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Interim Report

Accident on **27 November 2008**
off the coast of **Canet-Plage (66)**
to the **Airbus A320-232**
registered **D-AXLA**
operated by **XL Airways Germany**

BEA

Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

Ministère de l'Écologie, de l'Énergie, du Développement durable et de l'Aménagement du territoire

F O R E W O R D

This interim report presents the circumstances and facts established at this point in the investigation. Any interpretation or extrapolation of these elements would be mere speculation at the present time.

In accordance with Annex 13 to the Convention on International Civil Aviation, with EC directive 94/56 and with the French Civil Aviation Code (Book VII), the investigation is intended neither to apportion blame, nor to assess individual or collective responsibility. The sole objective is to draw lessons from this occurrence which may help to prevent future accidents or incidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

SPECIAL FOREWORD TO ENGLISH EDITION

This report has been translated and published by the BEA to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in French is the work of reference.

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ministère
de l'Ecologie, de l'Energie,
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BEA
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Interim Report
Accident to D-AXLA (27 November 2008)

ERRATUM

1.6.6 Flight control laws
[…]
In the last paragraph, the text should read:
In direct law, there is no automatic pitch trimming. The control surfaces are activated directly by the controls.

1.11.4 Analysis of data
[…]
The text should read: 15 h 45 min 39 s
instead of: 15 h 45 min 29 s

1.18.2 FAA safety message
The text should read: 10 December 2008
instead of: 12 October 2008

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GLOSSARY

AP	Autopilot
ATM	Air Traffic Management
ATPL	Air Transport Pilot's License
CAM	Cockpit Area Microphone
CEPHISMER	Undersea intervention diving group
CRNA	Regional ATC centre (Centre Régional de the Navigation Aérienne)
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
ECAM	Electronic Centralized Aircraft Monitor
EPR	Engine Pressure Ratio
FAA	Federal Aviation Administration
FAC	Flight Augmentation Computer
FD	Flight Director
FDR	Flight Data Recorder
FL	Flight level
FSK	Frequency Shift Keying
IAE	International Aero Engines
ILS	Instrument Landing System
ISATM	In Service Aircraft Test Manual
METAR	Meteorological Air Report
OFC	Operational Flight Check
PFD	Primary Flight Display
PF	Pilot Flying
PNF	Pilot Not Flying
QNH	Altimeter setting to obtain aerodrome elevation when on the ground
RTL	Rudder Travel Limit
SA CAM	Single Aisle Customer Acceptance Manual
SAMAR	Sea Rescue
TAF	Terminal Area Forecast
TEMSI	Significant weather chart
TMA	Terminal control Area
TO/GA	Take-Off/Go-Around thrust
TRI	Type Rating Instructor
ULB	Underwater Location Beacon
UTC	Coordinated Universal Time
VLS	Lowest selectable speed
VOR	VHF Omni-directional Range
Y/D	Yaw Damper

SYNOPSIS

Date of accident Thursday 27 November 2008 at 15 h 46 (1) **Site of accident** Off the coast of Canet-Plage (66) **Type of flight** Flight at end of leasing agreement	**Aircraft** Airbus A320 – 232 S/N 2500 registered D-AXLA **Owner** Air New Zealand Aircraft Holdings Limited **Operator** XL Airways Germany GmbH **Persons on board** 2 Flight Crew, 5 passengers

Summary

The flight from Perpignan – Rivesaltes aerodrome was undertaken in the context of the end of a leasing agreement, before the return of D-AXLA to its owner. The programme of planned checks could not be performed in general air traffic, so the flight was shortened. After about an hour of flight, the airplane returned to the departure aerodrome airspace and the crew was cleared to carry out an ILS procedure to runway 33, followed by a go around and a departure towards Frankfurt/Main (Germany). A short time after overflying the initial approach point, during a phase of flight at low speed, the crew lost control of the airplane, which crashed into the sea.

Consequences

	Injuries			Equipment
	Fatal	Serious	Slight/None	
Crew members	2	-	-	Destroyed
Passengers	5	-	-	

(1) All times in this report are UTC, except where otherwise specified. One hour should be added to express official time in metropolitan France on the day of the accident.

ORGANISATION OF THE INVESTIGATION

The BEA was informed of the accident on Thursday 27 November 2008 at around 16 h. In accordance with Annex 13 to the Convention on International Civil Aviation and the French Civil Aviation Code (Book VII), a technical investigation was launched by the BEA.

A BEA investigator arrived in Perpignan on the evening of Thursday 27 November 2008 and four others arrived the following morning.

In accordance with the provisions of Annex 13, Accredited Representatives from Germany (State of Registry and the Operator of the aircraft) and the United States (State of Design of the aircraft's engines) were associated with the investigation. Since the passengers were of New Zealand nationality, the BEA accepted the participation of New Zealand. The New Zealand Accredited Representative asked for assistance from the AAIB (United Kingdom).

Operations to locate the flight recorders started on 28 November. The recorders were recovered on 29 and 30 November 2008.

Working groups were set up in the following areas:

- Sea Search
- Operations
- Maintenance documentation
- Flight recorders
- Systems
- ATM data
- Witness testimony

1 – FACTUAL INFORMATION

1.1 History of Flight

The A320-232 registered D-AXLA operated by the airline XL Airways Germany had been ferried to Perpignan aerodrome on 3 November 2008 for maintenance and painting work. It had been released to service on 27 November 2008.

The airplane, chartered from Air New Zealand, was at the end of its leasing agreement and was to be returned to its owner. The leasing agreement specified a programme of in-flight checks; to this end, a flight had been planned for the afternoon. The crew was made up of a Captain (PF) and a Co-pilot (PNF) from the airline XL Airways Germany. A pilot and three engineers from Air New Zealand, as well as a representative of the New Zealand Civil Aviation authority were on board. The pilot and one of the engineers had taken seats in the cockpit.

The estimated departure time in the flight plan was 12 h 30 for a total planned flight time of 2 h 35 over the west of France with a return to Perpignan. At the end of the flight, the airplane was supposed to return to Frankfurt/Main.

The departure was postponed to 14 h 00 then to 14 h 30, and the takeoff took place at 14 h 44 min.

Phase 1: from takeoff to flight at low speed

A few minutes after takeoff, the crew requested, but was not authorised to perform any “360”. The en route controller explained to the crew that they could not undertake tests in general air traffic and that the flight plan filed was not compatible with the manoeuvres requested. The crew announced that they wanted to continue on the route planned in the flight plan and asked to climb to FL310 before turning back towards Perpignan.

At around 15 h 12 min, the crew turned back. Some checks planned in the flight programme were performed. The maximum flight level reached was FL 390.

At 15 h 33 min 34 s, in descent towards the FL130, the crew contacted Perpignan Approach. They were then cleared to descend to FL 120 towards the PPG VOR. The approach controller asked them to reduce speed to 250 kt and to plan a hold at the PPG VOR. They were number two on approach.

At 15 h 34 min 34 s, the crew requested radar vectoring. The approach controller asked the crew to turn left onto heading 090 and to reduce the speed to 200 kt.

Phase 2: flight at low speed

The approach controller asked the crew to reduce speed to 180 kt and to descend to FL 80 then to FL 60.

From 15 h 38 min 03 s and for about forty seconds, the pilot from New Zealand described the actions to take to perform a check at low speed planned in the programme.

At around 15 h 40 min, the approach controller asked the crew to turn right on heading 190 and to maintain 180 kt. The airplane speed was 215 kt. About one minute later, the approach controller cleared the crew to the LANET ILS approach for runway 33 and to descend

towards 5,000 ft altitude. At the request of the crew, the approach controller repeated the message. While the co-pilot was reading back, the Captain indicated to the New Zealand pilot that the low speed flight should probably be made later or during the flight towards Frankfurt. He even considered not performing it.

At 15 h 42 min 14 s, the approach controller asked for the speed of the airplane. The co-pilot answered that the speed was falling then at 15 h 42 min 25 s that it was 180 kt. The approach controller then asked them to maintain 180 kt and to descend to 2,000 ft. The slat and flap controls lever was put in position 2.

At 15 h 42 min 46 s, the Captain stated that the approach was not included in the database. Thirty-six seconds later, the co-pilot carried out the approach briefing.

At 15 h 43 min 37 s, the Captain announced that he was passing under the cloud layer. He disengaged the autopilot and asked the New Zealand pilot what he wanted. The latter answered that it was necessary to go slowly and described to him the necessary actions to activate the alpha floor protection. During these exchanges, the Captain called for gear extension and put the thrust levers in the IDLE position.

At the same time, the approach controller asked the crew its intentions twice. The Co-pilot answered that they wanted to make a go-around and continue towards Frankfurt.

Phase 3: the loss of control

At 15 h 44 min 30 s, the Captain stabilised the airplane at an altitude of 3,000 ft. The airplane was in landing configuration (FULL). In thirty-five seconds, the speed went from 136 to 99 kt and the horizontal stabilizer went to the pitch-up stop. The stall warning sounded. The pitch angle was then slightly below 19 degrees. The thrust levers were advanced towards the TO/GA position in the following second. While the thrust on the engines increased in a symmetrical manner, the speed continued to drop to 92.5 kt, then began to increase. The airplane started to roll slightly to the left, then to the right. The Captain countered these movements.

At 15 h 45 min 15 s, the flight control laws changed to “direct” law. The bank angle was 50 degrees to the right.

At 15 h 45 min 19 s, the stall warning stopped. The bank angle was 40 degrees to the left. One second later, the pitch angle was 7 degrees, the wings were close to horizontal and the speed was 138 kt. The airplane’s pitch and altitude then began to increase. During this climb, the stall warning sounded a second time. The crew retracted the landing gear and the flight control law in pitch changed to « alternate ».

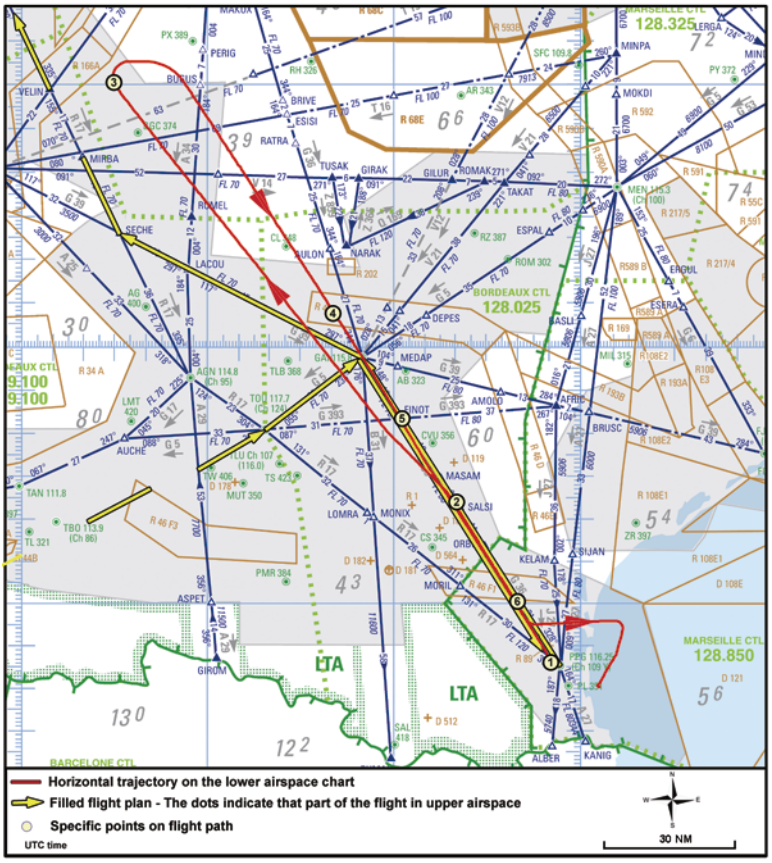
At 15 h 45 min 44 s the maximum recorded values were: pitch 57 degrees, altitude 3,800 ft. The speed was below 40 kt.

At 15 h 45 min 47 s the stall warning stopped. It sounded again five seconds later. From 15 h 45 min 55 s, the airplane banked to the right up to 97 degrees and its pitch reached 42 degrees nose-down.

At 15 h 45 min 58 s, the slat and flap controls selector was placed in position 1, then 0 two seconds later. The Captain made inputs on the flight controls and the thrust levers.

At 15 h 46 min 00 s, the stall warning stopped.

At 15 h 46 min 06.8 s, the last recorded values were a pitch of 14° nose down, a bank angle of 15° to the right, a speed of 263 kt and an altitude of 340 ft. Less than a second later, the airplane crashed into the sea.



① **14 h 44 min**
Take-off from Perpignan Airport

② **14 h 52 min**
The controller tells the crew they cannot do test flights in general air traffic

③ **15 h 12 min**
Aircraft turns back

④ **15 h 22 min**
Arrival at FL390

⑤ **15 h 26 min**
Beginning of descent

⑥ **15 h 34 min 34 s**
Co-pilot: "(...) we appreciate radar vector for the approach"

1.2 Injuries to Persons

Injuries	Crew members	Passengers	Others
Fatal	2	5	0
Serious	0	0	0
Slight/None	0	0	0

1.3 Damage to Airplane

The airplane was completely destroyed on impact with the surface of the sea.

1.4 Other Damage

None.

1.5 Personnel Information

1.5.1 Flight crew

1.5.1.1 Captain

Male, aged 51.

- Air Transport Pilot License ATPL (A) n°3311003773 issued by the Federal Republic of Germany on 24 August 1987 in accordance with the requirements of JAR-FCL1.
- Date first employed by airline: February 2006.
- Type rating on A318/A319/A320/A321 valid until 5 March 2009.
- Type rating Examiner authorisation for A318/A319/A320/A321 (TRE) n°D-196 issued on 2 July 2003 and valid until 2 August 2009.
- Qualification as instructor for type rating training on A318/A319/A320/A321 (TRI) valid until 18 September 2011.
- Rating for Cat III precision approaches valid until 5 March 2009.
- Last line check on 29 March 2008.
- Last base check on 30 September 2008.
- Medical aptitude class 1 on 12 December 2007 valid until 12 December 2008.
- Responsible for the airline's ground and air operations

Flying hours:
- 12,709 flying hours of which 7,038 on type.
- 128 hours in the previous three months, all on type.
- 14 hours in the previous thirty days, all on type.
- No flying hours in the previous 24 hours.

1.5.1.2 Co-pilot

Male, aged 58

- Air Transport Pilot License ATPL (A) n°3311003971 issued by the Federal Republic of Germany on 2 March 1988 in accordance with the requirements of JAR-FCL1.
- Date first employed by airline: April 2005.
- Type rating on A318/A319/A320/A321 valid until 8 July 2009.
- Rating for Cat III precision approaches valid until 8 July 2009.
- Last line check on 29 October 2008.
- Last base check on 17 June 2008 (extension of type rating on A318 /A319/A320/A321).
- Medical aptitude class 1 on 18 November 2008 valid until 5 December 2009, with the requirement to wear corrective lenses and to carry a spare pair of glasses.

Flying hours:
- 11,660 flying hours of which 5,529 on type.
- 192 hours in the previous three months, all on type.
- 18 hours in the previous thirty days, all on type.
- No flying hours in the previous 24 hours.

1.5.2 Other persons on board

Five other people, from New Zealand, were on board the airplane:

- A pilot from the Air New Zealand airline, nominated to carry out the checks planned during the flight.
- Three engineers from the Air New Zealand airline.
- An engineer from the New Zealand civil aviation authority.

1.6 Aircraft Information

1.6.1 Airframe

Manufacturer	Airbus
Type	A320-232
Serial number	2500
Registration	D-AXLA
Entry into service	July 2005
Certificate of Airworthiness	N°31 781 of 02 June 2006 issued by the German civil aviation authority
Airworthiness examination certificate	Ref. T519/ARC/009/2008 of 08/10/2008, issued by the German civil aviation authority and valid for one year
Utilisation as of 27 November 2008	10,124 flying hours and 3,931 cycles

1.6.2 Engines

Manufacturer: International Aero Engines (IAE)
Type: IAE V2527-A5

	Engine n° 1	Engine n° 2
Serial number	V12001	V12003
Installation Date	July 2005	July 2005
Total running time	10,124 hours and 3,931 cycles	10,124 hours and 3,931 cycles

1.6.3 Background

The airplane, initially registered ZK-OJL, was delivered by Airbus to its owner Air New Zealand in July 2005.

It was dry leased by XL Airways Germany from May 2006, with the approval of the German civil aviation authority. The registration of the airplane was then changed to D-AXLA. It was listed in the fleet of XL Airways Germany and was supposed to be returned to Air New Zealand on 28 November 2008, date of the end of the leasing agreement.

1.6.4 Maintenance

The IHP A320 GXL Maintenance Manual, approved by the German civil aviation authority and applicable to the airline's whole A320 fleet, described in detail the maintenance programme, in accordance with the manufacturer's manuals. This programme is based on airplane use of between 500 and 4,400 flying hours and between 300 and 2,500 cycles over a period of twelve months.

The documentation showed that the inspections following scheduled maintenance and mandatory inspections resulting from Airworthiness Directives had been carried out.

The leasing agreement for D-AXLA specified that a complete C check or equivalent would be undertaken in an approved maintenance facility before the return of the airplane to Air New Zealand.

The airplane was thus ferried to Perpignan to Europe-Aéro-Services Industries (EAS - Part 145 approved organisation n°FR.145.301) on 3 November 2008, for a 40-month check (2C) and to return the airplane to Air New Zealand specifications, in particular the livery (removal of XL Airways paint scheme and painting in Air New Zealand colours).

This check consisted only of visual and functional inspections, which were completed on 27 November 2008 at around 14 h 30 min without revealing anything significant.

N.B. Type C checks do not require a check flight.

1.6.5 Weight and balance

The airplane's weight and balance on takeoff were estimated at 56,450 kg and 22.8 %. The certified maximum takeoff weight (MTOW) is 77,000 kg.

At the time of the event, the weight and balance were estimated to be 53,700 kg and between 22 and 22.5 %.

1.6.6 Flight control laws

The Airbus A320 has fly-by-wire flight controls. The aerodynamic surfaces, which enable airplane control, are not mechanically linked to the controls. The airplane is flown using two sidesticks. The movements of these sidesticks are transmitted in the form of electrical signals to computers that transform them into orders to the actuators of the various surfaces. The laws that govern these transformations are called “flight control laws”. On the A320, in nominal operation, the flight control law is called “normal law”. Under certain conditions, it can be replaced by two reconfiguration laws: the “alternate law” or the “direct law”.

The normal law offers protections in attitude (the pitch and bank values are limited), load factor, high speed and angle of attack (specifically at low speed). Pitch trimming is ensured automatically by the auto-trim. Bank angle is coordinated with the rudder. The sidesticks control the load factor according to the normal airplane axis and the roll rate.

In alternate law, the sidesticks control the load factor according to the normal airplane axis as for the normal law, but with fewer protections. In roll, they directly control, as they do in normal law, the ailerons and the spoliers. When the landing gear is extended, the pitch control law passes to direct law.

In direct law, there is no automatic pitch trimming, only the load factor protection is maintained. The control surfaces are activated directly by the controls.

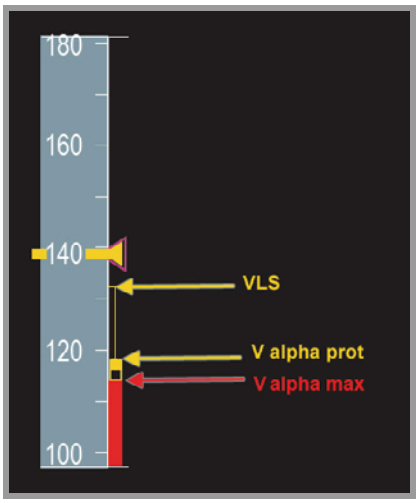
1.6.7 Angle of attack protections

When the airplane decelerates below VLS, the angle of attack can reach a value called « alpha prot ». In normal law, a protection is then activated that consists of introducing an order to pitch down and to stop the automatic pitch-up trimming.

If the deceleration continues, when the angle of attack reaches a value called « alpha floor », the maximum available thrust is automatically applied in order to regain speed. However, if on activation of the alpha floor function, the pilot disconnects auto-thrust, the airplane can continue to decelerate until it reaches a maximum angle of attack called « alpha max ». The value of this angle of attack is lower than the stall angle of attack.

In alternate or direct law the aforementioned protections are no longer available, only the stall warning remains active.

Except for the « alpha floor » function, the limit speeds that correspond to these protections are computed by the FAC and are displayed on the speed scale on the PFD.



Example of speed scale on PFD in normal law

1.7 Meteorological Conditions

A depression centred over the north of Morocco controlled a southwest flow, moderate at FL180 to strong at FL300. In the lower layers of the atmosphere, the depression was moving towards the south of Spain and generating light east winds over Catalonia and pulling two small cloudy fronts of Cu and Sc whose base was at 3,300 ft, the ceiling being at around 18,000 ft, giving light rain over Perpignan.

1.7.1 Significant messages

Perpignan METAR
LFMP 271400Z VRB02KT 9999 FEW033 BKN051 07/00 Q1019 NOSIG=
LFMP 271500Z 28003KT 9999 -RA FEW033 BKN053 07/03 Q1018 NOSIG=
LFMP 271600Z 30005KT 9999 FEW033 SCT043 BKN058 07/03 Q1018 NOSIG=

Perpignan TAF
LFMP 271100Z 2712 / 2812 32010KT 9999 FEW040 BKN060 BECMG 2715 / 2717 SCT020 BKN040 TEMPO 2718 / 2803 8000 SHRA BECMG 2807 / 2809 32015G25KT FEW040=

1.7.2 Information supplied to the crew

The flight file supplied to the crew contained the following information:

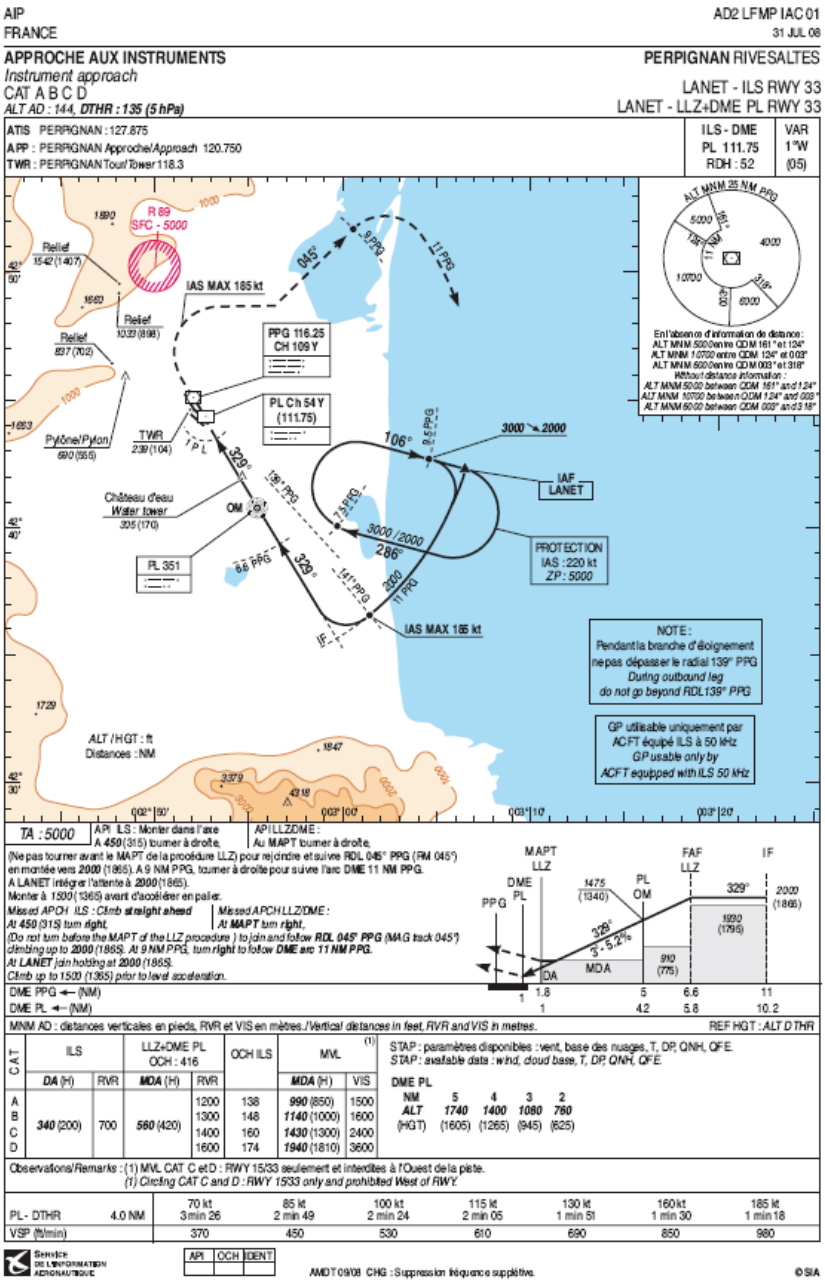
- ❑ A TEMSI EURO SIGWX valid at 18 h 00
- ❑ Various altitude wind charts (from FL 50 to FL 530)
- ❑ A list of METAR's and TAF's corresponding to the flight, including those for Perpignan :

Perpignan METAR
LFMP 271100Z 28004KT 240V360 9999 FEW045 08/M03 Q1023 NOSIG=

Perpignan TAF
TAF LFMP 271100Z 2712/2812 32010KT 9999 FEW040 BKN060 BECMG 2715/2717 SCT020 BKN040 TEMPO 2718/2803 8000 SHRA BECMG 2807/2809 32015G25KT FEW040=

1.8 Aids to Navigation

The LANET - ILS 33 approach procedure at Perpignan - Rivesaltes (see chart below) uses the following radio-navigation equipment:
• a locator (PL on the 351 kHz frequency);
• an ILS on runway 33 (PL on the 111.75 MHz frequency) associated with the DME installed alongside the glide; the localizer beam is on the runway centreline; the glide has a slope of 5.2 %;
• a VOR (PPG on the 116.25 MHz frequency) installed alongside the DME.



1.9 Telecommunications

1.9.1 Communications with the en-route ATC centres

The crew made radio contact with the southeast (Aix en Provence) and southwest (Bordeaux) CRNA. The crew did not notify any problems.

The communications were recorded.

1.9.2 Communications with Perpignan ATC

- **ATIS information (127.875 MHz):**

Information available on departure from Perpignan:

GOLF Information, recorded at 14 h 00 : VOR DME ILS approach runway 33, runway 33 in service, transition level 050, birds in vicinity, wind calm, visibility 10 km, FEW 3300, BKN 5100, temperature 7 °C, dew point temperature 1 °C, QNH 1 019 hPa, QFE 1014 hPa.

Information available on return towards Perpignan:

HOTEL Information, recorded at 15 h 00: VOR DME ILS approach runway 33, runway 33 in service, transition level 050, birds in vicinity, wind calm, visibility 10 km, light rain, FEW 3300, BKN 5300, temperature 7 °C, dew point temperature 3 °C, QNH 1 019 hPa, QFE 1 013 hPa.

- **Approach on 120.75 MHz**: The radio communications were recorded.

- **Tower on 118.30 MHz**: the crew did not contact the control tower during the approach.

1.10 Aerodrome Information

Perpignan - Rivesaltes is a controlled aerodrome, open to public air traffic, located 4 kilometres northwest of the town of Perpignan. It is attached to the southeast civil aviation management (Direction de l'aviation civile sud-est) for airport services and to southeast ATC service (Service de la navigation aérienne sud-est) for air traffic control services.

The aerodrome has one paved runway 15/33 that is 2,500 m by 45 m and one paved runway 13/31 that is 1265 m by 20 m. The reference altitude of the aerodrome is 144 ft.

Runway 33 was in service at the time of the accident.

1.11 – Flight Recorders

In accordance with the regulations, the airplane was equipped with a cockpit voice recorder (CVR) and a flight data recorder (FDR).

1.11.1 Cockpit Voice Recorder (CVR)

The CVR was a protected recorder with a solid state memory capable of reproducing at least the last two hours of recording:

- Make: Allied Signal (Honeywell)
- Type number: 980-6022-001
- Serial number: 1424

The following tracks were recorded:

1. VHF and headset microphone of the Captain (left seat), of thirty minutes duration,
2. VHF and headset microphone of the co-pilot (right seat), of thirty minutes duration,
3. VHF and public address, of thirty minutes duration,
4. Cockpit Area Microphone (CAM), of two hours duration,
5. Tracks 1, 2 and 3 mixed, of two hours duration.

An FSK signal coding the UTC time was recorded on tracks 3 and 5.

1.11.2 Flight Data Recorder (FDR)

The FDR was a protected recorder with a solid state memory capable of reproducing at least the last twenty-five hours of recording:

- Make: Honeywell
- Type number: 980-4700-042
- Serial number : 11270

1.11.3 Data readout

The CVR and the FDR, under judicial seals, were handed over to the BEA by a senior police officer on Sunday 30 November.

The electronic cards from the protected modules containing the recorded data were extracted. These cards were cleaned and then dried. Attempts to read them out using several types of independent equipment did not make it possible to recover the recorded data.

The electronic cards were placed under judicial seal again following these operations. They were examined at Honeywell, manufacturer of the recorders, in the United States on the 5th and 6th of January 2009 in the context of an International Commission of Inquiry. Some short-circuits were discovered on the cards. Eliminating the short-circuits allowed a complete readout of the data. The recordings were of good quality and the whole flight was included.

The graphs of the flight parameters are in appendix 1.

1.11.4 Analysis of data

The CVR and FDR recorders were synchronized in UTC based on the parameters of the *Master caution, Master Warning, BCD GMT time, GMT minute, GMT second*.

N.B.: Throughout this paragraph, except where otherwise mentioned, the headings are magnetic headings, the speeds mentioned are computed (CAS) and altitude values are those of the recorded parameter corrected for QNH (AMSL altitude).

Engine startup was completed at 14 h 32. The crew then performed the flight control surface movement check. The airplane left the ramp area at 14 h 33. The Captain was Pilot flying (PF) throughout the flight.

At 14 h 43 min 40 s, the thrust control levers were progressively moved forwards towards the TO/GA position (maximum takeoff thrust). The airplane took off at 14 h 44. Autopilot 1 was activated at 14 h 44 min 57 s. A transfer of authority from autopilot 1 to autopilot 2 took place at 14 h 48 min 10 s. Up to flight level 280, the speed was managed and stable at around 280 kt.

The airplane reached flight level 320 at about 15 h 03. From 15 h 04 min 03 s, the values of the left and right local angles of attack did not vary significantly, and were recorded respectively as 3.8 and 4.2 degrees. Towards 15 h 05 min 15 s, the crew began a descent towards flight level 310, which was reached at about one minute later.

At 15 h 10 min 45 s, the airplane was on a 330° heading. After having disengaged the autopilot, the crew began a turn to the right towards the selected 090 heading. The bank angle reached 44° before returning towards 31°. At around 15 h 11 min 58 s, the lateral navigation NAV mode was activated and autopilot 1 was engaged about five seconds later.

The airplane then climbed in steps towards flight level 390 which was reached at about 15 h 22. The descent began shortly after 15 h 26 towards flight level 200, reached at about 15 h 32.

At 15 h 34 min 34 s, the crew having requested radar vectoring, the approach controller asked them to turn left on heading 090 and reduce speed to 200 kt. At 15 h 34 min 58 s, the crew started a left turn to follow the 090 heading.

At 15 h 36 min 47 s, when the airplane was level at FL120, the Captain asked "*you want alternate law"* and the New Zealand pilot answered "*okay alternate law"*.

At 15 h 37 min 08 s, the autopilot was disengaged. Nine seconds later, the callout « *FAC 1, and FAC 2 is coming now »* was made and the Y/D 1 was recorded as FAULT. At 15 h 37 min 22 s, the Y/D 2 was recorded as FAULT, the control law for pitch passed from *normal* to *alternate* and the control law for roll passed from *normal* to *direct*. Some inputs on the sidestick were recorded on the Captain's side. At 15 h 37 min 52 s, the control law for pitch and for roll passed back to *normal* and autopilot 1 was engaged.

The New Zealand pilot then said "*Low speed flight is now probably next"* then described the sequence of events for the flight at low speed. The Captain asked if his intention was to go down to VLS and alpha prot. He confirmed that and said that, on reaching VLS, it would be necessary to pull quite hard to go as far as alpha floor. The Captain answered that he knew. The New Zealand pilot continued, saying that afterwards it would be necessary to push, disengage and re-engage.

At around 15 h 39 min, the approach controller asked the crew to descend towards flight level 60. The airplane was then slightly below flight level 100 and its speed was 215 kt.

At around 15 h 40 min, the approach controller asked the crew to turn to the right on heading 190 and to maintain 180 kt. The Captain made a right turn. The airplane speed was 215 kt.

At around 15 h 41 min, the approach controller twice asked the crew to resume navigation directly towards the LANET point, to continue the descent towards 5,000 ft QNH and cleared them for the ILS 33 approach. The Co-pilot read back after the second message. The Captain said "*I think we will have to do the slow flight probably later"* then "*Or we do it on the way to Frankfurt or I even skip it*".

The airplane reached 5 000 ft altitude at 15 h 42 min 00 s. Its speed was then 210 kt.

At 15 h 42 min 14 s, the approach controller asked for the airplane's speed. The Co-pilot answered initially that it was falling then at 15 h 42 min 25 s that it was 180 knots. The airplane speed was then slightly above 190 kt and the selected speed went from 180 kt to 157 kt. The approach controller then asked them to maintain 180 kt and to descend towards 2,000 ft.

At 15 h 42 min 23 s, the lateral autopilot mode changed from HDG to NAV. A few seconds later, the airplane began to descend.

At 15 h 42 min 46 s, the Captain said that the approach was not in the database.

At 15 h 43 min 37 s, the Captain disengaged the autopilot. He said "*Down below the clouds so you want what?"* The New Zealand pilot answered "*We need to go slow with err recovery from… recovery"*.

At 15 h 43 min 41 s, the Captain positioned the thrust control levers on IDLE and autothrust disengaged. The altitude was 4,080 feet and the speed was 166 kts. The Captain asked for landing gear extension the said "*we do the err the…"* and the New Zealand pilot answered "*Slow speed yeah".* They discussed the configuration to adopt; during this time the approach controller twice asked for confirmation that it would be a complete landing. The Co-pilot answered the second request by saying that it would be a go-around and a departure towards Frankfurt.

Between 15 h 43 min 20 s and 15 h 43 min 55 s, the spoliers were extended.

At 15 h 43 min 55 s, the airplane speed was 163 kt.

At 15 h 44 min 17 s, the airplane speed was 158 kt and the RTL reached 25°.

At 15 h 44 min 30 s, the Captain stabilised the airplane at an altitude of 3,000 ft. The airplane was in landing configuration (FULL). Flight Directors 1 and 2 were still active and the vertical mode changed from OP DES to V/S +0000. The speed was 136 kt.

At 15 h 44 min 44 s, the airplane altitude was 2,980 ft and the speed 123.5 kt.

At 15 h 44 min 57 s, while the airplane was near LANET, a « triple click » was recorded and the AP/FD lateral mode changed from NAV to HDG. The selected heading was the current heading of the airplane.

At 15 h 44 min 58 s, the airplane was at 2940 ft altitude and a speed of 107 kt.

Between 15 h 44 min 30 s and 15 h 45 min 05 s, the stabiliser moved from -4.4° to -11.2° (nose-up position). It remained in this position until the end of the recording.

At 15 h 45 min 05 s, the airplane was at 2,910 ft altitude and a speed of 99 kt. Pitch attitude was 18.6°. The stall warning sounded. In the following second, the thrust control levers were moved to TO/GA position. Auto-thrust changed to armed mode. A symmetrical increase in

engine RPM is noticeable up to N1 values of about 88 %.

At 15 h 45 min 09 s, the bank angle reached 8° to the left and the speed 92.5 kt. The Captain made a lateral input to the right and a longitudinal movement forwards on his sidestick.

Between 15 h 45 min 09 s and 15 h 45 min 13 s, the FAC 1 FAIL and FAC 2 FAIL parameters (recorded every four seconds) passed to the FAIL[2] value.

At 15 h 45 min 11 s, the airplane wings straightened up and began to roll to the right. The Captain made a lateral input to the left stop. The rudder pedal began to move in the direction of a left turn (rudder deflection to the left). The TLU function of FAC 1 and 2 de-activated. The yaw damper orders were limited to ± 5°. The RTL value increased to 32° in three seconds.

At 15 h 45 min 12 s, both flight directors disengaged.

At 15 h 45 min 14 s, autothrust disarmed.

At 15 h 45 min 15 s, bank angle reached 50° to the right. The Captain's lateral input was still at the left stop. The rudder pedal reached a 23° left position. At the same moment, the Captain's longitudinal input changed to the forward stop position. Pitch was 11°, the speed 98 kt and the altitude about 2,650 ft. The flight control laws for pitch and for roll passed almost simultaneously from *normal* to *direct*.

At 15 h 45 min 17 s, the bank angle was close to zero while the airplane was again starting to roll towards the left. The Captain made a lateral input to the right stop position. The rudder pedal came back to a position close to neutral though still to the left (about 4°).

At 15 h 45 min 19 s, Captain's longitudinal input was still at the forward stop position. The elevators reached their maximum nose-down position of about 11.6°. The bank angle reached 40° to the left and the Captain progressively cancelled his lateral input. The stall warning stopped.

At 15 h 45 min 20 s, the airplane's pitch was 7°, its speed was 138 kt, its altitude 2,320 ft. The Captain cancelled his longitudinal input. From this moment on, the airplane's pitch started to increase. In the following second, the Captain made a further longitudinal input to the forward stop position.

At 15 h 45 min 23 s, the altitude reached a minimum of about 2,250 ft and the speed 144.5 kt.

At 15 h 45 min 29 s, landing gear retraction was ordered.

At 15 h 45 min 36 s, the stall warning sounded again.

At 15 h 45 min 40 s, the control law for pitch passed from *direct* to *alternate*. The bank angle reached a maximum of 59° to the left and the normal load factor dropped below 0.5 g. The Captain's lateral input was practically at neutral, the longitudinal input was still forwards but was not constantly at the stop. The yaw damper orders were nil and remained so until the end of the flight.

[2] This value means that the DMC were no longer receiving limit speed information from the FAC.

At 15 h 45 min 42 s, the speed parameter recorded became invalid[3].

A 15 h 45 min 44 s, the altitude reached a maximum of about 3,800 ft and pitch reached 57° nose up. The bank angle was about 40° to the left.

At 15 h 45 min 47 s, the stall warning stopped.

At 15 h 45 min 48 s, the landing gear was retracted and locked. The HYD page was recorded as displayed on the ECAM (the parameter is recorded every four seconds).

Between 15 h 45 min 45 s and 15 h 45 min 49 s, a slight drop in engine EPR (from 1.45 to 1.44) and an increase in N1 RPM (from 88 % to 90 % for engine 1 and from 88 % to 92 % for engine 2) were observed.

Between 15 h 45 min 49 s and 15 h 45 min 53 s, the Captain made a longitudinal input towards the rear. The elevator reached values of about 30° nose up.

At 15 h 45 min 50 s, the normal load factor exceeded 0.5 g. The thrust control levers were placed in the CLIMB position (25°) for a second then repositioned on TO/GA.

At 15 h 45 min 52 s, the stall warning sounded again. The ENG page was recorded as displayed on the ECAM.

At 15 h 45 min 53 s, the pitch reached 7° nose down. The recorded speed became valid again at 46 kt. The bank angle was below 10°, to the left. The FAC 1 FAIL and FAC 2 FAIL parameters passed temporarily to NOT FAIL. Flight Director 1 re-activated temporarily.

During the period when the speed was invalid, the RTL value dropped to about 31.5°. It was at 32 ° as soon as the speed became valid again.

Between 15 h 45 min 55 s and 15 h 45 min 58 s, the Captain made a lateral input to the left stop; the airplane began to roll to the right. The bank angle went from 3° to 97° to the right. At the same time, the pitch went from 3 ° to 42 ° nose down.

From 15 h 45 min 57 s, the Captain's longitudinal input was nose up, the elevator was at 14.5° nose down.

At 15 h 45 min 58 s, the flaps and slats were selected to position 1, then to position 0 two seconds later.

At 15 h 46 min 00 s, the stall warning stopped and was followed by a CRC warning that corresponded to a *Master Warning,* which stopped two seconds later.

At 15 h 46 min 01 s, the pitch reached a maximum of 51° nose down. The bank angle was 45° to the right, the speed was 183 kt and the altitude about 1,620 ft. From this moment on, the Captain's longitudinal input was to the rear stop.

At 15 h 46 min 02 s, the thrust control levers were pulled back towards a position close to IDLE (about 6°). The EPR on both engines dropped towards 1.2.

At 15 h 46 min 02 s, the thrust control levers were placed on CLIMB. The EPR on both engines increased towards 1.25.

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[3] The parameter is invalid (NCD) below 40 kt.

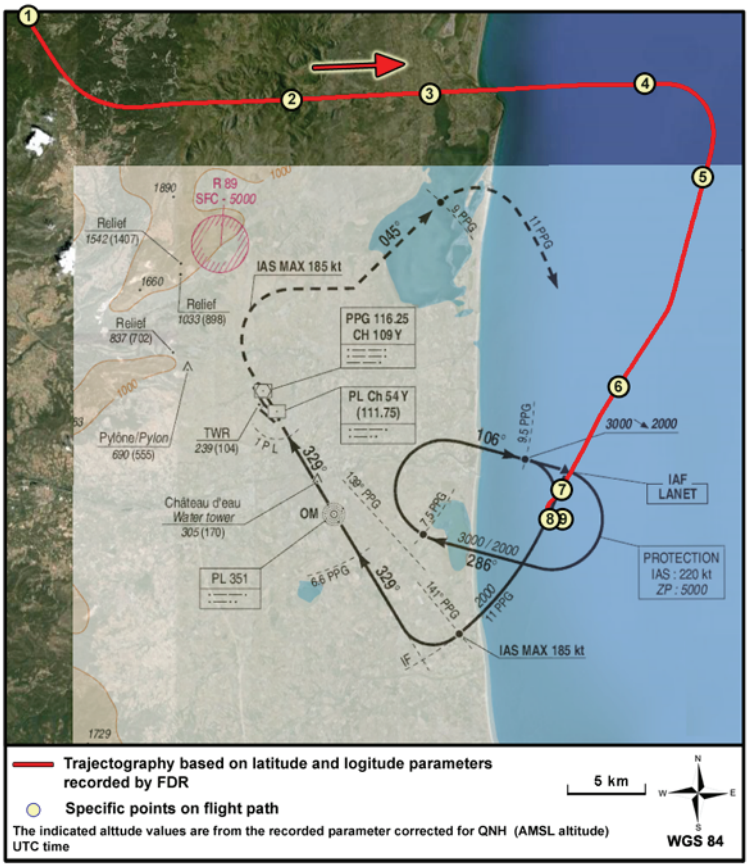
At 15 h 46 min 04 s, a GPWS *TERRAIN TERRAIN* warning was recorded.

At 15 h 46 min 05 s, another CRC warning (Master Warning) was set off.

The recordings stopped at 15 h 46 min 06.8 s. The last recorded values were a pitch of 14° nose down, a bank angle of 15° to the right, a speed of 263 kt and an altitude of 340 ft.

1.11.5 Trajectory

The following horizontal flight trajectory was made based on data from the FDR and the CVR.



1. **15 h 34 min 34 s**
   Co-pilot: "(...) we appreciate radar vector for the approach".
   CAS = 284 kt / FL 145 (In descent)

2. **15 h 36 min 47 s**
   Check on flight controls in alternate law
   CAS = 220 kt / FL 120

3. **15 h 38 min 03 s**
   Briefing for flight at low speed
   CAS = 208 kt / FL 110

4. **15 h 40 min 04 s**
   ATC: "(...) turn right heading 190 and descent FL60 maintain the speed 180 knots"
   CAS = 220 kt / ALT = 8540 ft

5. **15 h 41 min 20 s**
   ATC: "(...) cleared for the LANET ILS approach 33"
   CAS = 217 kt / ALT = 6390 ft

6. **15 h 43 min 37 s**
   Thrust levers in IDLE position
   CAS = 166 kt / ALT = 4190 ft

7. **15 h 45 min 05 s**
   Stall warning
   CAS = 99 kt / ALT = 2900 ft

8. **15 h 45 min 44 s**
   Maximum pitch value: 57° pitch up
   CAS = invalid parameter / ALT = 3800 ft

9. **15 h 46 min 06 s**
   Last recorded point
   CAS = 263 kt / ALT = 340 ft

1.12 Wreckage and Impact information

The wreckage was located about five kilometres off the coast on muddy seafloor. The zone covered measured 700 x 400 metres. The depth varied between 30 and 50 metres.

1.13 Medical and Pathological Information

The examinations carried out on the victims did not provide any information relevant to the understanding of the accident.

1.14 Fire

There was no fire.

1.15 Survival Aspects

The airplane wreckage and its spread bear witness to the violence of the impact with the surface of the sea. Under such conditions, the accident was not survivable for the occupants.

1.16 Tests and Research

1.16.1 Underwater Searches

The BEA participated in the operations to locate the recorders and identify aircraft parts. Operations to search for and recover wreckage from the airplane are still under way.

1.16.1.1 Information available

Ships went to the area in the hours following the accident. Witness testimony and the floating debris did not make it possible to determine a precise enough zone to begin the undersea search for the flight recorders.

The initial data from the Montpellier civil secondary radar allowed a starting point to be determined, whose coordinates were N42°40'34.56'' E003°06'31.43'' (WGS84).

1.16.1.2 Detection and localisation of recorders

N.B.: Every flight recorder[4] is equipped with a beacon (ULB[5]) designed to transmit a signal over a theoretical period of thirty days, when immersed in water. The use of a hydrophone makes it possible to listen to and quantify the signal transmitted by the beacon and thus to define a search area.

The ships and equipment mobilized for the detection, the localisation and the recovery of the recorders were:

- A minesweeper from the French Navy used as a support boat. This ship had two light boats that made it possible to use the directional hydrophones.
- The CEPHISMER[6] Omni directional and directional detection equipment (French Navy).
- The BEA's directional detection equipment, usable on the surface or by divers down to 60 metres.
- Support boats and diving teams from the French National Gendarmerie.

The localisation operations took place from 28 to 30 November 2008.

On 29 November, the CVR (chassis and protected box without the ULB) and the chassis of the DFDR were found and brought to the surface.
The following day, the protected box of the DFDR, still equipped with its ULB, was recovered.

1.16.2 Reconstitution of radar trajectory

[4] Damage caused to recorders on impact can lead to separation of the beacon and the chassis.
[5] ULB : « Underwater Location Beacon », acoustic transmitter that sends a continuous signal on a 37,5 kHz (± 1 kHz) frequency at a rhythm of 1 beep/second.
[6] Undersea intervention diving group.

During the first days of the investigation, the FDR not being available, the airplane trajectory was reconstituted based on the radar recordings. Readout of the SNER cassettes from CRNA southeast and southwest allowed a radar data file to be extracted, containing the secondary radar plots and the audio files. The secondary radar plots from Lestiac, Auch and Montpellier (CRNA southwest) and from Mont-Ventoux (CRNA southeast) were analysed.

Military radar data was also analysed (ARISTOTE military surveillance system).

A screenshot of the video of the Cap Béar semaphore was geo-referenced with the other radar data using indications of latitude and longitude visible on the video.

The geographical coordinates of the last airplane position were thus able to be validated.

1.17 Information on Organisations and Management

1.17.1 The Operator

XL Airways Germany is the holder of the Air Operator Certificate D – 139 issued by the Federal Republic of Germany on 16 July 2008 and valid until 31 May 2009.

Before the accident, the airline had one A320-232, one A320-214 and five Boeing B737-800 with which it undertook mainly charter flights.

1.17.2 Flights covered by the leasing agreement

The leasing agreement for D-AXLA between Air New Zealand and XL Airways Germany stipulated that flights called « test flights » had to be performed to check the condition of the airplane and to ensure its conformity with the conditions of the agreement:

- At least three days before the airplane delivery date with an Air New Zealand flight crew. Five representatives or observers from XL Airways Germany could be present on board. This flight had been undertaken on 21 May 2006 and had lasted about 1 h 30 min. The Captain of the 27 November 2008 flight was one of these observers.
- At least three days before the date of the return of the airplane to Air New Zealand with a flight crew from XL Airways Germany. Five representatives or observers from Air New Zealand could be present on board.

The airplane was thus operated under the Air Operator Certificate of Air New Zealand for the flight performed before delivery of the airplane in 2006, and XL Airways Germany Air Operator Certificate for the flight on 27 November 2008.

The agreement specifies that these flights must be undertaken in accordance with « Airbus check flight procedures », mutually agreed between the two airlines. The length of the flight must not be over two hours.

The Air New Zealand pilot nominated to undertake the checks during the flight planned before return of the airplane to Air New Zealand and the Captain had reached an agreement to undertake the programme that had been followed during the first flight before the delivery of the airplane to XL Airways Germany in 2006. This programme had been established by Air New Zealand in coordination with XL Airways Germany. It is presented in the Air New Zealand « OPERATIONAL FLIGHT CHECK » (OFC) document and is based on the SA CAM (Single Aisle Customer Acceptance Manual) developed by Airbus (version EVR 473.0152/04).

This SA CAM manual is used as the basis for the delivery of a new airplane by Airbus to a customer. It is made up of three sections:

- checks to be performed on the ground with engines stopped;
- engine tests on the ground;
- the acceptance flight. This flight is performed under the responsibility of Airbus with an acceptance pilot and engineer from Airbus and a flight crew from the customer that is qualified to fly the airplane.

The manual contains a list of actions and checks that the manufacturer proposes to perform in the presence of the customer. It specifies that any unplanned change in the programme during the flight can endanger the safety of the flight. On request from the customer, additional checks, defined by Airbus in the SA SHOPPING LIST manual, can be added to the programme of this acceptance flight.

The OFC document does not include any ground checks and does not cover in an exhaustive manner all of the checks listed in the section linked to the flight in the SA CAM manual. Nevertheless, the checks described in the OFC document and the SA CAM manual are similar; they are detailed in relation to the phase of flight (see appendix 2).

The checks that were carried out during the flight are described in appendix 3.

For airplanes already in service Airbus has described a group of checks that correspond to flights for a transfer from one operator to another in the IN SERVICE AIRCRAFT TEST MANUAL (ISATM). This manual, supplied for information to customers that request it, cannot be used as a flight manual. Neither Air New Zealand nor XL Airways Germany had requested it.

1.17.3 Flight at low speed – FULL configuration

The flight at low speed described in the SA CAM consists of checking the activation of the angle of attack protections in normal law and FULL configuration. The flight at low speed as described in the OFC document is identical but does not include going as far as the check on the alpha max protection.

The check is supposed to be performed at about FL140. The crew must adjust the thrust in order to maintain the speed at VLS. When the speed is stable, they should place the thrust levers in the IDLE position and manage the airplane's pitch attitude so as to obtain a rate of deceleration of one knot per second. During the deceleration, they should observe auto-trim disconnect (activation of alpha prot) then activation of the alpha floor function. This function should then be de-activated.

At a weight of 53.7 tons at the time of the check, the OFC document indicates a VLS speed of 123 knots and a minimum speed of 107 knots.

N.B.: the speeds indicated by the SA CAM document depend on the type of engines. The speed reference in the OFC document corresponds to CFM engines but the speeds indicated are in conformity with the speeds in the SA CAM manual for IAE engines.

In the ISATM manual, the flight at low speed is described in more detail. It should be performed first in clean configuration and it is specifically required to compare the three AOA values before performing the flight at low speed in FULL configuration.

N.B.: extracts from these three documents are in appendix 4.

1.17.4 Procedures and limitations applicable to non-revenue flights in Europe

Regulatory aspects (EU-OPS)

The EU-OPS determines that each flight performed by an operator must be undertaken in accordance with the specifications in its Operations Manual[7]. This manual must define procedures and limitations for non-revenue flights[8]. The EU-OPS provides the following list:

- Training flights,
- Test flights,
- Delivery flights,
- Ferry flights,
- Demonstration flights,
- Positioning flights.

and specifies that these types of flight must be described in the airline's operations manual.

XL Airways Germany Operations Manual

The XL Airways Germany Operations Manual re-lists the types of non-revenue flight in the EU-OPS and establishes the associated procedures and limitations, mentioning the people that can be transported during these flights:

- "Training Flights";
- "Flight Test »: performed after special maintenance and/or repair work and on special request of the authority. Flights must be performed according to programmes issued by the responsible technical department in agreement with the flight operations department. Only experienced pilots should be assigned by flight operations for these flights with, if required, engineers or mechanics on board;
- « Delivery Flights »: flights where, after a purchasing or lease agreement, an airplane is flown from the manufacturer's, sellers or lessors facility to the airline or vice versa;
- « Ferry Flights » : to position airplanes for maintenance;
- "Demonstration Flights";
- « Positioning Flights »: to position an airplane to an aerodrome for commercial reasons.

The type of flight performed on 27 November 2008 did not correspond to any of these descriptions.

1.17.5 Procedures and limitations applicable to check flights in New Zealand

Regulatory aspects

In New Zealand, « *operational flight checks »* are required for the release to service of an aircraft after maintenance operations that may have appreciably affected the flight characteristics or operation of the aircraft[9]. The crew that performs this type of flight must ensure that these characteristics have not been modified and signal any defects encountered in the course of the flight. Only those persons having an essential function that is associated with the flight check may be present on board[10].

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[7] EU-OPS 1.175
[8] EU-OPS 1.1045
[9] Civil Aviation Rules Part 43.103
[10] Civil Aviation Rules Part 91.613

Air New Zealand Operations Manual

According to the Air New Zealand "*Fleet Procedures Manual"*, "*operational flight checks"* are carried out:

- According to the Maintenance Manual, when ground checks do not make it possible to establish that the flight characteristics and operation of the airplane have not been modified following repair, adjustment or replacement of systems or equipment;
- after the change of both engines on a twin-engine airplane ;
- to allow an airplane to undertake ETOPS flights;
- to perform additional operational checks on the airplane or systems, upon request from a senior person from Air New Zealand;
- before acceptance or delivery of an airplane, in the context of a lease or purchase, to determine that the airplane meets specifications agreed between the supplier/recipient and Air New Zealand.

The Air New Zealand "*Fleet Procedures Manual"* thus defines three types of "operational flight checks":

- operational flight checks to establish serviceability for ETOPS flights;
- operational flight checks to confirm the operational status of the airplane after some maintenance procedures. These flights may be undertaken by line crews;
- operational flight checks when the airplane is to be flown using anything other than its normal operating procedures.

This third type of operational flight check, mandatory before the acceptance or delivery of an airplane in the context of a lease or a purchase, can only be undertaken by specifically approved flight crew. When the flight check schedule includes manœuvres or procedures that do not correspond to the normal operation of the airplane, the flight is performed during daytime. The Operations Manual specifies that the Captain performing the flight must ensure that the flight programme and procedures are complied with and the flight is conducted safely. He must also check before the flight that appropriate airspace is available to perform the flight. In order to ensure that the objective and conditions associated with this type of flight are clearly understood, the crew receives a full briefing on the flight schedule.

1.17.6 Crew training

The crew had not received any specific training for this type of flight. The Air New Zealand pilot had undertaken two simulator training sessions following the programme described in by the OFC document.

1.17.7 Flight plans for specific flights in IFR

Flights in IFR with specific characteristics (technical type, aerial photography, sports event coverage …) that take place under the responsibility of the regional ATC centres (CRNA) have an impact on the workload and capacity of these organisations. In the context of air traffic management, it is specified in the AIP France (ENR 19-19) that this type of flight must be the subject of a request to the Operations Directorate of the DSNA, with three working days notice being provided. Without any advance agreement, the flight can have real-time limitations imposed on it or possibly be refused if the circumstances require.

The XL Airways Germany operations centre did not make any special request when it filed the flight plan the Wednesday 26 November. To define the nature of the flight, it had

indicated FERRY TRNG FLIGHT in box 18 (other information) on the flight plan.

1.18 Additional Information

1.18.1 Witness statements

1.18.1.1 XL Airways Germany maintenance technician

A maintenance technician from XL Airways Germany who was in charge of coordination with EAS on the maintenance operations stated that the XL Airways pilots arrived at around 11 h 00 from Montpellier. The representatives of Air New Zealand arrived at the end of the morning. When he went into the cockpit, shortly before the departure, the pilots from XL Airways Germany were seated at the controls, the New Zealand pilot was on the centre seat and a mechanic from Air New Zealand was on the jump seat. The other people were standing in the cabin. The airplane took off a short time after he left it.

As far as he knew, the flight was supposed to include a local flight then an instrument approach and touch-and-go, before a departure for Frankfurt/Main.

The crew and the pilot from Air New Zealand had had a meeting for about an hour in a room on EAS Industries premises.

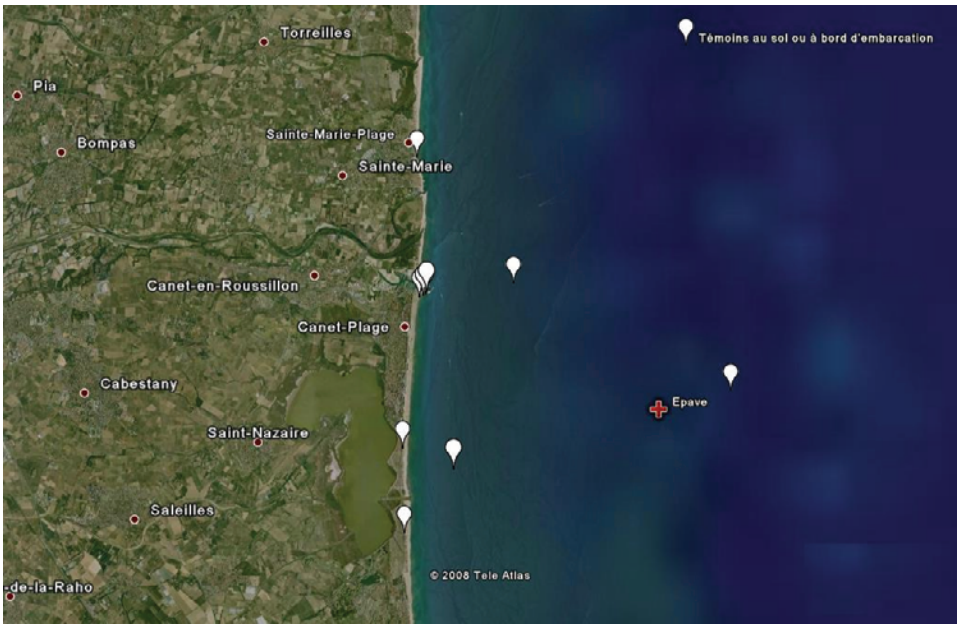
1.18.1.2 Approach controller

The approach controller stated that the air traffic was light and that she had not noticed any anomalies as regards the exchanges with the crew of D-AXLA.

After having cleared the airplane for the VOR DME ILS approach to runway 33, she noticed on her screen that the airplane's speed was high and that this could cause problems of separation with the preceding airplane, a B737. She then asked the crew on two occasions to reduce its speed. After having asked them to contact the tower, she noticed on her screen a deviation of the trajectory to the left. The loss of radar contact occurred shortly afterwards. After having alerted the rescues and fire fighting service, she telephoned to the duty room and, at the same time, received a call from the emergency medical service.

1.18.1.3 Eyewitnesses

Many people witnessed the end of the airplane's flight. They were spread out along the coast between Sainte Marie and Saint Cyprien. Yachtsmen and fishermen were on board three boats near the area of the accident.



Despite the divergences that can be explained by the different angles, all of the testimony allowed the end of the flight to be broken down into three major phases:

- The airplane was seen in level flight above the sea on approach towards the coast. Those who heard the engines stated that they were surprised and drawn by the sound of loud acceleration that was regular and unbroken. Several people said that it sounded like the noise generated by airplane during takeoff.

- A few seconds after the increase in the engine rpm, all the witnesses saw the airplane suddenly adopt a pitch up attitude that they estimated as being between 60 and 90°. The majority of the witnesses saw the airplane disappear behind a cloud layer. The noise generated by the engines was still constant and regular.

- The airplane reappeared after a few seconds with a very steep nose-down angle. During the descent, the airplane pitch seemed to increase and the airplane struck the surface of the sea. Some witnesses remember a very loud « throbbing » that they heard until the impact.

1.18.2 FAA safety message

On 12 October 2008, the United States civil aviation authority, the FAA, issued a Safety Alert for Operators that recommends that operators, according to the means that they have available for analysis, should analyse data from FDR‘s following non-revenue flights so as to identify any deviations from procedures (see appendix 5).

In fact, the National Transportation Safety Board (the US counterpart of the BEA) determined that, in the last ten years, twenty-five percent of accidents to turbine airplanes occurred during non-revenue flights, such as ferry and positioning flights.
Two factors contributed to these accidents: failure to respect standard operating procedures or a failure to respect the airplane’s limitations.

2 - SAFETY RECOMMENDATION

Note: in accordance with article 10 of Directive 94/56/CE on accident investigations, a safety recommendation shall in no case create a presumption of blame or liability for an accident or incident. Article R.731-2 of the Civil Aviation Code specifies that those to whom safety recommendations are addressed should make known to the BEA, within a period of ninety days of reception, the actions that they intend to take and, if appropriate, the time period required for their implementation.

The flight performed was intended to check the condition of the airplane in service, at the end of a leasing agreement. This type of flight, though not exceptional in worldwide air transport, is not included in the list of non-revenue flights detailed in the EU-OPS (1.1045), given that this list has no precisions or definitions for the aforementioned flights. Up to now, the BEA has been unable to identify any text applicable to EU states or to non-EU states that sets a framework for non-revenue flights, or indeed for « acceptance » flights. In addition, no documents detail the constraints to be imposed on these flights or the skills required of the pilots. As a result, operators are obliged to define for themselves the programme and the operational conditions for these flights in their operations manual, without necessarily having evaluated the specific risks that these flights may present. It appears that the majority of operators assimilate acceptance flights with check flights performed after certain maintenance operations.

In the context of their agreement, Air New Zealand and XL Airways Germany had agreed on a programme of in-flight checks based on an Airbus programme used for flights intended for the delivery (acceptance) of a new airplane to a client. These flights are performed by Airbus acceptance pilots and engineers.

The investigations initial findings brought to light the fact that there is a great diversity in the description made by operators of non-revenue flights, in the context that they establish for the preparation and execution of these flights, and in the selection and training of pilots. This diversity, along with the almost total absence of any indications or standards on non-revenue flights, can also lead to more or less improvising the performance of tests or to performing tests or checks in inappropriate parts of airspace and/or during flight phases with a high workload.

Consequently, the BEA recommends:

- **that EASA detail in the EU-OPS the various types of non-revenue flights that an operator from a EU state is authorised to perform,**
- **that EASA require that non-revenue flights be described precisely in the approved parts of the operations manual, this description specifically determining their preparation, programme and operational framework as well as the qualifications and training of crews,**

and

- **that as a temporary measure, EASA require that such flights be subject to an authorisation, or a declaration by the operator, on a case-by-case basis.**

LIST OF APPENDICES

Appendix 1

Graphs of parameters (FDR)

Appendix 2

Programmes of checks to be performed in flight

Appendix 3

Checks performed on 27 November 2008

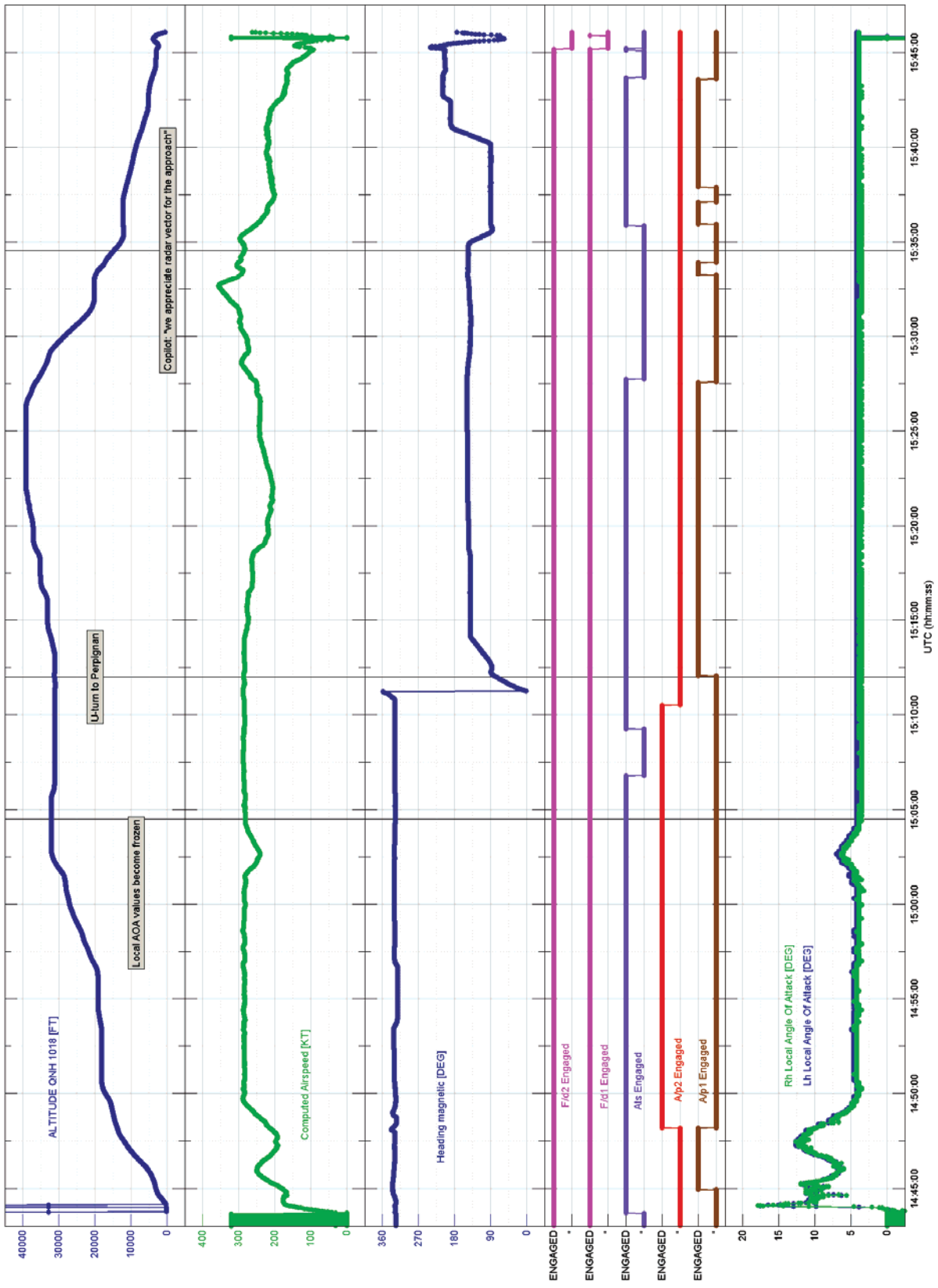
Appendix 4

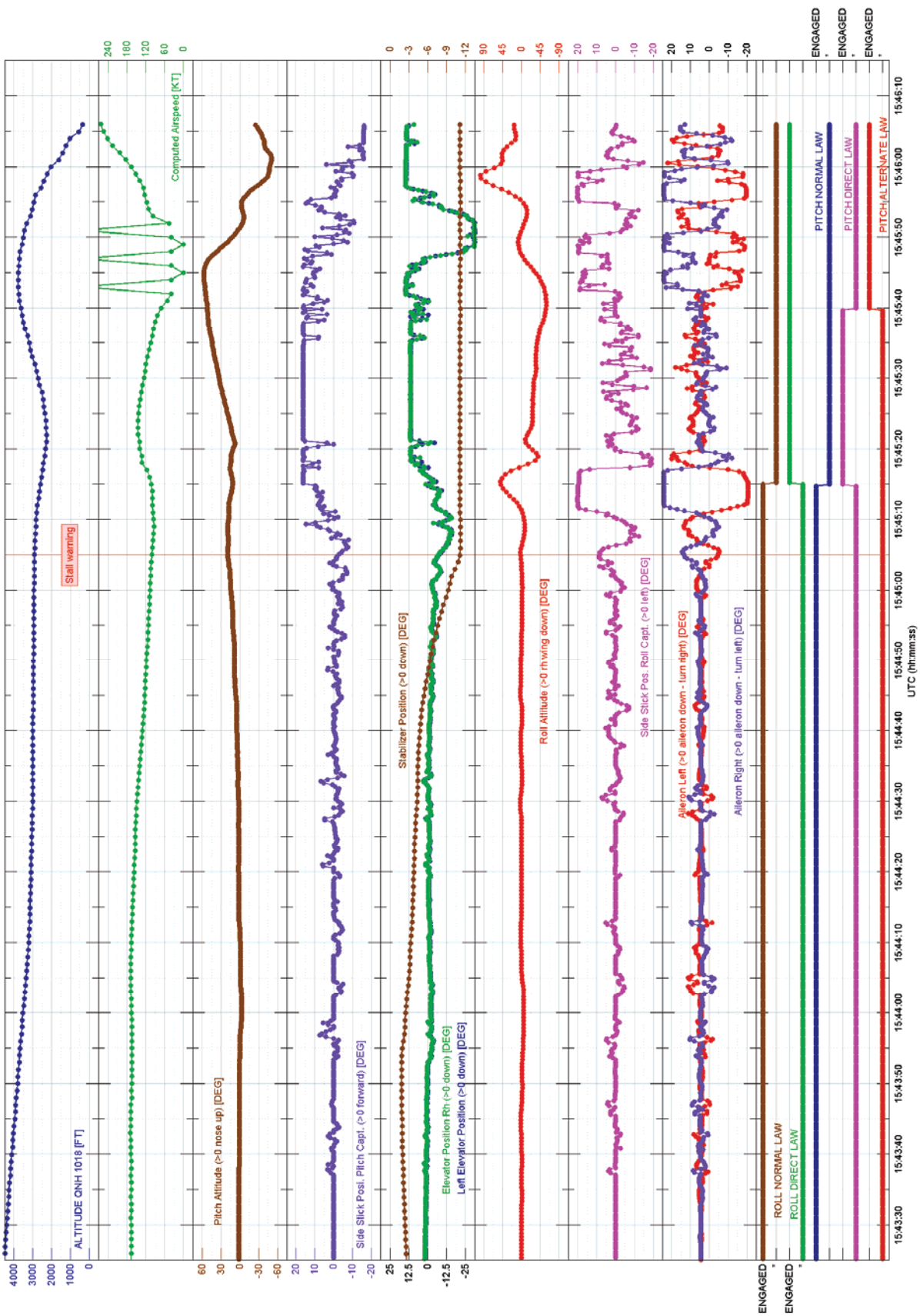
Descriptions of low speed flight – OFC document, SA CAM and ISATM manuals

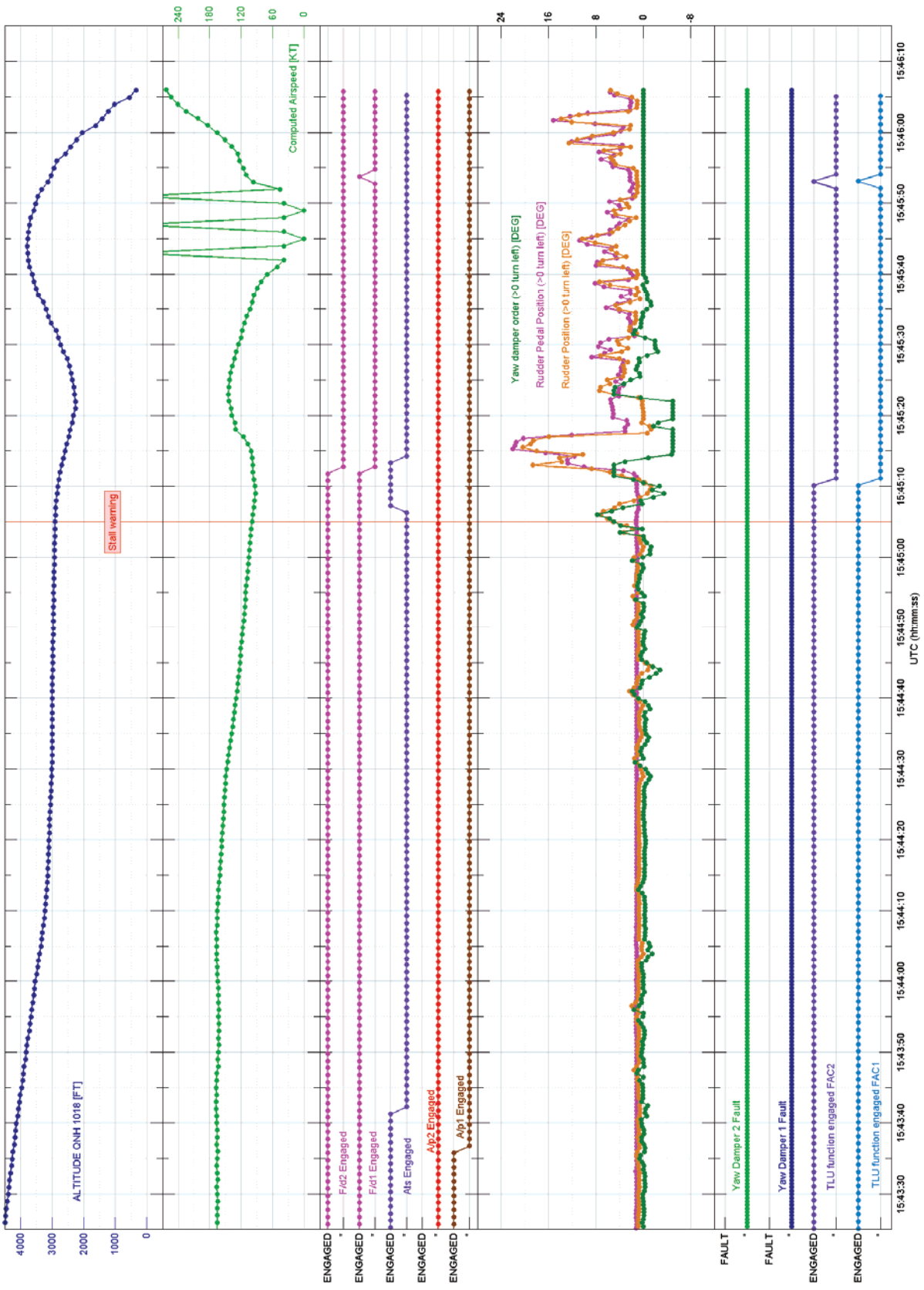
Appendix 5

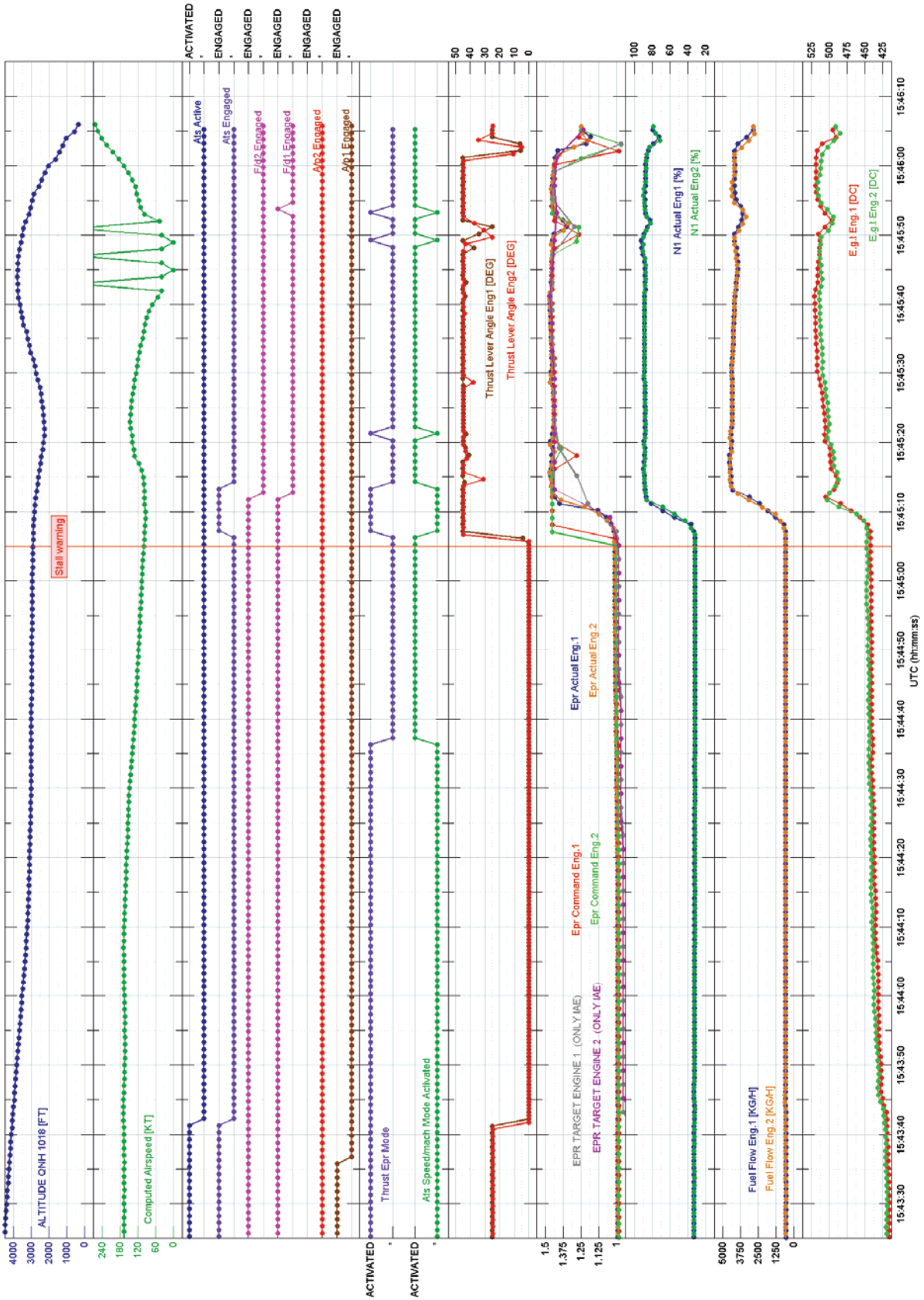
FAA Document - SAFO 08 024

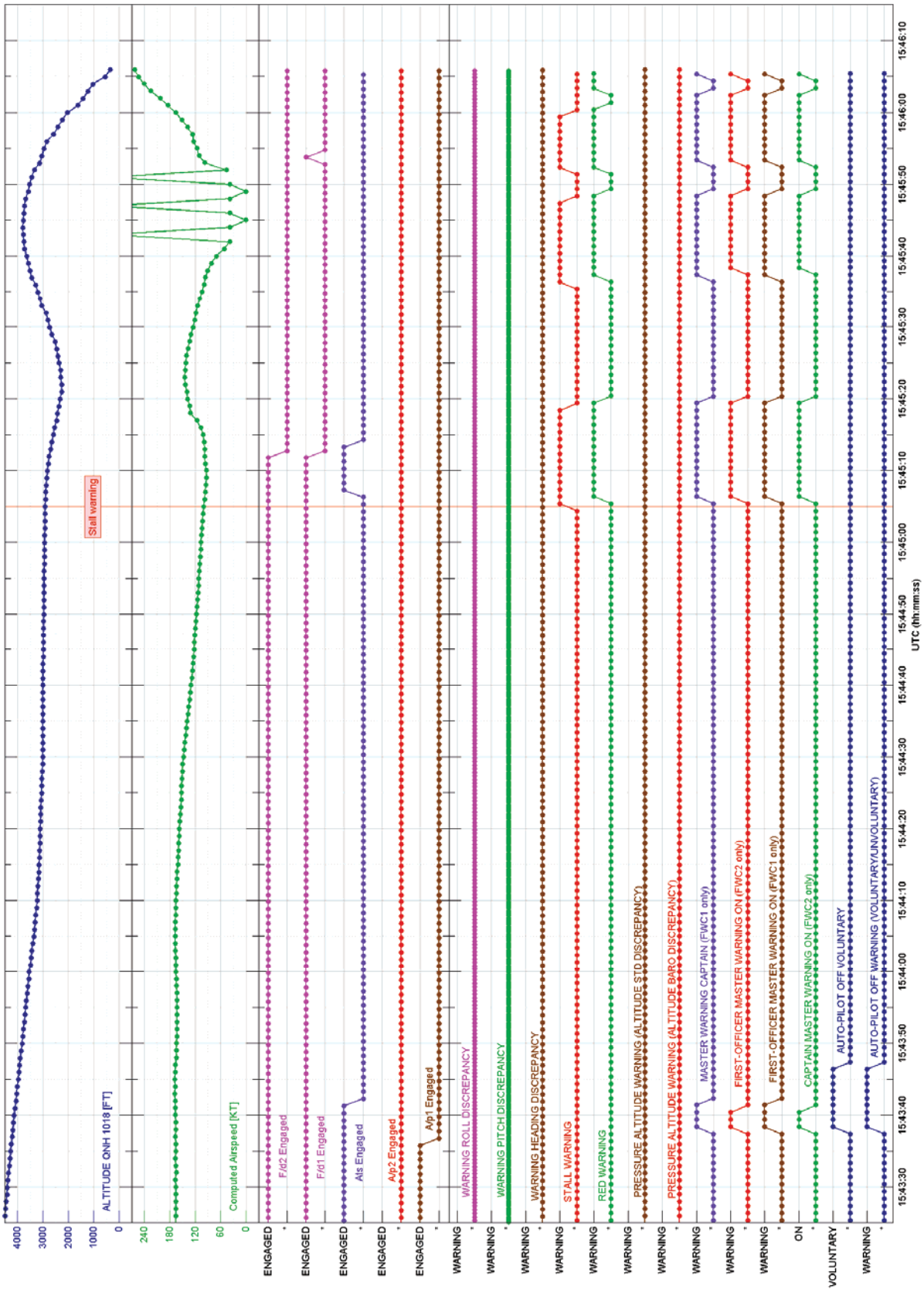
Appendix 1
Graphs of parameters (FDR)

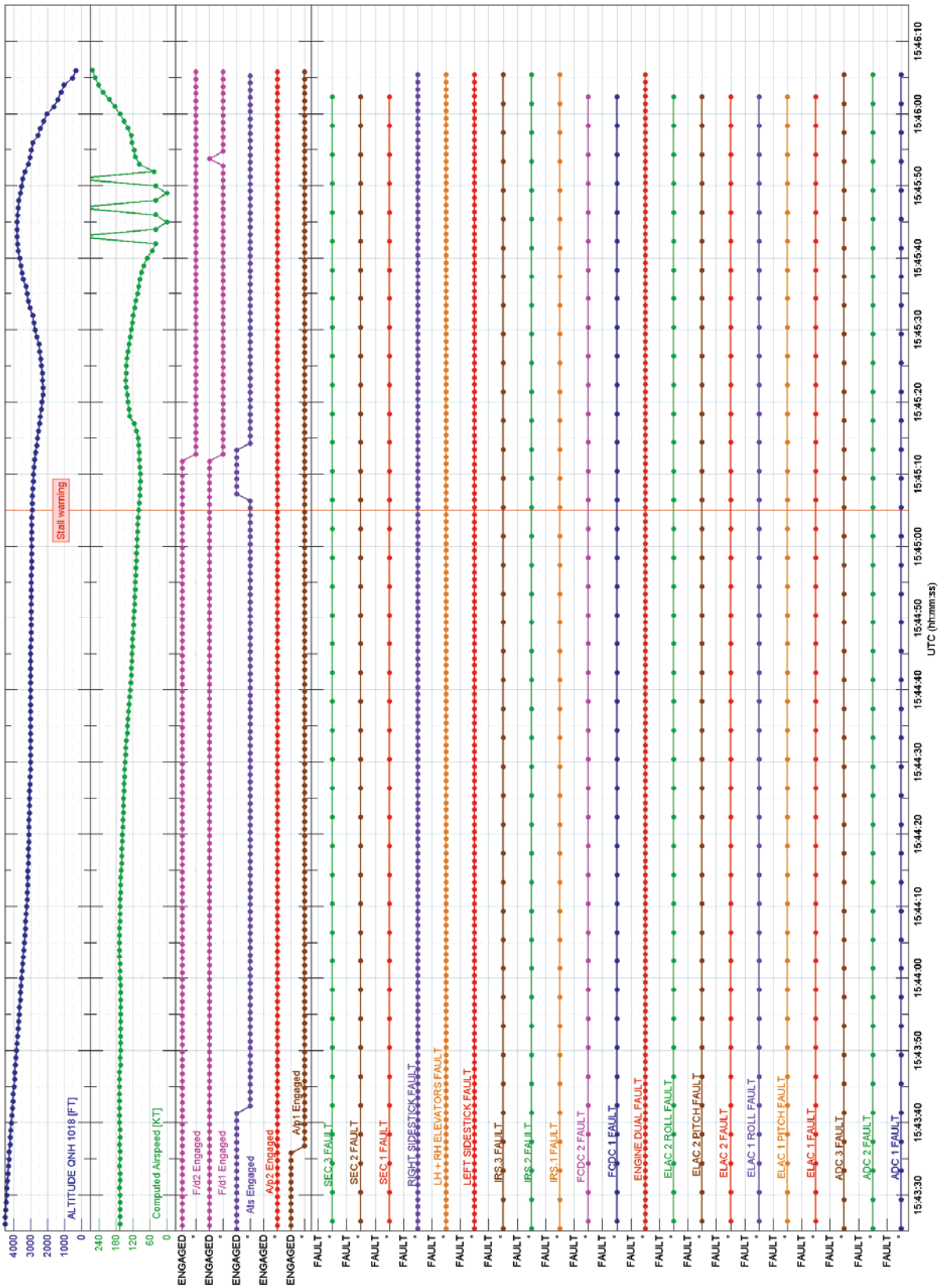


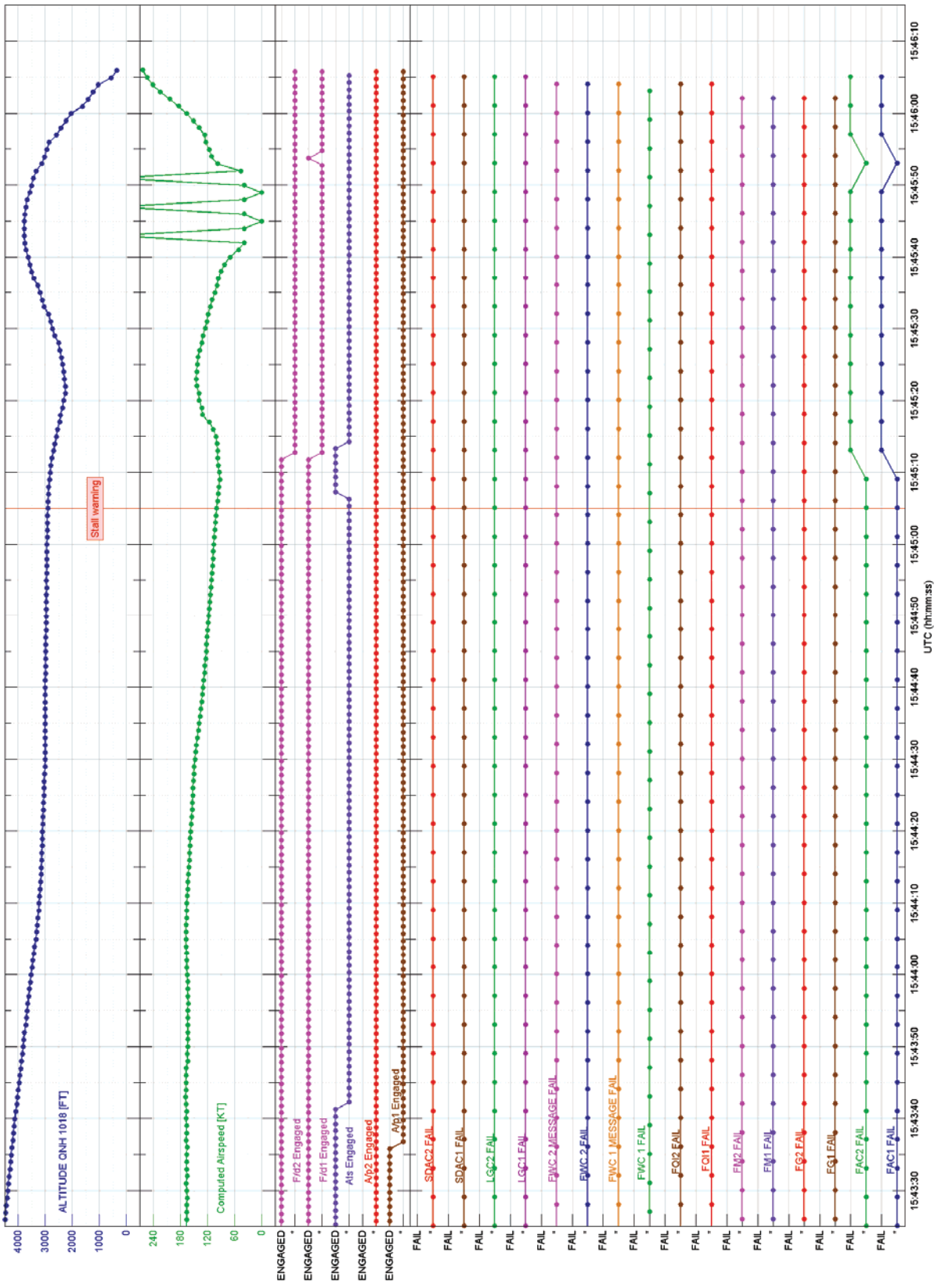

ALTITUDE QNH 1018 [FT]
Computed Airspeed [KT]
Stall warning
Pitch Attitude (>0 nose up) [DEG]
Side Stick Posi. Pitch Capt. (>0 forward) [DEG]
Stabilizer Position (>0 down) [DEG]
Elevator Position Rh (>0 down) [DEG]
Left Elevator Position (>0 down) [DEG]
Roll Attitude (>0 rh wing down) [DEG]
Side Stick Pos. Roll Capt. (>0 left) [DEG]
Aileron Left (>0 aileron down - turn right) [DEG]
Aileron Right (>0 aileron down - turn left) [DEG]
ENGAGED
ROLL NORMAL LAW
ROLL DIRECT LAW
PITCH NORMAL LAW
PITCH DIRECT LAW
PITCH ALTERNATE LAW
UTC (hh:mm:ss)

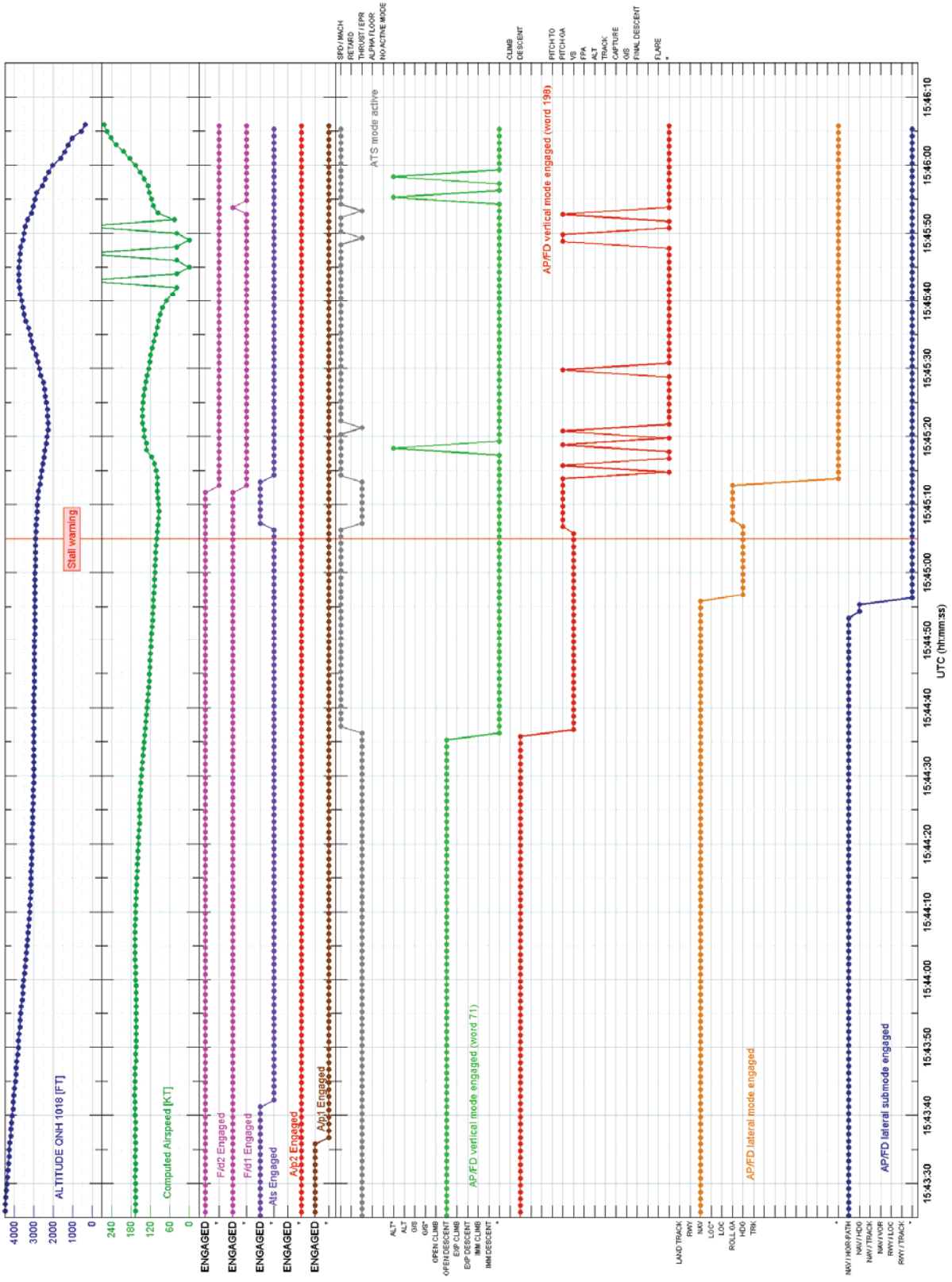

ALTITUDE QNH 1018 [FT]
4000
3000
2000
1000
0
Stall warning
Computed Airspeed [KT]
240
180
120
60
0
ENGAGED
F/d2 Engaged
F/d1 Engaged
Ats Engaged
A/p2 Engaged
A/p1 Engaged
Yaw damper order (>0 turn left) [DEG]
Rudder Pedal Position (>0 turn left) [DEG]
Rudder Position (>0 turn left) [DEG]
24
16
8
0
-8
FAULT
Yaw Damper 2 Fault
Yaw Damper 1 Fault
TLU function engaged FAC2
TLU function engaged FAC1
15:43:30
15:43:40
15:43:50
15:44:00
15:44:10
15:44:20
15:44:30
15:44:40
15:44:50
15:45:00
15:45:10
15:45:20
15:45:30
15:45:40
15:45:50
15:46:00
15:46:10
UTC (hh:mm:ss)


ALTITUDE QNH 1018 [FT]
Computed Airspeed [KT]
Stall warning
Ats Active
Ats Engaged
F/d2 Engaged
F/d1 Engaged
A/p2 Engaged
A/p1 Engaged
Thrust Epr Mode
Ats Speed/mach Mode Activated
Thrust Lever Angle Eng1 [DEG]
Thrust Lever Angle Eng2 [DEG]
EPR TARGET ENGINE 1 (ONLY IAE)
EPR TARGET ENGINE 2 (ONLY IAE)
Epr Command Eng.1
Epr Command Eng.2
Epr Actual Eng.1
Epr Actual Eng.2
N1 Actual Eng1 [%]
N1 Actual Eng2 [%]
Fuel Flow Eng.1 [KG/H]
Fuel Flow Eng.2 [KG/H]
E.g.t Eng.1 [DC]
E.g.t Eng.2 [DC]
ACTIVATED
ENGAGED
UTC (hh:mm:ss)
15:43:30
15:43:40
15:43:50
15:44:00
15:44:10
15:44:20
15:44:30
15:44:40
15:44:50
15:45:00
15:45:10
15:45:20
15:45:30
15:45:40
15:45:50
15:46:00
15:46:10


ALTITUDE QNH 1018 [FT]
4000
3000
2000
1000
0
Stall warning
Computed Airspeed [KT]
240
180
120
60
0
ENGAGED
F/d2 Engaged
ENGAGED
F/d1 Engaged
ENGAGED
Ats Engaged
ENGAGED
Apb2 Engaged
ENGAGED
Apb1 Engaged
WARNING
WARNING ROLL DISCREPANCY
WARNING
WARNING PITCH DISCREPANCY
WARNING
WARNING HEADING DISCREPANCY
WARNING
STALL WARNING
WARNING
RED WARNING
WARNING
PRESSURE ALTITUDE WARNING (ALTITUDE STD DISCREPANCY)
WARNING
PRESSURE ALTITUDE WARNING (ALTITUDE BARO DISCREPANCY)
WARNING
MASTER WARNING CAPTAIN (FWC1 only)
WARNING
FIRST-OFFICER MASTER WARNING ON (FWC2 only)
WARNING
FIRST-OFFICER MASTER WARNING ON (FWC1 only)
ON
CAPTAIN MASTER WARNING ON (FWC2 only)
VOLUNTARY
AUTO-PILOT OFF VOLUNTARY
WARNING
AUTO-PILOT OFF WARNING (VOLUNTARY/UNVOLUNTARY)
15:43:30
15:43:40
15:43:50
15:44:00
15:44:10
15:44:20
15:44:30
15:44:40
15:44:50
15:45:00
15:45:10
15:45:20
15:45:30
15:45:40
15:45:50
15:46:00
15:46:10
UTC (hh:mm:ss)


ALTITUDE QNH 1018 [FT]
Stall warning
Computed Airspeed [KT]
F/d2 Engaged
F/d1 Engaged
Ats Engaged
A/p2 Engaged
A/p1 Engaged
SEC 3 FAULT
SEC 2 FAULT
SEC 1 FAULT
RIGHT SIDESTICK FAULT
LH + RH ELEVATORS FAULT
LEFT SIDESTICK FAULT
IRS 3 FAULT
IRS 2 FAULT
IRS 1 FAULT
FCDC 2 FAULT
FCDC 1 FAULT
ENGINE DUAL FAULT
ELAC 2 ROLL FAULT
ELAC 2 PITCH FAULT
ELAC 2 FAULT
ELAC 1 ROLL FAULT
ELAC 1 PITCH FAULT
ELAC 1 FAULT
ADC 3 FAULT
ADC 2 FAULT
ADC 1 FAULT
UTC (hh:mm:ss)


ALTITUDE QNH 1018 [FT]
Stall warning
Computed Airspeed [KT]
F/d2 Engaged
F/d1 Engaged
Ats Engaged
A/p2 Engaged
A/p1 Engaged
SDAC2 FAIL
SDAC1 FAIL
LGC2 FAIL
LGC1 FAIL
FWC 2 MESSAGE FAIL
FWC 2 FAIL
FWC 1 MESSAGE FAIL
FWC 1 FAIL
FQI2 FAIL
FQI1 FAIL
FM2 FAIL
FM1 FAIL
FG2 FAIL
FG1 FAIL
FAC2 FAIL
FAC1 FAIL
UTC (hh:mm:ss)


ALTITUDE QNH 1018 [FT]
Computed Airspeed [KT]
Stall warning
ENGAGED
Fd2 Engaged
F/d1 Engaged
Ats Engaged
Ap2 Engaged
Ap1 Engaged
ATS mode active
AP/FD vertical mode engaged (word 71)
AP/FD vertical mode engaged (word 199)
AP/FD lateral mode engaged
AP/FD lateral submode engaged
SPD / MACH
RETARD
THRUST / EPR
ALPHA FLOOR
NO ACTIVE MODE
CLIMB
DESCENT
PITCH TO
PITCH GA
VS
FPA
ALT
TRACK
CAPTURE
GS
FINAL DESCENT
FLARE
ALT*
ALT
GS
GS*
OPEN CLIMB
OPEN DESCENT
GS* CLIMB
GS* DESCENT
MAN CLIMB
MAN DESCENT
LAND TRACK
HDG
NAV
LOC*
LOC
ROLL GA
HDG
TRK
NAV / HDG-PATH
NAV / HDG
NAV / TRACK
RWY / VOR
RWY / LOC
RWY / TRACK
15:43:30
15:43:40
15:43:50
15:44:00
15:44:10
15:44:20
15:44:30
15:44:40
15:44:50
15:45:00
15:45:10
15:45:20
15:45:30
15:45:40
15:45:50
15:46:00
15:46:10
UTC (hh:mm:ss)

APPENDIX 2
Programmes of checks to be performed in flight

Flight Phases		OFC Programme	SA CAM Programme
Ground	Cabin preparation Flight preparation	Cabin preparation Cabin general Flight preparation Before engine start Engine start After engine start	Cabin preparation Cabin general Flight preparation Before engine start Engine start After engine start
	Taxiing		
Takeoff	Takeoff TOGA After lift off	Max rated take off Before take off Thrust rating validity check Thrust acquisition check Auto flight systems Landing gear retraction	Max rated take off Before take off Thrust rating validity check Thrust acquisition check Auto flight systems Landing gear retraction
Climb to FL310	Initial climb Climb to FL 310	Auto throttle system Flight controls (normal law) Auto flight systems *Systems (ECAM pages)* Communication systems Navigation systems	Auto throttle system Flight controls (normal law) Auto flight systems Communication systems Navigation systems *Air conditioning system efficiency*
Cruise	Cruise at FL310	Engine parameters record A/C trim	Engine parameters record A/C trim
	Climb to FL390 – Mach 0.78	Air conditioning system efficiency Cabin general	Air conditioning system efficiency Cabin general
	Cruise at FL390 – Mach 0.78	APU start	APU start Cabin leak rate Cabin depressurisation
Descent	Descent to FL 140 Descent and cruise at FL140 – Any suitable A/C speed	Anti ice wing *MMO overspeed (prior to FL250)* VMO overspeed (below FL250) *Flight controls(alternate law)* ECS supply from the APU bleed Low speed – full configuration	Anti ice wing VMO overspeed (below FL250) ECS supply from the APU bleed *Low speeds - general* Low speed – full configuration *Overspeed (VFE)*
Approach and landing	Approach 1 (autoland)	Airplane general ILS Radio-altimeter Auto callout	Airplane general ILS Radio-altimeter Auto callout

	Automatic go-around (at 1 000 ft AGL) Second approach (manual) Manual landing	Auto flight systems Landing gear emergency Airplane general Flight controls Ground spoiler activation Auto brake accuracy	*The SA CAM manual has:* *- a touch-and-go after the first autoland approach,* *- a circuit during which the gear is extended in emergency,* *- a second approach followed by an automatic go-around,* *- a circuit during which checks on the efficiency of the RAT and the hydraulic circuits and electrical systems are tested* *- a third approach in manual mode* Ground spoiler activa-tion Auto brake accuracy
Taxi and engine shutdown	Taxi Shutdown		

APPENDIX 3
Checks performed on 27 November 2008

Flight Phases		OFC Programme	Checks performed during flight on 27/11
Ground	Cabin preparation Flight preparation	Cabin preparation Cabin general Flight preparation Before engine start Engine start After engine start	
	Taxiing		
Takeoff	Takeoff TOGA After lift off	Max rated take off Before take off Thrust acquisition check Auto flight systems Landing gear retraction	 Performed (initial climb)
Climb to FL310	Initial climb Climb to FL 310	Auto throttle system Flight controls (normal law) Auto flight systems *Systems (ECAM pages)* Communication systems Navigation systems	Performed with EXPD CLIMB Performed Performed (during climb towards FL320) Performed at FL320 by New Zealand pilot Performed FL280 Performed (during climb towards FL320)
Cruise	Cruise at FL310	Engine parameters record A/C trim	Performed FL320
	Climb to FL390 – Mach 0.78	Air conditioning system efficiency Cabin general	
	Cruise at FL390 – Mach 0.78	APU start	Performed
Descent	Descent to FL 140 Descent and cruise at FL140 – Any suitable A/C speed	Anti ice wing *MMO overspeed (prior to FL250)* VMO overspeed (below FL250) *Flight controls (alternate law)* ECS supply from the APU bleed Low speed – full configura-tion	Performed FL 390 (on descent to FL200) Performed on descent (FL330) Performed FL 200 Performed FL 120 Performed FL 120 Started at 4,080 ft.

Approach and landing	Approach 1 (autoland) Automatic go-around (at 1,000 ft AGL) Second approach (manual) Manual landing	Airplane general ILS Radio-altimeter Auto callout Auto flight systems Landing gear emergency Airplane general Flight controls Ground spoiler activation Auto brake accuracy	
Taxi and engine shutdown	Taxi Shutdown		

Appendix 4

Descriptions of flight at low speed – OFC document, SA CAM and ISATM manuals

DESCENT FL 140 cont'd

LO SPEED – CONF FULL

Check of the A/C behaviour in Low Speed

LDG GEAR : **DOWN**

FLAPS : **FULL**

Adjust the engine power as required to stable frame the A/C speed at VLS

– When the A/C speed is stable framed :

– Set the engine power at idle ❑

– Adjust the A/C pitch to obtain a deceleration rate of about 1kt/sec ❑

During the deceleration, observe :

– The autotrim stops ❑

– The α floor activation ❑

Disconnect this α floor function at once

Note: The corresponding VLS and Vmin are :

x1000 Kg	A320 CFM VLS Min
46.0 48.0 50.0 52.0 54.0 56.0 58.0	113 097 116 100 118 103 120 105 123 107 125 108 127 111
+/-	3 4

❑

PART 2 – FLIGHT TEST

2.12 A/C HANDLING BETWEEN FL 140 AND FL 100

LO SPEED CHECKS GENERAL

- When at the FL 135 :

Adjust the engine power as required to stable frame the A/C speed at Green Dot

- When the V (green dot) excursions have stabilized :

Record A/C weight ..... and CG ..... from any MCDU FUEL PRED page

□

PART 2 – FLIGHT TEST

2.12 A/C HANDLING BETWEEN FL 140 AND FL 100 (cont'd)

LO SPEED - CONF FULL

Qualitative check of the A/C behaviour in Low Speed

LDG GEAR : DOWN
FLAPS : FULL

Adjust the engines power as required to stable frame the A/C speed at VLS

- When the A/C speed is stable framed :

  - Set the engine power at idle

  - Adjust the A/C pitch attitude to obtain a deceleration rate of about 1 kt/sec

During the deceleration, observe :

- The auto trim stops ❑
- The α floor activation ❑

Disconnect this α floor function at once

Set the engine power at idle, and adjust the A/C pitch attitude to full nose up

Stabilize the A/C at the minimum speed

Note : for information, the corresponding VLS and Vmin are :

x1000 kg	318 VLS	318 CFM Min	318 PW VLS	318 PW Min	319 CFM VLS	319 CFM Min	319 IAE VLS	319 IAE Min	320 CFM VLS	320 CFM Min	320 IAE VLS	320 IAE Min	(LIP) 321 CFM VLS	321 CFM VLS	321 CFM Min	(LIP) 321 IAE VLS	321 IAE VLS	321 IAE Min	x1000 Lbs
44,0	107	93			108	92	107	92											96,8
46,0	109	96			110	94	110	94	113	097	113	097							101,2
48,0	112	98			113	96	112	96	116	099	116	100							105,6
50,0	114	100			115	98	114	98	118	101	118	103	111	114	094	111	114	097	110,0
52,0	117	102			117	100	117	100	121	103	120	105	113	116	096	113	116	099	114,4
54,0	119	104	TBD		119	102	119	102	123	106	123	107	115	118	098	115	118	101	118,8
56,0	121	106			122	104	121	104	125	108	125	108	117	121	099	117	121	103	123,2
58,0									127	110	127	111	119	123	101	119	123	104	127,6
60,0													121	125	102	121	125	106	132,0
62,0													123	127	105	123	127	108	136,4
64,0													125	129	107	125	129	109	140,8
66,0													127	131	109	127	131	111	145,2
68,0													129	133	111	129	133	112	149,6
70,0													131	135	113	131	135	114	154,0
+/-	3	4	TBD	TBD	3	4	3	4	3	4	3	4	3	3	4	3	3	4	+/-

❑

PART 2 – FLIGHT TEST CHAPTER 1

3.13 A/C HANDLING BETWEEN FL 140 AND FL 100

LOW SPEED CHECKS GENERAL

The following published low speed data are calculated and valid when the low speed checks are performed at FL 135 with the CG at 25 %

Deviation effect :

FL

No effect

CG

VLS - auto trim stop and minimum stabilized speed figures : -/+ 1 kt for +/- 5 % CG
Others figures ; no effect

LOW SPEED - CONF CLEAN

- From the AIDS obtain :

  - GWF (DMU Hamilton), GWFK (kg) or GWFL (lb) (DMU SFIM)
    AOA -AOA3, PTCH and FPA data [ ]

- When below FL 140 :

Adjust the engine power as required to stabilize the A/C speed at green dot [ ]

- When the green dot excursions have stabilized :

Record A/C weight ..... and CG ..... (MCDU FUEL PRED page) [ ]

Record AOA 1 / 2 / 3 ..... (PTCH-FPA) .....

- The AOA must not differ by more than 0.5 ° when compared to the (pitch-fpa) data ❑

PART 2 – FLIGHT TEST CHAPTER 1

3.13 A/C HANDLING BETWEEN FL 140 AND FL 100 (Cont'd)

LOW SPEED - CONF CLEAN (RECORD SHEET A320) GMT .....

x1000 kg	320 CFM			320 IAE			x1000 lbs
	GD	VLS	V Min	GD	VLS	V Min	
44,0							96,8
46,0	177	167	140	172	164	137	101,2
48,0	181	171	143	176	167	140	105,6
50,0	185	174	146	180	171	143	110,0
52,0	189	178	149	184	174	146	114,4
54,0	193	181	152	188	177	149	118,8
56,0	197	184	155	192	181	152	123,2
58,0	201	188	158	196	184	155	127,6
+/-	5	4	4	5	4	4	+/-

Record **'Green Dot'** ..... table value ..... ❑
Record **VLS** ..... table value ..... ❑

Set the engine power at idle and adjust the A/C pitch to obtain a deceleration rate of about 1 kt /sec

During the deceleration, observe :

- The auto trim stops ❑
- The α floor activation ❑

Disconnect this α floor function at once

Note: *The* ***α floor*** *function may be triggered by either:*
- the ELAC when at the protection angle of attack, with a 14 deg sidestick NU condition,
- or through the FAC angle of attack threshold whichever is detected first.

Maintain the engine power at idle and apply full back stick to stabilize Minimum speed

Record **V Min** ..... table value ..... ❑

PART 2 – FLIGHT TEST CHAPTER 1

3.13 A/C HANDLING BETWEEN FL 140 AND FL 100 (Cont'd)

SLATS ALPHA LOCK PROTECTION GMT .....

Accelerate the A/C to VLS [ ]

FLAPS : 1 [ ]

Slow the A/C with moderate engine power to get: [ ]

- AOA above 8.6 °, or IAS below 148 kt • A318 • A319 • A320
- AOA above 8.0 °, or IAS below 165 kt • A321

FLAPS : 0 [ ]

- The SLATS must not retract ❑
- The A-LOCK pulsing message appears ❑

LOW SPEED - CONF FULL GMT .....

FLAPS : FULL [ ]
LDG GEAR : DOWN [ ]
AP : off [ ]

Adjust the engines power as required to stabilize the A/C speed at VLS [ ]

PART 2 – FLIGHT TEST CHAPTER 1

3.13 A/C HANDLING BETWEEN FL 140 AND FL 100 (Cont'd)

LOW SPEED - CONF FULL (RECORD SHEET A320)

GMT .....

x1000 kg	A320 CFM		(LIP)	A320 IAE		x1000 lbs
	VLS	Min	VLS	VLS	Min	
44,0						97,0
46,0	113	097	108	113	097	101,4
48,0	116	099	110	116	100	105,8
50,0	118	101	112	118	103	110,2
52,0	121	103	114	120	105	114,6
54,0	123	106	117	123	107	119,0
56,0	125	108	119	125	108	123,4
58,0	127	110	121	127	111	127,9
+/-	3	4	3	3	4	+/-

Record **VLS** ..... table value ..... ❑

Set the engine power at idle and adjust the A/C pitch to obtain a deceleration rate of about 1 kt /sec

During the deceleration, observe :

- The auto trim stops ❑
- The α floor activation ❑

Disconnect this α floor function at once

Note: *The **α floor** function may be triggered by either:*
- the ELAC when at the protection angle of attack, with a 14 deg sidestick NU condition,
- or through the FAC angle of attack threshold whichever is detected first.

Maintain the engine power at idle and apply full back stick to stabilize Minimum speed

Record **V Min** ..... table value ..... ❑

Appendix 5

FAA Document - SAFO 08 024

U.S. Department
of Transportation
**Federal Aviation
Administration**

SAFO

Safety Alert for Operators

SAFO 08024
DATE: 12/10/08

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

Subject: Review of Flight Data Recorder Data from Non-revenue Flights

Purpose: This SAFO is issued to encourage all airlines operating under Title 14 of the Code of Federal Regulations (14 CFR) part 121, that have the capability to review flight data recorder (FDR) data, including in particular regional airlines, to review FDR data from non-revenue flights for safety analysis purposes.

Background: Approximately 25% of accidents involving turbine powered aircraft during the past decade have occurred during non-revenue flights (e.g.., ferry flights for maintenance purposes or re-positioning flights to pick-up passengers). During this same period, the technology needed for an airline to download and analyze FDR data has become significantly more accessible, either through the airline's acquisition of more affordable FDR data acquisition and analysis technology, or through the use of readily available vendor services.

Discussion: Two common factors found by the National Transportation Safety Board to have been contributory in non-revenue flight accidents are:

(1) the flightcrew's failure to adhere to standard operating procedures (SOPs) and,
(2) the flightcrew's failure to operate the airplane within its performance limitations.

Flight Operational Quality Assurance (FOQA) programs presently in operation by most major U.S. airlines have clearly established the capability of FDR data analysis to objectively identify the occurrence of both such factors.

Recommended Action: All air carriers operating under part 121 that have the capability to review FDR data, including in particular regional airlines, should place special emphasis on reviewing FDR data from non-revenue flights in order to verify that the flights are being conducted according to standard operating procedures (SOP). If FDR analysis indicates a potential trend of SOP non-compliance during such flights, that information should be communicated to appropriate airline management personnel for action to mitigate associated risks. If FDR data indicates noncompliance on the part of an individual crew, it is recommended that the information be communicated to the Chief Pilot and, if applicable, to Professional Standards group in the labor association, for the purposes of crew contact discussion, counseling and safety education.

Approved by: AFS-200 OPR: AFS-230

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