it has also been stated that it was not uncommon for airline companies not to take the action called for until long after the time limit has passed and after a reminder.

According to JAA document ”JAA Administrative & Guidance Material Chapter 20.3 JAA-NAA action for level 1 finding”, a civil aviation authority has the right to withdraw an airline company's AOC if what are termed ”Level 1 findings” are not remedied in time.

1.18.2 Audits carried out at EEE

EEE was one of the first airline companies in Sweden to be certified by the Civil Aviation Inspectorate according to JAR-OPS 1. From 1999 to 2003 six audits are documented. From 2000 to 2003, 19 audits remarks are documented. On at least one occasion, withdrawal of the company's AOC was considered, owing to serious deficiencies and failure to take action regarding ”Level 1 findings”. Additionally, several criticisms of the company's technical activity have been expressed. One of these was at “level 1”, which resulted in several aircraft being grounded. Correspondence between the company and the Inspectorate shows that the company on several occasions exceeded the stated time limits for correcting findings; or that action was taken within the stated time but with a very small margin.

In a review of the Inspectorate's operational supervision, SHK found that the Inspectorate, up to the time of the accident, had not conducted what is termed a Line Check, i.e. one in which an inspector follows the planning, execution and conclusion of a regular scheduled flight. In addition, no representative from the Inspectorate had during the same period taken part in any in-house training course for newly-recruited pilots, or in any of its pilots' internal OPCs[9].

1.18.3 Instructor's competence for Type Rating Instructor according to JAR OPS

The requirements for instructor authorisation for TRI[10] are described in JAR-FCL 1.365 and in the company's Operations Manual Part D.

The training of TRI may take place only at approved flying schools and by instructors approved by the Civil Aviation Authority for training on the aircraft type in question.

Instructor authorisation and aircraft types covered must be entered in the pilot's certificate.

Concurrently with the introduction of JAR-FCL into Swedish aviation many questions arose concerning, among other things, interim regulations and authorisation requirements for instructors.

1.18.4 The EEE flight route Pajala–Luleå-Pajala

At the time of the accident the company had a contract for flying the route twice a day on weekdays, with one return flight in the morning and one return flight in the evening. To conduct the traffic the same crew were commonly stationed in Pajala for five days.

1.18.5 Radar plot

The radar plot below shows the aircraft's approach to Luleå/Kallax Airport runway 32.

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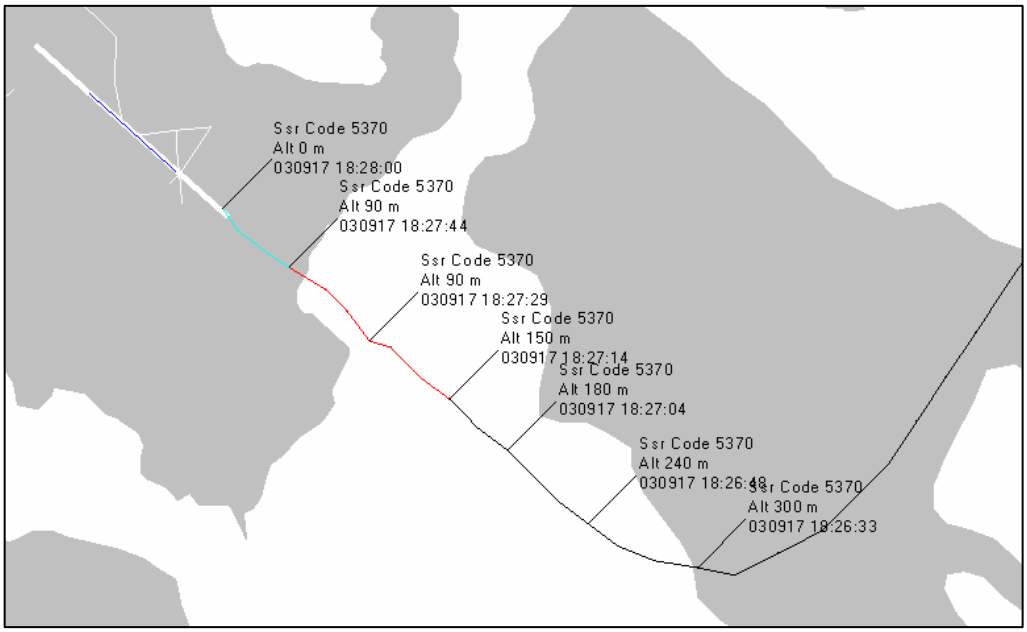
[9] OPC – Operators Proficiency Check
[10] TRI - Type Rating Instructor



2 ANALYSIS

2.1 The flight

With the routine the company used for the scheduled traffic between Pajala and Luleå there was ample time for the pilots to become well acquainted. Apart from the contact they had while flying, they often spent time together on the ground in Pajala. Before the flight in question the crew had been working for several days and performed many flights together. The commander was an older and very experienced pilot, while the co-pilot was comparatively young and less experienced. Everything goes to show that they had developed a good and friendly relationship.

Since the flight programme normally consisted only of flights between Pajala and Luleå twice every weekday it is easy to understand that some of the flights became fairly routine. That afternoon flight from Pajala to Luleå was a typical one with good weather all the way and at the destination airport.

The commander knew that the co-pilot was to do his next OPC during the next few days. When before the flight the pilots were informed that the flight would be without passengers the commander saw no obstacle to having the co-pilot carry out certain flight training during the flight. The commander considered he had both the qualifications and the necessary instructors' authorisation for this job, and was well disposed to helping a younger colleague and co-worker.

Everything indicates that the commander was not aware that flying training is not permitted during regular line traffic and that he himself was not competent to serve as an instructor on the Jetstream 32. The reason for this is discussed in section 2.4.

2.2 The accident

The exercise with a simulated engine failure after takeoff from Pajala was evidently conducted without problems. As shown on the radar plot and in the FDR printout, the approach to Luleå/Kallax was along the ordinary flight path and at normal speed. The CVR transcript shows that the com-

mander was satisfied with the co-pilot's flying and needed to give him only a few brief instructions.

The commander has stated that he intended to restore thrust on the right engine before landing. This, however, was not done and it has been impossible to elicit an explanation for this. The co-pilot, however, was prepared to perform the whole landing without thrust on the right engine.

When the aircraft had crossed the runway threshold, the altitude was approximately 63 feet (19 m) and speed approximately 107 knots, which was normal. However the FDR printout shows that the thrust on the right engine during this phase of the landing was down to just below 7 %. According to AFM page 6-8-4, engine thrust must not be below 12 % in connection with training involving simulated engine failure, since otherwise there is a risk of problems in manoeuvring.

The low engine thrust meant that the right engine propeller blades were adjusted to such a small angle that the propeller disc offered drag that was greater than the case with a feathered propeller. As well as increasing the aircraft's retardation, the drag from the propeller disc caused an extra yaw motion to the right, for which the co-pilot was obliged to compensate by applying opposite rudder and aileron. This in turn entailed further increased drag and hence further increased retardation.

The commander was probably unaware of the import of AFM page 6-8-4. His understanding was that the thrust on the right engine was "simulated feather" which would have involved the least possible drag. All the signs are that he was not conscious that the thrust set meant that the propeller disc gave appreciable drag.

When the aircraft was approaching the runway the co-pilot pulled the stick towards himself intending to perform a normal flare prior to touchdown. This was a natural action for him and he had received from the commander no instruction to the contrary.

The FDR transcription shows that the aircraft's attitude increased successively from approximately 5 degrees when crossing the runway threshold to almost 15 degrees.

At this point speed decreased rapidly to below Vmcl, whereupon the co-pilot lost control of the aircraft. The aircraft entered a yaw followed by a rapid right roll. During the roll the stall warning started to sound. Things happened so quickly that the commander was probably unable to grasp what was going on until too late. Neither the co-pilot nor the commander heard the stall warning signal.

Contributing to the commander carrying out the exercise in an unsuitable manner, and not realising in time that the situation was critical and hence taking over the controls, was probably the fact that he lacked the necessary instructor's experience for the aircraft type. Nor was he familiar with the special characteristics of the aircraft type at speeds close to Vmcl and in simulated loss of thrust on one engine, characteristics that are the subject of special warning in AFM page 6-8-4.

Although the simulator that SHK used for evaluating the aircraft type's landing performance did not permit simulation of engine thrust lower than about 10 %, the tests showed that it would probably have been possible to land the aircraft in the prevailing landing configuration.

2.3 The left aileron

As explained in section 1.16.2 damage to the left aileron was found during the technical inspection. The appearance of the 'stamp' damage to the wing and the fracture analysis of the fastening bolt show that the bolt must have caught in the shell plating when the wing-tip struck the ground and then been shorn off.

The wear damage at the same place suggests that there was a certain mechanical contact between the threaded end of the bolt and the shell plating on the underside of the wing before the accident even though the static clearance ought to have been almost 4 mm. The contact was evidently sporadic, depending on movements and vibrations in the wing and aileron. No report was made of inertia or resistance in the aileron system, indicating that in practice the somewhat reduced clearance between bolt and shell plating did not affect the mobility of the aileron.

The ”inertia” the co-pilot experienced in the ailerons just before the accident may have been due to such mechanical contact or because the firm application of aileron and rudder to compensate for the asymmetrical thrust felt unfamiliar to him

In the simulator trials at BAe Systems it was established that landing was possible with locked ailerons in the final phase of the landing. The damage to the left aileron is therefore judged not to have affected the course of events.

2.4 The airline

The airline company underwent great organisational changes during the three-plus years of its operation before the Luleå/Kallax Airport accident. The changes embraced both the operational and the technical management, the line network, and the geographical placing of the management and the out-stations. The company also suffered a serious air accident with the total wreckage of a Jetstream 32 just over three months after start-up

As is shown in section 1.17 the company had problems in building up an organisation that met the requirements of JAR-OPS 1, which was pointed out in the comments made by the Civil Aviation Inspectorate, chiefly regarding the company’s technical operation. It appeared particularly difficult to fill certain Nominated Post Holders with people possessing the necessary competence.

The commander’s insufficient knowledge of relevant rules and procedures indicates the existence of serious shortcomings in the company’s operating routines and regulations. Issues concerning in the company’s quality assurance system and its operations will, it appears, be treated in the HSLB investigation of the accident in Norway.

It must be noted in this connection that there is no doubt that the commander’s only motive for conducting flight training with the co-pilot was to help a colleague and comrade in his flying career.

2.5 The supervisory function of the Swedish Civil Aviation Administration

Deregulated civil aviation in Sweden has afforded space for existing airlines to expand and for new ones to be established. The difficulty in building a functioning organisation so that all quality control and safety demands are met and at the same time achieving acceptable profitability is often underestimated. Apart from access to a market, airlines need to be able to attract competent and experienced personnel, and to have sufficient economic resources to develop.

In this process there is a risk that the introduction of traffic is forced before there has been time for the organisation to develop, and this may negatively affect flight safety. The expansion of the present company may be a case in point.

Approval of commercial airline operators by the Civil Aviation Inspectorate, now the Civil Aviation Authority, constitutes the public’s guarantee that civil aviation is conducted according to regulations in force and with a

high standard of flight safety. The public has scant opportunity to judge whether an airline is safe to fly with; its members must rely on the authority's supervisory responsibility.

The Civil Aviation Authority must therefore ensure that all growth and establishment proceeds with the necessary standard of flight safety. To ensure this, strict routines are required for the work of supervision, clearly defined instruments of control, competent staff and the possibility for the staff to devote the time necessary for the job.

It is the view of the Board that the Civil Aviation Inspectorate in its control of EEE's operation, did not fully succeed in this. Much time and commitment was invested to have the company solve its problems of technical operation, but the inspectors seem not to have gained full insight into how flight-operational activities have been carried out in practice. The company's flight operations appear to have been studied predominantly through study of the documents regulating these operations.

Up to the time of the accident, for example, there had still been no Line Check or participation in any of the company's in-house training courses, and this was unfortunate. Had the inspectors inspected the company's operations "in the field", it is reasonable to assume that they would have picked up more of the company's shortcomings in quality assurance and operational routines.

Apart from suitable routines and personnel resources, it is also required that the inspectors of the Civil Aviation Authority have the authority and the means of control needed for ensuring that operators live up to established requirements.

That certain airline companies appear long to have been able to neglect taking action to remedy shortcomings brought to their notice has tended to undermine confidence in the Civil Aviation Inspectorate and reduce the authority's power to detect in good time and take action against companies that do not meet flight safety requirements.

It is therefore of utmost importance that the Civil Aviation Authority create and maintain routines, etc, for ensuring that airline companies, when shortcomings have been brought to their notice, remedy these within the stipulated time and if they do not, are prevented from continuing with their operations.

3 CONCLUSIONS

3.1 Findings

a) The crew members were qualified to perform the flight.
b) The aircraft had a valid Certificate of Airworthiness.
c) The commander was neither authorised nor qualified to serve as an instructor on the aircraft type.
d) The training of simulated engine failure was conducted during a commercial transport flight, which contravened regulations in force.
e) AMF page 6-8-4 was not available to all pilots in the company.
f) The pilots were not familiar with the aircraft's special flight characteristics in the present abnormal configuration.
g) Thrust on the right engine was lower than 12 % during the latter part of the approach and the landing.
h) The pilots lost control of the aircraft which stalled at a speed below Vmcl in connection with the landing with asymmetrical thrust.
i) Shortly before touchdown, speed was below Vmcl and thrust was asymmetrical
j) Shortly before touchdown the stall warning was activated.

k) When the right wing-tip struck the ground, indicated speed was 80 knots, four knots lower than Vs.
l) In connection with operational checks, the Civil Aviation Authority has on a number of occasions found fault with the company's operations.
m) The Civil Aviation Inspectorate did not discover certain operational shortcomings in the company.

3.2 Causes

The accident was caused by shortcomings in the company's quality assurance system, operational routines and regulations. These contributed to the facts that:

- the commander considered he was able to serve as a flying instructor on an aircraft type and in a flight situation for which he was neither qualified nor authorised,
- the pilots lacked necessary familiarity with the aircraft type's special flight characteristics during asymmetrical thrust, and
- the pilots lacked familiarity with the regulations in force for flying training.

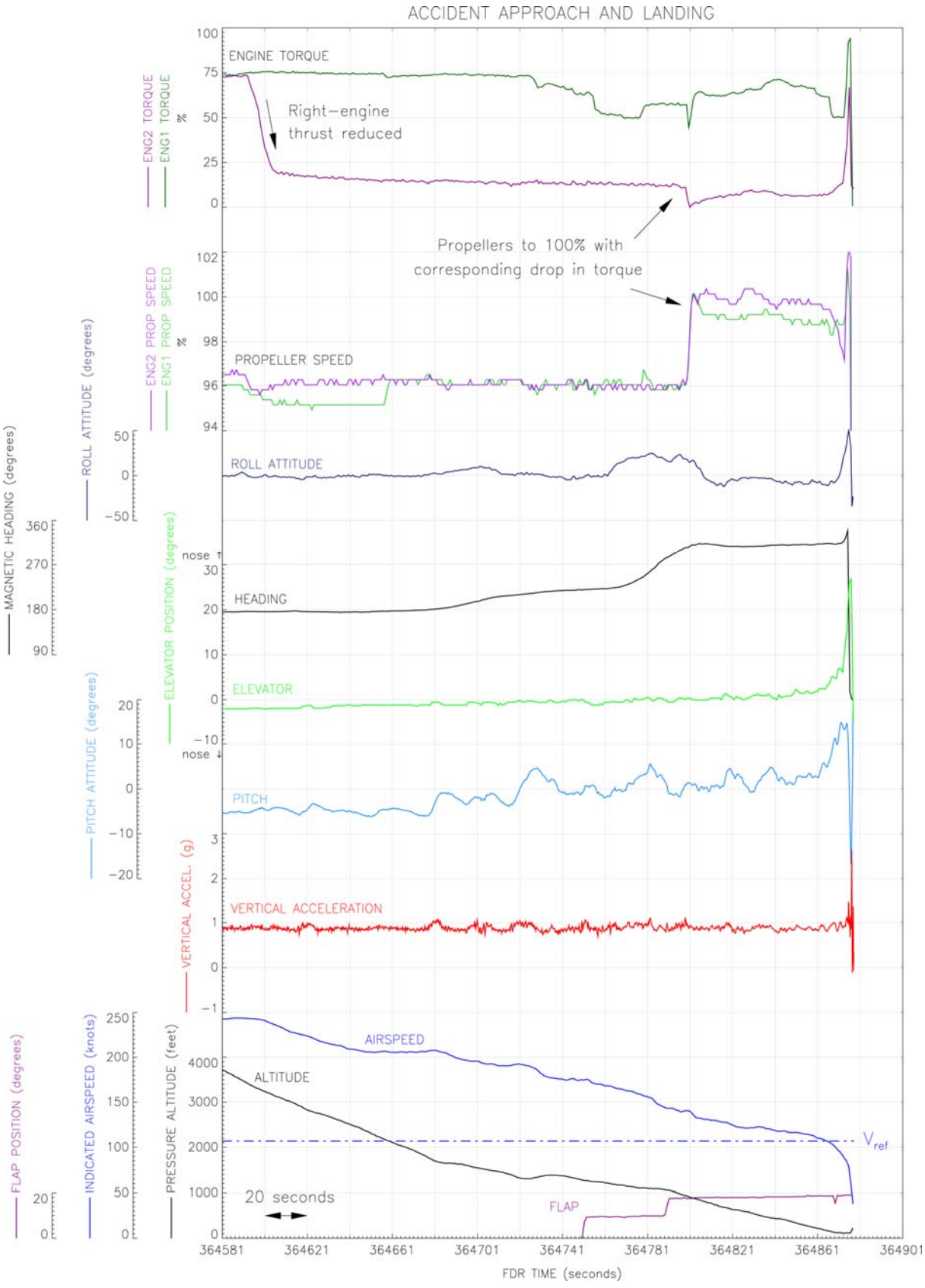
4 RECOMMENDATIONS

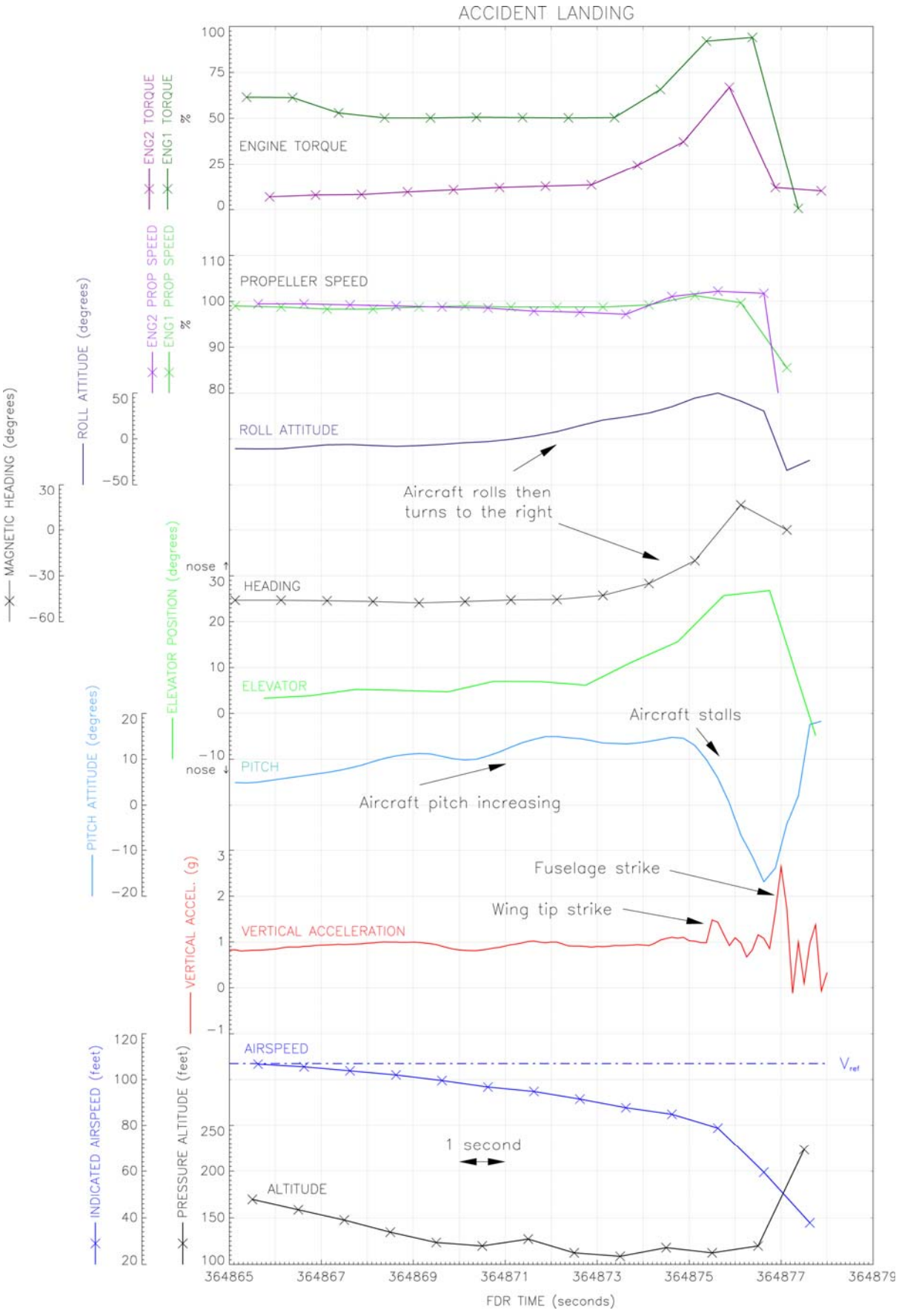
The Civil Aviation Authority is recommended to ensure that the Authority's routines and supervision are such that:

- aviation companies that are unable to maintain flight safety standards and meet official requirements in force are brought to book *(RL 2005:07e R1),*

- necessary steps are taken against aviation companies that neglect, or are unable, to remedy shortcomings in flight safety within the required time *(RL 2005:07e R2).*

Appendix 2


ACCIDENT APPROACH AND LANDING
ENGINE TORQUE
ENG2 TORQUE
ENG1 TORQUE
%
Right–engine thrust reduced
Propellers to 100% with corresponding drop in torque
PROPELLER SPEED
ENG2 PROP SPEED
ENG1 PROP SPEED
ROLL ATTITUDE
ROLL ATTITUDE (degrees)
MAGNETIC HEADING (degrees)
HEADING
ELEVATOR POSITION (degrees)
nose ↑
nose ↓
ELEVATOR
PITCH ATTITUDE (degrees)
PITCH
VERTICAL ACCEL. (g)
VERTICAL ACCELERATION
AIRSPEED
ALTITUDE
PRESSURE ALTITUDE (feet)
INDICATED AIRSPEED (knots)
FLAP POSITION (degrees)
FLAP
V_{ref}
20 seconds
FDR TIME (seconds)
364581
364621
364661
364701
364741
364781
364821
364861
364901


ACCIDENT LANDING
ENGINE TORQUE
ENG2 TORQUE
ENG1 TORQUE
%
PROPELLER SPEED
ENG2 PROP SPEED
ENG1 PROP SPEED
%
ROLL ATTITUDE
ROLL ATTITUDE (degrees)
Aircraft rolls then turns to the right
MAGNETIC HEADING (degrees)
HEADING
ELEVATOR POSITION (degrees)
nose ↑
ELEVATOR
Aircraft stalls
PITCH ATTITUDE (degrees)
PITCH
nose ↓
Aircraft pitch increasing
Fuselage strike
Wing tip strike
VERTICAL ACCELERATION
VERTICAL ACCEL. (g)
AIRSPEED
V_{ref}
1 second
INDICATED AIRSPEED (feet)
ALTITUDE
PRESSURE ALTITUDE (feet)
FDR TIME (seconds)

Appendix 3

SE-LNT Communication from CVR

Headings

Time: Time of message, UTC (local time–2 hours). Timing accurate to one to two seconds.

From: Origin of message.
CDR - Commander aboard SE-LNT.
COP - Co-pilot aboard SE-LNT.
AFIS - AFIS organ at Pajala Airport.
TWR - Kallax tower.
SDL - Sundsvall ATC.
TWR - Kallax tower.

Note: Notes
- Internal on flight deck.

Information: Message printed out in clear.
?? signifies impossibility of interpreting information.
(Brackets used to indicate that interpretation is uncertain).
[Square brackets indicate comments].

Time	*From*	**Note**	**Information**
15:56:08	COP	#	? pipe, trana in Swedish.
	COP	#	I guess you don't have the tale Nils Holgersson in Britain.
	CDR	#	No.
	CDR	#	We have swans, and the next big ones are Canada-geese.
	COP	#	Yes it's a kind of a geese but not, ehh whatever.
	COP	#	It's a big bird anyhow…
	CDR	#	It's a big bird yeah.
	COP		Echo Express 403 ready one one.
	AFIS		Echo Express 403 runway free.
	COP		Runway free, 403.
	COP	#	Okay.
	CDR	#	All right.
	CDR	#	You do your (props)
	COP	#	Yeah.
	COP	#	(Props)
			[Sound of engine rpm increasing]
	CDR	#	Okay here we go, you can set the power.
	COP	#	Set power.
16:57:03	COP	#	Power is set.
	COP	#	Airspeeds alive.
	COP	#	70 knots.
15:57:09	CDR	#	Your controls.
	COP	#	My controls.
15:57:14	CDR	#	V1, rotate, V2
	COP	#	Brakes and gear up.
	CDR	#	Gear is coming up.
			[Horn sound - landing gear warning]
15:57:31	CDR	#	OK, which engine failed?

	COP	#	Yeah, it's definitely … the …lef .. right ah left dead foot dead engine ? to the right one.
	CDR	#	Right engine, Good okay. I'll feather it for you.
15:57:45	COP	#	One two five climbing
	COP	#	Four hundred feet and I'll level off a little bit, gain some speed.
	CDR	#	That was nicely controlled.
	COP	#	A little bit lost there to the right
	CDR	#	No no, you're all right.
	CDR	#	Okey, speed is good.
15:58:05	COP	#	OK, continue the climb. Ahh, the memory items.
	CDR	#	Flaps up.
	COP	#	Flaps up.
15:58:11	CDR	#	Okay, so the engine is all contained.
	COP	#	Yes.
	CDR	#	And it is flap up ?? for you.
	COP	#	Good.
15:58:25	COP	#	Safe altitude.
	CDR	#	Yeah, okay, I'm going to reinstate the failed engine.
	COP	#	Ok.
15:58:40	CDR	#	Good, okay you've got both back again, (nicely done!).
15:58:48	CDR	#	What I'll do, I'll give you climb power straight away, then I'll do all the other bits and pieces.
	COP	#	Yeah.
	CDR	#	Try not to get confused which engine has failed, ehh, you've got one leg pushing the rudder, and the other ones dead. Dead leg, dead engine. That's it.
	CDR	#	Good.
	COP	#	Maybe we can do it one more if we have time sometime.
	CDR	#	Of course we can, yeah.
	CDR	#	If we get the opportunity, we will.
	COP	#	Yapp.
	COP	#	It's good to practice.
	CDR	#	Yeah.
15:59:23	AFIS		Echo Express 403, airborne five seven. Contact Sundsvall at 131,05. see you later, bye.
	CDR		131,05, bye bye.
			[Beep sound - VHF frequency change]
	CDR	#	Yeah.
15:59:45	CDR		Sundsvall good afternoon Echo Express 403 climbing through flight level 5, 3,6 for one four zero.
	SDL		Echo Express 403 Sundsvall good evening cleared Kallax via BESLA 2F runway 32
	CDR		BESLA 2F for 32 thank you very much 403.
	SDL		Sorry, BESLA 1F
	CDR		Ok, BESLA 1F.
16:00:12	CDR	#	Gear is up, flaps are up, APR we didn't use, flow selectors are on, climb power is set, pressurization is sorting itself, landing lights out, altimeters four point five mark.
	COP	#	Plus twenty.
	CDR	#	Yepp. Cabin signs off, cabin temperature is good, boost pumps we didn't use, great.
	COP	#	Okay.
	CDR	#	Yeah. Good.
16:00:45	COP	#	I guess the tricky thing is probably not going to happen in a check in a real plane but I guess to have close to V1 engine fail
	CDR	#	Yeah.

	COP	#	But I guess in Pajala it would be best just to break.
	CDR	#	Yeah, they recommend now that for training purposes you don't fail an engine exactly at V1 as we always used to. They recommend that somewhere between V1 and 200 feet you fail it.
	COP	#	Okay, yeah.
	COP	#	In a real plane?
	CDR	#	Yeah, when you are training in the airplane yeah.
	COP	#	But I guess that's for long runways then.
	CDR	#	Well no, if it fails before V1 you have no option, you have to stop. But if it fails at V1 then you have to cope with it, but when you are training, somewhere between V1 and 200 feet is an acceptable time to do it. We always used it, V1, rotate fail the engine you know, so everything happened…
	COP	#	Pretty unstable.
	CDR	#	Yeah, we've grown out of that ??, so it's much more sensible.
16:03:03	SDL		Echo Express 403 radar contact.
	CDR		403.
	SDL		Scandinavian 016 contact Kallax one two five decimal four five.
	SK016		One two five four five, Scandinavian 016.
	CDR	#	Right, that's one to go.
	COP	#	One to go.
			[A beep-sound - Altitude Alert]
	CDR	#	(I will write something down to make sure I'm making the impression I been doing something …)
			[A beep-sound - Altitude Alert]
16:09:06	CDR	#	Right, for a single engine approach then I would recommend landing with 20-flap.
	COP	#	Yeapp.
	CDR	#	Okay.
	COP	#	Yeah.
16:09:14		#	We'll carry on down the descent when we get down with both engines, when we get down to about ahh 3000 feet or something like that I'll put the same engine back into simulated feather for you. And you then fly ?? visual approach , whatever, on one engine, remember you'll only have this one to play with.
	COP	#	Yeah.
16:09:36	CDR	#	So with everything going for you here with long runway and good weather it would be quite sensible to stay a little bit high and not too fast but a few knots in hand. Then as you come down, and as you start flare, I would just gently bring this one back to zero thrust and then come back to nothing to match the other one, so you don't get a swing the other way.
	COP		Yeah.
	CDR	#	Okay.
16:11:19	Nordic		God kväll Sundsvall, Nordic 609 level eleven six climbing one six zero direct turning point 32 at Ume.
	SDL		Nordic 609 Sundsvall, evening, radar contact.
	SDL		Braathens 487 contact Bodö control 126,3, bye.
	B487		Roger, 1263 and goodbye to you, Braathens 487.
	SKY269		Sundsvall, god kväll Sky Express 269 with you, climbing through level 57 for FL340 inbound ROSMO.
	SDL		Sky Express 3, 269 Sundsvall good evening, radar contact.
16:15:35	CDR	#	Should I ask for descent?
	COP	#	Yes please, it's getting close.

	CDR		And Sundsvall Echo Express 403 we'd like initial descent please.
	SDL		Echo Express 403 descend to flight level 100.
	CDR		And 100, 403.
16.15:51	SDL		403 contact Kallax 12545.
	CDR		2545 bye bye.
			[Short beep - VHF frequency change]
	CDR	#	Right, pressurization set, landing data and approach briefing we've talked about so we're both happy with it.
	COP	#	Yepp.
	CDR	#	Ice protection is not required and boost pumps are off.
16.16:09	CDR		And Kallax, good afternoon Echo Express 403 just leaving 140 inbound to BESLA.
	TWR		Echo Express 403 good afternoon, radar contact descend to altitude 3000 feet QNH 1009, T-level 55.
	CDR		Cleared down 3000 one double o nine T-level 55, 403.
16:16:41	CDR	#	Right double o nine.
	CDR	#	13000 mark.
	COP	#	Checked, plus 40
	CDR	#	Yeah.
16:16:52	CDR	#	Fuel's good. Hydraulics are good, landing light on, cabin signs on, all right.
16:17:04	COP	#	So flap 10, flap 20 landing
		#	Yeah…
	TWR		Scandinavian 016 on ground 17 taxi right turn Alfa 3 to apron stand 4.
	COP	#	Hundred and ten.
	SK016		Alfa 3 to apron stand 4 Scandinavian 016.
	TWR		Scandinavian 016.
16:17:19	TWR		Echo Express 403 weather Kallax wind 260, 5 knots CAVOK temperature 13 intention visual approach right circuit 32.
16:17:28	CDR		Clearance all copied right circuit for 32, 403.
16:18:03	TWR		Sky Express 154 wind 260, 5 knots runway 32 cleared to land.
	SKY154		32 cleared to land Sky Express 154.
16:18:36	CDR	#	You happy if I call them visual?
	COP	#	Yeah.
16:18:39	CDR		Echo Express 403 is visual with the field.
	TWR		Echo Express 403 say again.
16:18:48	CDR		We are visual with the field.
16:18:51	TWR		Echo Express 403 Roger, cleared visual approach right circuit runway 32.
16:18:55	CDR		Cleared for a visual right hand 32, 403.
16:19:01	COP	#	Okay, heading for right base.
	CDR	#	Right, all yours.
	TWR		Sky Express 154 on ground 20 taxi right for Alfa 3 to apron stand 22.
	SKY154		Taxi via Alfa 3 to stand 22, sky Express 154.
16:22:08	CDR	#	300 litres a side.
	COP	#	300 per side, okay.
16:23:13	CDR	#	Okay, about to loose the other engine again
	COP	#	Yeah.
16:23:17	CDR	#	So it's going straight to feather.
	COP	#	Yeah.
	CDR	#	We have an auto-feather system.
	COP	#	Exactly.
16:23:38	CDR	#	Okay, that'll do for the time being.

16:24:39	CDR	#	Right, the secret is not to let your self get too low, it is easy to loose the height, very very difficult to get it back.
16:24:46	COP	#	Yeah I guess so (and you ??). Okay. So maybe slightly too high then on the glide slope than too low.
	CDR	#	Yeapp. Absolutely right.
16:25:51	COP	#	Flap 10.
16:25:54	CDR	#	Flap coming to ten.
16:26:12	CDR		403 coming final 32.
16:26:14	TWR		Echo Express 403 wind 270 degrees 5 knots runway 32 cleared to land.
16:26:19	CDR		Thank you Sir, cleared to land 32.
16:26:23	COP	#	Gear down.
16:26:24	CDR	#	Okay.
16:26:28	COP	#	Brakes (set), flaps twenty.
16:26:31	CDR	#	And landing flap is … set. Props to come.
	COP	#	Yeah.
16:26:40	COP	#	I can take the props then.
16:26:41	CDR	#	Okay.
16:26:49	CDR	#	I will just keep you feathered with the right hand engine.
	H97		Kontrollen 97
	TWR		Helge 97 kom.
16:26:52	H97		Ja då önskar vi komma in och landa platta 7 efter landande.
	CDR	#	That’s good.
16:26:58	TWR		Helge 97 är klar in mot fältet, markvinden 270 grader 5 knop.
	H97		Klar in mot fältet, Helge 97.
16:27:09			Five hundred [auto-call from a/c]
	CDR	#	I heard you first time.
	COP	#	[Skratt]
	H97		(Ja så) är vi 8 ombord.
16:27:17	TWR		Helge 97 8 ombord ja.
16:27:27	CDR	#	That’s lovely.
16:27:36			Minimums, minimums [auto-call from a/c].
16:27:40	CDR	#	That’s absolutely right, little bit of bank towards the live engine, keeps you nice and straight.
16:27:55	CDR	#	Keep it straight!
16:27:57			[Beep-sound - stall warning. Starts 0.37 seconds before “bank-angle”-call]
16:27:57			Bank angle [auto-call from a/c].
			[Beep-sound continues for a total of 3.3 seconds]
16:28:00			[Crash-sound]