AIRBUS

To:
Mr. Daniel Bower
Investigator In Charge
National Transportation Safety Board
490 L'Enfant Plaza, SW
Washington DC 20594

Copy:
Romain Bevillard, BEA
Nicolas Bardou, Airbus
Denis Cadoux, Airbus

From:
Frederic Combes
Airbus
Central Entity - Blagnac (AIC1 Blagnac)
+33 562119742

frederic.combes@airbus.com

Ref : 420.1142/14

25 April 2014

Subject: Airbus submission for United Parcel Services (UPS) A300-600 flight UP1354 Accident at Birmingham, Alabama – 14 August 2013

Dear Mr. Bower,

As requested by the NTSB during the technical review which held on March, 25 2013, please find attached the Airbus submission on the subject accident.
You will find here attached the electronic version of Airbus submission to your attention for distribution within the NTSB.

We would like to thank the NTSB for giving us the opportunity to make this submission. If you have any questions, please don't hesitate to contact us.

With my best regards,

[redacted]

Frederic Combes
Head of Accident/Incident investigations

UPS A300-600 Registration N155UP
Flight UP1354

Birmingham, Alabama
United States of America
14 August 2013

Airbus submission

Table of contents:

Introduction

In accordance with the National Transportation Safety Board (NTSB) rules, Airbus provides this submission on the investigation of the accident involving United Parcel Services (UPS) flight UP1354 controlled flight into terrain (CFIT) on August 14, 2013 during a scheduled cargo flight from Louisville, Kentucky to Birmingham, Alabama (USA).

The aircraft involved was an Airbus A300-600, Manufacturer Serial Number 841 equipped with PW 4158 engines.

The 2 flight crew members on board were fatally injured.

According to ICAO Annex 13, Airbus is acting as a technical advisor to the "Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile" (BEA) in this investigation.

This submission is not intended to be exhaustive but to aim at emphasizing some aspects of the factual data that were collected during the investigation.

Submission abstract

- Airbus, being the aircraft manufacturer and according to ICAO Annex 13, acts as a Technical Advisor to the French “Bureau d’Enquêtes et d’Analyses pour la Sécurité de l’Aviation Civile” (BEA) who is an Accredited Representative to the investigation board in charge of the investigation.
- The BEA represents the country of manufacture and provides assistance to the National Transportation Safety Board (NTSB).
- This submission is based on factual information made available by the NTSB as well as on the Airbus knowledge on aircraft and engine design definition.
- The aircraft, the engines and all their systems were functioning as expected and did not contribute to the accident.
- At 1000ft Above Aerodrome Level (AAL) (1644ft Mean Sea Level QNH), the approach was not stabilized with reference to the stabilized approach criteria for sink rate. A go-around should have been initiated.
- NTSB findings indicate the aircraft was still in clouds at and below Minimum Decision Altitude (MDA). This should have led the crew to decide to go-around.
- At and below the MDA, no visual reference callout was made with respect to the landing runway. This should have also led the crew to decide to go-around.
- At 1015 feet QNH, Enhanced Ground Proximity Warning System alert “SINK RATE” was triggered. A go-around should have been initiated.

All the available evidences support the following conclusions:

This accident occurred due to the flight crew’s failure to properly monitor the approach and to correct the excessive rate of descent which was selected and maintained throughout the approach.

The flight crew could have avoided this accident had they followed Standard Operating Procedures (SOP) and initiated a timely go-around which should have been called upon the following three different conditions:

- the approach did not meet the stabilized approach criteria
- the crew did not call for runway in sight at MDA
- the EGPWS “SINK RATE” alert at 1015ft QNH.

1 Factual information

1.1 History of the flight

On August 14 2013, at about 04:50 a.m central daylight time (CDT), an Airbus A300-600 operated by UPS as flight UP1354 impacted trees approximately one nautical mile before runway 18 at Shuttlesworth airport, Birmingham, Alabama (USA).

After initial contact with the trees, the aircraft hit the ground about 0.5 nautical miles from the runway threshold and was destroyed by impact forces.

Flight UP1354 was a regularly scheduled cargo flight to Birmingham with 2 flight crew members on board.

The 2 flight crew members were fatally injured.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	2	-	-
Serious	-	-	-
Minor/none	-	-	-
Total	2	-	-

1.3 Damage to aircraft
The aircraft was destroyed by post impact forces and post impact fire.

1.4 Aircraft information
A300-622R-F4, MSN 0841

Total aircraft flight hours: 10857[1]

Total aircraft takeoffs: 6721[2]

Engines: Pratt & Whitney PW4158

1.5 Meteorological information
Information concerning the weather condition is detailed in NTSB Operations Group and Meteorological Group Chairman Factual Reports.

The UP1354 accident occurred at 0947 UTC, 0447 local time.

The UP1354 flight crew received the METAR[3] 0853 UTC information giving 10 statute miles visibility, clouds broken (5/8 to 7/8) at 1000ft, overcast (8/8) at 7500ft. Temperature 23°C, dew point 22°C, baro-pressure 29.97 inches of mercury.

1.6 Aerodrome information
Birmingham-Shuttlesworth airport[4] has two runways: 06/24 and 18/36. Runway 06/24 is equipped with Instrument Landing System (ILS).

Jeppesen published the following approaches;
- ILS or LOC runway 06
- ILS Cat II runway 06
- ILS or LOC DME runway 24
- LOC 18
- RNAV GPS 06
- RNAV GPS 18
- RNAV GPS 24
- RNAV GPS 36
- RNAV RNP 06
- RNAV RNP 24

On August 14 2013; runway 06/24 was closed from 0400 local time, for construction work and a NOTAM[5] had been issued. During the closure of runway 06/24, runway 18/36 was active for departures and arrivals.

Runway 06/24 was scheduled to be reopened at 0500 local time, UP1354 accident occurred at 0447 local time.

---

[1] Last value known at Airbus
[2] Last value known at Airbus
[3] METAR: METeorological Aerodrome Report
[4] Refer to Jeppesen chart provided in appendix 1
[5] NOTAM : Notice to Airmen: See NTSB Air Traffic Control Group Chairman's Factual Report

1.7 Wreckage and impact information

The aircraft was destroyed by post impact forces and post impact fire.

1.8 Fire

The center fuselage, wings and tail caught fire after the initial impact.

1.9 Survival aspects

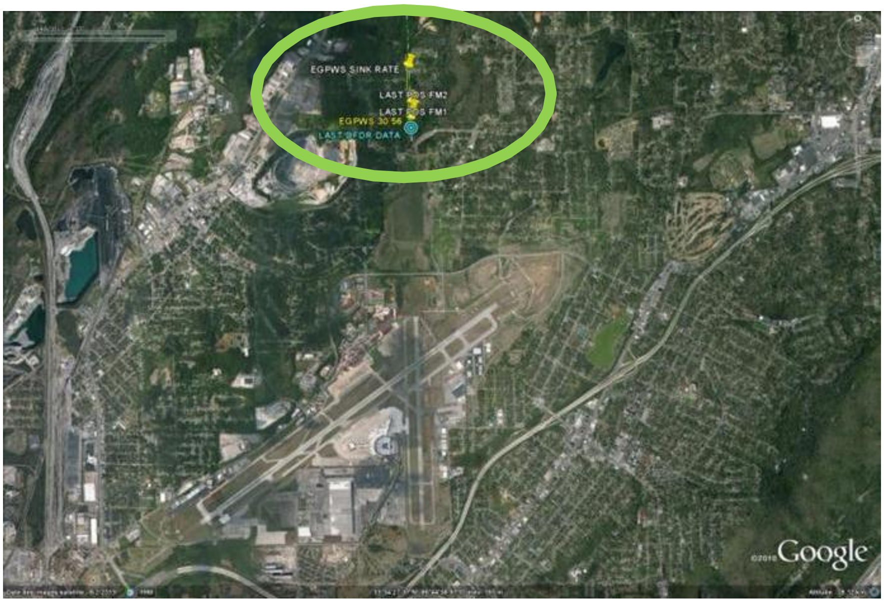
Information concerning the survival aspects is set out in the NTSB Survival Group Chairman Factual Report.

1.10 Tests and research

A trajectory of the flight UP1354 has been recomputed using Digital Flight Data Recorder (DFDR) and radar data. These data were synchronized using barometric altitude parameter.

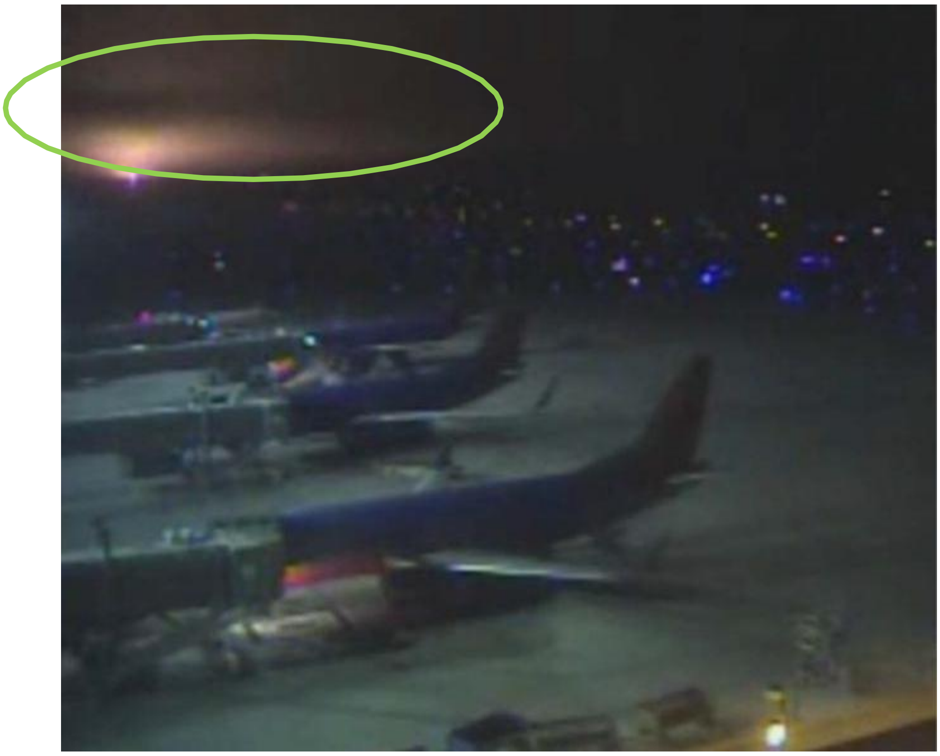
Last recorded aircraft position was determined taking into account potential measurement inaccuracy (localizer accuracy, and radar accuracy and DFDR/radar time shift). This position corresponds with the first trees impacted and DFDR stopping time.

<u>Graphical representation</u>: UP1354 trajectory relative to Birmingham airport.



Zoom on the last aircraft position:

Based on security video analysis, the NTSB[6] estimated the cloud bases at 1000ft QNH, while the MDA was 1200ft.



[6] Refer to NTSB Aircraft performance study.

2 Analysis

2.1 Sequence of events from DFDR

The complete list and associated mnemonics signification recorded in UP1354 DFDR is provided in appendix 2.
DFDR traces of flight UP1354 as a function of time are provided in appendix 3.

2.1.1 Take off

Louisville METAR at takeoff:

KSDF 140856Z 01008KT 10SM CLR 14/10 A3009 RMK AO2 SLP186 T01390100 53006

Location:	KSDF: Louisville, Kentucky
Day of month:	14
Time:	08:56 UTC
Wind:	true direction 010 degrees; wind speed 8kt
Visibility:	10 Statute Miles
Ceiling:	Clear
Temperature:	14 degrees Celsius
Dewpoint:	10 degrees Celsius
QNH:	30.09 inches of Mercury (1019hPa)

The aircraft took off from Louisville, Kentucky (KSDF) runway 35R.
Altitude setting changed to QNH. 1019HPa was set on Captain and First Officer sides.

Gross weight was 137tons. Center of Gravity was 28.7%.

In the following paragraphs, all altitudes given hereafter are the ones displayed to the flight crew function of their altimeter settings. Altitude setting changes will be highlighted below.

2.1.2 Climb

Aircraft was in climb autopilot (AP) OFF, flight director (FD) modes in PROFILE climb, heading select.

At 7030ft, a direct to waypoint[7] (KBHM: Birmingham airport) was performed by the flight crew via the Flight Management Computer (FMC). Aircraft was about 280Nautical Miles (NM) from the destination airport.

Autopilot 1 was engaged at 11500ft in PROFILE climb / NAV modes and autothrottle (A/THR) was engaged and active in Thrust mode.

2.1.3 Cruise

At around 17500ft, Captain and First Officer changed their altitude settings from QNH to Standard. FL 280 was selected.

2.1.4 Descent

Flight UP1354 started its descent from FL 280, about 90NM from Birmingham airport and 15 minutes and 20 seconds before the end of the DFDR recording.

METAR

KBHM 140904Z 00000KT 10SM SCT010 BKN075 23/22 **A2996** RMK AO2

KBHM 140953Z 34004KT 10SM FEW011 BKN035 OVC075 23/22 A2997 RMK AO2 SLP141 T02330222

Note: 29.96inches of Mercury = 1014.6hPa

At FL 175, the Captain and First Officer changed their altitude settings from Standard to QNH (1015HPa).

This altitude setting (QNH) and reference is used for the rest of the description.

[7] See Systems Group Chairman's Factual Report of Investigation

2.1.5 Descent and approach

The flight crew selected Localizer (LOC) Frequency 111.3MHz in accordance to the KBHM runway 18 chart. At 11000ft, the aircraft was flying with autopilot 1 engaged in altitude hold and navigation modes and A/THR engaged in speed mode.

5minutes and 30seconds before the end of the recording, the flight crew selected 3000ft altitude, aircraft started the descent. Speed brakes lever was set on notch 11 (speed brakes were fully extended at 50°), airspeed was 253kt.

At 20NM DME (9600ft), the landing gears selector was selected down, landing gear were extended and then recorded locked down.

Localizer capture

At 15.9NM DME (6200ft), selected altitude was set to 2500ft.

At 14.6NM DME (5300ft), Localizer was captured.

At 11.6NM DME (2950ft), 170kt airspeed was selected (actual airspeed was 244kt).

At 11 NM DME (2700ft), Slats/Flaps were extended in configuration 1 (16.4°/0°) and speed brakes were retracted (airspeed was 237kt).

From 2680ft to 2600ft, the speed brakes lever was set on notch 4 (out of 11) and they were deployed to 17° for 9 seconds.

At 9.1NM DME (2550ft), maximum speed brakes (notch 11) were selected and they were deployed to 50° for 34 seconds.

At 8.9NM DME, the selected altitude (2500ft) was captured. AP/FD modes changed to ALT / LOC. Selected airspeed was set to 160kt and Slats/Flaps were extended in configuration 2 (16.4°/8.5°).

At 7.8NM DME, NAV pushbutton was pushed. AP/FD modes changed to ALT / NAV. Then, NAV pushbutton was pushed again and ALT / HDG modes were set and displayed on Flight Mode Annunciator (FMA).

At 7.7NM DME, VOR/LOC (V/L) push/button was pushed and LOC was captured again.

Configuration for landing

At 7.1NM DME, Slats/Flaps were extended in configuration 3 (16.4°/18°) and speed brakes were retracted.

At 6.9NM DME (2500ft), approach speed was set (137kt). Airspeed was 168kt. Ground spoilers were armed.

At 6.5NM DME, Slats/Flaps were extended in configuration full (33.9°/24.3°).

> *Note: At this time, the aircraft was in landing configuration: slat/flap full, gears down, ground spoilers armed.*

At 6.3NM DME (2500ft), vertical speed selector was pulled and AP/FD mode changed to Vertical Speed. At this time, selected vertical speed was 0ft/mn.

At 6.1NM, 3 seconds later, vertical speed selector was rotated for 4 seconds to select -700ft/mn. Pitch decreased from 5.6° to 3.5° and remained stable at 3.5°. The flight path angle was stable at -2.8° (ground flight path angle from IRS source).

Final Approach Fix:

87 seconds before the end of the DFDR recording:
At 6NM DME (BASKN FAF), the aircraft was at 2500ft (QNH), airspeed was 142kt, vertical speed was -300ft/mn.

At 5.4NM DME (2400ft), vertical speed was selected at -1000ft/mn. The pitch attitude decreased and remained stable at 2.5°. The flight path angle was stable at -3.9°.

60 seconds before the end of the DFDR recording:
At 4.9NM DME (2200ft), 12 seconds later, vertical speed was selected at -1500ft/mn, airspeed was 137kt (Vapp), go around altitude was set at 3800ft.
The pitch was stable at 0.4° and the flight path angle was -6.3°.

24 seconds before the end of the DFDR recording:
At 3.3NM DME (IMTOY point), aircraft was at 1350ft QNH (780ft radio altitude), airspeed was 141kt, vertical speed was -1500ft/mn.

9.5 seconds before the end of the DFDR recording:
At 2.7NM DME, Enhanced Ground Proximity Warning System (EGPWS) **"SINK RATE"** alert was recorded during 3 samples. Altitude was 1015ft QHN, 235ft radio altitude with -1500ft/mn vertical speed.

> Comments:
> SINKRATE parameter is recorded at 1 sample per second in the DFDR. Hence it could have been triggered almost 1 second before it was recorded. See paragraph 2.4 Enhanced Ground Proximity Warning System for detailed EGPWS data analysis.

Two seconds later, at 2.6NM DME (152ft radio altitude), selected vertical speed was set to -600ft/mn then -400ft/mn 3 seconds later (at 115ft radio altitude).
The pitch increased progressively from 0.4° to 2.8° then to 7.4° (last recorded value).

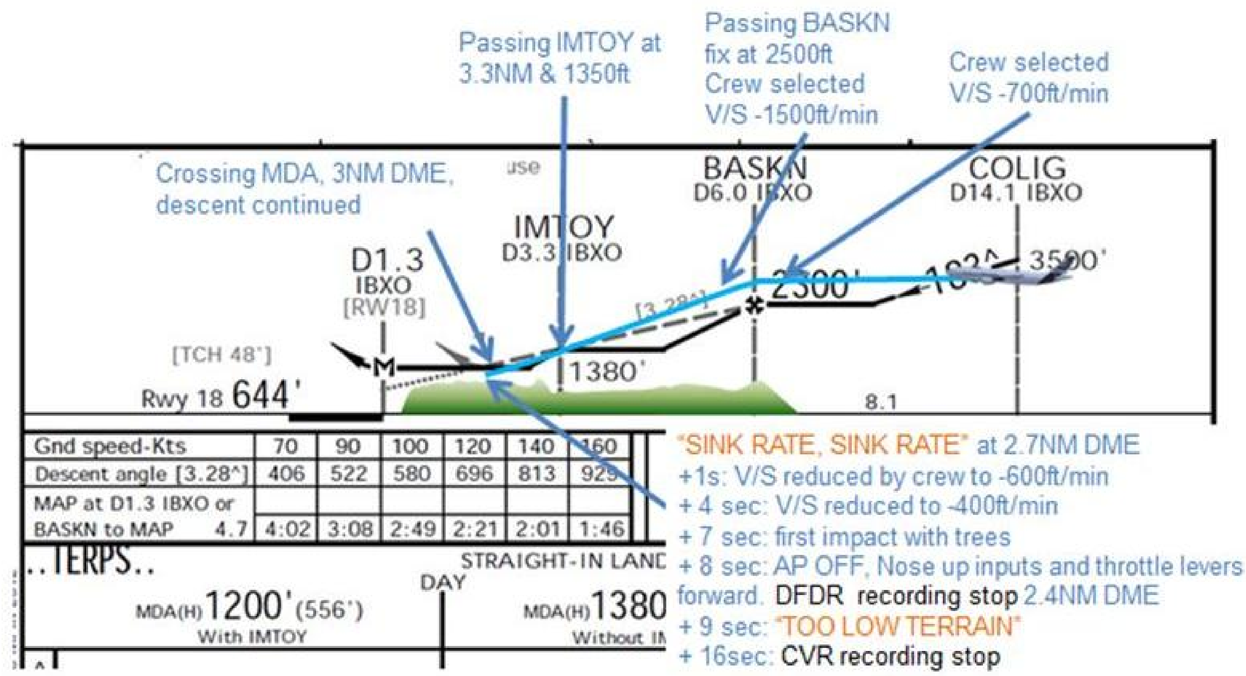
At 2.4NM DME (14ft RALT1 / 90ft RALT2), the autopilot was disconnected by applying 3.5° of nose up control column deflection. Elevators moved accordingly. Horizontal stabilizer was at -6.3° (nose up).

The throttle levers 1 and 2 were respectively advanced to 55° and 60°. The Engine Pressure Ration (EPR) started to increase in accordance with throttle levers command.

Note: IDLE is 37°, MAX CLIMB is 72°, TOGA is 82°

The DFDR stopped recording at 09.47.30 UTC (2.4NM DME).

Graphical summary:



2.2 Non Precision Approaches: Airbus Standard Operating Procedures

Non Precision Approaches[8] (NPA) applies to all non-ILS (Instrument Landing System) approaches.

e.g: NDB, VOR, VOR-DME, LOC ONLY, LOC-DME, RNAV GPS.

Non Precision Approaches can be performed using two different autopilot and flight directors' guidance: 1/ managed or 2/ selected.

1- Managed guidance using the Flight Management System (FMS):

- Navigation (NAV) mode down to the Minimum Decision Altitude (MDA) or until localizer (LOC) interception (lateral).
- PROFILE[9] (P.DES) mode down to the MDA provided final approach status in FMS (FINAL APP) is active before the Final Approach Fix (FAF) (vertical).

NAV and PROFILE modes can be used in final approach provided:

- The approach stored in the NAV database has been validated and is approved by the operator and
- GPS PRIMARY is available (required for RNAV (GPS) approach) or HIGH accuracy is displayed with the appropriate Required Navigation Performance (RNP), or the navigation aids raw data are tuned and monitored.

Otherwise, selected guidance must be used.

2- Selected guidance:

- HEADING SELECT (HDG SEL) mode down to the MDA or until LOC interception (lateral).
- VERTICAL SPEED (V/S) mode down to the MDA (vertical).

The standard technique is to be ready to intercept the final descent path (before the FAF) in the landing configuration (landing gear down, ground spoilers armed, flaps full, approach speed) and at the approach speed (Vapp) using autopilot and autothrottle.

The objective is to obtain **stabilized approach** flight parameters no lower than 500ft Above Ground Level (AGL) in Visual Meteorological Conditions VMC (1000ft AGL in Instrument Meteorological Conditions IMC) by ensuring that:

- The aircraft is on the correct lateral and vertical flight path,
- The engine thrust is stabilized and the aircraft is trimmed to maintain approach speed on the desired approach path, and
- There is no excessive flight parameter deviation[10].

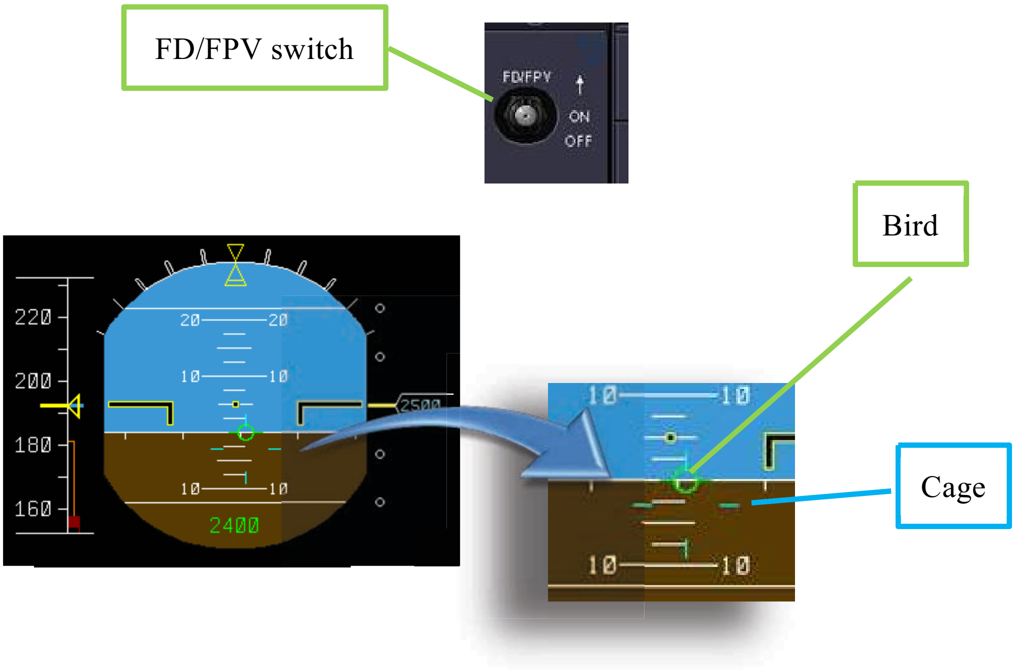
If the approach is not stabilized when reaching 500ft AGL minimum in VMC (or 1000ft AGL in IMC), **a go around must be initiated.**

---

[8] Refer to FCOM/FCTM 2.03.20 provided in appendix 4 and 2.32.72 provided in appendix 5.
[9] Refer to FCOM 1.03.52 provided in appendix 6 and 1.20.21 provided in appendix 7.
[10] See paragraph 2.3 Monitoring.

2.2.1 Standard Operating Procedure to conduct a Non Precision Approach using vertical speed guidance

For selected guidance, the recommended flight reference display for a Non-Precision Approach (NPA) are the Flight Path Vector (FPV) and the Flight Path Reference (FPR) (also known as "bird" and "cage"). This is selected using the Flight Director / Flight Path Vector switch (FD/FPV).



The Flight Path Vector (FPV) symbol (bird in green) indicates the actual inertial trajectory of the aircraft, in terms of:

– Flight Path Angle (FPA),
– Track or Course (CRS).

The Flight Path Reference (FPR) symbol (cage in blue) indicates the intended trajectory. The FPR can be set in order to provide:

– Flight Path Angle (FPA) reference,
– Track or Course (CRS) reference.

By setting the Flight Path Reference (FPR/Cage) to a desired Flight Path Angle (using the FPA SET knob), and a desired track (by setting a course on either the VOR or ILS control panel), the FPR (or cage) can be used as a reference for the Flight Path Vector (FPV or bird) to enable the pilot to maintain a desired flight path or to monitor the actual flight path relative to a desired Flight Path Angle and track.

When using the cage and the bird together for course and glide path tracking during an approach, raw data must be used to ensure that the aircraft is on the published course and vertical profile.

This use of the cage and the bird relies on close monitoring of aircraft position and altitude at the time the descent is started. In particular altitude and DME distance are used to ensure the correct aircraft position when crossing the FAF.

The Airbus operational documentation[11] recommends being at the FAF published altitude when approaching the FAF:

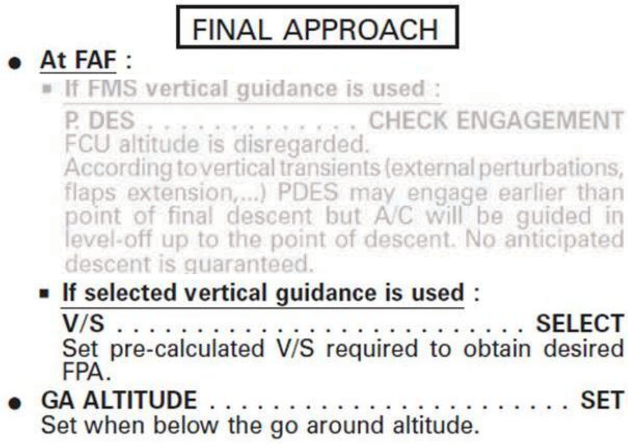
APPROACHING FAF

It is important to be at the published FAF-crossing altitude, in landing configuration at Vapp shortly before the FAF, so that a stabilized final approach is established as the FAF is overflown.

The crew has to closely monitor the flight path, Pilot Monitoring[12] calling the required DME/ALT cross-checks on final approach, as published on approach chart.
Small adjustments to vertical speed and to heading may be needed to correct profile and approach course. This is accomplished by changing the respective value, monitoring the effect of the correction by the position of the bird, then to return the bird to the center of the cage.

[11] Refer to FCOM/FCTM 2.32.72 p5 provided appendix 5.
[12] As per Airbus policy, the term « Pilot Not Flying » (PNF) has been replaced by « Pilot Monitoring » (PM). This change is effective and will be reflected in all operational documentation at the next revision.

The Airbus Standard Operating Procedure (SOP) for selected vertical guidance is set out below:


FINAL APPROACH

- **At FAF :**
  - If FMS vertical guidance is used :

    P. DES . . . . CHECK ENGAGEMENT

    FCU altitude is disregarded.

    According to vertical transients (external perturbations, flaps extension,...) PDES may engage earlier than point of final descent but A/C will be guided in level-off up to the point of descent. No anticipated descent is guaranteed.
  - **If selected vertical guidance is used :**

    V/S . . . . **SELECT**

    Set pre-calculated V/S required to obtain desired FPA.
- **GA ALTITUDE** . . . . **SET**

  Set when below the go around altitude.

The Vertical Speed is selected using the vertical speed rotary button on the Mode Control Panel and VERTICAL SPEED mode is engaged pulling this button. The selected vertical speed is displayed above in hundreds of feet per minute.

The Flight Mode Annunciator displays the V/S mode engagement in green.

The actual vertical speed is displayed on the vertical speed indicator:

- **During final approach :**

  POSITION and FLIGHT PATH . . . CHECK/ADJUST
  - Monitor reference navaid raw data.
  - Monitor altitude in relation with the published descent profile and the distance to the runway.
  - Adjust HDG SEL and V/S accordingly, in selected guidance.
  - If FMS NAV is not satisfactory, revert to HDG/SEL. Note that if FMS vertical guidance is used, the reversion to HDG/S disengages AP and FMA reverts to basic modes.

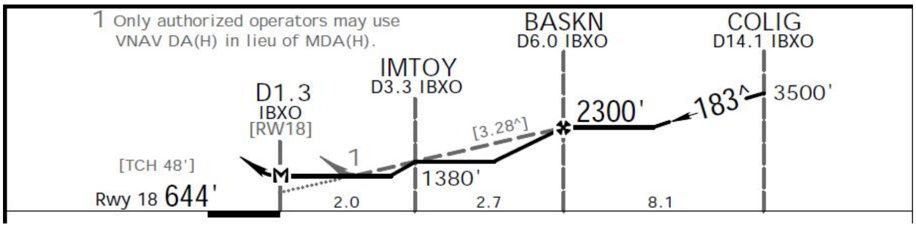
  LANDING CHECKLIST . . . . COMPLETE

The altitude is read on the altitude indicator.

ILS Distance displayed on the Primary Flight Display

The ILS DME distance (raw data) is displayed on the bottom left of the PFD, below the speed scale.

ILS DME Distance (8.2NM here)



Arriving at BASKN, the altitude (read on the altimeter) is checked with regards to the approach chart to monitor aircraft position. According to the diagram above, the aircraft should be at 2300ft at BASKN.

During the approach, the Pilot Monitoring monitors the flight parameters and calls out any deviation:

FLIGHT PARAMETERS . . . . CHECK
PF announces any FMA modification.
PNF calls out if :
- Speed becomes lower than VAPP – 5 kt or greater than speed target + 10 kt.
- Pitch attitude becomes lower than – 2.5° or greater than 10° nose up.
- Bank angle becomes greater than 7°.
- Descent rate becomes greater than 1000 ft/min.
- VDEV exceeds one dot in FMS vertical guidance.
- Any significant changes in ground speed that might indicate windshear.
- Excessive LOC deviation for a LOC approach.

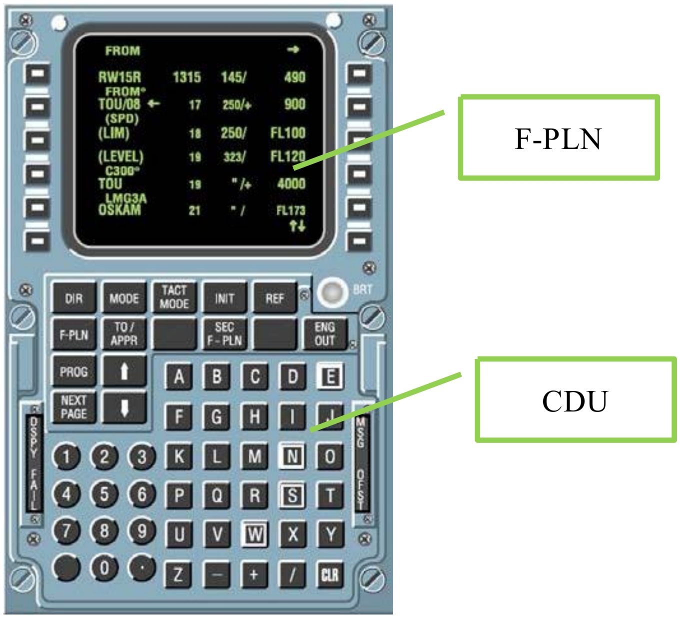
When the PNF calls flight parameter exceedance, the suitable PF response is :
- Acknowledge the PNF call out, for proper crew coordination purposes
- Take immediate corrective action to control the exceeded parameter back into the defined stabilized conditions
- Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around.

Arriving at the MDA, pending of visual references to the runway acquisition, the decision to continue the approach is taken:

- **At MDA (MDH) + 100 ft :**
  HUNDRED ABOVE . . . . ANNOUNCE
- **Reaching MDA (MDH) and VDP :**
  - **When visual references are acquired and confirmed by both PF/PNF :**
    CONTINUE . . . . ANNOUNCE
    Continue as visual approach with the standard call outs.
    AP . . . . OFF
    Note : Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.
  - **If no visual references are acquired :**
    GO AROUND/FLAPS . . . . ANNOUNCE
    Initiate go around.
    Note : In selected guidance, if ground references are not visible when the aircraft reaches MDA, an immediate go around must be initiated.
    However, if the distance to the runway is not properly assessed, a step descent approach may be considered and a level off at MDA may be performed, using ALT HOLD to level off not lower than MDA, while searching for visual references. If the pilot has no visual reference at MAPt at the latest, he must begin a go around.

2.2.2 Standard Operating Procedure to conduct a Non Precision Approach using profile guidance

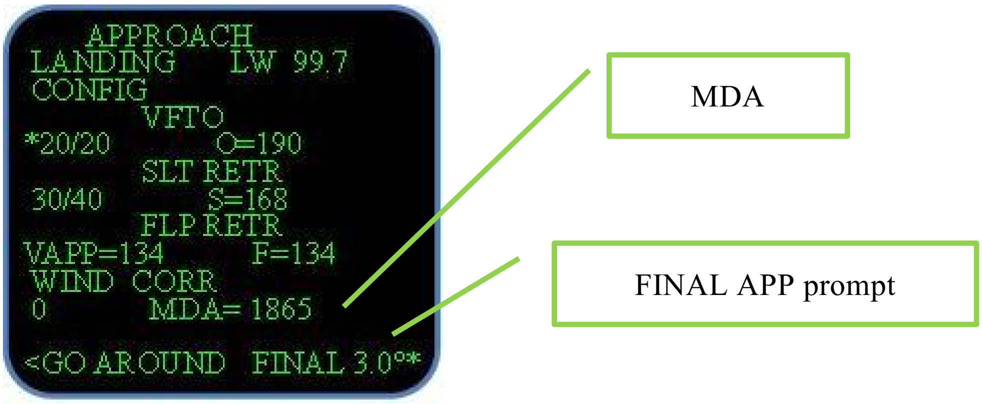
To prepare the approach, the flight crew has to enter the approach in the F-PLN via the Control and Display Unit (CDU) of the Flight Management Computer (FMC).



Then, the Minimum Decision Altitude (MDA) has to be set and checked on the CDU APPROACH page and on the altimeter using the amber index.

The barometric altitude (raw data) is displayed on the analog altitude indicator.

Then final approach prompt can be pressed



The PROFILE pushbutton is pressed on the Mode Control Panel (MCP).

The PROFILE mode must be armed after levelling off at the FAF altitude and before crossing the FAF.

FINAL APPROACH

- **At FAF :**
  - **If FMS vertical guidance is used :**

    P. DES . . . . CHECK ENGAGEMENT
    FCU altitude is disregarded.
    According to vertical transients (external perturbations, flaps extension,...) PDES may engage earlier than point of final descent but A/C will be guided in level-off up to the point of descent. No anticipated descent is guaranteed.
  - **If selected vertical guidance is used :**

    V/S . . . . SELECT
    Set pre-calculated V/S required to obtain desired FPA.
- **GA ALTITUDE . . . . SET**
  Set when below the go around altitude.

The mode status is monitored on the Pilot Flying and Pilot Monitoring FMA as follows:

Before the FAF, P.DES is armed:

P.DES blue flashes 30 sec before engaging (green).

Then P.DES is engaged:

For a PROFILE descent or final approach, the vertical deviation on the vertical axis is monitored on the Navigation Display via the Vertical Deviation (V/DEV) scale. For final approach one dot corresponds to 100ft deviation from the theoretical vertical flight path.

CLEARED FOR APPROACH

PROFILE must be armed after levelling off at the FAF altitude : if not, P.DES armed mode will be lost in case of altitude capture.

Check NAV, LOC or LOC* lateral mode active : if not, PROFILE mode will not automatically engage at the pseudo Glide Slope intercept point.

Check V/DEV decreasing and engagement of P.DES at FAF (or shortly before). P.DES blue flashes 30 sec before reaching the Descent Point. G/A altitude must be set after FAF when P.DES is engaged.

FMA in final approach : P.SPD-P.DES-NAV (or LOC)

CAUTION

After selecting FINAL X.X° (FINAL APP function active), the FMS PROFILE mode does not consider vertical constraints. It is pilot's responsibility to ensure safe altitude margin for obstacle clearance.

On the picture below the aircraft is seen slightly below the theoretical flight path.

V/DEV : Vertical Deviation scale

Then the flight crew monitors the numerical value (in feet) of the V/DEV via the approach page (FINAL APP) and the progress (ECON DES) page on the Flight Management Computer (FMC).

In case of an aircraft below the theoretical vertical flight plan, V/DEV will display a negative value as shown on the picture below:

Vertical deviation displayed on the FMC Approach page

Vertical deviation displayed on the FMC Progress page

For managed guidance, the recommended flight reference display is the Flight Director (FD).

All along the approach, the aircraft position is monitored regularly using altitude and distance indications[13].

- **During final approach** :

  POSITION and FLIGHT PATH . . . CHECK/ADJUST
  - Monitor reference navaid raw data.
  - Monitor altitude in relation with the published descent profile and the distance to the runway.
  - Adjust HDG SEL and V/S accordingly, in selected guidance.
  - If FMS NAV is not satisfactory, revert to HDG/SEL. Note that if FMS vertical guidance is used, the reversion to HDG/S disengages AP and FMA reverts to basic modes.

  LANDING CHECKLIST . . . . COMPLETE

During the approach, the flight crew monitors its vertical trajectory by regularly checking aircraft distance to next waypoint and altitude.

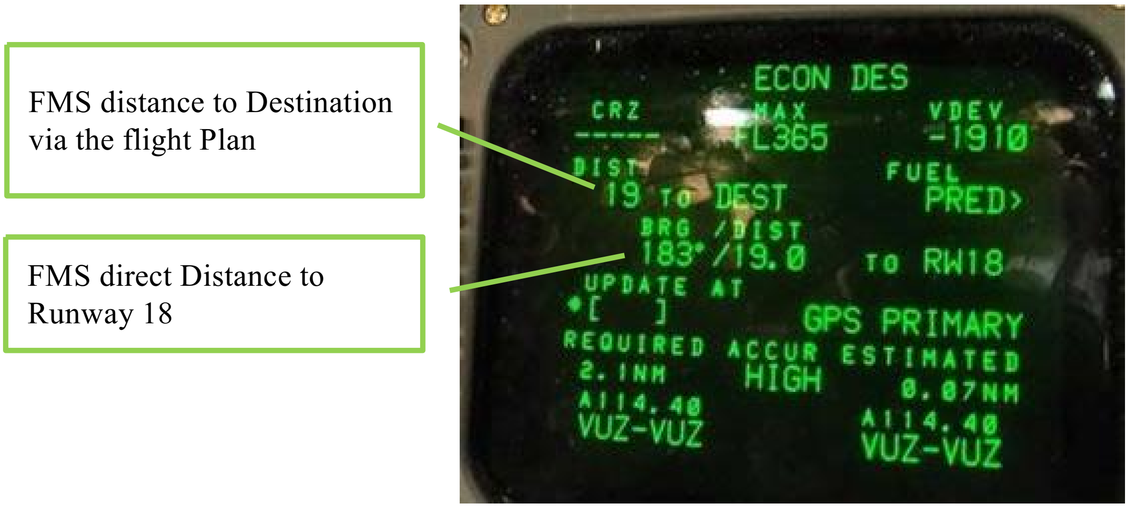
The altitude is read on the altitude indicator.

[13] See paragraph 2.3 Monitoring

The distance to the next waypoint can be read on either the Flight Management Computer, the Primary Flight Display, or on the Navigation Display.

The flight crew can monitor the distance to destination and the distance to runway on the progress page of the FMC.

Distance displayed on the Flight Management Computer
In the following picture of an FMC progress page, the distance to destination and distance to runway correctly match.

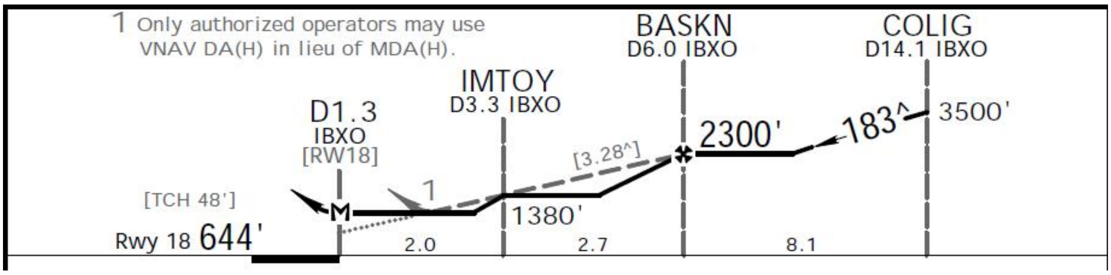


ILS Distance displayed on the Primary Flight Display
Finally the ILS DME distance (raw data) is also displayed on the bottom left of the PFD, below the speed scale.

Distance displayed on the Navigation Display

The FMS distance to the next waypoint is also displayed on the Navigation Display (ND).

In the example below the aircraft is at 2.0NM from the Final Approach Fix (FAF) named “BASKN” which has an altitude constraint of 2300ft (along a 181° track).



Arriving at BASKN, the altitude (read on the altimeter) is checked with regards to the approach chart to monitor aircraft position. According to the diagram above, the aircraft should be at 2300ft at BASKN.

During the approach, the Pilot Monitoring monitors the flight parameters and calls out any deviation:

FLIGHT PARAMETERS . . . . CHECK

PF announces any FMA modification.

PNF calls out if :

- Speed becomes lower than VAPP – 5 kt or greater than speed target + 10 kt.
- Pitch attitude becomes lower than – 2.5° or greater than 10° nose up.
- Bank angle becomes greater than 7°.
- Descent rate becomes greater than 1000 ft/min.
- VDEV exceeds one dot in FMS vertical guidance.
- Any significant changes in ground speed that might indicate windshear.
- Excessive LOC deviation for a LOC approach.

When the PNF calls flight parameter exceedance, the suitable PF response is :

- Acknowledge the PNF call out, for proper crew coordination purposes
- Take immediate corrective action to control the exceeded parameter back into the defined stabilized conditions
- Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around.

Arriving at the MDA, pending of visual references to the runway acquisition, the decision to continue the approach is taken:

- **At MDA (MDH) + 100 ft** :

  HUNDRED ABOVE . . . . ANNOUNCE
- **Reaching MDA (MDH) and VDP** :
  - **When visual references are acquired and confirmed by both PF/PNF** :

    CONTINUE . . . . ANNOUNCE

    Continue as visual approach with the standard call outs.

    AP . . . . OFF

    Note : *Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.*
  - **If no visual references are acquired** :

    GO AROUND/FLAPS . . . . ANNOUNCE

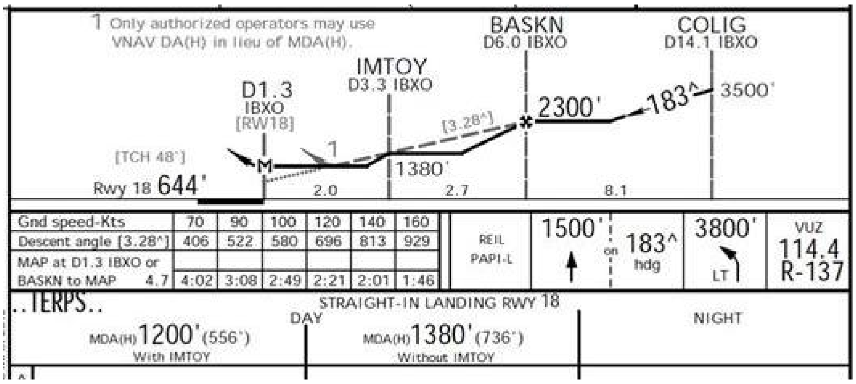
    Initiate go around.

    Note : *In selected guidance, if ground references are not visible when the aircraft reaches MDA, an immediate go around must be initiated.*

    However, if the distance to the runway is not properly assessed, a step descent approach may be considered and a level off at MDA may be performed, using ALT HOLD to level off not lower than MDA, while searching for visual references. If the pilot has no visual reference at MAPt at the latest, he must begin a go around.

2.2.3 Comparison of UP1354 sequence of events and applicable Airbus Standard Operating Procedures

On flight UP1354[14], the flight crew elected to perform the localizer non-precision approach to runway 18 (LOC 18). On the approach chart below, the FAF is BASKN, the MDA is at 1200ft, and the Missed Approach Point (MAP) is IBXO.



SOP: The approach strategy must be clearly explained during the approach briefing.

UP1354: According to CVR transcript, the PROFILE mode final approach was initially briefed, no mention was made of an alternative plan if Profile could not be flown.

SOP: With reference to Airbus operational documentation[15] the flight plan must be sequenced during the initial approach and checked during the descent and approach preparation.

F-PLN SEQUENCING

In NAV mode, the F-PLN automatically sequences. In HDG/S mode, the F-PLN waypoints will automatically sequence only if the aircraft flies close to the prepared route.

Correct F-PLN sequencing is important to ensure that :

- The programmed missed approach route is available in case of go-around
- The predictions are correct.

A good cue to monitor the proper F-PLN sequencing is the TO waypoint on the upper right side of the ND, which should be the next WPT ahead of the aircraft.

If under radar vectors and if automatic waypoint sequencing does not occur, it is recommended to sequence the F-PLN by either using the DIR TO function, or by deleting the FROM WPT on the F-PLN page until the next WPT to be overflown is displayed as the TO WPT on the ND.

[14] NTSB Cockpit Voice Recorder (CVR) Factual Report of Group Chairman
[15] Refer to FCOM/FCTM 2.03.16 provided in appendix 8 and 2.32.70 provided in appendix 9.

This ensures :

- A coherent ND display
- Assistance for lateral interception
- VDEV computed on reasonable distance assumption.
- In case of go-around, NAV mode can be engaged to follow missed approach routing as programmed in F-PLN.

The check of the flight plan is part of the approach briefing:

APPROACH BRIEFING

It is recommended to use FMS pages and ND as a guide for descent and approach briefing. Main points to be covered are :

Navaid	– ILS, VOR selection procedures and crossing altitudes.
F-PLN page	– STAR, APPR, TRANS, MISSED APPROACH
APPR page	– Landing Config, speeds, MDA,
FUEL PRED	– Fuel needed for diversion, holding fuel available.

– Runway conditions, lighting and dimensions
– Ground Spoiler, reverse operation and autobrake selection
– Terminal area topography, transition level and minimum safe altitudes to ensure a proper terrain awareness.
– Weather at destination
– Go Around :
 · Standard call/task sharing
 · Diversion decision

Note : *If AP disengaged, it is recommended to descend at Mach 0.8 or below to avoid alpha-trim activation.*

UP1354: *The flight plan was not sequenced after the approach was entered and the flight plan was not reviewed during the approach briefing.*

SOP: The PROFILE descent mode engagement must be checked just before the FAF in order to monitor the capture and tracking of the vertical profile by the autopilot.

UP1354: *Approaching the FAF, no mention of FMA descent modes (PROFILE or VERTICAL SPEED) was ever made.*

SOP: In the case of PROFILE DESCENT non engagement, the reversion to VERTICAL SPEED and HEADING is still possible only if that change of approach strategy has been already explained in the briefing.

UP1354: *The change of strategy was not discussed or announced.*

SOP: In a Non Precision Approach using VERTICAL SPEED mode, the flight path reference (FPR) and flight path vector (FPV) should be used to fly the approach.

UP1354: *The crew maintained the Flight Director bars engaged and did not switch to FPV and FPR (the "bird" and the "cage") display.*

SOP: In selected guidance using VERTICAL SPEED mode, with the FPV/FPR, the appropriate vertical speed should be selected by the Pilot Flying. The vertical speed selection must be called by the Pilot Flying and acknowledged by the Pilot Monitoring.

UP1354: The Pilot Flying selected a vertical speed up to -1500ft/mn but did not call out this selection and the Pilot Monitoring did not acknowledge any selection.

SOP: According to the KBHM Localizer 18 approach chart, the FAF (BASKN) altitude is 2300ft. To follow the published approach path, the aircraft must be flown at FAF altitude. Then, arriving at the FAF, a callout "**PASSING BASKN at 2300ft"** should be done by the Pilot Flying.

UP1354: The flight crew flew the aircraft at 2500ft, not 2300ft at the FAF and no altitude deviation callout was made.

SOP: During the approach, the Pilot Monitoring must monitor flight parameters and call out for any deviation. With reference to Airbus operational documentation[16] standard callouts are defined to monitor the approach.

Pilot Monitoring closely monitors the flight path and calls out the required cross-checks:

- The crew should closely monitor the flight path, PNF calling the required DME/ALT cross-checks on final approach, as published on approach chart.

  Note : *If DME/ALT checks are not published, an approximate profile cross-check may be made using distance to threshold shown on PROGRESS page and applying the usual 300 ft/nm rule.*

PNF will make calls for the following conditions during final approach. Attitude callouts are also to be made through to landing.

CONDITIONS	PNF
When airspeed becomes less than Vapp – 5 or more than speed target + 10.	SPEED
When V/S is greater than – 1000 ft/min.	SINK RATE
When bank angle becomes greater than 7°.	BANK
When pitch attitude becomes lower than 0° or higher than + 10° nose up. For non precision approach, when pitch attitude becomes lower than –2.5° or higher than 10° nose up.	PITCH
When excessive LOC or GLIDE deviation occurs : – 1/4 dot LOC – 1 dot GS.	LOC or GLIDE
When greater than 0,5 dot (VOR) or 5 degrees (ADF).	COURSE
At altitude checks points.	__FT HIGH (LOW)

UP1354 *The following callouts should have been made but were not present in the CVR transcript:*

- **"200ft HIGH"** when passing the FAF
- From 1000ft AAL IMC or 500ft AAL VMC, **"SINK RATE"** when the vertical speed exceeded -1000ft/mn
- Passing IMTOY, **"1380ft ON THE PATH"**
- Passing MDA+100ft (1300ft), **"ONE HUNDRED ABOVE"**
- At MDA (1200ft), **"MINIMUM"**

[16] Refer FCOM/FCTM 2.03.30 provided in appendix 10 and 2.32.72 provided in appendix 5.

SOP: At the MDA, if visual references are acquired and confirmed by both flight crews, ***"CONTINUE"*** should be called out. If the visual references are not found, a missed approach must be initiated. This entails executing the standard go around procedure, keeping autopilot engaged.

UP1354: Passing the MDA, no mention of visual reference is made in the CVR transcript and no go around was performed.

SOP: If visual references are met, the autopilot must be disengaged and Flight Path Reference (FPR/"cage") removed. The approach and landing is continued with the Flight Path Vector (FPV/"bird") to assist tracking runway center line, and continuing on a classic approach path.

UP1354: The crew kept the autopilot engaged below the MDA and the FPV was not used by the crew.

SOP: Below 1000ft AAL, the approach must be stabilized; an Enhanced Ground Proximity Warning System (EGPWS) alert during an approach in night conditions is a clear positive signal of an unstabilized approach. A go around must be performed.

UP1354: The flight crew response to the "SINK RATE" EGPWS alert was to reduce the rate of descent and to verbalize they had the runway in sight. No go around was performed.

2.3 Monitoring

2.3.1 Golden rules

Flight crew roles are defined by the operational documentation[17]. Notably the Airbus Golden Rules point out that the flight crew primary task is to **fly, navigate and communicate** in this order with appropriate task sharing.

The very first Golden Rule "Fly" is not the responsibility of Pilot Flying only, but the Pilot Monitoring[18] has an active role.

- ***Fly***

  "**Fly**" indicates that :

  - **The Pilot Flying (PF)** must concentrate on **"flying the aircraft"** to monitor and control the pitch attitude, bank angle, airspeed, thrust, sideslip, heading, etc., in order to achieve and maintain the desired targets, vertical flight path, and lateral flight path.
  - **The Pilot Not Flying (PNF)** must assist the PF and must **actively monitor** flight parameters, and call out any excessive deviation. The PNF's role of "actively monitoring" is very important.

  Therefore, both flight crewmembers must :

  - Focus and concentrate on their tasks to ensure appropriate tasksharing
  - Maintain situational awareness and immediately resolve any uncertainty as a crew.

[17] Refer to FCOM/FCTM 2.31.10 TR 032-1 provided in appendix 11.
[18] As per Airbus policy, the term « Pilot Not Flying » (PNF) has been replaced by « Pilot Monitoring » (PM). This change is effective and will be reflected in all operational documentation at the next revision.

2.3.2 Standard Call outs

During an approach the Pilot Monitoring checks and calls for deviations in order to be stabilized on the final descent path at Vapp, in landing configuration at 1000ft AAL in IMC and 500ft AAL in VMC.

Those call outs are defined in the Airbus operational documentation[19].

Flight parameter deviations are called by the Pilot Monitoring and acknowledged by the Pilot Flying. A go around must be initiated unless the crew estimates that only small corrections are necessary to rectify minor deviations from stabilized conditions.

The standardized call outs with associated triggering values are as follows:

FLIGHT PARAMETERS

PNF will make calls for the following conditions during final approach. Attitude callouts are also to be made through to landing.

CONDITIONS	PNF
When airspeed becomes less than Vapp – 5 or more than speed target + 10.	SPEED
When V/S is greater than – 1000 ft/min.	SINK RATE
When bank angle becomes greater than 7°.	BANK
When pitch attitude becomes lower than 0° or higher than + 10° nose up. For non precision approach, when pitch attitude becomes lower than –2.5° or higher than 10° nose up.	PITCH
When excessive LOC or GLIDE deviation occurs : – 1/4 dot LOC – 1 dot GS.	LOC or GLIDE
When greater than 0,5 dot (VOR) or 5 degrees (ADF).	COURSE
At altitude checks points.	__FT HIGH (LOW)

[19] Refer to FCOM/FCTM 2.03.18 provided in appendix 12, FCOM/FCTM 2.03.30 provided in appendix 10, and Flight Operations Briefing Note “Standard Calls” provided in appendix 13.

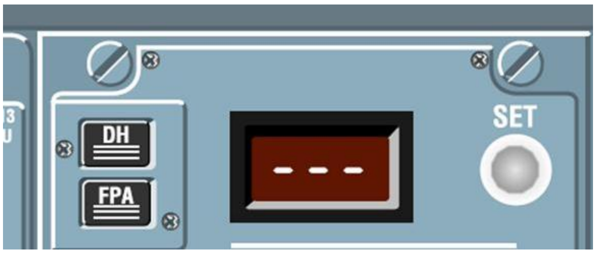
2.3.3 Automatic call outs

Flight Warning Computer generates synthetic voice call outs based on Radio Altitude.

Automatic call outs can be activated function of aircraft radio altitude (in feet) as follows:

Radio height (ft)	Call out
400	FOUR HUNDRED
300	THREE HUNDRED
200	TWO HUNDRED
100	ONE HUNDRED
50	FIFTY
40	FORTY
30	THIRTY
20	TWENTY
10	TEN
5	FIVE
DH + 100	HUNDRED ABOVE
DH	MINIMUM

Whatever the approach flown, if a decision height is set, automatic call out is emitted 100ft above the decision height "HUNDRED ABOVE" and at the decision height "MINIUM".



Note: for a Non Precision Approach, the Minimum Decision Altitude (MDA) is used. For a precision approach (e.g ILS), the Decision Height (DH) is used.

Despite the Non precision Approach flown by UP1354 using a MDA, the flight crew also set a DH.

The A300-600 aircraft is capable of emitting all the auto callouts listed above. It is the operator's choice to select which auto callouts will be activated on the aircraft at delivery.

100ft, 50ft, 30ft, 20ft and 10ft auto callouts were activated on UP1354 aircraft configuration.

2.4 Enhanced Ground Proximity Warning System

2.4.1 Aircraft configuration

At the time the UP1354 aircraft was manufactured, Airbus offered EGPWS part number 965-1676-001.

UPS instead chose to have the Airbus part number 965-0976-003-206-206 installed for delivery.

Post-delivery, UPS requested that Honeywell install EGPWS Honeywell part number 965-0976-003-212-212. This EGPWS standard was installed and approved by a Supplemental Type Certificate (STC) ref. n°ST00440SE in February 2004 and installed on the aircraft.[20]

The EGPWS part number 965-0976-003-212-212 is not included in Airbus catalogue and not offered by Airbus to operators.

At the time of the accident, UP1354 aircraft was fitted with Honeywell EGPWS part number 965-0976-003-212-212, database version no. 447 and configured to receive its aircraft position data from the Flight Management System (FMS).

Honeywell specialists provided the following EGPWS part number correspondence table as it applies to functionality relevant to the UP1354 accident scenario.

Date	**Comment**	**Honeywell certified P/N (short name)**	**Equivalent[21] Airbus certified P/N (short name)**
Mod available since 1999	UP1354 aircraft configuration at time of delivery (2004).	965-0976-003-206-206 (P/N -206)	
Mod available since 2001.	P/N -001 proposed at time of UP1354 aircraft delivery.	965-0976-003-214-214 (P/N -214)	965-1676-001 (P/N -001)
February 2004.	UP1354 aircraft modification by STC.	965-0976-003-212-212 (P/N -212)	N/A
Mod available since 2005.	Enlarged version of Terrain Clearance Floor (TCF) envelope.	965-0976-003-218-218 (P/N -218)	965-1676-002 (P/N -002)

A technical description of the EGPWS is available in Airbus operational documentation[22].

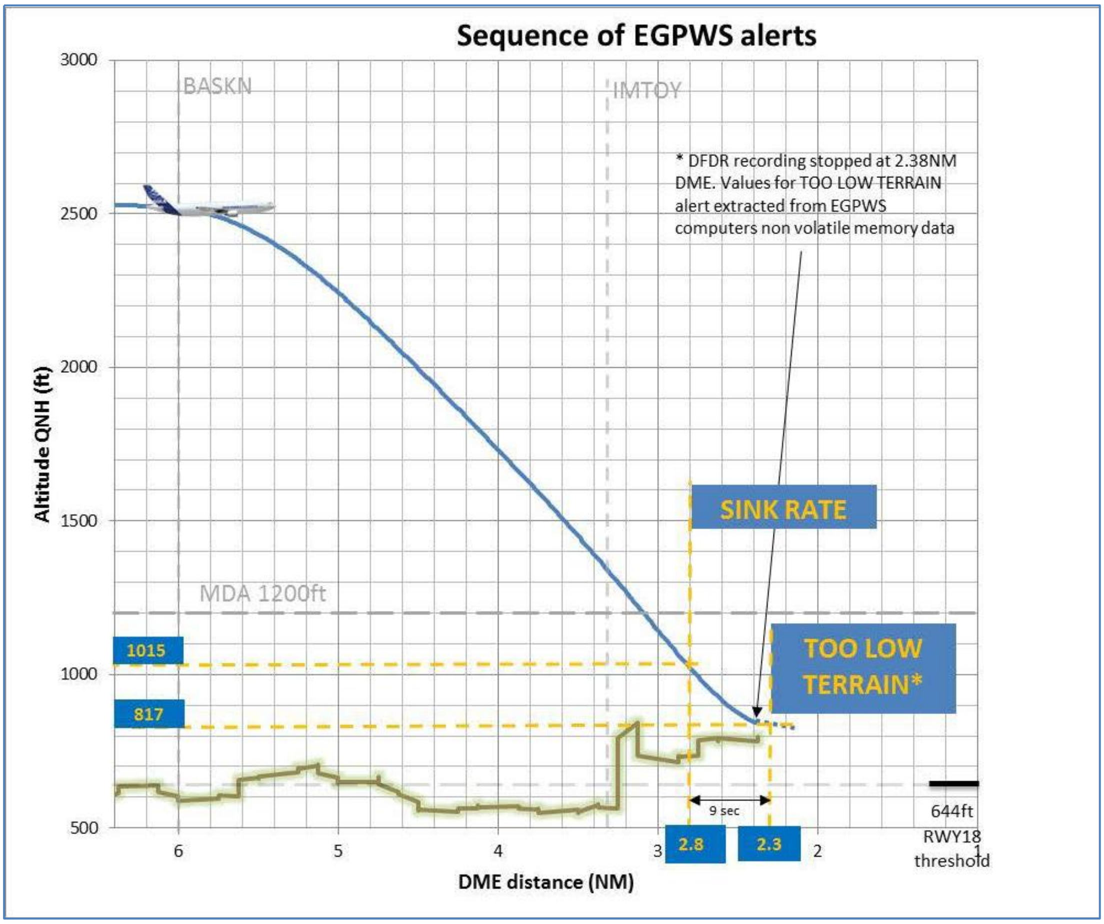
[20] See NTSB Systems Group Chairman's Factual Report of Investigation.
[21] Functionally equivalent for UP1354 accident scenario from Honeywell.
[22] Refer to FCOM 1.10.80 provided in appendix 14.

2.4.2 UP1354 EGPWS P/N -212 alerts analysis

The DFDR, CVR and EGPWS computer nonvolatile memory data reflect that the EGPWS on UP1354 triggered the following alerts:

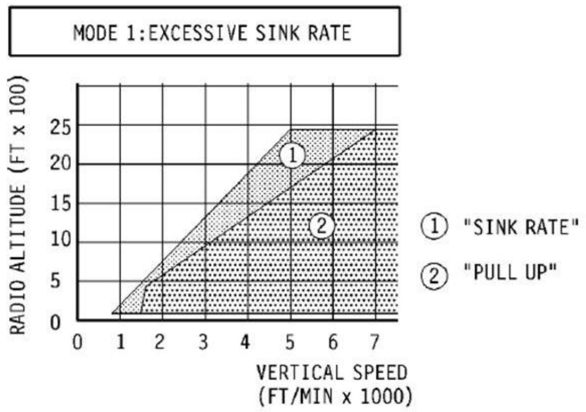
- The SINK RATE alert (basic mode 1) at 262ft radio-altitude, 1015ft QNH, 2.8NM DME,
- The TOO LOW TERRAIN alert (Terrain Clearance Floor TCF enhanced mode), 9 seconds after first SINK RATE alert, at 817ft NQH, about 1NM from runway threshold (2.3NM DME), just after the sound of first tree impact was recorded on CVR.

The sequence of EGPWS alerts during flight UP1354 is represented along the final approach trajectory using an Altitude versus Distance representation:

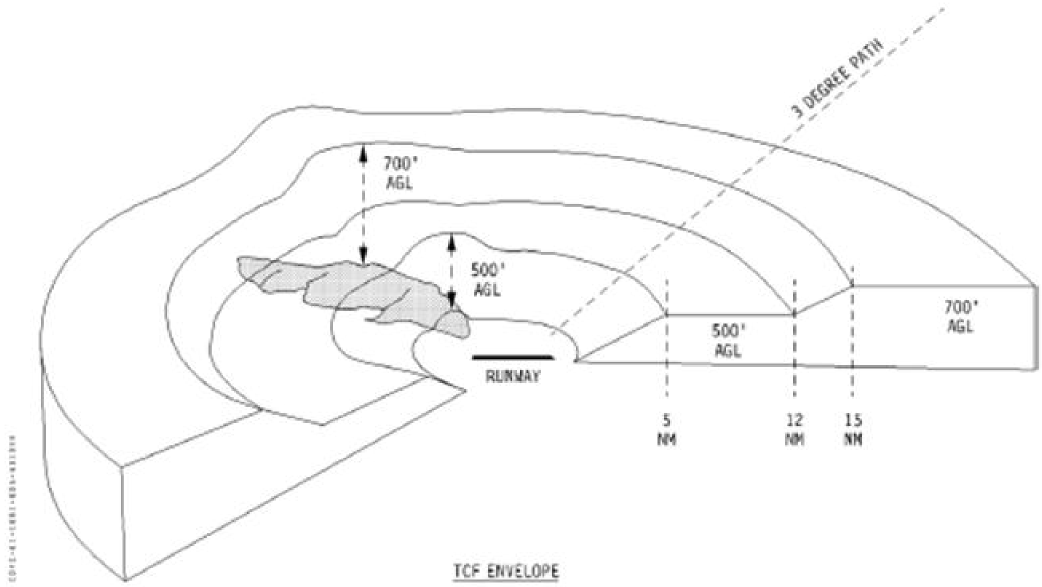


Those 2 alerts are described in Airbus operational documentation:

PULL UP and SINK RATE alert are defined as a function of radio altitude and vertical speed. They are implemented below 2500ft.



The TOO LOW TERRAIN alert associated to Terrain Clearance Floor is based on an envelope around the destination runway. The alert is triggered when the aircraft penetrates this envelope as pictured below:

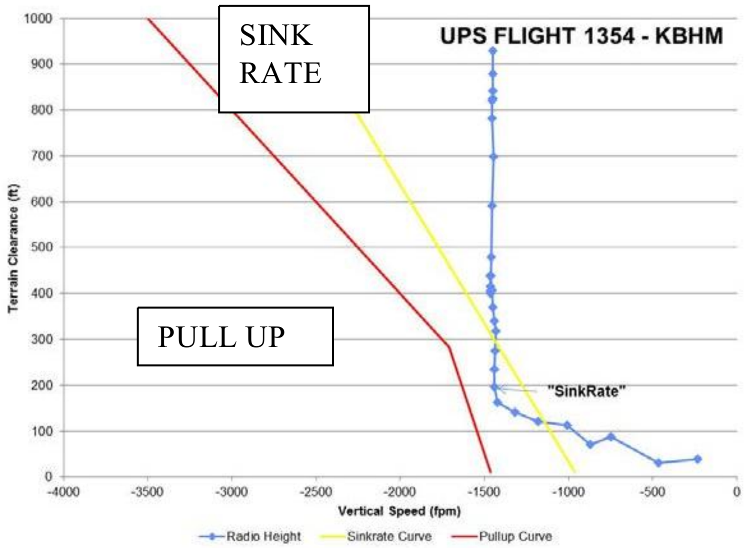


An examination of EGPWS fitted on UP1354 was held on the 11-12th September 2013 in Honeywell facilities (Redmond, WA) where investigation party members attended (UPS, NTSB, Honeywell, FAA, IBT and Airbus).

This examination confirmed that the UP1354 EGPWS behaved in accordance with its design, triggering alerts in the way that can be expected for this version.

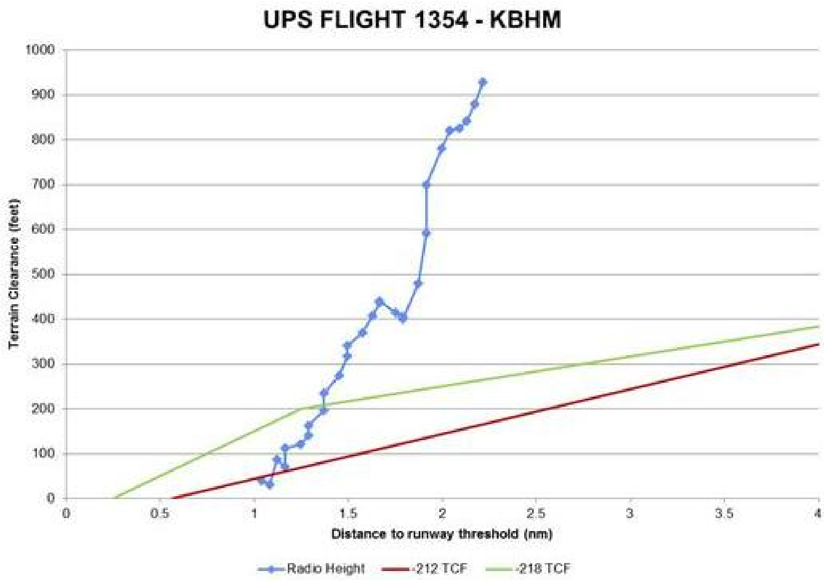
Furthermore the following have been verified:

- The envelopes relative to PULL UP alert (EGPWS basic or enhanced modes) were never violated during the approach (see figure[23] below for basic mode part: red curve),



Basic mode 1 envelope

- The TOO LOW TERRAIN alert trigger was consistent with the Terrain Clearance Floor (TCF) envelope relevant to this software version -212 (see below figure red curve).

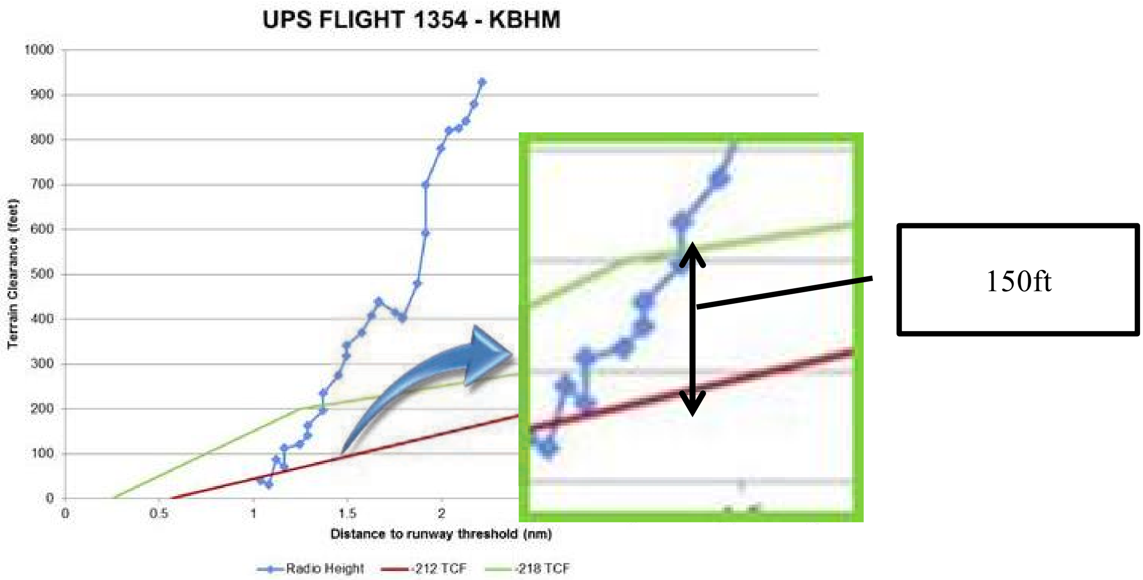


[23] Figure extracted from Honeywell performance analysis of 11-12 September 2012 examination.

2.4.3 EGPWS P/N -218 behaviour

The Honeywell P/N -218 combined with use of GPS source for aircraft position, provides an enlarged TCF mode envelope compared to previous software version. (See figure below green curve).

Simulating the EGPWS P/N -218 behavior with the UP1354 accident data indicates the EGPWS -218 would trigger the SINK RATE alert at the exact same altitude and the TOO LOW TERRAIN alert 150ft higher than with the P/N -212 version.



2.4.4 Airbus operational procedures

EGPWS ALERTS

CAUTION : During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis.
During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert ceases or a safe trajectory is ensured.

SINK RATE alert

According to the Airbus operational documentation[24], the expected crew response to a cautionary SINK RATE alert is the following:

- **"SINK RATE"**
  - Adjust pitch attitude and thrust to silence the warning.

The Airbus Aircraft Flight Manual[25] (AFM) gives more details when an EGPWS caution alert occurs:

- When a caution occurs, adjust the flight path/configuration so that the caution alert ceases. Climb and/or turn as necessary based on analysis of all available instruments and information.

This procedure is provided for general cases.

Considering the circumstances of UP1354's approach (at night and with an EGPWS alert below 1000ft AAL), the "SINK RATE" alert has to be considered as a positive and an additional sign to the crew that the approach is destabilized.

One of the stabilized approach criteria addresses excess of vertical speed during final approach (see paragraph 2.3 Monitoring). When vertical speed exceeds -1000ft/mn, a "*SINK RATE*" verbal call out is performed by the Pilot Monitoring.

An acknowledgment and positive reaction of the Pilot Flying is then required. After a destabilization call out by the Pilot Monitoring, the expected crew response is to go around unless the crew estimates that only small corrections are necessary to rectify minor deviations from stabilized conditions due, among others, to external perturbations.

During flight UP1354, the EGPWS triggered the "SINK RATE" alert in night conditions, after a late and unbriefed approach strategy change, below the 1000ft AAL stabilized approach criteria altitude and below the MDA. Under these circumstances, a go around maneuver is the appropriate course of action according to Standard Operating Procedure (SOP).

[24] Refer to FCOM 2.04.34 provided in appendix 15 and QRH 11.05 provided in appendix 16.
[25] Refer to Aircraft Flight Manual 6.01.06 provided in appendix 17.

TOO LOW TERRAIN alert

According to the operational documentation, the expected crew response to a "TOO LOW TERRAIN" alert is the following:

■ **"TERRAIN TERRAIN" – "TOO LOW TERRAIN"**
– Adjust the flight path or initiate a go around.

Considering the context of the approach (night time, clouds below 1000ft AAL and MDA) and the direct reference to a terrain conflict, the expected crew response according to operational documentation is to initiate a go around maneuver.

2.4.5 Loss of altitude in the event of missed approach scenario

The UP1354 investigation team (UPS, NTSB, BEA, FAA, UPS and IPA) were invited to use Airbus laboratory facilities in Toulouse on January 2014, where an engineering simulator session was performed.

This session provided the following results:

- The UP1354 sequence of events according to the DFDR and CVR data was reproduced. Notably the aircraft trajectory, cockpit displays and sequence of alerts were confirmed by replaying the event using a system configuration equivalent to UP1354 aircraft.
- Loss of altitude following the EGPWS SINK RATE alert was assessed considering alternative recovery actions by the crew and resulting reaction time windows in response to the alert.
- UP1354 sequence of events was replayed introducing an Airbus EGPWS P/N -002 with the enlarged TCF mode envelope. The TOO LOW TERRAIN triggering and associated crew reaction and aircraft trajectory were then assessed.

Loss of altitude from SINK RATE alert

UP1354 sequence of events was replayed in an engineering simulator configured as close as possible to the UP1354 aircraft configuration at the time of the accident.

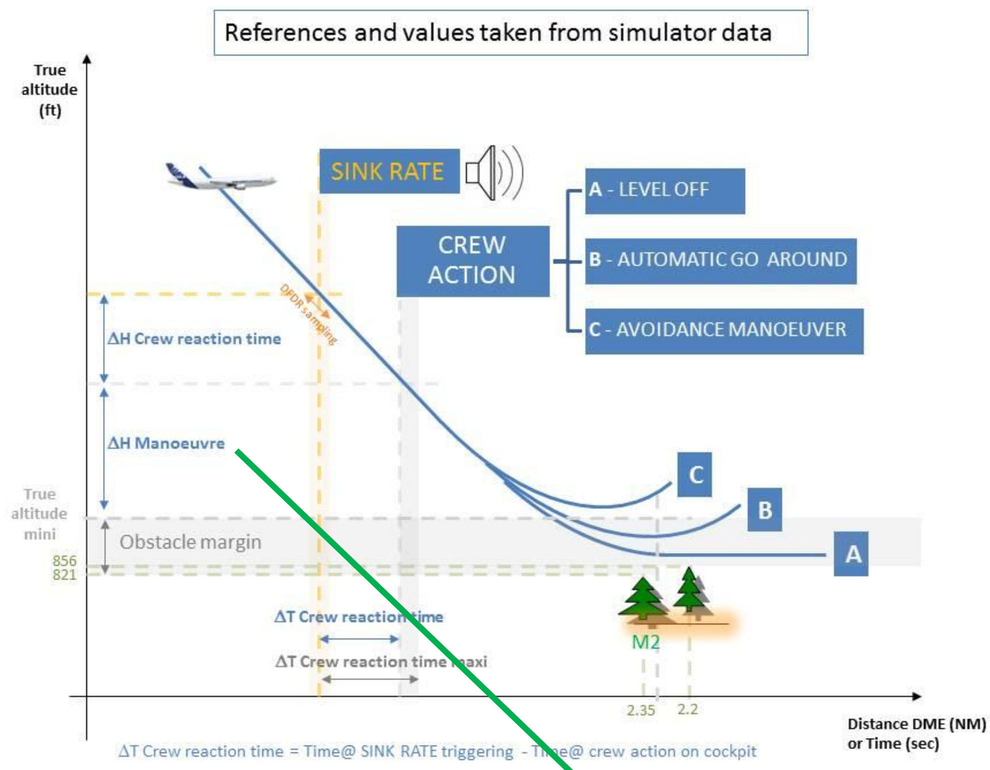
There were 2 objectives: to confirm aircraft behavior following UP1354 sequence of events and to measure aircraft performance following different crew responses to the EGPWS SINK RATE alert.

Three alternative crew recovery actions were considered in response to a SINK RATE alert:

A. Level off by setting the vertical speed target to 500ft/mn.
B. Automatic Go around by triggering the go levers (autopilot ON)
C. Manual avoidance maneuver (TOGA, Pull up)

Note: In this analysis, neither the radioaltitude from the DFDR nor from the engineering simulator are used due to the low sampling rate on DFDR data and to avoid potential erroneous obstacle clearance estimation. Indeed, radioaltimeter may measure the height above trees or above ground level according to the local tree density in this forest area.

To separate the results from crew reaction time during this simulator session, the first task was to measure the altitude lost from the point where the crew initiated the recovery action to the lowest altitude reached by the aircraft during each manoeuver.



Loss of altitude measured during simulator session:

Crew action	**Loss of altitude (ΔH maneuver)**
A/ LEVEL OFF By selecting 500ft/mn	~120ft
B/ AUTOMATIC GO AROUND by selecting Go levers	~80ft
C/ AVOIDANCE MANOEUVER by manual override	~50ft

Then to quantify the crew reaction time effect (and the altitude lost during reaction time) for the UP1354 accident, the DFDR data sampling rate must be taken in to account.

Indeed, the DFDR records SINK RATE alert, vertical speed target and altitude with a sampling rate of one sample per second. As a result, at the time the parameters are recorded, the information is true but could also have been true any time in the second before.

Based on the above, the crew reaction time from the time of the EGPWS SINK RATE alert measured on the DFDR to the time the crew initiated the recovery action is between 0.5s and 2.5s.

EGPWS ALERT ⟵ 0.5 to 2.5s ⟶ CREW ACTION.

Considering the distance and altitude covered by the aircraft during the maneuver, the altitude of the highest trees measured along the flight path[26] was also considered for obstacle clearance assessment.

The measured altitude losses were converted to a time reference considering the vertical speed (-1500ft/mn) recorded in the DFDR when the recovery maneuver was initiated.

During flight UP1354, the EGPWS triggered the SINK RATE alert at 1015ft QNH (below the MDA of 1200ft), in night conditions, after a late and unbriefed approach strategy change and below 1000ft AAL stabilized criteria altitude. Under these circumstances, a go around maneuver is the appropriate course of action according to Standard Operating Procedures.

If a go around with autopilot is performed following a SINK RATE alert, there was between 3 to 4.5 seconds available to the crew to initiate the maneuver and clear obstacle.

[26] Refer to NTSB Aircraft Performance Study.

TOO LOW TERRAIN alert with EGPWS Airbus P/N -002 or Honeywell P/N -218

During this engineering simulator session, two runs were dedicated to replay UP1354 accident with an EGPWS Airbus P/N -002 providing an enlarged TCF envelope.

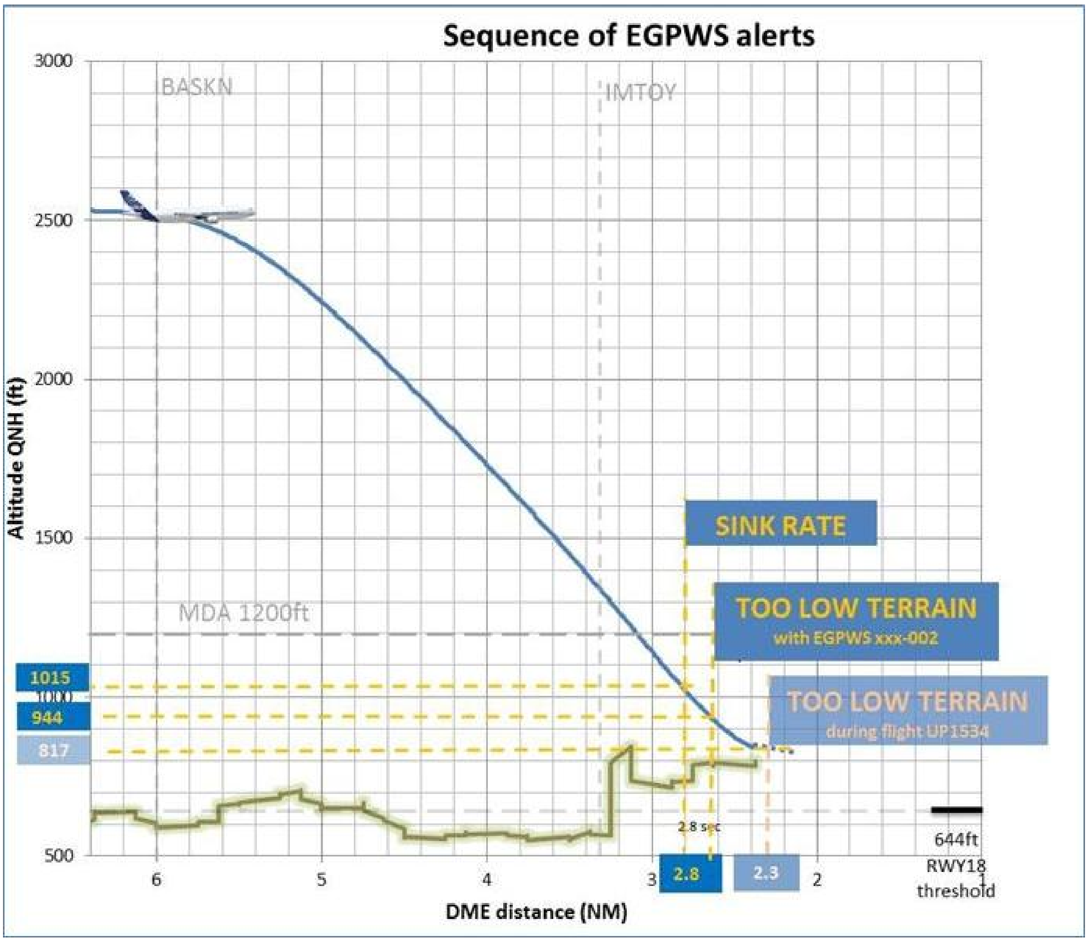
The aim of these runs was to confirm Honeywell's engineering analysis and to estimate the operational benefit of the enlarged TCF version during UP1354 scenario type of flight.

Each run was ended by a go around procedure or by a manual avoidance manoeuver.

This session showed that:

- With an EPGWS P/N -002, the TOO LOW TERRAIN alert is triggered at 156ft radio-altitude, 944ft QNH, 2.6NM DME, **2.5 sec after the SINK RATE alert**.

  *Note: On UP1354 accident aircraft fitted with EGPWS P/N -206, CVR recorded TOO LOW TERRAIN alert **9sec[27] after SINK RATE**, after the aircraft had hit the trees and the DFDR had stopped. EGPWS nonvolatile memory recorded a standard altitude equal to 782ft at the time of the TOO LOW TERRAIN alert triggering, corresponding to a QNH altitude of 817ft.*



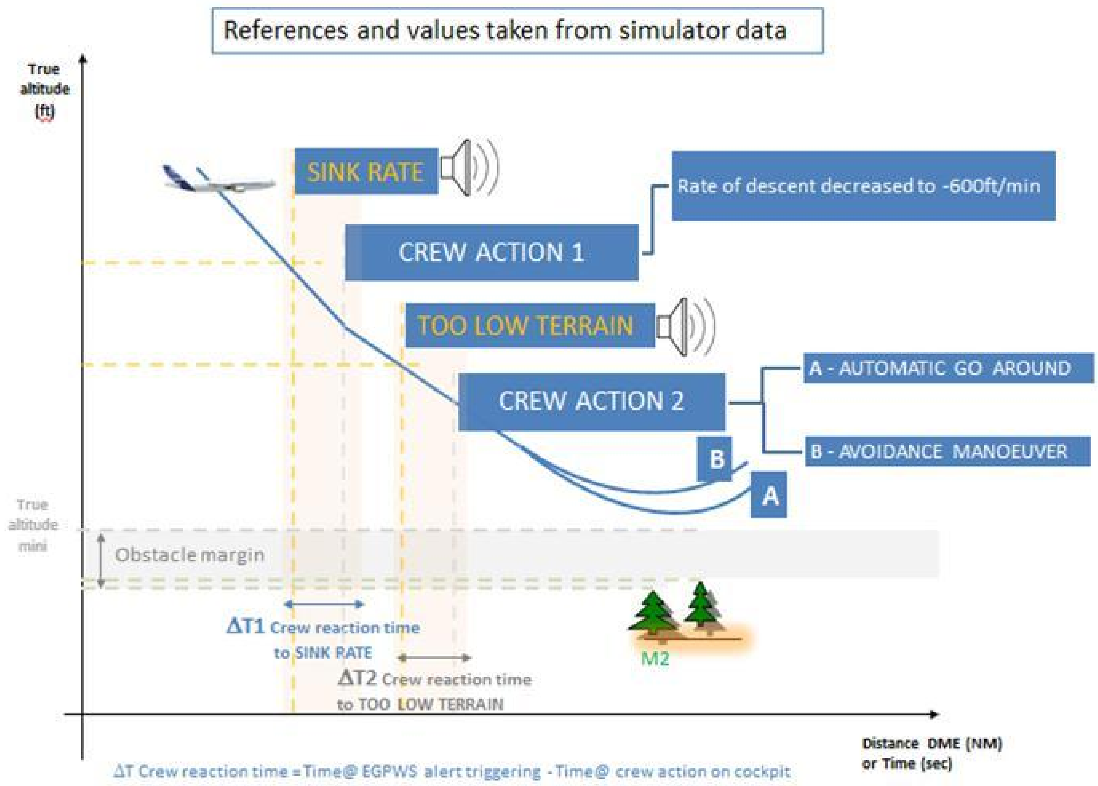
---

[27] Refer to NTSB Cockpit Voice Recorder (CVR) Factual Report of Group Chairman.

- Performing an automatic go around recovery maneuver, with about 1.5sec reaction time from the TOO LOW TERRAIN alert, the minimum altitude reached is 880ft QNH. The altitude loss from crew recovery action is about 40ft. (run 2.1[28])

- Performing a manual avoidance recovery maneuver with about 1.5sec reaction time, the minimum altitude reached is 910ft QNH. The altitude loss from crew recovery action is about 30ft. (run 2.0)

The graph below summarizes these simulator runs:



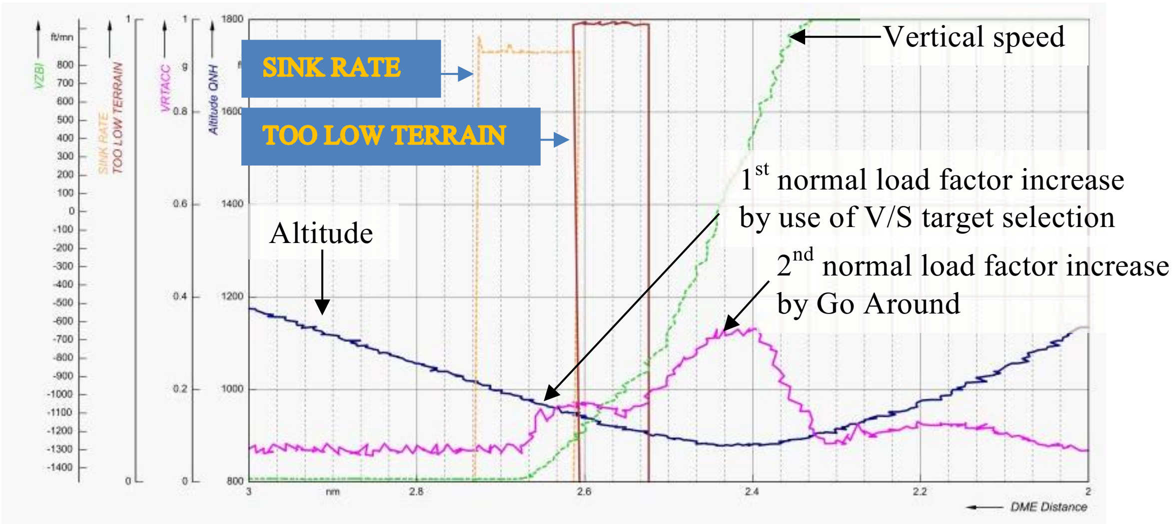
Comparing with runs previously performed for SINK RATE alert, it can be noted that for the same recovery maneuver (automatic go around) the loss of altitude after a TOO LOW TERRAIN (40ft) and SINK RATE (80ft) are different.

The reason for this difference is that according to the UP1354 sequence of events, the crew reduced the rate of descent in response to the SINK RATE alert to -600ft/mn. The aircraft's response benefits from the dynamic initiated by this reduced rate of descent, thereby inducing vertical speed and normal load factor increase. The altitude loss is then logically lower.

---

28 Refer to detailed analysis provided in appendix 18.

This dynamic is illustrated in the graph below, plotting altitude (in blue), vertical speed (in green), and normal load factor (in pink) as well as EGPWS Booleans alerts (orange and red) experienced during simulator session (run 2.1):



2.4.6 Communications on EGPWS System upgrades

Honeywell and Airbus continuously promoted the Enhanced Ground Proximity Warning System improvements using various materials.

Engineering and Maintenance
The Airbus Service Information Letter (SIL) ref. 34-080provided regular updates on regulations, design improvements and service bulletins availability from October 1998 (rev 0) to October 2007 (Rev 07). This Letter was distributed to all Airbus operators. Refer to appendix 19.

After the EGPWS -002 was certified (MOD 13095) by airworthiness authorities the associated Airbus Service Bulletin Ref (34-6177 July 2006) was addressed to all customers. Refer to appendix 20.

Airbus Operator Information Telex (OIT) ref. 999.0013/04 issued in February 2004, reminded all operators of the forthcoming change of regulations rendering the installation of EGPWS mandatory. Refer to appendix 21.

Engineering, Maintenance and Operations
The engineering and operational aspects were addressed by the following Airbus Operator Information Telex and Flight Operations Telex (OIT-FOT):

- OIT-FOT ref. SE 999.0015-04-00 issued on February 2004 to all operators introduced a new Airbus policy change strongly encouraging the selection of aircraft position from the GPS source to be used by EGPWS system. Refer to appendix 22.

- OIT-FOT ref. 999.0050/06 issued on March 2006 to all operators introduced EGPWS P/N 965-1676-002 which includes significant operational improvements and represents the technical answer to the Airbus policy regarding the use by the EGPWS of aircraft position from GPS source. Refer to appendix 23.

Conferences to operators
Airbus presented in various conferences the benefits of the EGPWS upgrades to its customers:

- A300/A310 Family Operational Liaison Meeting (OLM) on April 2006 in Louisville, US. The new EGPWS features introduced into the last EGPWS version and the interest of using GPS source for aircraft position, were presented. Refer to appendix 24.

- 14th Flight Safety Conference on October 2007 in Barcelona, Spain. In the frame of a near CFIT (Controlled Flight Into Terrain) investigation the benefits of upgrading to EGPWS P/N -002 with respect to the EGPWS TCF mode envelope extension was presented. Refer to appendix 25.

- A300/A310 Family Technical symposium in 2003 (Cancun, Mexico), 2005 (Rhodes, Greece) and November 2007 (Toulouse, France). EGPWS operations using GPS source for aircraft position and new EGPWS features introduced into last EGPWS software were presented. Refer to appendix 26.

Articles

- In December 2007, a near CFIT event during a non-precision approach was described in an article published in the Airbus "*Safety First*" magazine. The lessons learned highlighted the requirement to perform a go around if the visual references are not acquired at the MDA. They also highlighted the importance of flight parameters monitoring during the approach and promoted the use of a Constant Angle Non Precision Approach rather than the step adown type of approach. Finally, it promoted the upgrade to the latest EGPWS software standard. (*Airbus Safety First magazine #5, Near CFIT during NPA*). Refer to appendix 27.

- In August 2008, Honeywell promoted the benefits of upgrading to the latest version of the EGPWS in an article published in the Flight Safety Foundation magazine (*Flight Safety Foundation journal AeroSafety World, Indispensable Upgrades*). Refer to appendix 28.

2.4.7 Summary

During flight UP1354, the EGPWS triggered the "SINK RATE alert at 1015ft QNH, in night conditions, after a late and unbriefed approach strategy change, below the 1000ft AAL stabilized criteria altitude and below the MDA. Under these circumstances, a go around maneuver is the appropriate course of action according to the standard operating procedures.

Depending on the maneuver performed (go around or manual avoidance) from the first SINK RATE alert, there were between 3 and 6 seconds available to the crew to initiate the corrective maneuver and clear any obstacles.

Using the EGPWS Airbus P/N -002 or the EGPWS Honeywell P/N -218, the "TOO LOW TERRAIN" alert would be triggered about 2.5sec after the SINK RATE at 944ft QNH.

A go around maneuver performed about 1.5 seconds after the "TOO LOW TERRAIN" alert from an EGPWS Honeywell P/N -218 or Airbus P/N -002 would provide sufficient altitude to clear the obstacles.

From 2006, Airbus has been promoting to the operators the upgrade to EGPWS standard to P/N -002.

3 Conclusion

3.1 Findings

1. UP1354 took off from Louisville, Kentucky with no open Minimum Equipment List item.
2. The flight was uneventful up to the initial approach.
3. The flight crew briefed a Non Precision Profile final approach towards the runway 18 at Birmingham, Alabama using the localizer for lateral guidance.
4. The flight crew did not properly sequence the flight plan and did not review it during the approach briefing.
5. Before the Final Approach Fix, the Pilot Flying changed from managed to selected approach strategy.
6. The change of approach strategy was neither discussed nor briefed.
7. The pilot selected a rate of descent of -1500ft/mn which was eventually reached.
8. This rate of descent was maintained until the first EGPWS “SINK RATE” alert.
9. From 1000 feet AAL (1644ft QNH), the approach was not stabilized and the Pilot Monitoring did not call out any flight parameter deviations during the approach (excessive sink rate). No go around was performed.
10. Before and at the MDA, no mention of visual reference acquisition was made by either pilot. This is consistent with the NTSB assessment of the cloud base at 1000ft QNH versus 1200ft MDA. No go around was performed.
11. In response to the EGPWS “SINK RATE” alert at 1015ft QNH, the flight crew reduced the rate of descent and acknowledged having the runway in sight. No go around was performed.
12. The aircraft impacted the trees and the engines started to ingest tree branches.
13. Tree branches ingestion caused both engines to stop; DFDR recording stopped.
14. The CVR and EGPWS continued to record.
15. The EGPWS emitted a “TOO LOW TERRAIN” alert at 817ft QNH.
16. The aircraft impacted the ground and 2 pilots were fatally injured.
17. The aircraft was fitted with an EGPWS P/N -212 installed by UPS STC.
18. EGPWS P/N -218 or Airbus P/N -002, was proposed to all operators in 2006 providing an enlarged TCF envelope. This enlarged enveloped would have allowed to trigger the “TOO LOW TERRAIN” alert at 944ft QNH which would have been 6.5 seconds before the time it was triggered during UP1354 flight.

3.2 Probable Cause

The probable cause of the accident involving flight 1354 was the failure of the crew to properly conduct and monitor the approach and to correct the excessive rate of descent selected and maintained throughout the approach.

The crew failed to perform a go around while descending below the MDA without a callout of a visual reference with the runway 18 or after the EGPWS triggering the "SINK RATE" alert at low altitude.

APPENDIX 1

List of pages in this Trip Kit

General Information

Location: Birmingham AL USA
IATA Code: BHM
Lat/Long: N33° 33.8' W086° 45.1'
Elevation: 650 ft

Airport Use: Public
Magnetic Variation: 3.1°W
Sectional Chart: Atlanta

Fuel Types: 100 Octane (LL), Jet A
Oxygen Types: High Pressure, Low Pressure
Repair Types: Major Airframe, Major Engine
Customs: ADCUS
Airport Type: IFR
Landing Fee: No
Control Tower: Yes
Jet Start Unit: Yes
LLWS Alert: No
Beacon: Yes

Sunrise: 1108 Z
Sunset: 0035 Z,

Runway Information

Runway: 06
Length x Width: 11998 ft x 150 ft
Surface Type: asphalt
TDZ-Elev: 606 ft
Lighting: Edge, ALS, Centerline, TDZ

Runway: 18
Length x Width: 7099 ft x 150 ft
Surface Type: asphalt
TDZ-Elev: 644 ft
Lighting: Edge, REIL

Runway: 24
Length x Width: 11998 ft x 150 ft
Surface Type: asphalt
TDZ-Elev: 640 ft
Lighting: Edge, ALS, Centerline
Displaced Threshold: 1197 ft

Runway: 36
Length x Width: 7099 ft x 150 ft
Surface Type: asphalt
TDZ-Elev: 633 ft

Lighting: Edge, REIL

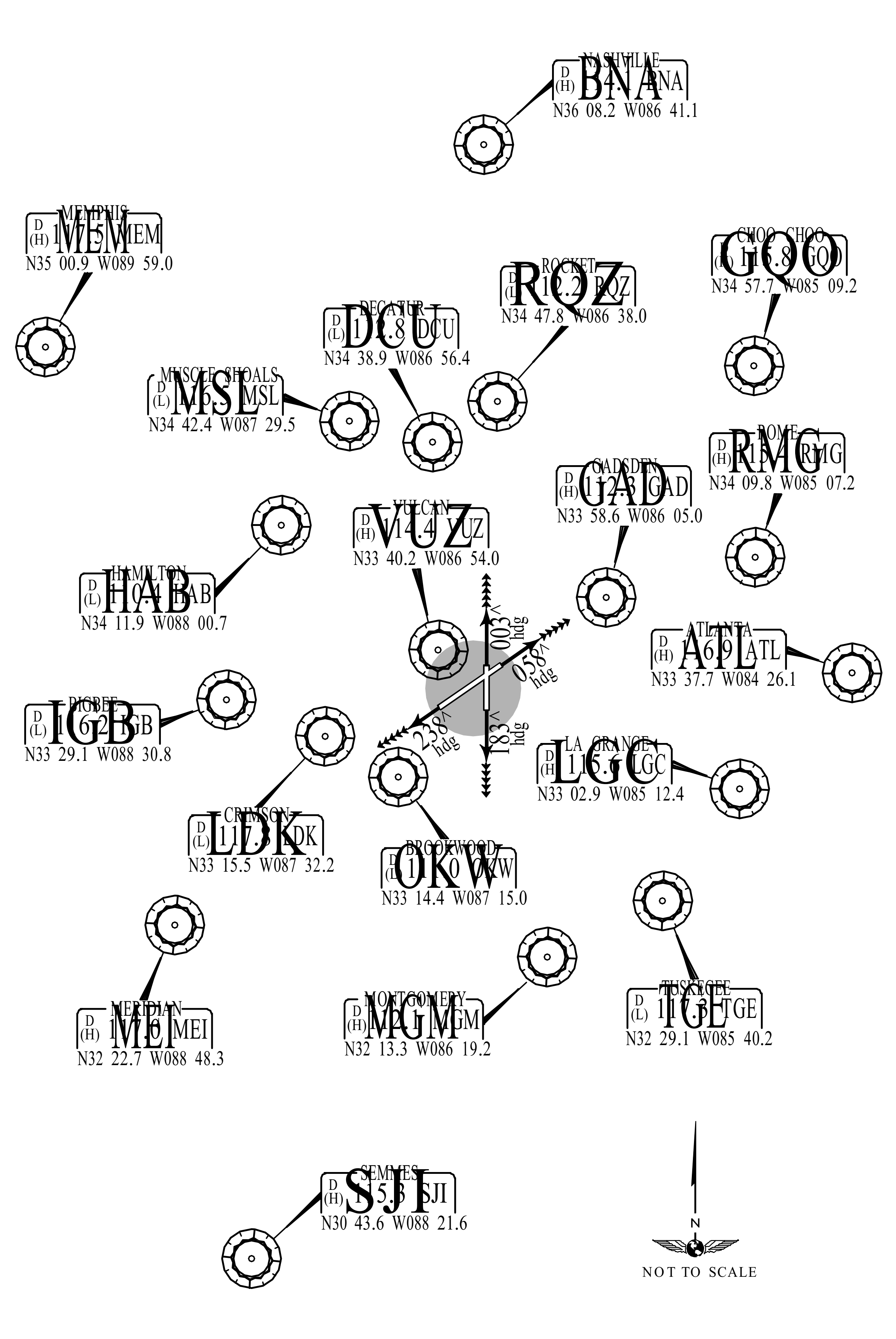
Communication Information

ATIS 119.4
Birmingham Tower 119.9
Birmingham Ground Control 121.7
Birmingham Clearance Delivery 125.675
Birmingham Pre-Taxi Clearance 125.675
Birmingham Approach Control 127.675 (231°-49°)
Birmingham Approach Control 123.8 (50°-230°) Initial Contact
Birmingham App ARSA 127.675 (231°-49°)
Birmingham App ARSA 123.8 (50°-230°)
Birmingham Departure Control 127.675 (231°-49°)
Birmingham Departure Control 123.8 (50°-230°)
Birmingham Intl Unicom 122.95
Pemco Aeroplex Operations 570.3 Military
Pemco Aeroplex Operations 123.2 Military
Dixie Control Operations 1121.7 Military
Army Guard Operations 125.525 Military
Anniston Flight Service Station 123.65 RCO
Anniston Flight Service Station 122.2 RCO

BIRMINGHAM Departure (R) 231^-049^	050^-230^	Apt Elev	Trans level: FL 180 Trans alt: 18000'
127.67	123.8	650'	RADAR required.

BIRMINGHAM FIVE DEPARTURE (BHM5.BHM)

For Procedure Text and Takeoff Minimums see 10-3-1.



BIRMINGHAM FIVE DEPARTURE (BHM5.BHM)

For Procedure Graphic see 10-3

PROCEDURE TEXT

This SID requires take-off minimums (for standard minimums, refer to airport chart):
Rwy 6: 300-1 3/4 with minimum climb of 279' per NM to 1800' or standard (or lower than standard, if authorized) with minimum climb of 421' per NM to 1300'.
Rwy 18: 600-3 with minimium climb of 215' per NM to 1400' or standard (or lower than standard, if authorized) with minimum climb of 450' per NM to 1500'.
Rwy 24: Standard (or lower than standard, if authorized) with minimum climb of 271' per NM to 1400'.
Rwy 36: 300-2 1/4 or standard (or lower than standard, if authorized) with minimum climb of 420' per NM to 1000'.

Gnd speed-KT	75	100	150	200	250	300
215' per NM	269	358	538	717	896	1075
271' per NM	339	452	678	903	1129	1355
279' per NM	349	465	698	930	1163	1395
420' per NM	525	700	1050	1400	1750	2100
421' per NM	526	702	1053	1403	1754	2105
450' per NM	563	750	1125	1500	1875	2250

OBSTACLES
Rwy 6: Tree 1456' from DER, 854' RIGHT of centerline, 61' AGL/ 767' MSL. Terrain 1759' from DER, 2' RIGHT of centerline, 722' MSL.
Rwy 18: Rising terrain beginning 135' from DER, LEFT and RIGHT of centerline, up to 670' MSL. Tree and poles beginning 536' from DER, LEFT and RIGHT of centerline, up to 46' AGL/ 701' MSL. Poles, tower, and trees beginning 1483' from DER, LEFT and RIGHT of centerline, up to 64' AGL/ 749' MSL.
Rwy 24: Tree 991' from DER, 562' LEFT of centerline, 38' AGL/642' MSL. Sign 2394' from DER, 1018' LEFT of centerline, 54' AGL/671' MSL.
Rwy 36: Fence, tree, and vehicles on road beginning 130' from DER, LEFT and RIGHT of centerline, up to 28' AGL/662' MSL. Tree and pole beginning 467' from DER, 470' RIGHT of centerline, up to 63' AGL/ 726' MSL. Trees beginning 637' from DER, 420' LEFT of centerline, up to 13' AGL/ 696' MSL. Pole and tree beginning 1353' from DER, 669' LEFT of centerline, up to 37' AGL/739' MSL. Trees, pole, and fence beginning 1279' from DER, 492' RIGHT of centerline, up to 19' AGL/713' MSL. Terrain beginning 43' from DER, LEFT and RIGHT of centerline, up to 794' MSL.

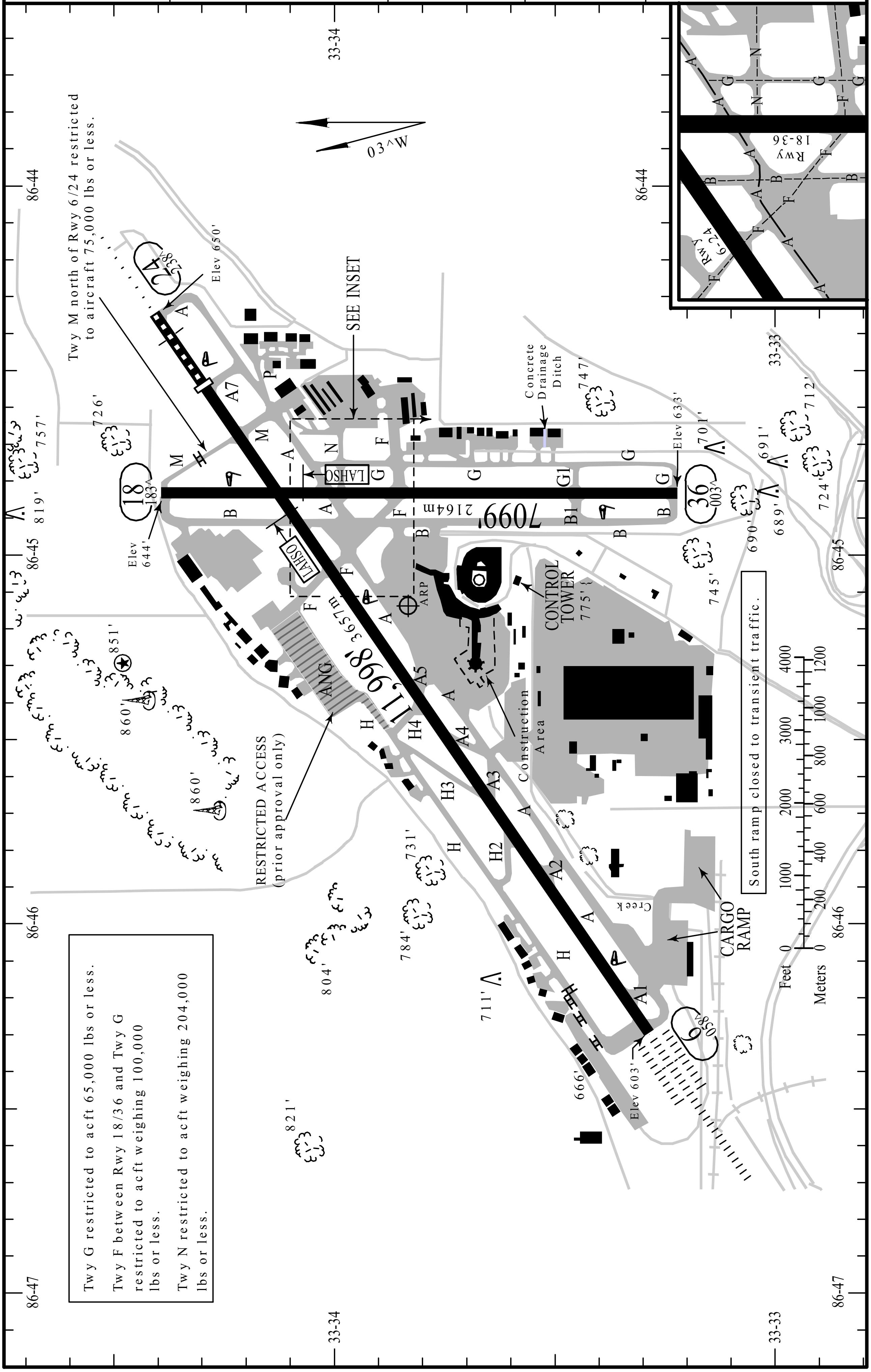
RWY	INITIAL CLIMB
6	Climb heading 058^ to 1500'.
18	Climb heading 183^ to 2300'.
24	Climb heading 238^ to 2300'.
36	Climb heading 003^ to 1400'.

ROUTING

EXPECT vectors to filed route. MAINTAIN 4000' or assigned lower altitude.
EXPECT clearance to filed altitude 10 minutes after departure.

CHANGES: Procedure renumbered, takeoff minimums, initial climb.

ATIS	BIRMINGHAM Clearance (Cpt)	Ground	Tower	BIRMINGHAM Departure (R) 231^-049^	050^-230^
119.4 VOT 110.0	125.67	121.7	119.9	127.67	123.8



GENERAL

Weather systems processor.
Birds in vicinity of airport.

ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS: LANDING BEYOND Threshold	USABLE LENGTHS: LANDING BEYOND Glide Slope	USABLE LENGTHS: LAHSO Distance	USABLE LENGTHS: TAKE-OFF	WIDTH
6	HIRL CL ALSF-II TDZ PAPI-L (angle 3.0^) grooved RVR		10,980' 3347m	18/36 8700' 2652m		150' 46m
24	HIRL CL MALSR PAPI-L (angle 3.0^) grooved RVR	10,801' 3292m	9566' 2916m			
18	MIRL REIL PAPI-L (angle 3.2^) grooved					150' 46m
36	MIRL REIL grooved			6/24 5150' 1570m		

TAKE-OFF & OBSTACLE DEPARTURE PROCEDURE

Rwy 24

2 operating RVRs are required / All operating RVRs are controlling		With Mim climb of 271'/NM to 1400'		
CL & HIRL	CL, or RCLM & HIRL	Adequate Vis Ref	STD 3 & 4 Eng	STD 1 & 2 Eng
TDZ RVR 5 Mid RVR 5 Rollout RVR 5	TDZ RVR 10 Mid RVR 10 Rollout RVR 10	RVR 16 or ¼	RVR 24 or ½	RVR 50 or 1

Rwy 6

With Mim climb of 421'/NM to 1300'			With Mim climb of 279'/NM to 1800'
Adequate Vis Ref	STD 3 & 4 Eng	STD 1 & 2 Eng	
RVR 16 or ¼	RVR 24 or ½	RVR 50 or 1	300-1 ¾

Rwy 36

With Mim climb of 420'/NM to 1000'			Other
Adequate Vis Ref	STD 3 & 4 Eng	STD 1 & 2 Eng	
¼	½	1	300-2¼

Rwy 18

With Mim climb of 450'/NM to 1500'			With Mim climb of 215'/NM to 1400'
Adequate Vis Ref	STD 3 & 4 Eng	STD 1 & 2 Eng	
¼	½	1	600-3

OBSTACLE DP

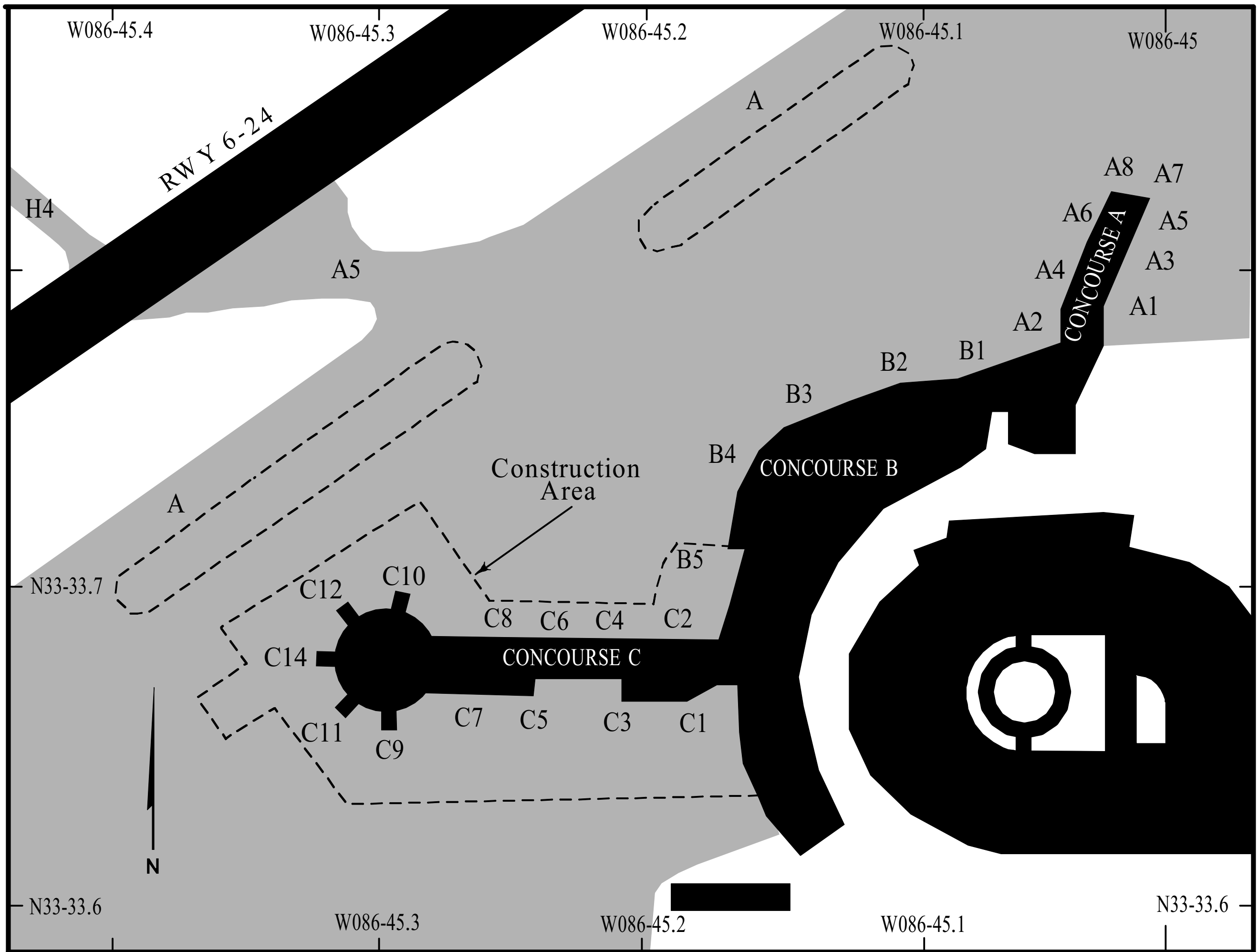
Rwy 6, climb heading 058^ to 1500' before proceeding on course. Rwy 18, climb heading 183^ to 2300' before proceeding on course. Rwy 24, climb heading 238^ to 2300' before proceeding on course. Rwy 36, climb heading 003^ to 1400' before proceeding on course.

FOR FILING AS ALTERNATE

	ILS Rwy 6 ILS Rwy 24	LOC Rwy 6 LOC Rwy 18 LOC DME Rwy 24 RNAV (GPS) Y Rwy 6 RNAV (GPS) Rwy 18 RNAV (GPS) Y Rwy 24	Authorized Only When Local Weather Available RNAV (RNP) Z Rwy 6 RNAV (RNP) Z Rwy 24	RNAV (GPS) Rwy 36
A	600-2	800-2	800-2	900-2
B	600-2	800-2	800-2	900-2
C	600-2	800-2	800-2	900-2 ½
D	600-2	800-2	800-2	900-2 ¾

AMEND 7

CHANGES: Amendment number.



PARKING GATE COORDINATES

GATE No.	COORDINATES
Concourse A	
A 1, A 3, A 5, A 6, A 7, A 8	N33 33.8 W086 45.0
A 2, A 4	N33 33.8 W086 45.1
Concourse B	
B 1, B 2	N33 33.8 W086 45.1
B 3	N33 33.8 W086 45.2
B 4, B 5	N33 33.7 W086 45.2
Concourse C	
C1 thru C6	N33 33.7 W086 45.2
C 7, C 8	N33 33.7 W086 45.3
C 10, C 12, C 14	N33 33.7 W086 45.3
C 9, C 11	N33 33.6 W086 45.3

CHANGES: Construction area added, Concourse C depiction.

BRIEFING STRIP ™

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

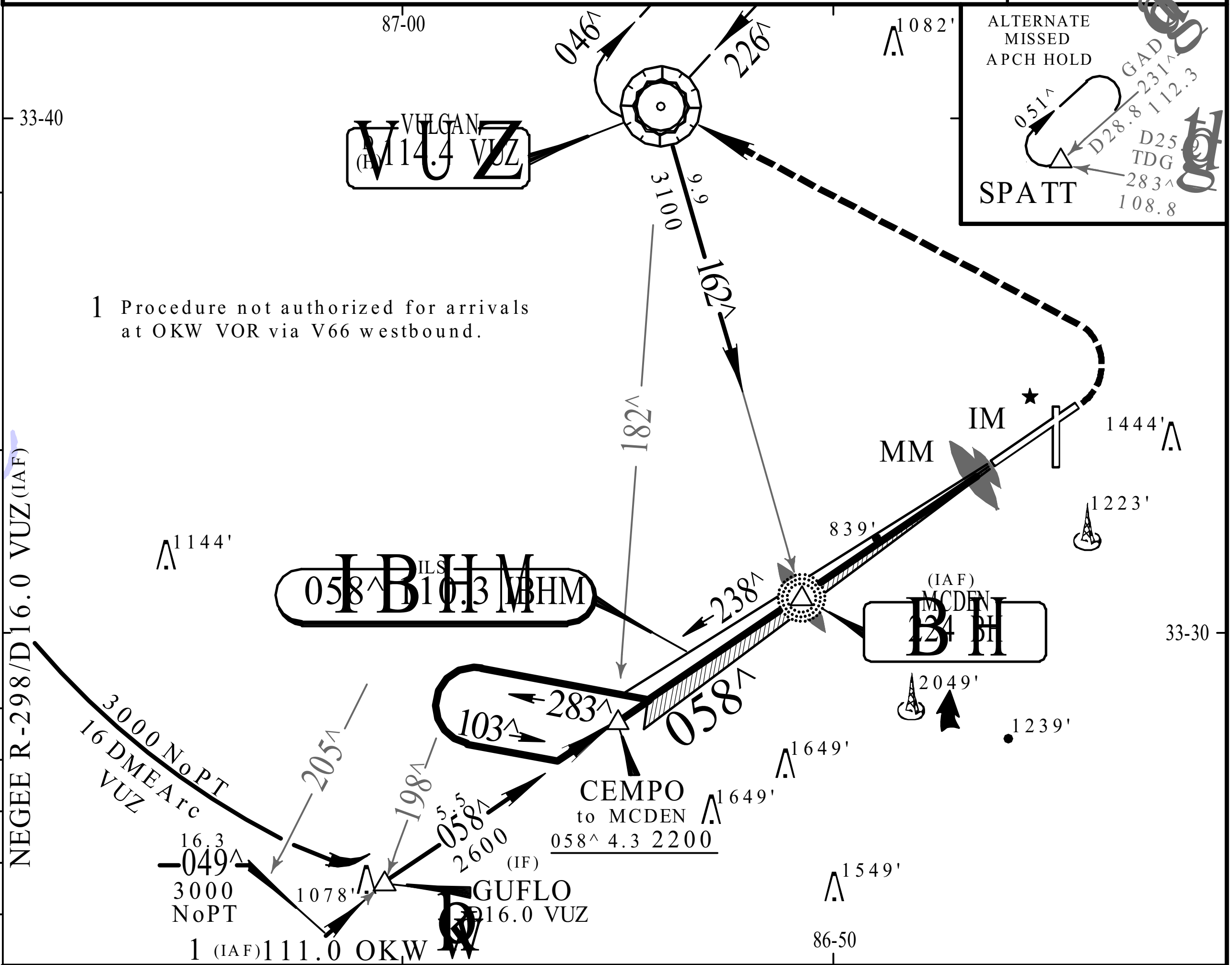
LOC IBHM	Final Apch Crs	GS MCDEN	ILS DA(H)	Apt Elev 650' TDZE 606'
110.3	058^	2121'(1515')	806'(200')	

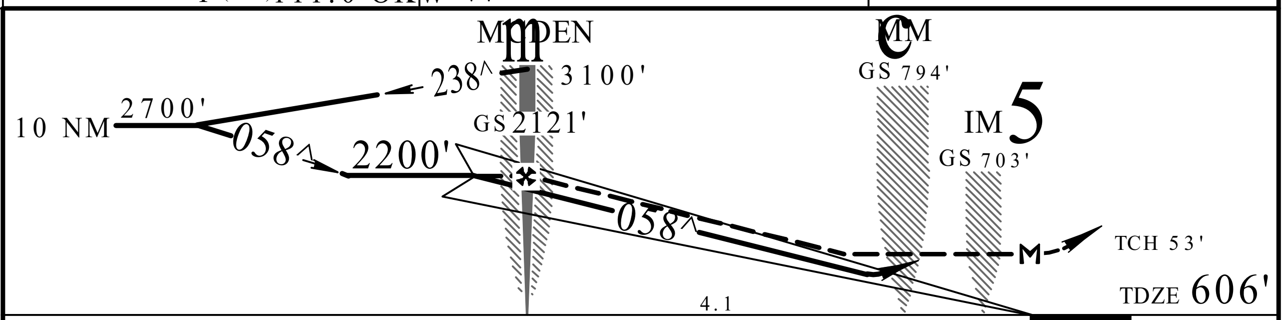
MISSED APCH: Climb to 2000' then climbing LEFT turn to 3000' direct VUZ VOR and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'

1. VGSI and ILS glidepath not coincident.

3700'
MSA BH OM





Gnd speed-Kts	70	90	100	120	140	160
GS 3.00^	372	478	531	637	743	849
MCDEN to MAP 4.5	3:51	3:00	2:42	2:15	1:56	1:41

ALSF-II
PAPI
2000'
3000' LT
D
VUZ 114.4

STRAIGHT-IN LANDING RWY 6

	ILS DA(H) 806'(200') FULL	TDZ or CL out	ALS out	LOC (GS out) MDA(H) 1180'(574')	ALS out
A	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 50 or 1
B	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 24 or ½	RVR 50 or 1
C	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	1½
D	RVR 18 or ½	RVR 24 or ½	RVR 40 or ¾	RVR 60 or 1¼	1 ¾

TERPS AMEND 42A 25 JUL 2013

CHANGES: Minimums.

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

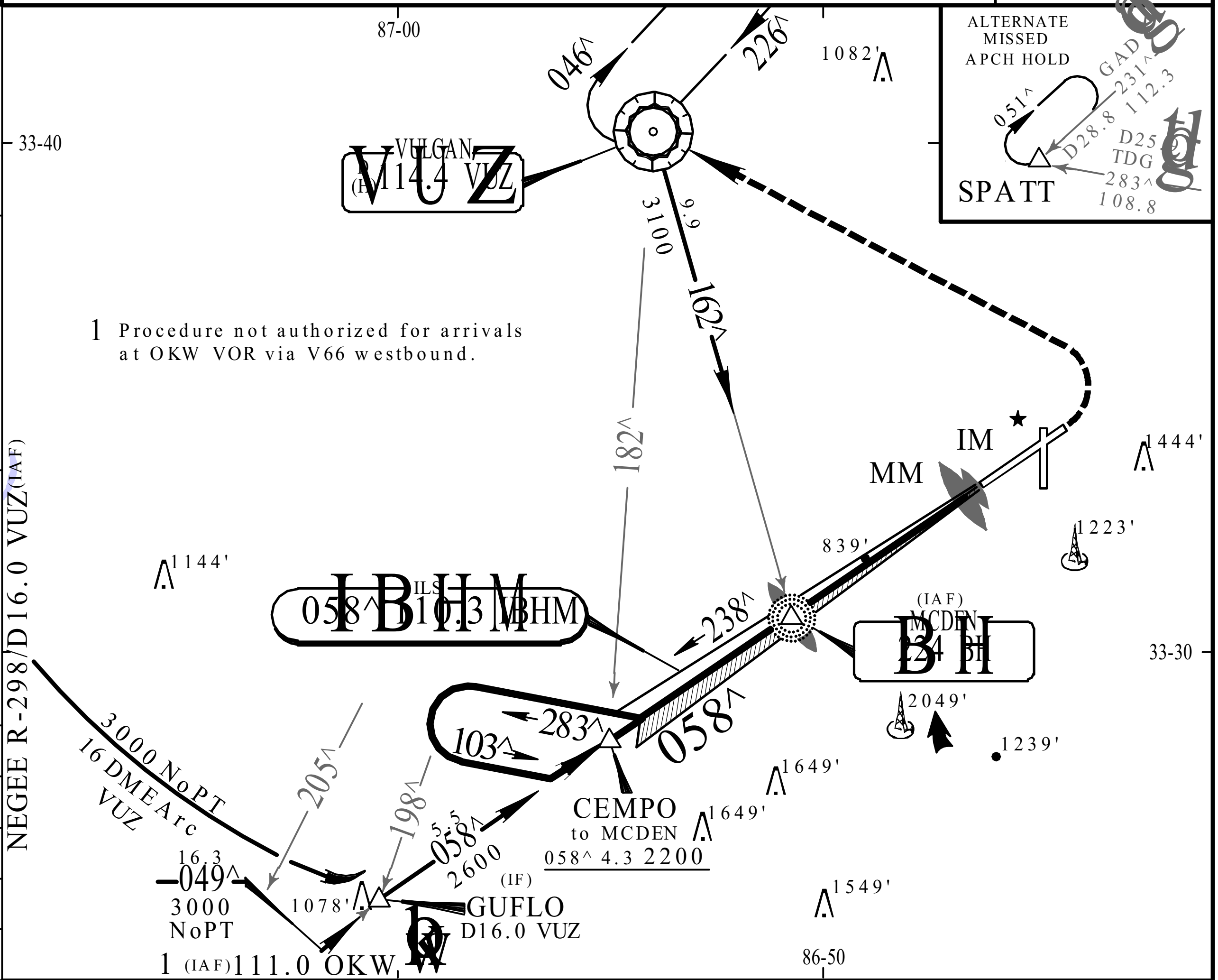
BRIEFING STRIP ™

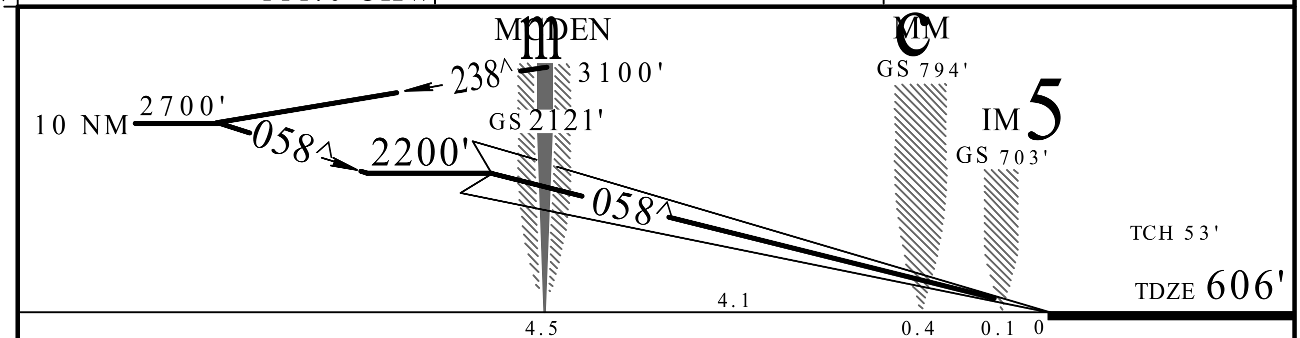
LOC	Final Apch Crs	GS MCDEN	CAT II ILS	Apt Elev 650'
IBHM 110.3	058^	2121'(1515')	RA 118' DA(H) 706'(100')	TDZE 606'

MISSED APCH: Climb to 2000' then climbing LEFT turn to 3000' direct VUZ VOR and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'
1. Special Aircrew & Aircraft Certification Required. 2. VGSI and ILS glidepath not coincident.

3700'
MSA BH LOM





Gnd speed-Kts	70	90	100	120	140	160
GS 3.00^	372	478	531	637	743	849

ALSF-II PAPI | 2000' ↑ | 3000' LT | VUZ 114.4

STRAIGHT-IN LANDING RWY6
CAT II ILS

RA 118'
DA(H) 706'(100')

RVR 12

TERPS AMEND 42A 25 JUL 2013

CHANGES: TERPS amendment number.

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

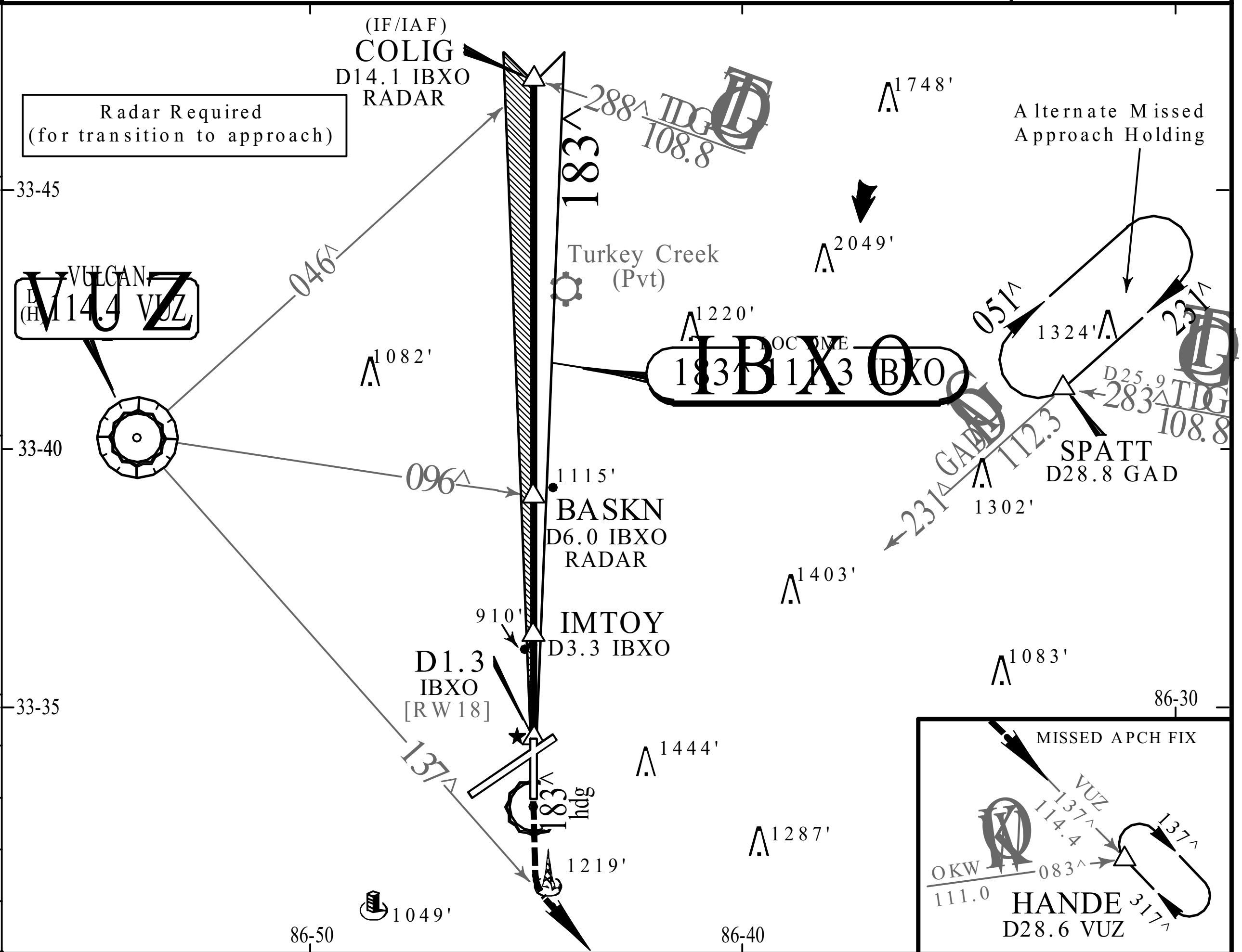
BRIEFING STRIP ™

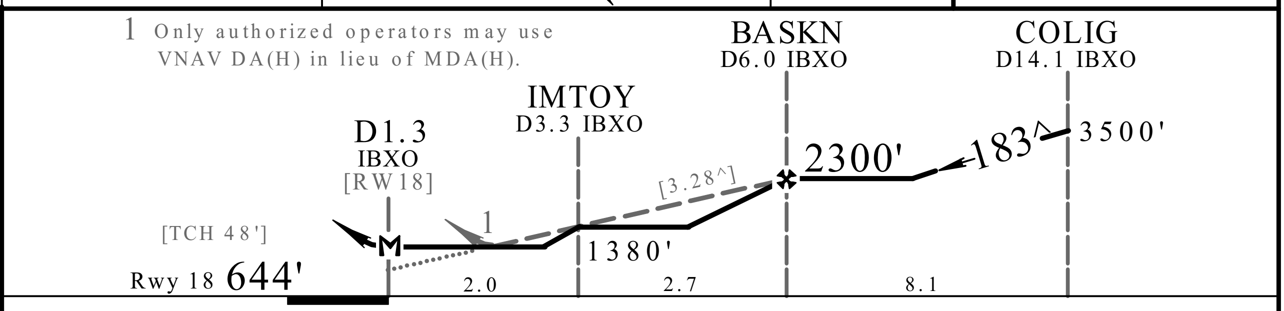
LOC IBXO	Final Apch Crs	Minimum Alt BASKN	MDA(H) (CONDITIONAL)	Apt Elev 650' Rwy 18 644'
111.3	183^	2300'(1656')	1200'(556')	

MISSED APCH: Climb to 1500' on heading 183^ then climbing LEFT turn to 3800' on VUZ VOR R-137 outbound to HANDE INT/D28.6 VUZ and hold, or as directed by ATC.

Alt Set: INCHES   Trans level: FL 180   Trans alt: 18000'
1. DME or Radar required. 2. When VGSI inop, procedure not authorized at night.
3. Localizer unusable beyond 15 degrees right of course. 4. Visibility reduction by helicopters not authorized.

3700'
MSA VUZ VOR





Gnd speed-Kts	70	90	100	120	140	160
Descent angle [3.28^]	406	522	580	696	813	929
MAP at D1.3 IBXO or BASKN to MAP 4.7	4:02	3:08	2:49	2:21	2:01	1:46

REIL
PAPI-L

1500' on 183^ hdg → 3800' LT → VUZ 114.4 R-137

..TERPS..

STRAIGHT-IN LANDING RWY 18

	DAY: MDA(H) 1200'(556') With IMTOY	DAY: MDA(H) 1380'(736') Without IMTOY	NIGHT
A	1	1	NA
B			
C	1⅝	2	
D			

TERPS AMEND 2A 8 MAR 2012

CHANGES: Note.

KBHM/BHM
-SHUTTLESWORTH INTL

JEPPESEN
17 AUG 12 (11-3)

BIRMINGHAM, ALA
ILS or LOC DME Rwy 24

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

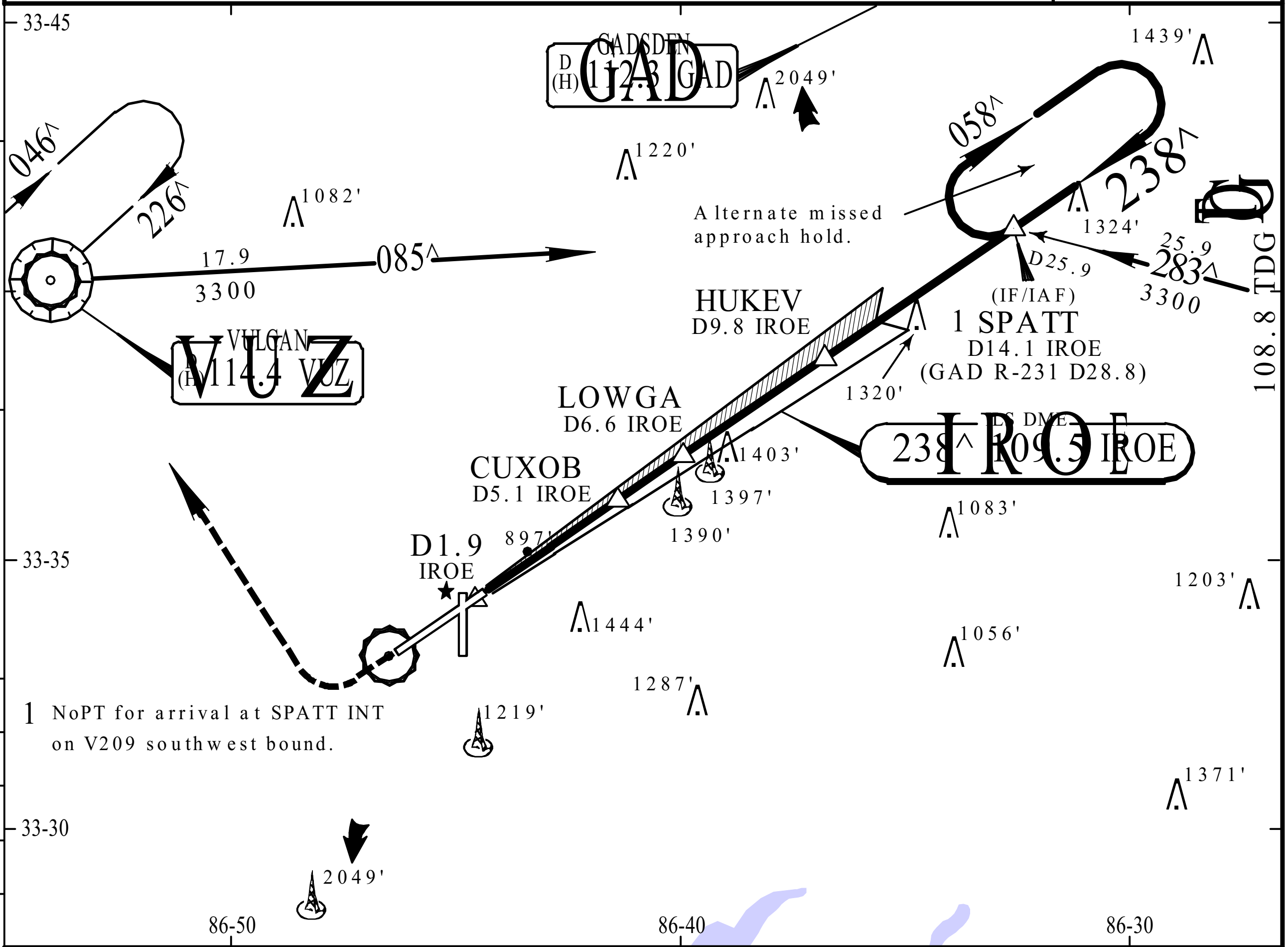
BRIEFING STRIP™

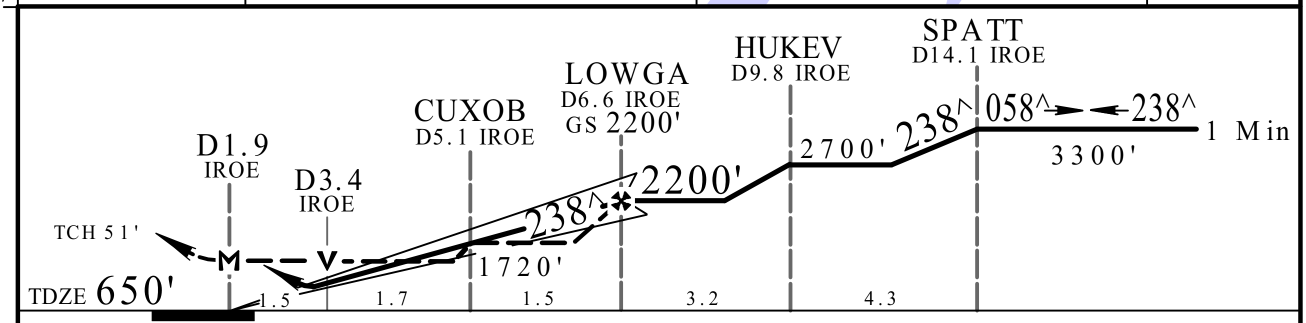
LOC IROE	Final Apch Crs	GS LOWGA	ILS DA(H)	Apt Elev / TDZE
109.5	238^	2200'(1550')	942'(292')	Apt Elev 650' TDZE 650'

MISSED APCH: Climb to 2000' then climbing RIGHT turn to 3000' direct VUZ VOR and hold.

Alt Set: INCHES   Trans level: FL 180   Trans alt: 18000'
1. VGSI and ILS glidepath not coincident. 2. Visibility reduction by helicopters not authorized.

MSA VUZ VOR 3700'





Gnd speed-Kts	70	90	100	120	140	160
GS 3.00^	372	478	531	637	743	849
MAP at D1.9 IROE						

MALSR PAPI

2000' ↑ 3000' RT → VUZ 114.4

STRAIGHT-IN LANDING RWY 24

	ILS DA(H) 942'(292') FULL	ILS RAIL or ALS out	LOC (GS out) MDA(H) 1160'(510') RAIL out	ALS out
A	RVR 40 or ¾		RVR 40 or ¾	RVR 50 or 1
B	RVR 40 or ¾		RVR 40 or ¾	RVR 50 or 1
C	RVR 40 or ¾		RVR 50 or 1	1½
D	RVR 40 or ¾		RVR 50 or 1	1½

TERPS AMEND 2 22 OCT 2009

CHANGES: None.

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

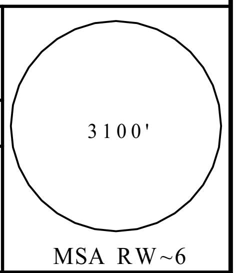
BRIEFING STRIP™

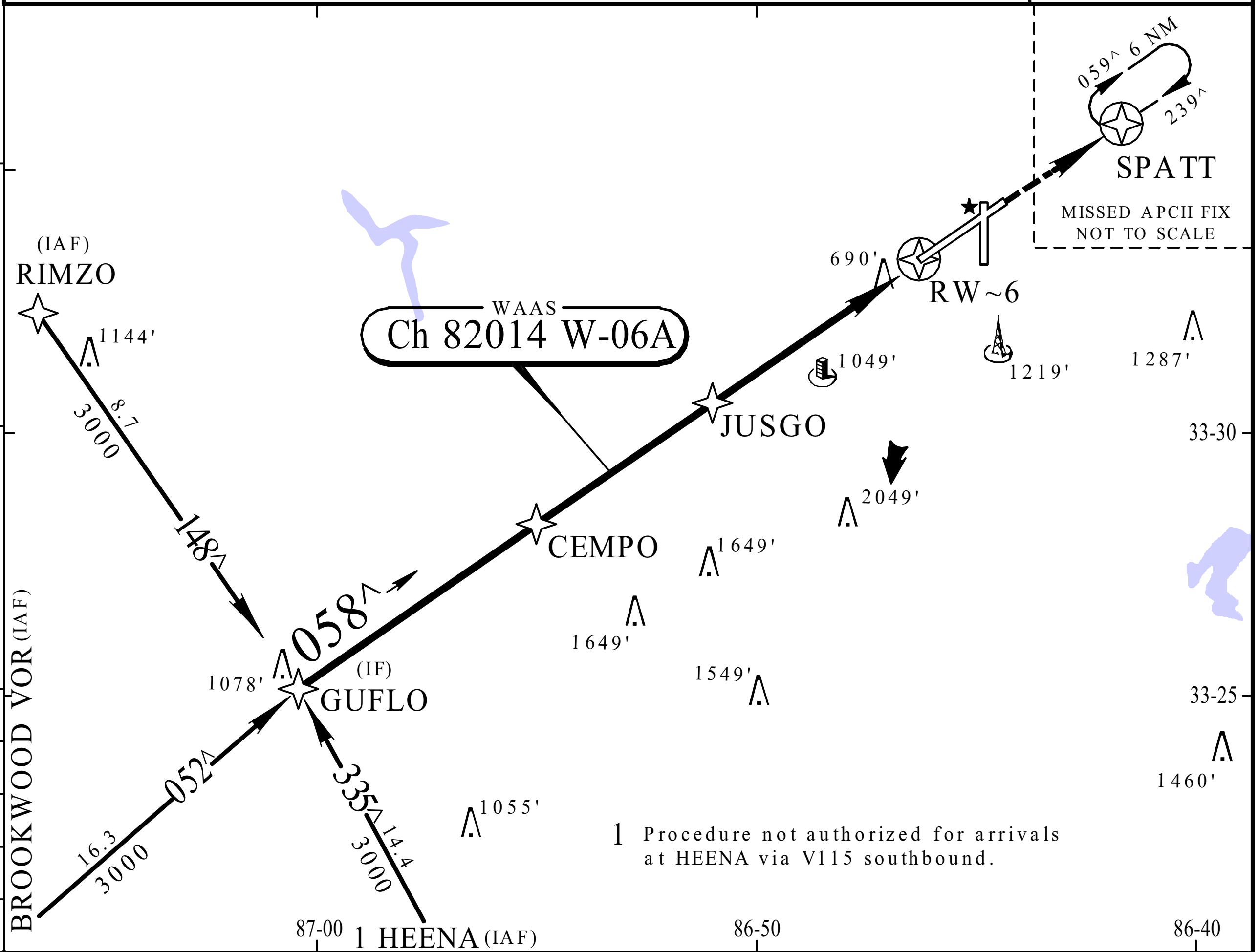
WAAS	Final Apch Crs	Minimum Alt JUSGO	LPV DA(H)	Apt Elev 650'
Ch 82014 W-06A	058^	2200'(1594')	806'(200')	TDZE 606'

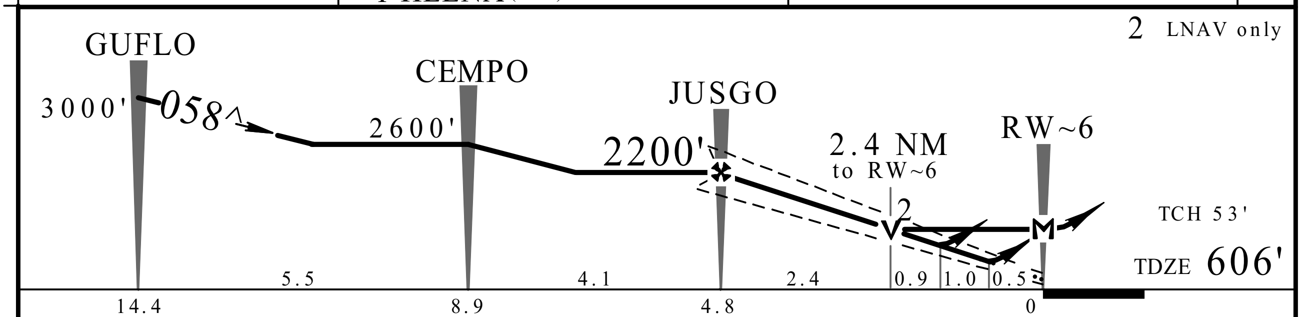
MISSED APCH: Climb to 3300' direct SPATT and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'

1. DME/DME RNP-0.30 not authorized. 2. For uncompensated Baro-VNAV systems, LNAV/VNAV not authorized below -16^C (4^F) or above 47^C (116^F). 3. VGSI and RNAV glidepath not coincident.







Gnd speed-Kts	70	90	100	120	140	160
Glide Path Angle 3.00^	372	478	531	637	743	849
MAP at RW~6						

ALSF-II PAPI | 3300' | SPATT

STRAIGHT-IN LANDING RWY 6

	LPV DA(H) 806'(200')		LNAV/VNAV DA(H) 1120'(514')		LNAV MDA(H) 1440'(834')	
		ALS out		ALS out		ALS out
A	RVR 24 or 1/2	RVR 40 or 3/4	RVR 60 or 1 1/4	1 3/4	RVR 24 or 1/2	RVR 50 or 1
B					RVR 40 or 3/4	RVR 60 or 1 1/4
C					2	2 1/2
D					2 1/4	2 3/4

TERPS AMEND 1A 23 SEP 2010

CHANGES: None.

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

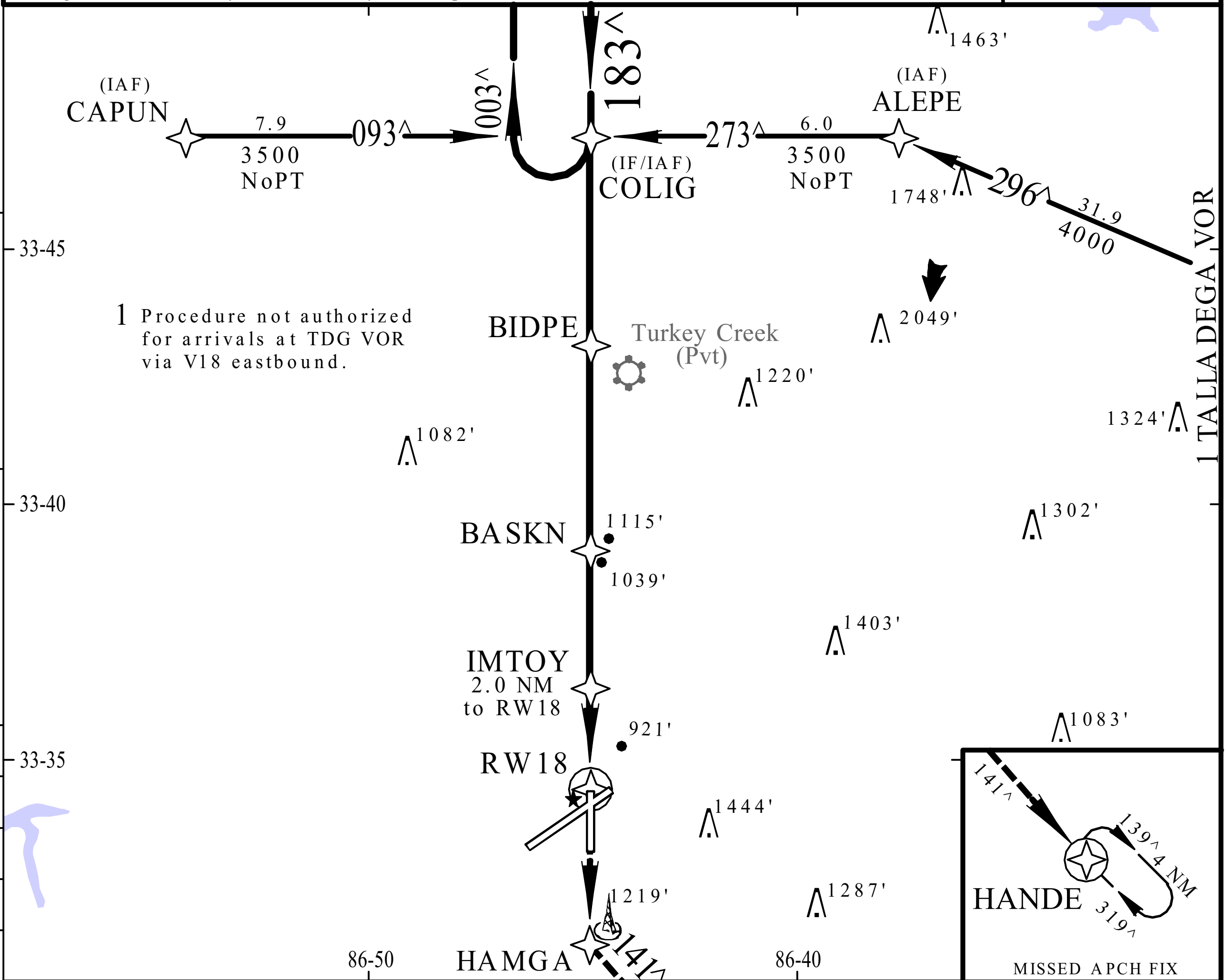
BRIEFING STRIP ™

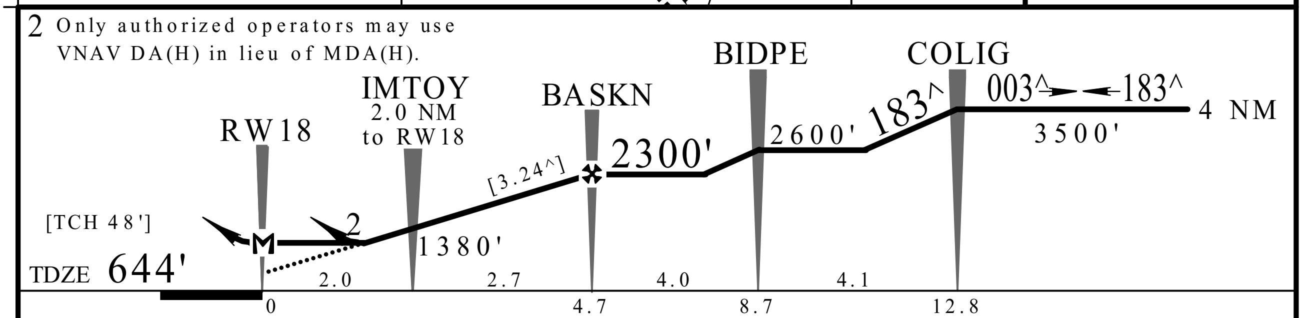
RNAV	Final Apch Crs	Minimum Alt BASKN	LNAV MDA(H)	Apt Elev 650' TDZE 644'
	183^	2300'(1656')	1200'(556')	

MISSED APCH: Climb to 3800' direct HAMGA and via 141^ track to HANDE and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'
1. DME/DME RNP-0.30 not authorized. 2. When VGSI inop, procedure not authorized at night. 3. Visibility reduction by helicopters not authorized.

3100'
MSA RW18





Gnd speed-Kts	70	90	100	120	140	160
Descent angle [3.24^]	401	516	573	688	803	917
MAP at RW18						

REIL
PAPI-L

3800' ↑ D→ HAMGA

STRAIGHT-IN LANDING RWY 18

LNAV
MDA(H) 1200'(556')

A	1
B	
C	1½
D	1¾

TERPS AMEND 1A 8 MAR 2012

CHANGES: Note.

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

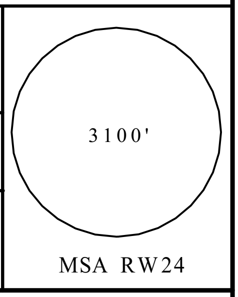
BRIEFING STRIP ™

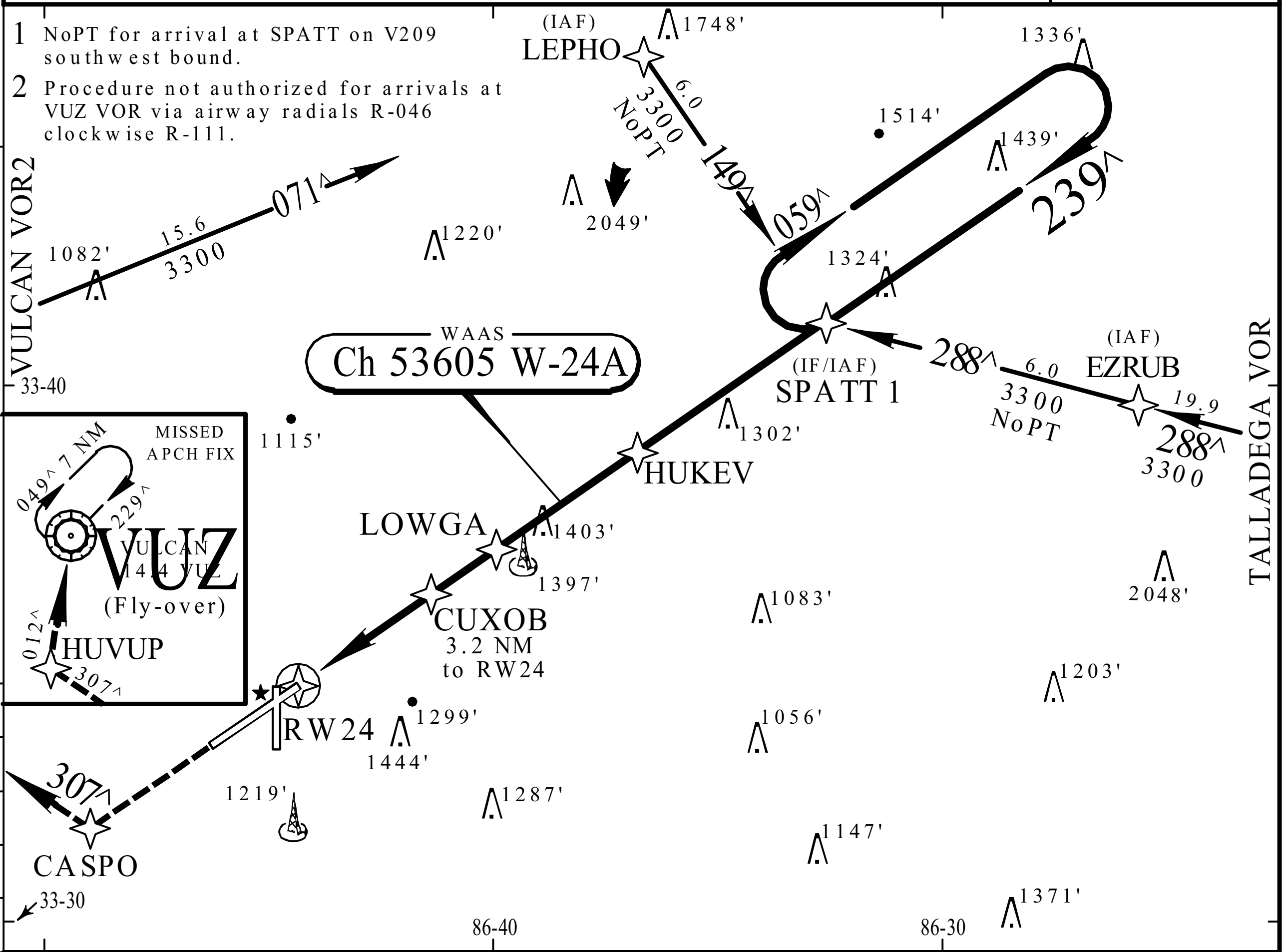
WAAS	Final Apch Crs	Minimum Alt LOWGA	LPV DA(H)	Apt Elev 650'
Ch 53605 W-24A	239^	2200'(1550')	971'(321')	TDZE 650'

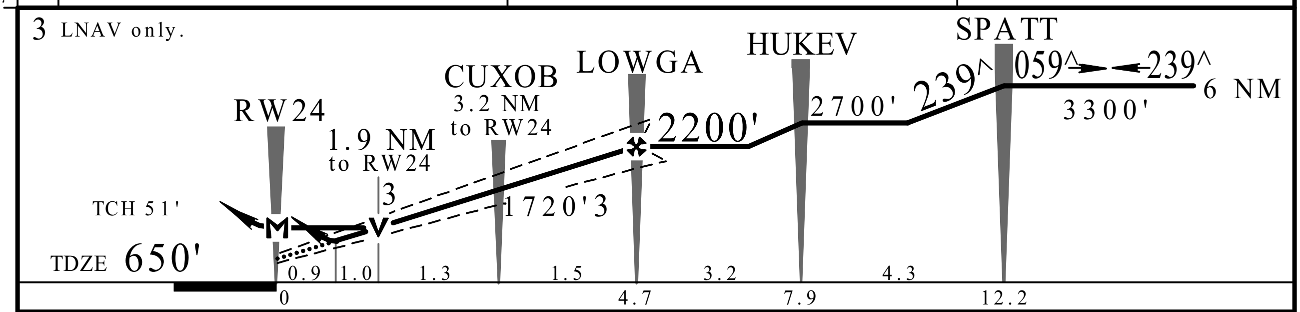
MISSED APCH: Climb to 3000' direct CASPO and via 307^ track to HUVUP and via 012^ track to VUZ VOR and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'

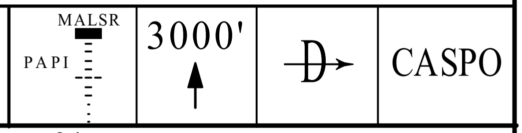
1. DME/DME RNP-0.30 not authorized. 2. VGSI and RNAV glidepath not coincident.
3. Visibility reduction by helicopters not authorized.







Gnd speed-Kts	70	90	100	120	140	160
Glide Path Angle 3.00^	372	478	531	637	743	849
MAP at RW24						



STRAIGHT-IN LANDING RWY 24

	LPV DA(H) 971'(321')		LNAV MDA(H) 1320'(670')	
		RAIL or ALS out	RAIL out	ALS out
A	RVR 40 or 3/4	RVR 60 or 1 1/4	RVR 40 or 3/4	RVR 50 or 1
B	RVR 40 or 3/4	RVR 60 or 1 1/4	RVR 40 or 3/4	RVR 50 or 1
C	RVR 40 or 3/4	RVR 60 or 1 1/4	RVR 60 or 1 1/4	1 3/4
D	RVR 40 or 3/4	RVR 60 or 1 1/4	1 1/2	2

TERPS AMEND 2A 23 SEP 2010

CHANGES: Procedure name.

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

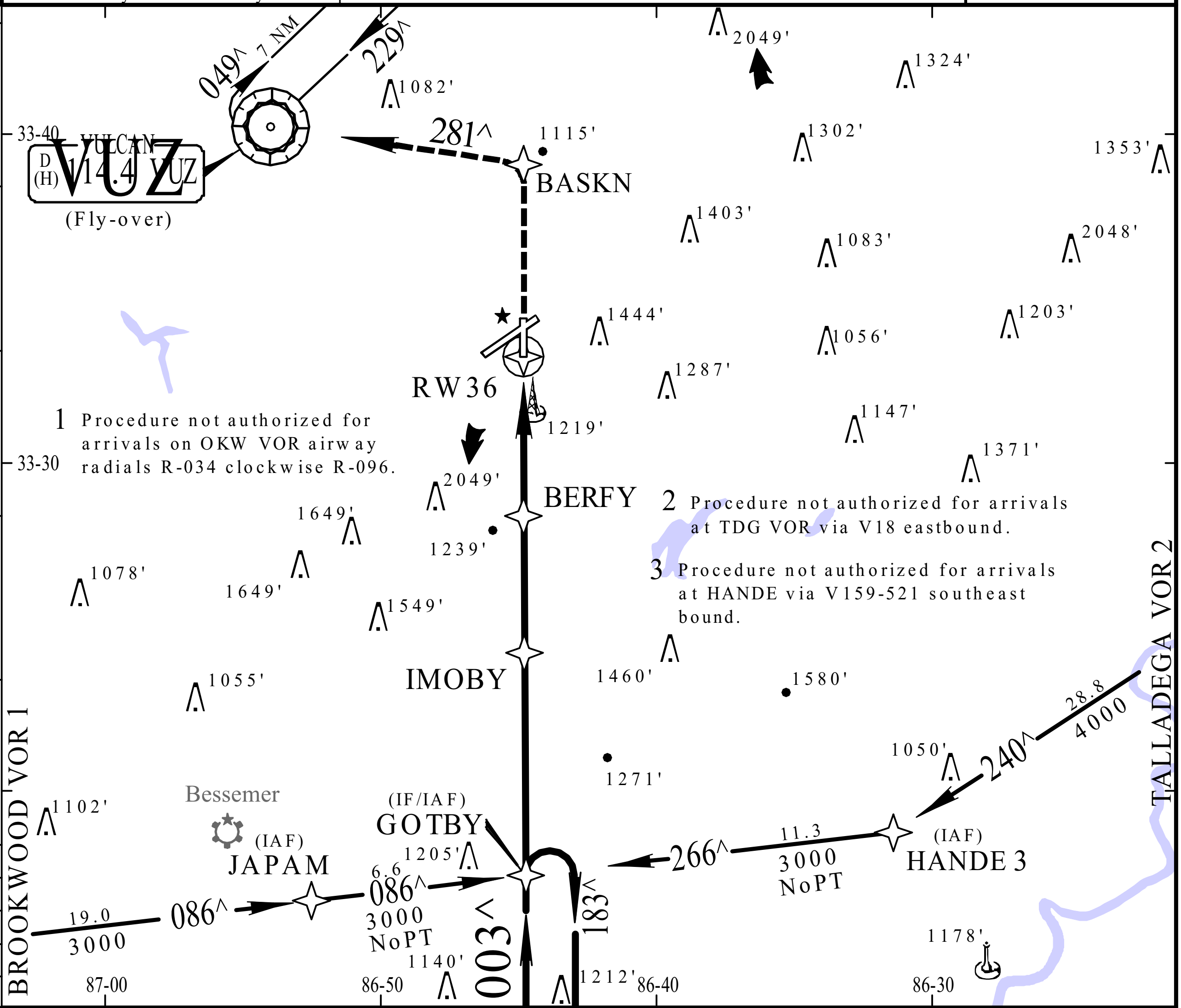
BRIEFING STRIP ™

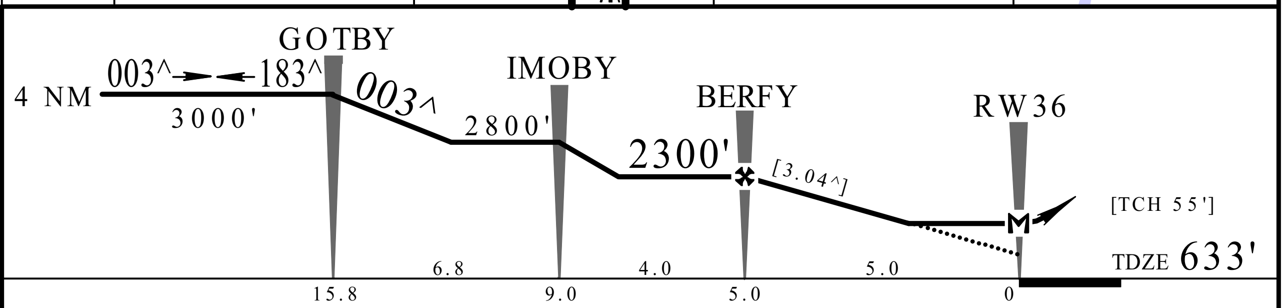
RNAV	Final Apch Crs	Minimum Alt BERFY	LNAV MDA(H) (CONDITIONAL)	Apt Elev 650'
	003^	2300'(1667')	1480'(847')	TDZE 633'

MISSED APCH: Climb to 3000' direct BASKN and via 281^ track to VUZ VOR and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'
1. DME/DME RNP-0.30 not authorized. 2. Procedure not authorized at night.
3. Visibility reduction by helicopters not authorized.

3100'
MSA RW36





Gnd speed-Kts	70	90	100	120	140	160
Descent angle [3.04^]	376	484	538	645	753	861
MAP at RW36						

REIL

3000' ↑ BASKN

STRAIGHT-IN LANDING RWY 36
LNAV

	DAY MDA(H) 1480'(847')	NIGHT
A	1	NA
B	1¼	NA
C	2½	NA
D	2¾	NA

TERPS AMEND 1 22 OCT 2009

CHANGES: None.

KBHM/BHM
-SHUTTLESWORTH INTL

JEPPESEN
22 JUL 11 (12-20)

BIRMINGHAM, ALA
RNAV (RNP) Z Rwy 6

ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

BRIEFING STRIP ™

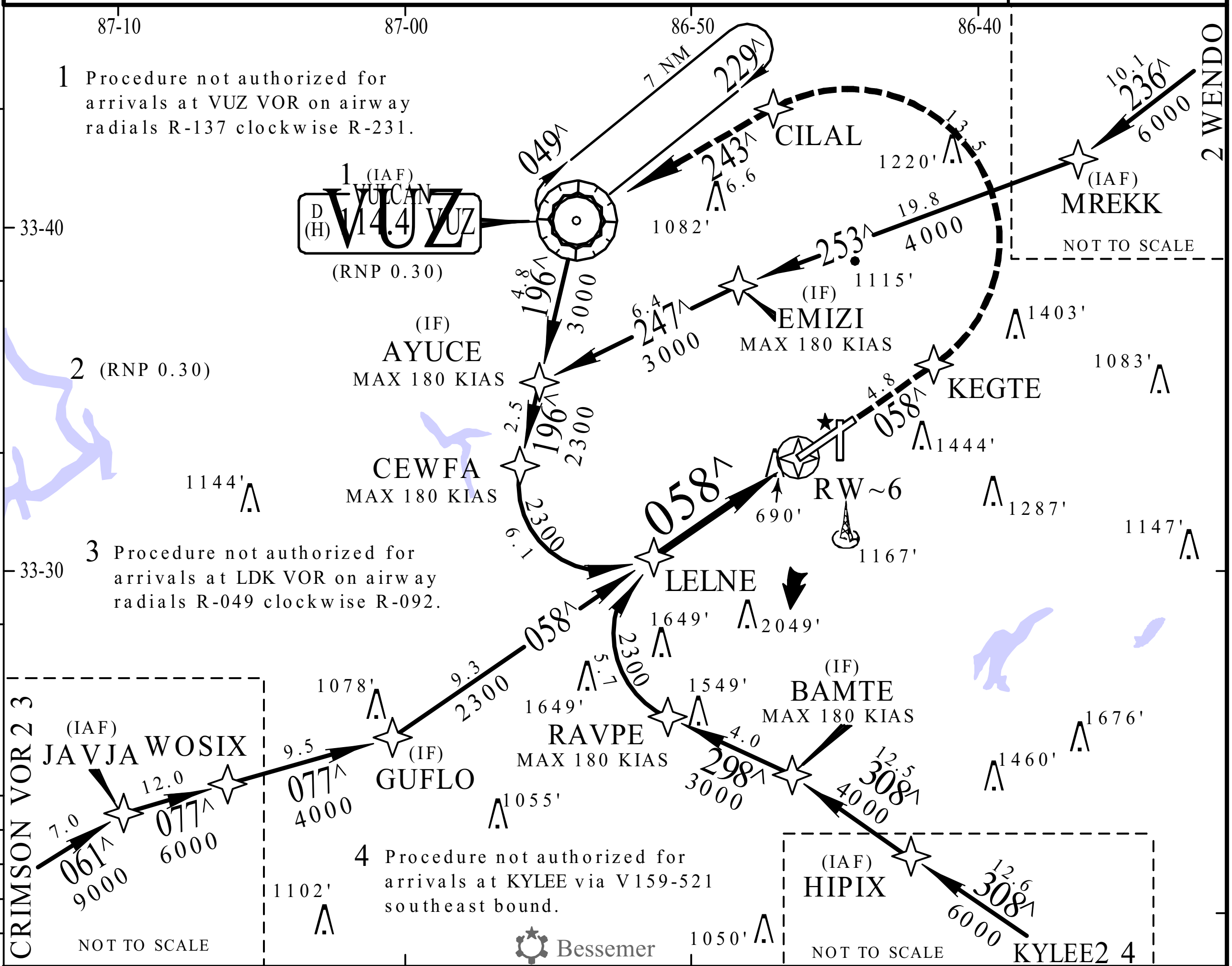
RNAV	Final Apch Crs 058^	Minimum Alt LELNE 2300'(1694')	RNP 0.30 DA(H) 1115'(509')	Apt Elev 650' TDZE 606'

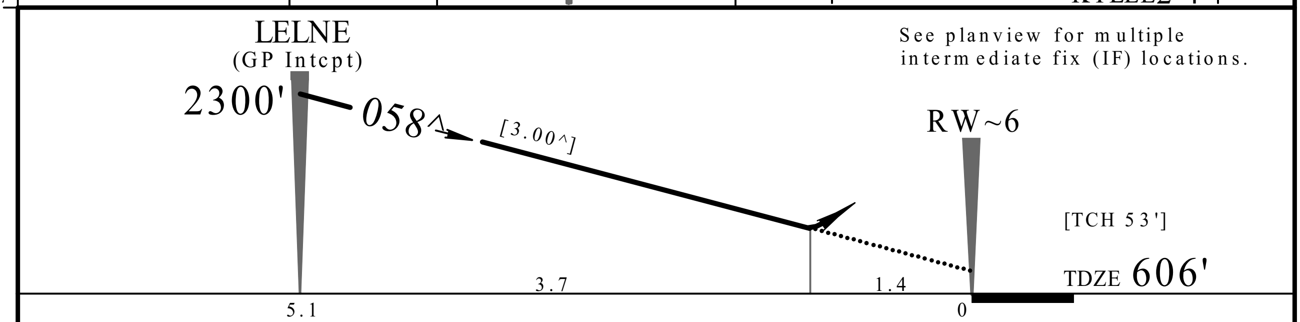
MSA RW~6: 3200'

MISSED APCH: Climb to 3000' on track 058^ to KEGTE and LEFT turn to CILAL and track 243^ to VUZ VOR and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'

1. AUTHORIZATION REQUIRED. 2. RF and GPS required.
3. For uncompensated Baro-VNAV systems, procedure not authorized below -8^C (18^F) or above 47^C (117^F). 4. VGSI and RNAV glidepath not coincident.





Gnd speed-Kts	70	90	100	120	140	160
Descent Angle [3.00^]	372	478	531	637	743	849
MAP at DA						

ALSF-II PAPI

3000' on 058^ KEGTE

STRAIGHT-IN LANDING RWY 6
RNP 0.30
DA(H) 1115'(509')

		ALS out
A B C D	RVR 60 or 1¼	1¾

TERPS AMEND 0A 28 JUL 2011

CHANGES: Procedure authorization note.

KBHM/BHM
-SHUTTLESWORTH INTL

JEPPESEN

22 JUL 11 (12-21)

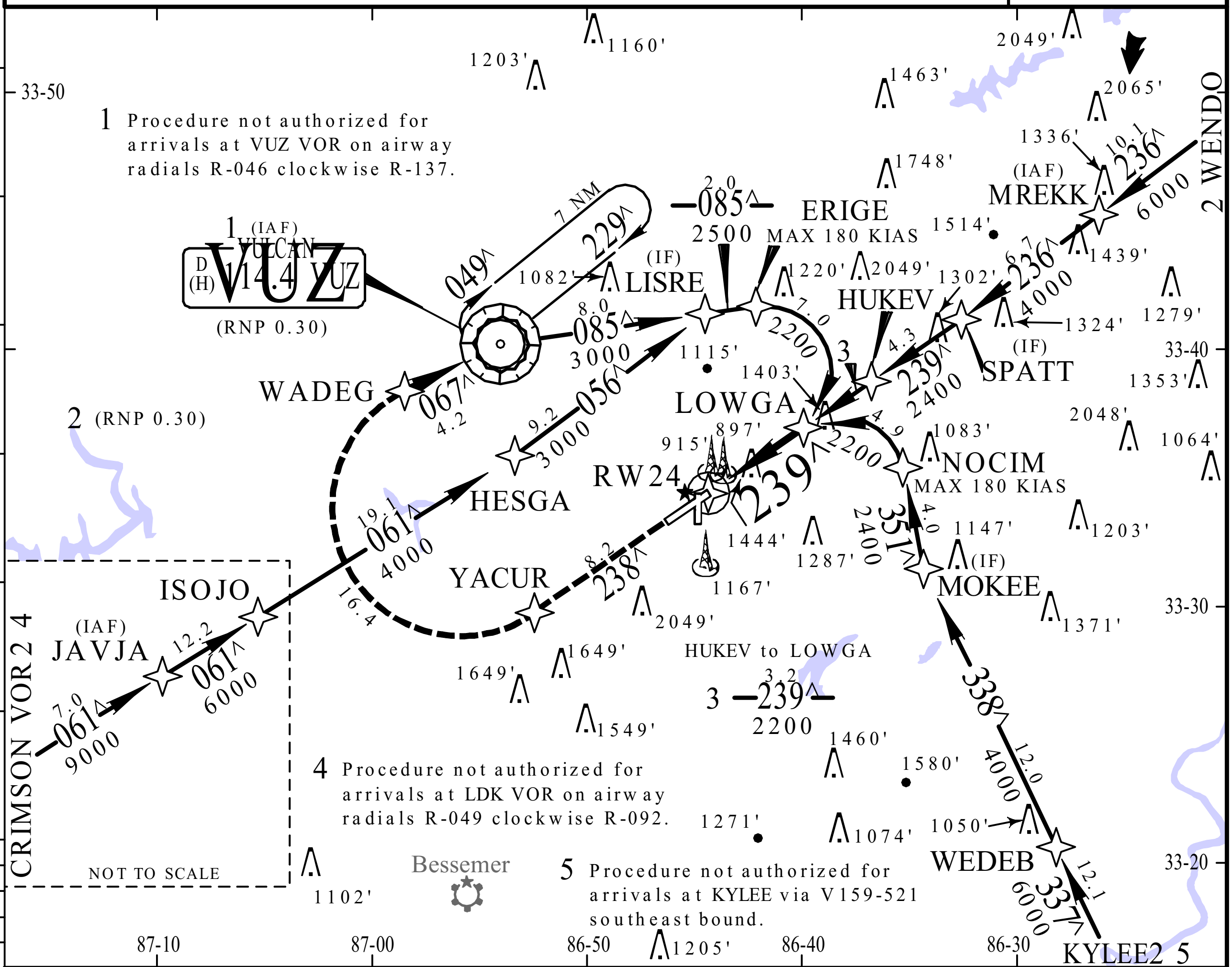
BIRMINGHAM, ALA
RNAV (RNP) Z Rwy 24

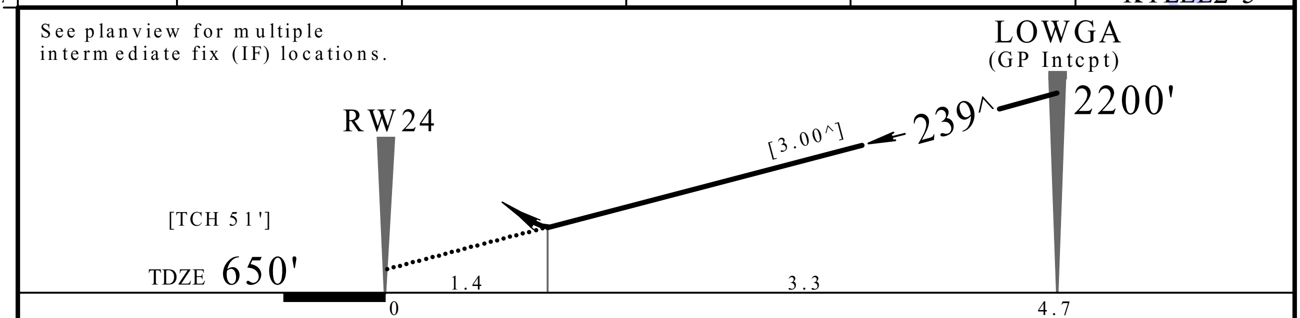
ATIS	BIRMINGHAM Approach (R)	BIRMINGHAM Tower	Ground
119.4	123.8	119.9	121.7

RNAV	Final Apch Crs	Minimum Alt LOWGA	RNP 0.15 DA(H)	Apt Elev	MSA RW24
	239^	2200'(1550')	1139'(489')	650' TDZE 650'	3200'

MISSED APCH: Climb to 3000' on track 238^ to YACUR and RIGHT turn to WADEG and track 067^ to VUZ VOR and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000'
1. AUTHORIZATION REQUIRED. 2. RF and GPS required.
3. For uncompensated Baro-VNAV systems, procedure not authorized below -8^C (17^F) or above 47^C (117^F). 4. VGSI and RNAV glidepath not coincident.





Gnd speed-Kts	70	90	100	120	140	160
Descent Angle [3.00^]	372	478	531	637	743	849
MAP at DA						

MALSR PAPI — 3000' on 238^ YACUR

STRAIGHT-IN LANDING RWY 24

	RNP 0.15 DA(H) 1139'(489')			RNP 0.30 DA(H) 1245'(595')	
		RAIL out	ALS out	RAIL out	ALS out
A B C D	RVR 60 or 1¼	1¾	1¾	2	

TERPS AMEND 0A 28 JUL 2011

CHANGES: Procedure authorization note.

JEPPESEN
e-Link for Windows

Chart changes since cycle 15-2013

ADD = added chart, REV = revised chart, DEL = deleted chart.

ACT	PROCEDURE IDENT	INDEX	REV DATE	EFF DATE

BIRMINGHAM, AL (BIRMINGHAM-SHUTTLESWORTH INTL - KBHM)

TERMINAL CHART CHANGE NOTICES

No Chart Change Notices for Airport KBHM

APPENDIX 2

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
1170404	SECONDE GMT ED55F2 for printout only	NA	CLOCK	150	1/4	1	NA
1170405	MINUTE GMT ED55F2 for printout only	NA	CLOCK	150	1/4	60	NA
1180104	HEURE BCD GMT ED55F2 for printout only	NA	CLOCK	150	1/64	3600	NA
120NMC	120 NM CAPT (B27 AND 28)	NA	FNCP1	273	1/4	NA	1= SELECTED
120NMF	120 NM F/O (B27 AND 28)	NA	FNCP2	273	1/4	NA	1= SELECTED
15NMC	15 NM CAPT (B24 AND 25)	NA	FNCP1	273	1/4	NA	1= SELECTED
15NMF	15 NM F/O (B24 AND 25)	NA	FNCP2	273	1/4	NA	1= SELECTED
1CAT1	MMR1 MODE ILS (CAT 1)	NA	MMR	33	1/4	NA	NA
1CAT2	MMR1 MODE ILS (CAT 2)	NA	MMR	33	1/4	NA	NA
1CAT3	MMR1 MODE ILS (CAT 3)	NA	MMR	33	1/4	NA	NA
1MLSCH	MLS CHANEL MMR1 (19-29)	NA	ILS or MMR DMC	33	NA	1	NA
1NOTCAT	MMR1 MODE ILS (CAT NOT ENCODED)	NA	MMR	33	1/4	NA	NA
201022	VOR CAPTAIN (LAB272	NA	FNCP1	NA	1	NA	1= SET
203022	VOR FIRST-OFFICER (LAB272	NA	FNCP2	NA	1	NA	1= SET
211120	LATITUDE POSITION FINE (BITS 9-19+29)	DA	FMC1	310	1/2	NA	NA
212080	LATITUDE POSITION COARSE (BITS 20-27)	DA	FMC1	310	1/2	NA	NA
215120	LATITUDE POSITION FINE (BITS 9-19+29)	DA	FMC2	310	1/2	NA	NA
216080	LATITUDE POSITION COARSE (BITS 20-27)	DA	FMC1	310	1/2	NA	NA
221120	LONGITUDE POSITION FINE (BITS 9-19+29)	DA	FMC1	311	1/2	NA	NA
222090	LONGITUDE POSITION COARSE (BITS 20-28)	DA	FMC1	311	1/2	NA	NA
225120	LONGITUDE POSITION FINE (BITS 9-19+29)	DA	FMC2	311	1/2	NA	NA
226090	LONGITUDE POSITION COARSE (BITS 20-28)	DA	FMC2	311	1/2	NA	NA
240NMC	240 NM CAPT (B28 AND 29)	NA	FNCP1	273	1/4	NA	1= SELECTED
240NMF	240 NM F/O (B28 AND 29)	NA	FNCP2	273	1/4	NA	1= SELECTED
2CAT1	MMR2 MODE ILS (CAT 1)	NA	MMR	33	1/4	NA	NA
2CAT2	MMR2 MODE ILS (CAT 2)	NA	MMR	33	1/4	NA	NA
2CAT3	MMR2 MODE ILS (CAT 3)	NA	MMR	33	1/4	NA	NA
2MLSCH	MLS CHANEL MMR2 (19-29)	NA	ILS or MMR DMC	33	NA	1	NA
2NOTCAT	MMR2 MODE ILS (CAT NOT ENCODED)	NA	MMR	33	1/4	NA	NA
30NMC	30 NM CAPT (B25 AND 26)	NA	FNCP1	273	1/4	NA	1= SELECTED
30NMF	30 NM F/O (B25 AND 26)	NA	FNCP2	273	1/4	NA	1= SELECTED
311032	TEST INITIATE CAPTAIN	NA	FNCP1	NA	1	NA	1= SET
313032	TEST INITIATE FIRST-OFFICER	NA	FNCP2	NA	1	NA	1= SET
331037	TCAS R-A COMBINATED CONTROL NOT USED	NA	TCAS	270	1	NA	NA
331045	TCAS R-A VERTICAL CONTROL NOT USED	NA	TCAS	270	1	NA	NA
331046	TCAS R-A VERTICAL CONTROL NOT USED	NA	TCAS	270	1	NA	NA
331047	TCAS R-A VERTICAL CONTROL NOT USED	NA	TCAS	270	1	NA	NA
331076	TCAS R-A NOT USED	NA	TCAS	270	1	NA	NA
331077	TCAS R-A NOT USED	NA	TCAS	270	1	NA	NA
331106	TCAS R-A NOT USED	NA	TCAS	270	1	NA	NA
331107	TCAS R-A NOT USED	NA	TCAS	270	1	NA	NA
335120	SEL.BARO SETT. CPT FINE	MB	FCU DMC	234	1/4	0.1	NA
336070	SEL.BARO SETT. CPT COARSE	MB	FCU DMC	234	1/4	100	NA
337120	SEL.BARO SETT. F/O FINE	MB	FCU DMC	236	1/4	0.1	NA
338070	SEL.BARO SETT. F/O COARSE	MB	FCU DMC	236	1/4	100	NA
375092	SELECTED COURSE VOR1	DA	VOR	100	1	0.70313	NA
385092	SELECTED COURSE VOR2	DA	VOR	100	1	0.70313	NA
455002	SELECTED HEADING	DA	FCU	101	1	0.70313	NA
495112	ALTITUDE	FT	FNSG1/3-2/3	203	1	NA	NA
515020	DME1 FREQUENCY LSB	MHZ	DME1	35	1/4	0.05	NA
515100	DME1 FREQUENCY	MHZ	DME1	35	1/4	0.1	NA
517020	DME2 FREQUENCY LSB	MHZ	DME2	35	1/4	0.05	NA
517100	DME2 FREQUENCY	MHZ	DME2	35	1/4	0.1	NA
535042	ALTITUDE (Bits 24to27)	FT	FNSG1/3-2/3	203	1/4	NA	NA
538010	SECONDE UTC	NA	F/O CLOCK	150	1/4	NA	NA
538070	MINUTE UTC	NA	F/O CLOCK	150	1/4	NA	NA
545000	HEURE UTC	NA	F/O CLOCK	150	1/64	NA	NA
545049	CYCLE COMPTEUR FOR SUPER-FRAME BITS 9-12	NA	NA	NA	1/4	NA	NA
545110	SELECTED DECISION HEIGHT FINE CAPTAIN	FT	EFIS CTL PANEL SGU	370	1/64	NA	NA

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
545120	SELECTED DECISION HEIGHT FINE FIRST-OFFICER	FT	EFIS CTL PANEL SGU	370	1/64	NA	NA
546000	CENTER OF GRAVITY	%	CGCC	76	1/64	NA	NA
546010	GROSS WEIGHT LSH	LBS	FMC	75	1/64	40	NA
546012	GROSS WEIGHT LSH	KG	FMC	75	1/64	18.14	NA
546020	GROSS WEIGHT MSH	LBS	FMC	75	1/64	10240	NA
546022	GROSS WEIGHT MSH	KG	FMC	75	1/64	4644.79	NA
546030	TRIM TANK QUANTITY	LBS	FQI	263	1/64	4	NA
546032	TRIM TANK QUANTITY	KG	FQI	263	1/64	1.81	NA
546070	AIRCRAFT TYPE IDENT	NA	DFDAU	NA	1/64	NA	NA
546072	FLEET IDENT	NA	DFDAU	NA	1/64	NA	NA
546080	AIRCRAFT TAIL NUMBER	NA	DFDAU	NA	1/64	NA	NA
546082	FRAME SELECT	NA	DFDAU	NA	1/64	NA	NA
546110	SELECTED DECISION HEIGHT COARSE CAPTAIN	FT	EFIS CTL PANEL SGU	370	1/64	NA	NA
546120	SELECTED DECISION HEIGHT COARSE FIRST-OFFICER	FT	EFIS CTL PANEL SGU	370	1/64	NA	NA
546140	FLIGHT NUMBER LSH	NA	FMC	261	1/64	NA	NA
546150	FLIGHT NUMBER MSH	NA	FMC	261	1/64	NA	NA
555000	LEFT OUTER TANK FUEL QUANTITY	LBS	FQI	256	1/64	32	NA
555002	LEFT OUTER TANK FUEL QUANTITY	KG	FQI	256	1/64	14.5	NA
555010	LEFT INNER TANK FUEL QUANTITY	LBS	FQI	257	1/64	32	NA
555012	LEFT INNER TANK FUEL QUANTITY	KG	FQI	257	1/64	14.5	NA
555020	CENTER TANK FUEL QUANTITY	LBS	FQI	260	1/64	32	NA
555022	CENTER TANK FUEL QUANTITY	KG	FQI	260	1/64	14.5	NA
555030	RIGHT INNER TANK FUEL QUANTITY	LBS	FQI	261	1/64	32	NA
555032	RIGHT INNER TANK FUEL QUANTITY	KG	FQI	261	1/64	14.5	NA
555040	RIGHT OUTER TANK FUEL QUANTITY	LBS	FQI	262	1/64	32	NA
555042	RIGHT OUTER TANK FUEL QUANTITY	KG	FQI	262	1/64	14.5	NA
555050	AC1 TANK FUEL QUANTITY	LBS	FQI	264	1/64	32	NA
555052	AC1 TANK FUEL QUANTITY	KG	FQI	264	1/64	14.5	NA
555060	AC2 TANK FUEL QUANTITY	LBS	FQI	265	1/64	32	NA
555062	AC2 TANK FUEL QUANTITY	KG	FQI	265	1/64	14.5	NA
565082	MLS CHANEL MMR1 FINE (19-26)	NA	MMR DMC	33	1/4	NA	NA
565120	ILS1 OR MMR1 FREQUENCY 1 0.1 0.01 mhz	NA	ILS or MMR DMC	33	1/4	NA	NA
565123	GLS FREQUENCY MMR1 LSP	NA	MMR1 DMC	33	1/4	1	NA
566020	ADF1 FREQUENCY 1000 and 0.5 khz	KHZ	ADF DMC	32	1/4	NA	NA
566032	ILS1 OR MMR1 FREQUENCY 100 and 10 mhz	NA	ILS or MMR DMC	33	1/4	NA	NA
566033	GLS FREQUENCY MMR1 MSP1	NA	MMR1 DNC	33	1/4	4096	NA
566034	MLS CHANEL MMR1 COARSE (27-29)	NA	MMR DMC	33	1/4	NA	NA
566049	GLS FREQUENCY MMR1 MSP2	NA	MMR1 DNC	33	1/4	NA	NA
566050	MMR1 MODE ILS (NOT USED)	NA	MMR	33	1/4	NA	NA
566060	MMR1 MODE ILS (NOT USED)	NA	MMR	33	1/4	NA	NA
566070	MMR1 MODE ILS (NOT USED)	NA	MMR	33	1/4	NA	NA
566120	MMR1 MODE ILS (RSVD)	NA	MMR	33	1/4	NA	NA
566140	MMR1 MODE ILS (RSVD)	NA	MMR	33	1/4	NA	NA
566150	MMR1 MODE ILS (RSVD)	NA	MMR	33	1/4	NA	NA
567080	MLS CHANEL MMR2 FINE (19-26)	NA	MMR DMC	33	1/4	NA	NA
567120	ILS2 OR MMR2 FREQUENCY 1 0.1 0.01 mhz	NA	ILS or MMR DMC	33	1/4	NA	NA
567123	GLS FREQUENCY MMR2 LSP	NA	MMR2 DMC	33	1/4	1	NA
568020	ADF2 FREQUENCY 1000 and 0.5 khz	KHZ	ADF DMC	32	1/4	NA	NA
568032	ILS2 OR MMR2 FREQUENCY 100 and 10 mhz	NA	ILS or MMR DMC	33	1/4	NA	NA
568033	GLS FREQUENCY MMR2 MSP	NA	MMR2 DMC	33	1/4	4096	NA
568034	MLS CHANEL MMR2 COARSE (27-29)	NA	MMR DMC	33	1/4	NA	NA
568049	GLS FREQUENCY MMR2 MSP2	NA	MMR2 DNC	33	1/4	NA	NA
568050	MMR2 MODE ILS (NOT USED)	NA	MMR	33	1/4	NA	NA
568060	MMR2 MODE ILS (NOT USED)	NA	MMR	33	1/4	NA	NA
568070	MMR2 MODE ILS (NOT USED)	NA	MMR	33	1/4	NA	NA
568120	MMR2 MODE ILS (RSVD)	NA	MMR	33	1/4	NA	NA
568140	MMR2 MODE ILS (RSVD)	NA	MMR	33	1/4	NA	NA
568150	MMR2 MODE ILS (RSVD)	NA	MMR	33	1/4	NA	NA
576120	ADF1 FREQUENCY 100 10 1 khz	KHZ	ADF DMC	32	1/4	NA	NA

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
578120	ADF2 FREQUENCY 100 10 1 khz	KHZ	ADF DMC	32	1/4	NA	NA
603033	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
603034	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
603035	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
603036	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
603037	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
60NMC	60 NM CAPT (B26 AND 27)	NA	FNCP1	273	1/4	NA	1= SELECTED
60NMF	60 NM F/O (B26 AND 27)	NA	FNCP2	273	1/4	NA	1= SELECTED
9545000	UTC	NA	F/O CLOCK	150	NA	NA	NA
9546010	GROSS-WEIGHT LSH	NA	NA	NA	NA	NA	NA
9546012	GROSS-WEIGHT LSH	NA	NA	NA	NA	NA	NA
9546020	GROSS-WEIGHT MSH	NA	NA	NA	NA	NA	NA
9546022	GROSS-WEIGHT MSH	NA	NA	NA	NA	NA	NA
9546110	SELECTED DECISION HEIGHT COARSE CAPTAIN	NA	NA	NA	NA	NA	NA
9546120	SELECTED DECISION HEIGHT COARSE FIRST-OFFICER	NA	NA	NA	NA	NA	NA
9546140	FLIGHT NUMBER LSH	NA	NA	NA	NA	NA	NA
9546150	FLIGHT NUMBER MSH	NA	NA	NA	NA	NA	NA
9565123	GLS FREQUENCY MMR1	MHZ	MMR1 DMC	33	NA	1	NA
9567123	GLS FREQUENCY MMR2	MHZ	MMR2 DMC	33	NA	1	NA
A+BSMOW	AFT + BULK COMPT SMOKE (SINGLE LOOP)	NA	FWC	NA	1	NA	1= WARNING
AC1COR	AIR CONDITIONNING.1	NA	TCC	273/11	1/4	NA	1=CORR THRUST APPLIED
AC2COR	AIR CONDITIONNING.2	NA	TCC	273/12	1/4	NA	1=CORR THRUST APPLIED
ACABSMOW	AFT CABIN SMOKE	NA	FWC	NA	1	NA	1= WARNING
ACB1OFF	AC BUS 1 OFF (NOT B12 AND NOT 13)	NA	SDAC	270/12-13	1/4	NA	0= OFF
ACB1SOFF	AC BUS 1 OFF	NA	RELAY	NA	1/4	NA	1= OFF
ACB2OFF	AC BUS 2 OFF (NOT B24 AND NOT 25)	NA	NA	270/24-25	1/4	NA	0= OFF
ACRGSMOW	AFT MAIN DECK CARGO SMOKE (POL FREIGHT)	NA	FWC	NA	1	NA	1= WARNING
ACT1QKG	AC1 TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
ACT1QLB	AC1 TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
ACT2QKG	AC2 TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
ACT2QLB	AC2 TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
ACTAIL	AIRCRAFT TAIL NUMBER	NA	NA	NA	NA	NA	NA
ACTYPE	AIRCRAFT TYPE IDENT	NA	NA	NA	NA	NA	NA
ADC1F	ADC.1 FAULT	NA	FWC	NA	1	NA	1= WARNING
ADC2F	ADC.2 FAULT	NA	FWC	NA	1	NA	1= WARNING
ADCUC	ADC USED ON CPT BUS	NA	FNSG1/3	271/16	1	NA	1=ADC2
ADCUF	ADC USED ON F/O BUS	NA	FNSG2/3	271/16	1	NA	1=ADC2
ADFF1	ADF1 FREQUENCY	KHZ	ADF DMC	32	NA	NA	NA
ADFF2	ADF2 FREQUENCY	KHZ	ADF DMC	32	NA	NA	NA
ADVNOTONE	TCAS R-A VERTICAL CONTROL ADV.IS NOT ONE OF THE FOLLOW.TYPES	NA	TCAS	270	1	NA	NA
AFTLDG	FLIGHT PHASE AFTER LANDING	NA	FWC1	270/11-12-13-14	1	NA	NA
AFTSMOW	AFT COMPT SMOKE (DUAL LOOP)	NA	FWC	NA	1	NA	1= WARNING
AILL	LEFT AILERON	DA	SDAC	310	4	0.088	>0= AIL. DOWN TURN RIGHT
AILLHBW	FCTL WARNING ROLL LH BLUE AILERON	NA	FWC	NA	1	NA	1= WARNING
AILLHGW	FCTL WARNING ROLL LH GREEN AILERON	NA	FWC	NA	1	NA	1= WARNING
AILLHYW	FCTL WARNING ROLL LH YELLOW AILERON	NA	FWC	NA	1	NA	1= WARNING
AILR	RIGHT AILERON	DA	SDAC	310	4	0.088	>0= AIL.DOWN TURN LEFT
AILRHBW	FCTL WARNING ROLL RH BLUE AILERON	NA	FWC	NA	1	NA	1= WARNING
AILRHGW	FCTL WARNING ROLL RH GREEN AILERON	NA	FWC	NA	1	NA	1= WARNING
AILRHYW	FCTL WARNING ROLL RH YELLOW AILERON	NA	FWC	NA	1	NA	1= WARNING
AILT	AILERON TRIM	DA	SYNCHRO	NA	1	0.096	>0= LEFT
AILTS	AILERON TRIM SYNCHRO	DA	SYNCHRO	NA	1	1	>0= LEFT

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
AILTT	AILERON TRIM TOTAL	DA	SYNCHRO	NA	1	1	>0= LEFT
ALAND12	AUTOLAND LOGIC 1 OR 2	NA	FWC	NA	1	NA	1= WARNING
ALT	ALTITUDE (Bits 14to27+29)	FT	FNSG1/3-2/3	203	NA	4	NA
ALTACQ	ALTITUDE ACQUIRE	NA	FCC	274/13-29	1	NA	1= SET
ALTC	COARSE ALTITUDE (Bits 23to27)	FT	FNSG1/3-2/3	203	1/4	2048	NA
ALTF	FINE ALTITUDE(Bits 14to23+29)	FT	FNSG1/3-2/3	203	1	4	NA
ALTH	ALTITUDE HOLD	NA	FCC	274/13-22	1	NA	1= SET
ALTLOST	TCAS R-A COMBINATED CONTROL ALTITUDE LOST	NA	TCAS	270	1	NA	NA
ALTRADC	ALTITUDE RATE	FT/MN	ADC1	212	1	8	>0=UP
AP12OFF	AUTO-PILOT OFF LOGIC1 OR 2 ************** SEE LOGIC	NA	FWC	71	1	NA	1= WARNING
AP1E	AUTO-PILOT 1 COMMAND	NA	FCC1	146/12	1	NA	1= ENGAGED
AP2E	AUTO-PILOT 2 COMMAND	NA	FCC2	146/12	1	NA	1= ENGAGED
APALAND12	AUTO-PILOT OFF AUTOLAND LOGIC1 OR 2 (BELOW 200FT)	NA	FWC	NA	1	NA	1= WARNING
APOFF	AUTO-PILOT OFF	NA	FWC	71	1	NA	1= OFF
APP	FLIGHT PHASE APPROACH	NA	FWC1	270/11-12-13-14	1	NA	NA
APU	APU PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
APUBV	A.P.U BLEED VALVE NOT FULLY OPEN	NA	SDAC	145/15	1/4	NA	1= NOT OPEN
ARCC	ARC MODE CAPT	NA	FNCP1	273/23	1/4	NA	1= SELECTED
ARCF	ARC MODE F/O	NA	FNCP2	273/23	1/4	NA	1= SELECTED
ASKIDAOFF	BRAKE ANTI-SKID SEL ALT/OFF	NA	BRAKE CTL	NA	1	NA	1= SELECTED
ASKIDAON	BRAKE ANTI-SKID SEL ALT/ON	NA	BRAKE CTL	NA	1	NA	1= SELECTED
ASKIDN	BRAKE ANTI-SKID SEL NORMAL/ON	NA	BRAKE CTL	NA	1	NA	1= SELECTE
ATHRAFLOOR	A/THR ALPHA FLOOR ENGAGED	NA	TCC	274/28	1	NA	1= ENGAGED
ATHRCLUTCH	A/THR CLUTCHES OFF (T/O)	NA	TCC	274/16	1	NA	1= OFF
ATHRE	A/THR MODE ENGAGED	NA	TCC	274/13	1	NA	1= ENGAGED
ATHREPR	A/THR THRUST EPR MODE ENGAGED (PW ENGINE)	NA	TCC	274/19	1	NA	1= ENGAGED
ATHRMACH	A/THR MACH MODE ENGAGED	NA	TCC	274/20	1	NA	1= ENGAGED
ATHRMAN	A/THR MANUAL THROTTLE ARMED	NA	TCC	274/12	1	NA	1=MAN ARMED
ATHRN1	A/THR THRUST N1 MODE ENGAGED (GE ENGINE)	NA	TCC	274/18	1	NA	1= ENGAGED
ATHRRTD	A/THR RETARD MODE ENGAGED	NA	TCC	274/22	1	NA	1= ENGAGED
ATHRSPD	A/THR SPEED MODE ENGAGED	NA	TCC	274/21	1	NA	1= ENGAGED
ATHRVNAV	A/THR VNAV MODE PROFILE ENGAGED	NA	TCC	274/17	1	NA	1= ENGAGED
ATSARM	ATS ARMING LEVER OFF	NA	TCC	274/11	1	NA	1= OFF
AVISMOW	AVIONICS SMOKE	NA	FWC	NA	1	NA	1= WARNING
B+GSLP	BLUE+GREEN SYS. LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
B+GSVLP	BLUE+GREEN SERVO LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
B+YSLP	BLUE+YELLOW SYS. LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
B+YSVLP	BLUE+YELLOW SERVO LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
BARSTDC	CAPT BARO CORRECTED/STD ALTITUDE	NA	BAROSETCPT	NA	1	NA	1=BARO CORRECTED
BARSTDF	F/O BARO CORRECTED/STD ALTITUDE	NA	BAROSETF/O	NA	1	NA	1=BARO CORRECTED
BATSMOW	BATTERY SMOKE	NA	FWC	NA	1	NA	1= WARNING
BLEED	BLEED PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
BRKLOW	AUTO BRAKE MODE LOW	NA	BRAKE CTL	NA	1	NA	1= ARMED
BRKMAX	AUTO BRAKE MODE MAX	NA	BRAKE CTL	NA	1	NA	1= ARMED
BRKMED	AUTO BRAKE MODE MED	NA	BRAKE CTL	NA	1	NA	1= ARMED
BRKPDL	BRAKE PEDAL DEFLECTION LH	DA	BSCU	NA	1	0.264	NA
BRKPDR	BRAKE PEDAL DEFLECTION RH	DA	BSCU	NA	1	0.264	NA
BRKPTGL	BRAKE PRESSURE TRANS LH GREEN SYSTEM	BAR	BSCU LLDC	NA	1	4	NA
BRKPTGR	BRAKE PRESSURE TRANS RH GREEN SYSTEM	BAR	BSCU LLDC	NA	1	4	NA
BRKVPYL	BRAKE VALVE PRESSURE LH YELLOW SYSTEM	BAR	INDIC.TRIPLE	NA	1	3.175	NA
BRKVPYR	BRAKE VALVE PRESSURE RH YELLOW SYSTEM	BAR	INDIC.TRIPLE	NA	1	3.175	NA
BULKSMOW	BULK COMPT SMOKE (DUAL LOOP)	NA	FWC	NA	1	NA	1= WARNING

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
BVSW1OFF	ENG.1 BLEED VALVE SWITCH OFF	NA	FWC	276/20	1/4	NA	1= OFF
BVSW2OFF	ENG.2 BLEED VALVE SWITCH OFF	NA	FWC	276/21	1/4	NA	1= OFF
BVSWAPUOFF	APU BLEED VALVE SWITCH OFF	NA	FWC	276/22	1/4	NA	1= OFF
CABALTW	EXCESS CABIN ALTITUDE	NA	FWC	NA	1	NA	1= WARNING
CABPR1F	CABIN PRESSURE REG.1 FAULT	NA	FWC	NA	1	NA	1= WARNING
CABPR2F	CABIN PRESSURE REG.2 FAULT	NA	FWC	NA	1	NA	1= WARNING
CANCELW	CANCELLED WARNING	NA	FWC	NA	1	NA	1= ON
CAS	INDICATED AIRSPEED	KT	FNSG1/3-2/3	206	1	0.5	NA
CAUTIONOBST	CAUTION OBSTACLE OR OBSTACLE AHEAD	NA	(E)GPWS	270/28	1	NA	1= WARNING ON
CAUTIONTERR	CAUTION TERRAIN	NA	(E)GPWS	270/21	1	NA	1= WARNING ON
CCCLN	CAPTAIN CONTROL COLUMN POSITION	DA	POT	NA	4	NA	>0= NOSE DOWN
CCCLNF	CAPTAIN CONTROL COLUMN FORCE	N	FTUCCCPT	330	1	1	>0= NOSE DOWN
CCWHF	CAPTAIN CONTROL WHEEL FORCE	N	FTUCWCPT	310	1	1	>0= TURN LEFT
CCWHL	CAPTAIN CONTROL WHEEL POSITION	DA	EFCU1	71	4	0.18543	>0= TURN LEFT
CG	COMPUTED CENTER OF GRAVITY	%	NA	NA	NA	0.02	NA
CGRGSMOW1	MAIN DECK CARGO SMOKE (MID1/POL FREIGHT/POL COMBI)	NA	FWC	NA	1	NA	1= WARNING
CGRGSMOW2	MID2 MAIN DECK CARGO SMOKE	NA	FWC	NA	1	NA	1= WARNING
CGW	EXCESS AFT CG	NA	FWC	NA	1	NA	1= WARNING
CHECKATT	CHECK ATT	NA	FWC	145/12	1	NA	1= WARNING
CHECKHDG	CHECK HDG	NA	FWC	145/12	1	NA	1= WARNING
CLB1	FLIGHT PHASE CLIMB1	NA	FWC1	270/11-12-13-14	1	NA	NA
CLB2	FLIGHT PHASE CLIMB2	NA	FWC1	270/11-12-13-14	1	NA	NA
CLIMB	TCAS R-A CLIMB	NA	TCAS	NA	1	NA	NA
CLOCKGPS	CLOCK SYNCHRONISED BY GPS	NA	F/O CLOCK	150/11	1/4	NA	1=YES
CLRCFL	TCAS R-A COMBINATED CONTROL CLEAR OF CONFLICT	NA	TCAS	270	1	NA	NA
CMACH	CALCULATED MACH NUMBER	NA	FROM ALT & CAS	NA	NA	NA	NA
COCKPIT	FLIGHT PHASE COCKPIT PREPARATION	NA	FWC1	270/11-12-13-14	1	NA	NA
COND	COND PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
CP1F	PILOT CP FAULT	NA	EFIS SGU	350/14	1/4	NA	1= FAULT
CP2F	F/O CP FAULT	NA	EFIS SGU	350/15	1/4	NA	1= FAULT
CREWAUTO	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	016/15-16-17	1/4	NA	NA
CREWSTBY	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
CREWTA	TCAS SENS. LEVEL CREW SEL.	NA	TCAS	16	1/4	NA	NA
CROSSING	TCAS R-A VERTICAL CONTROL CROSSING	NA	TCAS	270	1	NA	NA
CROSSTRK	CROSS TRACK ERROR	NM	FMC1/2	116	1	0.0625	NA
CRZ	FLIGHT PHASE CRUISE	NA	FWC1	270/11-12-13-14	1	NA	NA
CSAT	CALCULATED STATIC AIR TEMPERATURE (NOT RECORDED)	NA	FROM TAT & CAL.MACH	NA	NA	NA	NA
CTASTAT	CALCULATED TRUE AIRSPEED (NOT RECORDED)	KT	FROM TAT & CAL.MACH	NA	NA	NA	NA
CTQKG	CENTER TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
CTQLB	CENTER TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
CVERTDEV	VERTICAL DEVIATION.1	MA	FMC1	117	1	1	NA
CVERTDEVRES	VERTICAL DEVIATION RES.1	NA	FMC1	271/09	1	NA	1= FINAPP ACTIVE
CWS1	AUTO-PILOT 1 CWS MODE	NA	FCC1	146/11	1	NA	1= ENGAGED
CWS2	AUTO-PILOT 2 CWS MODE	NA	FCC2	146/11	1	NA	1= ENGAGED
CWXRMAP	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= MAP ONLY
CWXRSTBY	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= STANDBY
CWXRTST	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= TEST
CWXRTUR	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= TURB. ONLY
CWXRTWS	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WXR+TURB

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
CWXRWSHAZS	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WINDSHEAR HAZARD FACTOR
CWXRWSIC	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WINDSHEAR ICON
CWXRWXR	CAPTAIN RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WEATHER ONLY
DA	DRIFT ANGLE	DA	IRS 1/3	321	1	0.088	NA
DAY	DATE DAY	NA	CLOCK-CPT	260	1/64	NA	NA
DCBF	DC NORMAL BUS OFF	NA	FWC	276/17	1/4	NA	1= OFF
DESCEND	TCAS R-A DESCEND	NA	TCAS	270	1	NA	NA
DMEDME	NAVIGATION MODES INERTIAL DME/DME	NA	FMC	270/13-15	1	NA	NA
DMEF1	DME1 FREQUENCY ELAB.	MHZ	DME DMC	35	NA	NA	NA
DMEF2	DME2 FREQUENCY ELAB.	MHZ	DME DMC	35	NA	NA	NA
DMEID1	DME1/ILS DISTANCE	NM	DME	202	1/4	0.125	NA
DMEID2	DME2/ILS DISTANCE	NM	DME	202	1/4	0.125	NA
DMEVD1	DME1/VOR DISTANCE	NM	DME	201	1/4	1	NA
DMEVD2	DME2/VOR DISTANCE	NM	DME	201	1/4	1	NA
DONTSINK	DON'T SINK	NA	(E)GPWS	270/14	1	NA	1= WARNING ON
DOOR	DOOR PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
DROPTRK	TCAS R-A COMBINATED CONTROL DROP TRACK	NA	TCAS	270	1	NA	NA
DTCLB	TCAS R-A DON'T CLIMB	NA	TCAS	270	1	NA	NA
DTCLB1000	TCAS R-A DON'T CLIMB >1000FT	NA	TCAS	270	1	NA	NA
DTCLB2000	TCAS R-A DON'T CLIMB >2000FT	NA	TCAS	270	1	1	NA
DTCLB500	TCAS R-A DON'T CLIMB >500FT	NA	TCAS	270	1	NA	NA
DTDES	TCAS R-A DON'T DESCEND	NA	TCAS	270	1	NA	NA
DTDES1000	TCAS R-A DON'T DESCEND >1000FT	NA	TCAS	270	1	NA	NA
DTDES2000	TCAS R-A DON'T DESCEND >2000FT	NA	TCAS	270	1	NA	NA
DTDES500	TCAS R-A DON'T DESCEND >500FT	NA	TCAS	270	1	NA	NA
DWNADVCOR	TCAS R-A COMBINATED CONTROL DOWN ADVISORY CORRECTIVE	NA	TCAS	270	1	NA	NA
ECU1F	ECU FAULT ENG.1 GE ENGINES	NA	ECU	270/25	1/4	NA	1= FAULT
ECU2F	ECU FAULT ENG.2 GE ENGINES	NA	ECU	270/25	1/4	NA	1= FAULT
EEC1F	EEC FAULT ENG.1 PW ENGINES	NA	EEC	350/15	1/4	NA	1= FAULT
EEC2F	EEC FAULT ENG.2 PW ENGINES	NA	EEC	350/15	1/4	NA	1= FAULT
EGT1PG	E.G.T ENG.1 PW & GE ENGINES	DC	FADEC EEC/ECU	345	1	1	NA
EGT2PG	E.G.T ENG.2 PW & GE ENGINES	DC	FADEC EEC/ECU	345	1	1	NA
EGTI1	E.G.T ENG.1 (WITHOUT FADEC)	DC	EGT INDICATOR	NA	1	0.224	NA
EGTI2	E.G.T ENG.2 (WITHOUT FADEC)	DC	EGT INDICATOR	NA	1	0.224	NA
ELECAC	ELEC AC PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
ELECDC	ELEC DC PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
ELVLHBW	FCTL WARNING PITCH LH BLUE ELEVATOR	NA	FWC	NA	1	NA	1= WARNING
ELVLHGW	FCTL WARNING PITCH LH GREEN ELEVATOR	NA	FWC	NA	1	NA	1= WARNING
ELVLHYW	FCTL WARNING PITCH LH YELLOW ELEVATOR	NA	FWC	NA	1	NA	1= WARNING
ELVR	ELEVATORS POSITION	DA	SDAC	314	4	0.088	>0= NOSE DOWN
ELVRHBW	FCTL WARNING PITCH RH BLUE ELEVATOR	NA	FWC	NA	1	NA	1= WARNING
ELVRHGW	FCTL WARNING PITCH RH GREEN ELEVATOR	NA	FWC	NA	1	NA	1= WARNING
ELVRHYW	FCTL WARNING PITCH RH YELLOW ELEVATOR	NA	FWC	NA	1	NA	1= WARNING
EMERGON	EMERGENCY CANCEL ON	NA	FWC	NA	1	NA	1= ON
ENG	ENGINE PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
ENG1OVLMT	ENG.1 OVER LIMIT EGT-N1-N2	NA	FWC	NA	1	NA	1= WARNING
ENG2OVLMT	ENG.2 OVER LIMIT EGT-N1-N2	NA	FWC	NA	1	NA	1= WARNING
EPRA1	EPR ACTUAL ENG.1 PW4000 ENGINES	NA	EEC	340	1	0.00195	NA
EPRA1P	EPR ACTUAL ENG.1 PW ENG. JT9D-7R4	NA	EEC	340	1	0.00098	NA
EPRA2	EPR ACTUAL ENG.2 PW4000 ENGINES	NA	EEC	340	1	0.00195	NA
EPRA2P	EPR ACTUAL ENG.2 PW ENG. JT9D-7R4	NA	EEC	340	1	0.00098	NA
EPRC1	EPR COMMAND ENG.1 PW ENGINE	NA	EEC	341	1/2	0.00156	NA

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
EPRC2	EPR COMMAND ENG.2 PW ENGINE	NA	EEC	341	1/2	0.01563	NA
EPRLMT	EPR LIMIT (PW ENGINES)	NA	TCC1/2	342	1	0.00098	NA
EPRT	EPR TARGET PW ENGINES	NA	TCC1/2	343	1/4	0.01563	NA
EQPTSMOW	MIN EQUIPMENT BAY SMOKE	NA	FWC	NA	1	NA	1= WARNING
EVTMKR	EVENT MARKER	NA	EVENT BUTTON	NA	1	NA	1= EVENT
EWDF	ECAM D-U WARNING FAULT	NA	DU MON. and DU CTL	NA	1/4	NA	0= FAULT
EWDOFF	ECAM D-U WARNING OFF	NA	DU MON. and DU CTL	NA	1/4	NA	1= OFF
FAPU	A.P.U FIRE	NA	FWC	NA	1	NA	1= WARNING
FCABSMOW	FWD CABIN SMOKE	NA	FWC	NA	1	NA	1= WARNING
FCCLN	FIRST-OFFICER CONTROL COLUMN POSITION	DA	POT	NA	4	NA	>0= NOSE DOWN
FCCLNF	FIRST-OFFICER CONTROL COLUMN FORCE	N	FTUCCF/O	330	1	1	>0= NOSE DOWN
FCTL	F/CTL PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
FCTR	FRAME COUNTER	FRAME	DFDAMU	NA	1/4	1	NA
FCWHF	FIRST-OFFICER CONTROL WHEEL FORCE	N	FTUCWF/O	310	1	1	>0= TURN LEFT
FCWHL	FIRST OFFICER CONTROL WHEEL POSITION	DA	EFCU1	71	4	0.18543	>0= TURN LEFT
FD1E	FLIGHT DIRECTOR 1 ENGAGED	NA	FCC1	146/13	1	NA	1= ENGAGED
FD2E	FLIGHT DIRECTOR 2 ENGAGED	NA	FCC2	146/13	1	NA	1= ENGAGED
FENG1	ENGINE 1 FIRE	NA	FWC	NA	1	NA	1= WARNING
FENG2	ENGINE 2 FIRE	NA	FWC	NA	1	NA	1= WARNING
FFKG1	FUEL FLOW ENG.1	KG/H	FUEL FLOW IND.	NA	1	3.0525	NA
FFKG2	FUEL FLOW ENG.2	KG/H	FUEL FLOW IND	NA	1	3.0525	NA
FFLB1	FUEL FLOW ENG.1	LBS/H	FUEL FLOW IND	NA	1	6.73	NA
FFLB2	FUEL FLOW ENG.2	LBS/H	FUEL FLOW IND	NA	1	6.73	NA
FFV1	FUEL FIRE VALVE ENG.1 NOT FULLY CLOSED	NA	SDAC	273/12	1	NA	1= NFC
FFV2	FUEL FIRE VALVE ENG.2 NOT FULLY CLOSED	NA	SDAC	273/11	1	NA	1= NFC
FINAPP	FLIGHT PHASE FINAL APPROACH	NA	FWC1	270/11-12-13-14	1	NA	NA
FLAP	FLAPS POSITION A300-600	DA	FPPU	NA	1/2	1.41	NA
FLARE	FLARE	NA	FCC	274/15	1	NA	1= SET
FLEET	FLEET IDENT	NA	NA	NA	NA	NA	NA
FLEXT	FLEX TEMPERATURE	DC	TCC	214	1	1	NA
FLP1	FLAPS LEVER POSITION SFCC1	NA	SFCC1	137/11-15	1/2	NA	NA
FLP2	FLAPS LEVER POSITION SFCC2	NA	SFCC2	137/11-15	1/2	NA	NA
FLPF	FLAPS 1+2 FAULT	NA	FWC	126/12	1/4	NA	1= FAULT
FLRALAND12	LONG FLARE AUTOLAND LOGIC1 OR 2	NA	FWC	NA	1	NA	1= WARNING
FLT	FLIGHT NUMBER	NA	FMC	261	NA	NA	NA
FMCAS	SELECTED AIRSPEED AUTO. TARGET	KT	FMC	103	1	1	NA
FNTO	FLAP NOT IN TAKE-OFF CONFIGURATION	NA	FWC	NA	1	NA	1= WARNING
FPAIRS	FLIGHT PATH ANGLE	DA	IRS1/3	322	1	0.35	NA
FUEL	FUEL PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
FULDEP1	REVERSER IN POSITION ENG.1	NA	GREEN LIGHT	NA	1	NA	0=IN POSITION
FULDEP2	REVERSER IN POSITION ENG.2	NA	GREEN LIGHT	NA	1	NA	0= IN POSITION
FVERTDEV	VERTICAL DEVIATION.2	MA	FMC2	117	1	1	NA
FVERTDEVRES	VERTICAL DEVIATION RES.2	NA	FMC2	271/09	1	NA	1= FINAPP ACTIVE
FWDSMOW	FWD COMPT SMOKE	NA	FWC	NA	1	NA	1= WARNING
FWXRMAP	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= MAP ONLY
FWXRSTBY	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= STANDBY
FWXRTST	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= TEST
FWXRTUR	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= TURB. ONLY

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
FWXRTWS	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WXR+TURB
FWXRWSHAZS	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WINDSHEAR HAZARD FACTOR
FWXRWSIC	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WINDSHEAR ICON
FWXRWXR	FIRST-OFFICER RADAR OPERATING MODE	NA	EFIS1/2/3	270/19-20-21	1/4	NA	1= WEATHER ONLY
G+YSLP	GREEN+YELLOW SYS. LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
G+YSVLP	GREEN+YELLOW SERVO LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
GLIDESLOPE	GLIDESLOPE	NA	(E)GPWS	270/18	1	NA	1= WARNING ON
GLS1	GLIDESLOPE DEV. ILS1	MA	ILS	174	1/2	0.335	>0= ABOVE BEAM
GLS1DDM	GLIDESLOPE DEV. ILS1	DDM	ILS	174	1/2	0.00039	>0= ABOVE BEAM
GLS1PT	GLIDESLOPE DEV. ILS1	PT	ILS	174	1/2	0.0045	>0= ABOVE BEAM
GLS2	GLIDESLOPE DEV. ILS2	MA	ILS	174	1/2	0.335	>0= ABOVE BEAM
GLS2DDM	GLIDESLOPE DEV. ILS2	DDM	ILS	174	1/2	0.00039	>0= ABOVE BEAM
GLS2PT	GLIDESLOPE DEV. ILS2	PT	ILS	174	1/2	0.0045	>0= ABOVE BEAM
GLSALAND12	GLIDE DEV.AUTOLAND LOGIC1 OR 2	NA	FWC	NA	1	NA	1= WARNING
GLSDEV	GLIDE DEV.	NA	FWC	NA	1	NA	1= WARNING
GLSF1	GLS FREQUENCY MMR1	MHZ	MMR1 DMC	33	NA	1	NA
GLSF2	GLS FREQUENCY MMR2	MHZ	MMR2 DMC	33	NA	1	NA
GS	GROUND SPEED	KT	IRS	312	1	1	NA
GSCPT	G/S CAPTURE	NA	FCC	274/19-29	1	NA	1= SET
GSND	GEAR SELECTOR NOT DOWN	NA	LDG CTL LEVER	NA	2	NA	1= NOT DOWN
GSNU	GEAR SELECTOR NOT UP	NA	LDG CTL LEVER	NA	2	NA	1= NOT UP
GSPNA	GROUND SPOILER NOT ARMED	NA	HANDLE SWITCH	NA	2	NA	1= NOT ARMED
GSTRK	G/S TRACK	NA	FCC	274/19-22	1	NA	1= SET
GWK	GROSS WEIGHT	KG	FMC	75	NA	18.1	NA
GWL	GROSS WEIGHT	LBS	FMC	75	NA	40	NA
HDGH	HEADING HOLD	NA	FCC	275/12	1	NA	1= SET
HDGS	HEADING SELECT	NA	FCC	275/13	1	NA	1= SET
HF1	H.F1 KEING	NA	RADIO TRANSMITTER	NA	1	NA	0= EMITTING
HF2	H.F2 KEING	NA	RADIO TRANSMITTER	NA	1	NA	0= EMITTING
HPFSOV1	HP FUEL VALVE ENG.1 CLOSED	NA	FWC	272/13	1	NA	1= CLOSED
HPFSOV2	HP FUEL VALVE ENG.2 CLOSED	NA	FWC	272/14	1	NA	1= CLOSED
HPV1	HP BLEED VALVE1 NOT FULLY CLOSED	NA	SDAC	145/13	1/4	NA	1= NFC
HPV2	HP BLEED VALVE2 NOT FULLY CLOSED	NA	SDAC	145/14	1/4	NA	1= NFC
HYD	HYD PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
HYDBP	BLUE HYDRAULIC PRESSURE	PSI	SDAC	174	1/2	8	NA
HYDBW	HYD. BLUE SYSTEM NO LOW PRESSURE	NA	BLUE SENSOR FWC	NA	1/2	NA	1= NO LOW PRESS
HYDGP	GREEN HYDRAULIC PRESSURE	PSI	SDAC	174	1/2	8	NA
HYDGW	HYD. GREEN SYSTEM NO LOW PRESSURE	NA	GREEN SENSOR FWC	NA	1/2	NA	1= NO LOW PRESS
HYDYP	YELLOW HYDRAULIC PRESSURE	PSI	SDAC	174	1/2	8	NA
HYDYW	HYD. YELLOW SYSTEM NO LOW PRESSURE	NA	YELLOW SENSOR FWC	NA	1/2	NA	1= NO LOW PRESS
IAI1	INLET ANTI-ICE VALVE OPEN ENG.1	NA	A-I VALVE	NA	1/4	NA	1= OPEN
IAI1ON	INLET ANTI-ICE PUSH BUTTON ENG.1	NA	A-I VALVE	NA	1/4	NA	1= OFF
IAI2	INLET ANTI-ICE VALVE OPEN ENG.2	NA	A-I VALVE	NA	1/4	NA	1= OPEN
IAI2ON	INLET ANTI-ICE PUSH BUTTON ENG.2	NA	A-I VALVE	NA	1/4	NA	1= OFF
ICEDET	ICE DETECTION	NA	ICE DET CONT	NA	1/4	NA	1= NOT DETECTED
ILSCS	ILS MODE CAPT	NA	FNCP1	272/25	1/4	NA	1=ILS
ILSF1	ILS1 OR MMR1 FREQUENCY	MHZ	ILS or MMR DMC	33	NA	0.01	NA
ILSF2	ILS2 OR MMR2 FREQUENCY	MHZ	ILS or MMR DMC	33	NA	0.01	NA
ILSFS	ILS MODE F/O	NA	FNCP2	272/25	1/4	NA	1=ILS
IMKR	INNER MARKER	NA	VOR1	222/B13	1	NA	1= PASSAGE

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
INCREASE	TCAS R-A VERTICAL CONTROL INCREASE	NA	TCAS	270	1	NA	NA
INERTGPS	NAVIGATION MODES INERTIAL GPS	NA	FMC	270/13-15	1	NA	NA
INERTONLY	NAVIGATION MODES INERTIAL ONLY	NA	FMC	270/13-15	1	NA	NA
IRS11F	IRS.1 FAULT (ONE TCC)	NA	FWC	NA	1	NA	1= WARNING
IRS12F	IRS.1 FAULT (TWO TCC)	NA	FWC	NA	1	NA	1= WARNING
IRS1UC	IRS1 USED ON CPT BUS	NA	IRS	271/14-15	1	NA	NA
IRS1UF	IRS1 USED ON F/O BUS	NA	IRS	271/14-15	1	NA	NA
IRS21F	IRS.2 FAULT (ONE TCC)	NA	FWC	NA	1	NA	1= WARNING
IRS22F	IRS.2 FAULT (TWO TCC)	NA	FWC	NA	1	NA	1= WARNING
IRS2UC	IRS2 USED ON CPT BUS	NA	IRS	271/14-15	1	NA	NA
IRS2UF	IRS2 USED ON F/O BUS	NA	IRS	271/14-15	1	NA	NA
IRS31F	IRS.3 FAULT (NIV 1)	NA	FWC	NA	1	NA	1= WARNING
IRS32F	IRS.3 FAULT (NIV 2)	NA	FWC	NA	1	NA	1= WARNING
IRS3UC	IRS3 USED ON CPT BUS	NA	IRS	271/14-15	1	NA	NA
IRS3UF	IRS3 USED ON F/O BUS	NA	IRS	271/14-15	1	NA	NA
L/GNDWN	LANDING GEAR NOT DOWN	NA	FWC	NA	1	NA	1= WARNING
LANDCAP	LAND CAPABILITY CHANGE	NA	FWC	NA	1	NA	1= WARNING
LANDTRK	LAND TRACK	NA	FCC	146/14	1	NA	1= ACTIVE
LAOA1	LOCAL INDICATED ANGLE OF ATTACK CAPTAIN	DA	FNSG1/3	221	2	0.353	>0= UP
LAOA2	LOCAL INDICATED ANGLE OF ATTACK FIRST-OFFICER	DA	FNSG2/3	221	2	0.353	>0= UP
LATG	BODY LATERAL ACCELERATION	G	3 AXIS ACCEL	NA	4	0.00204	>0= RH SIDESLIP
LATGIRS	LATERAL ACCELERATION	G	IRS	332	1	1	>0= RH SIDESLIP
LATP1	LATITUDE POSITION ELAB (BITS 9-27+29)	DA	FMC1	310	NA	0.00017	NA
LATP2	LATITUDE POSITION ELAB (BITS 9-27+29)	DA	FMC2	310	NA	0.00017	NA
LAVSMOW	LAVATORY SMOKE	NA	FWC	NA	1	NA	1= WARNING
LDGROLL	FLIGHT PHASE LANDING ROLL	NA	FWC1	270/11-12-13-14	1	NA	NA
LEAKBLAPU	APU BLEED LEAK	NA	FWC	NA	1	NA	1= WARNING
LEAKBLV1	ENG. BLEED VALVE BLEED.1 LEAK	NA	FWC	NA	1	NA	1= WARNING
LEAKBLV2	ENG. BLEED VALVE BLEED.2 LEAK	NA	FWC	NA	1	NA	1= WARNING
LHLGDWN	LH L/G DOWN AND LOCKED	NA	L/G MICROSWITCH	NA	2	NA	0= DOWN & LOCKED
LHSQUAT	L/G LH COMPRESSED SHOCK ABSORBER	NA	L/G MICROSWITCH	NA	4	NA	1= COMPRESSED
LITQKG	LEFT INNER TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
LITQLB	LEFT INNER TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
LOC1	LOCALIZER DEV. ILS1	MA	ILS	173	1/2	0.756	>0= LEFT OF BEAM
LOC1DDM	LOCALIZER DEV. ILS1	DDM	ILS	173	1/2	0.00078	>0= LEFT OF BEAM
LOC1PT	LOCALIZER DEV. ILS1	PT	ILS	173	1/2	0.01	>0= LEFT OF BEAM
LOC2	LOCALIZER DEV. ILS2	MA	ILS	173	1/2	0.756	>0= LEFT OF BEAM
LOC2DDM	LOCALIZER DEV. ILS2	DDM	ILS	173	1/2	0.00078	>0= LEFT OF BEAM
LOC2PT	LOCALIZER DEV. ILS2	PT	ILS	173	1/2	0.01	>0= LEFT OF BEAM
LOCALAND12	LOC DEV.AUTOLAND LOGIC1 OR 2	NA	FWC	NA	1	NA	1= WARNING
LOCCPT	LOCALIZER CAPTURE MODE	NA	FCC	275/15-21	1	NA	1= SET
LOCDEV	LOCALIZER DEV.	NA	FWC	NA	1	NA	1= WARNING
LOCTRK	LOCALIZER TRACK MODE	NA	FCC	275/15-23	1	NA	1= SET
LONG	BODY LONGITUDINAL ACCELERATION	G	3 AXIS ACCEL	NA	4	0.00204	<0= ACCELERATION

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
LONP1	LONGITUDE POSITION ELAB (BITS 9-29)	DA	FMC1	311	NA	0.00017	>0=EAST
LONP2	LONGITUDE POSITION ELAB (BITS 9-29)	DA	FMC2	311	NA	0.00017	>0=EAST
LOTQKG	LEFT OUTER TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
LOTQLB	LEFT OUTER TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
MACH1	MACH NUMBER	NA	ADC1	205	1	0.008	NA
MACHCLB	MACH CLIMB	NA	FCC	274/10-18	1	NA	1= SET
MACHDES	MACH DESCENT	NA	FCC	274/9-18	1	NA	1= SET
MAINTAIN	TCAS R-A VERTICAL CONTROL MAINTAIN	NA	TCAS	270	1	NA	NA
MAPC	MAP MODE CAPT	NA	FNCP1	272/11	1/4	NA	1= SELECTED
MAPF	MAP MODE F/O	NA	FNCP2	272/11	1/4	NA	1= SELECTED
MCABSMOW	MID CABIN SMOKE	NA	FWC	NA	1	NA	1= WARNING
METRALT	METRIC ALTITUDE	NA	FNSG1/3-2/3	270/27	1	NA	0=FEET
MHDG	MAGNETIC HEADING	DA	FNSG1/3-2/3	320	1	0.352	NA
MMKR	MIDDLE MARKER	NA	VOR1	222/B12	1	NA	1= PASSAGE
MMR1DATLK	MMR1 MODE ILS (DATA LINK)	NA	MMR	33	1/4	NA	NA
MMR1GLS	MMR1 MODE ILS (GLS)	NA	MMR	33	1/4	NA	NA
MMR1MLS	MMR1 MODE ILS (MLS AUTO MODE)	NA	MMR	33	1/4	NA	NA
MMR1SCAT	MMR1 MODE ILS (RSVD SCAT1 MODE)	NA	MMR	33	1/4	NA	NA
MMR1VHF	MMR1 MODE ILS (VHF HYBRID MODE)	NA	MMR	33	1/4	NA	NA
MMR1VOR	MMR1 MODE ILS (VOR MODE)	NA	MMR	33	1/4	NA	NA
MMR2DATLK	MMR2 MODE ILS (DATA LINK)	NA	MMR	33	1/4	NA	NA
MMR2GLS	MMR2 MODE ILS (GLS)	NA	MMR	33	1/4	NA	NA
MMR2MLS	MMR2 MODE ILS (MLS AUTO MODE)	NA	MMR	33	1/4	NA	NA
MMR2SCAT	MMR2 MODE ILS (RSVD SCAT1 MODE)	NA	MMR	33	1/4	NA	NA
MMR2VHF	MMR2 MODE ILS (VHF HYBRID MODE)	NA	MMR	33	1/4	NA	NA
MMR2VOR	MMR2 MODE ILS (VOR MODE)	NA	MMR	33	1/4	NA	NA
MN123	MACH NUMBER	NA	FNSG1/3 or 2/3	205	1	0.008	NA
MONTH	DATE MONTH	NA	NA	NA	1/64	NA	NA
MW1	CAPTAIN MASTER WARNING	NA	FWC1	NA	1	NA	0= LIGHT ON
MW2	FIRST-OFFICER MASTER WARNING	NA	FWC2	NA	1	NA	0= LIGHT ON
N1A1	N1 ACTUAL ENG.1 GE ENG.CF6-80C2/80A3 (WITHOUT FADEC)	%	PMC	346	1	0.0625	NA
N1A1P	N1 ACTUAL ENG.1 PW4000 ENGINES	%	EEC	346	1	0.0625	NA
N1A2	N1 ACTUAL ENG.2 GE ENG.CF6-80C2/80A3 (WITHOUT FADEC)	%	PMC	346	1	0.0625	NA
N1A2P	N1 ACTUAL ENG.2 PW4000 ENGINES	%	EEC	346	1	0.0625	NA
N1C1	N1 COMMAND ENG.1 GE ENGINE	%	PMC OR ECU	341	1/2	1	NA
N1C2	N1 COMMAND ENG.2 GE ENGINE	%	PMC OR ECU	341	1/2	1	NA
N1FA1	N1 ACTUAL ENG.1 GE ENG.CF6-80C2A5F (WITH FADEC)	%	ECU	346	1	0.0625	NA
N1FA2	N1 ACTUAL ENG.2 GE ENG.CF6-80C2A5F (WITH FADEC)	%	ECU	346	1	0.0625	NA
N1I1P	N1 ACTUAL ENG.1 PW ENG. JT9D-7R4	%	INDIC	NA	1	0.0293	NA
N1I2P	N1 ACTUAL ENG.2 PW ENG. JT9D-7R4	%	INDIC	NA	1	0.0293	NA
N1LMT	N1 LIMIT (GE EMGINES)	%	TCC1/2	342	1	0.0625	NA
N1T	N1 TARGET GE ENGINES	%	TCC1/2	343	1/4	1	NA
N1V1	EVM FAN ENG.1 N1	UNIT	SDAC	135	1	0.05	NA
N1V2	EVM FAN ENG.2 N1	UNIT	SDAC	135	1	0.05	NA
N21PG	N2 ACTUAL ENG.1 PW & GE with FADEC	%	FADEC EEC/ECU	344	1	0.0625	NA
N22PG	N2 ACTUAL ENG.2 PW & GE with FADEC	%	FADEC EEC/ECU	344	1	0.0625	NA
N2I1	N2 ENG.1 GE ENG.	%	N2 INDICATOR	NA	1	0.0293	NA
N2I2	N2 ENG.2 GE ENG.	%	N2 INDICATOR	NA	1	0.0293	NA
N2V1	EVM TURBINE ENG.1 N2	UNIT	SDAC	136	1	0.05	NA
N2V2	EVM TURBINE ENG.2 N2	UNIT	SDAC	136	1	0.05	NA
NAICOR	NACELLE ANTI-ICING	NA	TCC	273/15	1/4	NA	1=CORR THRUST APPLIED
NAV	NAV MODE	NA	FCC	275/11-23	1	NA	1= SET
NAVACCY	NAV ACCURACY	NA	FMC1/2	270/11	1	NA	1= HIGH
NAVCS	NAV MODE CAPT	NA	FNCP1	272/25	1/4	NA	1=NAV
NAVFS	NAV MODE F/O	NA	FNCP2	272/25	1/4	NA	1=NAV
ND1F	PILOT ND FAULT	NA	EFIS SGU	350/16	1/4	NA	1= FAULT
ND2F	F/O ND FAULT	NA	EFIS SGU	350/17	1/4	NA	1= FAULT

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
NOADV	TCAS R-A COMBINATED CONTROL NO ADVISORY	NA	TCAS	270	1	NA	NA
NODOWN	TCAS R-A NO DOWN ADVISORY	NA	TCAS	270	1	NA	NA
NOLGDWN	NOSE L/G DOWN AND LOCKED	NA	L/G MICROSWITCH	NA	2	NA	0= DOWN & LOCKED
NONAV	NAVIGATION MODES NO NAV	NA	FMC	270/13-15	1	NA	NA
NOSQUAT	L/G NOSE COMPRESSED SHOCK ABSORBER	NA	L/G MICROSWITCH	NA	4	NA	1= COMPRESSED
NOUP	TCAS R-A NO UP ADVISORY	NA	TCAS	270	1	NA	NA
NSRA1	RADIO-HEIGHT FROM RADIO-ALTI:1 (NO SIGN)	FT	RA1	164	1/2	1	NA
NSRA2	RADIO-HEIGHT FROM FIRST-OFFICER BUS (NO SIGN)	FT	FNSG 2/3	164	1/2	1	NA
OBSTX2	OBSTACLE-OBSTACLE	NA	(E)GPWS	270/29	1	NA	1= WARNING ON
OIP1	OIL PRESSURE ENG.1	PSI	SDAC	317	1	1	NA
OIP2	OIL PRESSURE ENG.2	PSI	SDAC	317	1	1	NA
OIQ1	OIL QUANTITY ENG.1	US/QT	SDAC	73	1	0.05	NA
OIQ2	OIL QUANTITY ENG.2	US/QT	SDAC	73	1	0.05	NA
OIT1	OIL TEMPERATURE ENG.1	DC	SDAC	316	1	0.5	NA
OIT2	OIL TEMPERATURE ENG.2	DC	SDAC	316	1	0.5	NA
OLP1	ENG.1 OIL LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
OLP2	ENG.2 OIL LOW PRESSURE	NA	FWC	NA	1	NA	1= WARNING
OMKR	OUTER MARKER	NA	VOR1	222/11	1	NA	1= PASSAGE
ORIGPAGE	ORIGIN PAGE CALLED	NA	FWC	NA	1	NA	1=AMBER OR RED WARNING
PB1	BURNER PRESSURE ENG.1 (PW4000 ENG. WITH FADEC)	PSI	EEC1	264	1	0.25	NA
PB2	BURNER PRESSURE ENG.2 (PW4000 ENG. WITH FADEC)	PSI	EEC2	264	1	0.25	NA
PBRKW	PARKING BRAKE ON	NA	FWC	NA	1	NA	1= WARNING
PCK1VLV	PACK1 VALVE NOT FULLY CLOSED	NA	SDAC	145/16	1/4	NA	1= NFC
PCK2VLV	PACK2 VALVE NOT FULLY CLOSED	NA	SDAC	145/17	1/4	NA	1= NFC
PCP1	PRE COOLER PRESSURE INPUT.1	PSI	SDAC	141	1	0.5	NA
PCP2	PRE COOLER PRESSURE INPUT.2	PSI	SDAC	141	1	0.5	NA
PCT1	PRE COOLER TEMPERATURE OUTPUT.1	DC	SDAC	140	1	1	NA
PCT2	PRE COOLER TEMPERATURE OUTPUT.2	DC	SDAC	140	1	1	NA
PFD1F	PILOT PFD FAULT	NA	EFIS SGU	350/11	1/4	NA	1= FAULT
PFD2F	F/O PFD FAULT	NA	EFIS SGU	350/12	1/4	NA	1= FAULT
PFEEL1F	PITCH FEEL 1 FAULT	NA	FWC	NA	1	NA	1= WARNING
PFEEL2F	PITCH FEEL 2 FAULT	NA	FWC	NA	1	NA	1= WARNING
PGPSC	GPS PRIMARY CPT SIDE	NA	FM/SGU	350/19	1	NA	1= GPS PRIMARY
PGPSF	GPS PRIMARY F/O SIDE	NA	FM/SGU	350/19	1	NA	1= GPS PRIMARY
PH	FLIGHT PHASE	NA	FWC1	270/11-12-13-14	1	NA	NA
PLA1P	POWER LEVER ANGLE ENG.1	DA	EEC	133	1	0.08789	NA
PLA2P	POWER LEVER ANGLE ENG.2	DA	EEC	133	1	0.08789	NA
PLANC	PLAN MODE CAPT	NA	FNCP1	272/14	1/4	NA	1= SELECTED
PLANF	PLAN MODE F/O	NA	FNCP2	272/14	1/4	NA	1= SELECTED
PRESS	PRESS PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
PREVENT	TCAS R-A COMBINATED CONTROL PREVENTIVE	NA	TCAS	270	1	NA	NA
PREWSHOFF	PREDICTIVE WINDSHEAR 1 OR 2 AUTO/OFF	NA	WEATHER RADAR	NA	1	NA	0= OFF
PROFALT	PROFILE ALTITUDE	NA	FCC	274/12	1	NA	1= SET
PROFCLB	PROFILE CLIMB	NA	FCC	274/12-10	1	NA	1= SET
PROFDES	PROFILE DESCENT	NA	FCC	274/12-9	1	NA	1= SET
PRV1	BLEED VALVE (PRV) ENG.1	NA	SDAC	145/12	1/4	NA	1= OPEN
PRV2	BLEED VALVE (PRV) ENG.2	NA	SDAC	145/11	1/4	NA	1= OPEN
PS31	PS3 SEL ENG.1 (GE CF6-80C2A5F ENG. WITH FADEC)	PSI	ECU1	264	1	0.25	NA
PS32	PS3 SEL ENG.2 (GE CF6-80C2A5F ENG. WITH FADEC)	PSI	ECU2	264	1	0.25	NA
PT1F	PITCH TRIM 1 FAULT	NA	FWC	126/27	1/4	NA	1= FAULT
PT2F	PITCH TRIM 2 FAULT	NA	FWC	126/28	1/4	NA	1= FAULT

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
PTCH	PITCH ATTITUDE	DA	FNSG1/3-2/3	324	4	0.352	>0= NOSE UP
PTCHGA	PITCH GO AROUND MODE	NA	FCC	274/16	1	NA	1= SET
PTCHTO	PITCH TAKE-OFF	NA	FCC	274/17	1	NA	1= SET
PTWS	PITCH TRIM WHEEL SYNCHRO	DA	SYNCHRO	NA	1	0.017	>0= NOSE DOWN
PULLUP	PULL UP	NA	(E)GPWS	270/12	1	NA	1= WARNING ON
RAALAND12	DISCREPANCY AUTOLAND LOGIC1 OR 2	NA	FWC	NA	1	NA	1= WARNING
RACU	RADIO-ALTI USED ON CAPTAIN BUS	NA	FNSG1/3	271/18	1	NA	1=RA2
RAFU	RADIO-ALTI USED ON FIRST-OFFICER BUS	NA	FNSG2/3	271/18	1	NA	1=RA2
RALT1	RADIO HEIGHT NO.1 SIGNE ET CORRIGE (-96 TO 4000 FT) ***combine trajecto	FT	RA1	164	NA	1	NA
RALT2	RADIO HEIGHT NO.2 SIGNE ET CORRIGE (-96 TO 4000 FT) ***combine trajecto	FT	RA2	164	NA	1	NA
RESIDUALP	EXCESS RESIDUAL PRESSURE ** Valid for FWC S15 or heighter	NA	FWC1	NA	1	NA	1= WARNING
REVERSAL	TCAS R-A VERTICAL CONTROL REVERSAL	NA	TCAS	270	1	NA	NA
RHLGDWN	RH L/G DOWN AND LOCKED	NA	L/G MICROSWITCH	NA	2	NA	0= DOWN & LOCKED
RHSQUAT	L/G RH COMPRESSED SHOCK ABSORBER	NA	L/G MICROSWITCH	NA	4	NA	1= COMPRESSED
RITQKG	RIGHT INNER TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
RITQLB	RIGHT INNER TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
ROLL	ROLL ATTITUDE	DA	FNSG1/3-2/3	325	2	0.352	>0= RH WING DOWN
ROLL1	FLIGHT PHASE ROLL1	NA	FWC1	270/11-12-13-14	1	NA	NA
ROLL2	FLIGHT PHASE ROLL2	NA	FWC1	270/11-12-13-14	1	NA	NA
ROLLGA	ROLL GO AROUND MODE	NA	FCC	275/18	1	NA	1= SET
ROLLOUT	ROLL OUT MODE	NA	FCC	275/16	1	NA	1= SET
ROSEC	ROSE MODE CAPT	NA	FNCP1	272/28	1/4	NA	1= SELECTED
ROSEF	ROSE MODE F/O	NA	FNCP2	272/28	1/4	NA	1= SELECTED
ROTQKG	RIGHT OUTER TANK FUEL QUANTITY	KG	NA	NA	NA	14.5	NA
ROTQLB	RIGHT OUTER TANK FUEL QUANTITY	LBS	NA	NA	NA	32	NA
RUDD	RUDDER POSITION	DA	SDAC	312	2	0.088	>0= TURN LEFT
RUDDBW	FCTL WARNING YAW BLUE RUDDER	NA	FWC	NA	1	NA	1= WARNING
RUDDGW	FCTL WARNING YAW GREEN RUDDER	NA	FWC	NA	1	NA	1= WARNING
RUDDYW	FCTL WARNING YAW YELLOW RUDDER	NA	FWC	NA	1	NA	1= WARNING
RUDP	RUDDER PEDALS POSITION (ETAL THEORIQUE)	DA	POT	NA	2	0.021	>0= TURN LEFT
RUDPF	RUDDER PEDALS FORCE	N	FTURP	320	1	1	>0= TURN LEFT
RUDT	RUDDER TRIM (YAW TRIM CTL INPUT POSITION)	DA	EFCU2	313	1	0.044	>0= LEFT
RUDTRV1F	RUDDER TRAVEL 1 FAULT	NA	FWC	NA	1	NA	1= WARNING
RUDTRV2F	RUDDER TRAVEL 2 FAULT	NA	FWC	NA	1	NA	1= WARNING
RUDTT	RUDDER TRIM (YAW TRIM CTL INPUT POSITION) TOTAL	DA	EFCU2	313	1	0.044	>0= LEFT
SALT	SELECTED ALTITUDE (MANUAL)	FT	FCU	102	1	64	NA
SAV1	START VALVE ENG.1	NA	START VALVE	NA	1/4	NA	0= OPEN
SAV2	START VALVE ENG.2	NA	START VALVE	NA	1/4	NA	0= OPEN
SBAROC	SELECTED BARO SETTING CAPTAIN	MB	ADC1	234	NA	0.1	NA
SBAROF	SELECTED BARO SETTING FIRST-OFFICER	MB	ADC1	236	NA	0.1	NA
SBCPOS	SPEED BRAKE COMMAND HANDLE POSITION	NOTCH	SPEED BRAKE TRANSDUCER UNIT	NA	2	0.056	NA
SBNR	SPEED BRAKE NOT RETRACTED	NA	FWC	NA	1	NA	1= WARNING
SCAS	SELECTED AIRSPEED MANUAL	KT	FCU	103	1	1	NA
SCRSV1	SELECTED COURSE VOR1 (O to 360)	DA	VOR	100	1	0.70313	NA
SCRSV2	SELECTED COURSE VOR2 (O to 360)	DA	VOR	100	1	0.70313	NA
SDBC1	DATA BASE UPDATE CYCLE	NA	FMC1	263	1/64	NA	0=CYCLE1
SDBC2	DATA BASE UPDATE CYCLE	NA	FMC2	263	1/64	NA	0=CYCLE1
SDBD1	DATA BASE UPDATE DAY	NA	FMC1	263	1/64	NA	NA
SDBD2	DATA BASE UPDATE DAY	NA	FMC2	263	1/64	NA	NA
SDBM1	DATA BASE UPDATE MONTH	NA	FMC1	263	1/64	NA	NA
SDBM2	DATA BASE UPDATE MONTH	NA	FMC2	263	1/64	NA	NA

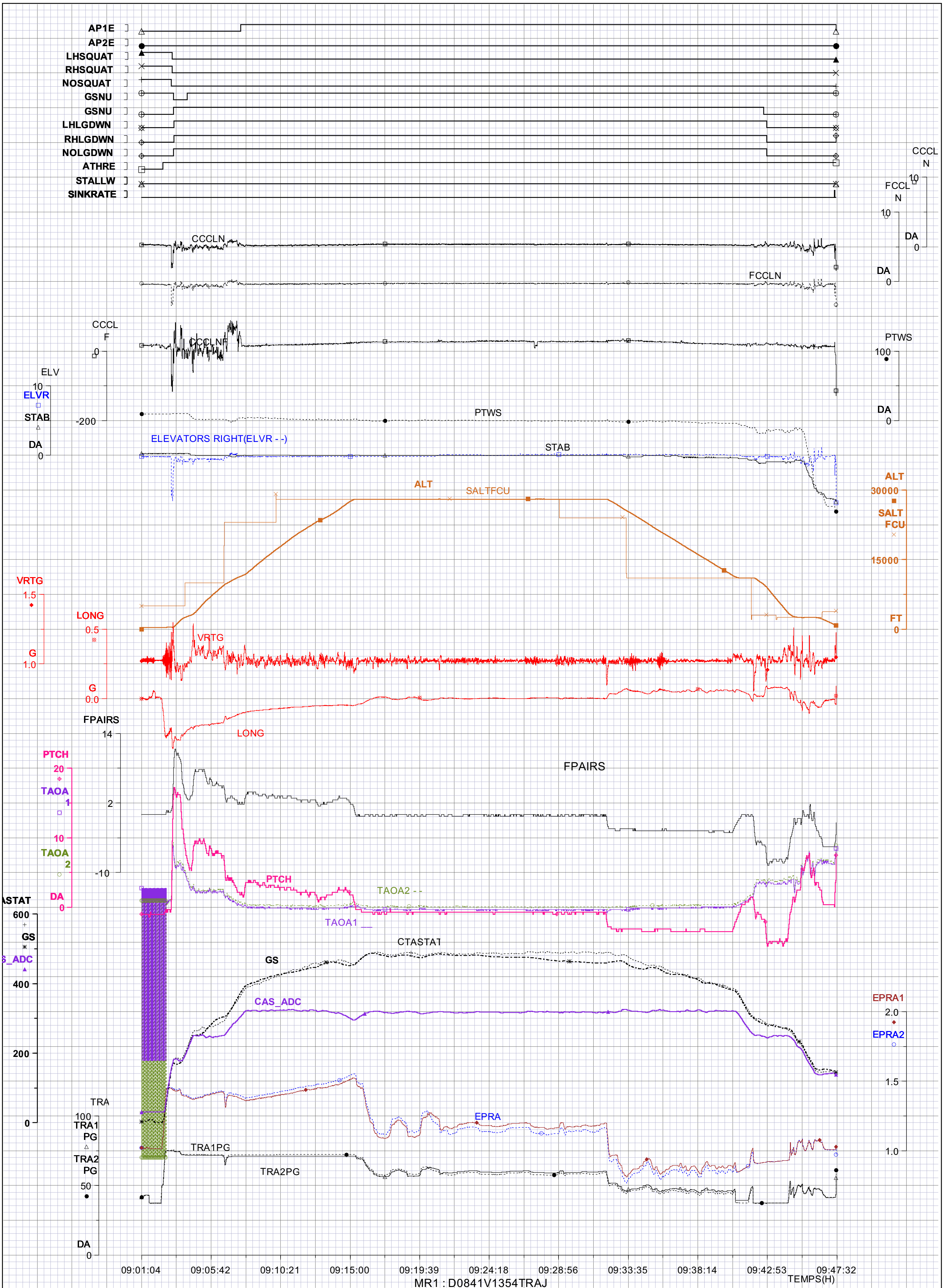
MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
SDF	ECAM D-U SYSTEM FAULT	NA	DU MON. and DU CTL	NA	1/4	NA	0= FAULT
SDHC	SELECTED DECISION HEIGHT CAPTAIN	FT	EFIS CTL PANEL SGU	370	NA	0.5	NA
SDHF	SELECTED DECISION HEIGHT FIRST-OFFICER	FT	EFIS CTL PANEL SGU	370	NA	0.5	NA
SDOFF	ECAM D-U SYSTEM OFF	NA	DU MON. and DU CTL	NA	1/4	NA	1= OFF
SFPAC	SELECTED FLIGHT PATH ANGLE CAPTAIN	DA	FNCP	273	1	0.1	NA
SFPAF	SELECTED FLIGHT PATH ANGLE FIRST-OFFICER	DA	FNCP	273	1	0.1	NA
SFRM	FRAME SELECT	NA	NA	NA	NA	NA	NA
SGU1/3U	EFIS SGU 1/3 USED	NA	EFIS-SGU	271/10	1	NA	1=FNSG3
SGU13F	SGU 1/3 FAULT	NA	EFIS SGU	350/18	1/4	NA	1= FAULT
SGU2/3U	EFIS SGU 2/3 USED	NA	EFIS-SGU	271/9	1	NA	0=FNSG2
SGU23F	SGU 2/3 FAULT	NA	EFIS SGU	350/18	1/4	NA	1= FAULT
SHDG	SELECTED HEADING (0 to 360)	DA	FCU	101	1	0.70313	NA
SINKRATE	SINKRATE	NA	(E)GPWS	270/11	1	NA	1= WARNING ON
SLAT	SLATS POSITION A300-600	DA	FPPU	NA	1	0.209	NA
SLTF	SLATS 1+2 FAULT	NA	FWC	126/11	1/4	NA	1= FAULT
SLTP1	SLATS LEVER POSITION SFCC1	NA	SFCC1	127/11-15	1	NA	NA
SLTP2	SLATS LEVER POSITION SFCC2	NA	SFCC2	127/11-15	1	NA	NA
SMACH	SELECTED MACH MANUAL	NA	FCU	106	1	0.008	NA
SNTO	SLAT NOT IN TAKE-OFF CONFIGURATION	NA	FWC	NA	1	NA	1= WARNING
SOFTNBR	DFDAU SOFWARE NUMBER UPLOADED (ISO5)	NA	DFDAU	NA	1/64	NA	NA
SP14F	SPOILER 4+1 FAULT/OFF	NA	EFCU2 FWC2	126/13	2	NA	0= NOT FAULT
SP32F	SPOILER 3+2 FAULT/OFF	NA	EFCU1 FWC1	126/14	2	NA	0= NOT FAULT
SP5F	SPOILER 5 FAULT/OFF	NA	EFCU2 FWC2	126/15	2	NA	0= NOT FAULT
SP6F	SPOILER 6 FAULT/OFF	NA	EFCU1 FWC1	126/16	2	NA	0= NOT FAULT
SP7F	SPOILER 7 FAULT/OFF	NA	EFCU1 FWC1	126/17	2	NA	0= NOT FAULT
SPDBRK	SPEED BRAKE COMMAND HANDLE POSITION	DA	SPEED BRAKE TRANSDUCER UNIT	NA	2	0.056	NA
SPDCLB	SPEED CLIMB	NA	FCC	274/10-11	1	NA	1= SET
SPDDES	SPEED DESCENT	NA	FCC	274/9-11	1	NA	1= SET
SPLH1B	SPOILER LH.1	NA	SDAC	146/11	2	NA	1= RETRACTED
SPLH2B	SPOILER LH.2	NA	SDAC	146/13	2	NA	1= RETRACTED
SPLH3	LH SPOILER 3 POSITION	DA	EFCU1	363	2	NA	NA
SPLH4	LH SPOILER 4 POSITION	DA	EFCU2	364	2	NA	NA
SPLH5	LH SPOILER 5 POSITION	DA	EFCU1	365	2	NA	NA
SPLH6	LH SPOILER 6 POSITION	DA	EFCU1	366	2	NA	NA
SPLH7	LH SPOILER 7 POSITION	DA	EFCU1	367	2	NA	NA
SPRH1B	SPOILER RH.1	NA	SDAC	146/12	2	NA	1= RETRACTED
SPRH2B	SPOILER RH.2	NA	SDAC	146/14	2	NA	RETRACTED
SPRH3	RH SPOILER 3 POSITION	DA	EFCU1	373	2	NA	NA
SPRH4	RH SPOILER 4 POSITION	DA	EFCU2	374	2	NA	NA
SPRH5	RH SPOILER 5 POSITION	DA	EFCU1	375	2	NA	NA
SPRH6	RH SPOILER 6 POSITION	DA	EFCU1	376	2	NA	NA
SPRH7	RH SPOILER 7 POSITION	DA	EFCU1	377	2	NA	NA
SRALT1	RADIO-HEIGHT FROM RADIO-ALTI:1 (WITH SIGN RANGE/2)	FT	RA1	164	1/2	1	NA
SRALT2	RADIO-HEIGHT FROM FIRST-OFFICER BUS (WITH SIGN RANGE/2)	FT	RA EFIS SGU 2/3	164	1/2	1	NA
STAB	STABILIZER POSITION	DA	SDAC	315	1	0.088	>0= NOSE DOWN
STABGW	FCTL WARNING PITCH TRIM GREEN STAB	NA	FWC	NA	1	NA	1= WARNING
STABNTO	PITCH TRIM NOT IN TAKE-OFF RANGE	NA	FWC	NA	1	NA	1= WARNING
STABYW	FCTL WARNING PITCH TRIM YELLOW STAB	NA	FWC	NA	1	NA	1= WARNING
STALLW	STALL	NA	FWC	NA	1	NA	1= WARNING
SVS	SELECTED VERTICAL SPEED MANUAL	FT/MN	FCU	104	1	64	>0=UP
SYNC1	SYNCHRO WORD SUB-FRAME 1 247 HEXA)	NA	NA	NA	1/4	NA	NA

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
SYNC2	SYNCHRO WORD SUB-FRAME 2 (5B8 HEXA)	NA	NA	NA	1/4	NA	NA
SYNC3	SYNCHRO WORD SUB-FRAME 3 (A47 HEXA)	NA	NA	NA	1/4	NA	NA
SYNC4	SYNCHRO WORD SUB-FRAME 4 (DB8 HEXA)	NA	NA	NA	1/4	NA	NA
TAOA1	TRUE ANGLE OF ATTACK CAPTAIN f(conf)	DA	LAOA1-SLAT-FLAP	NA	NA	0.353	>0= UP
TAOA2	TRUE ANGLE OF ATTACK FIRST-OFFICER f(conf)	DA	LAOA2-SLAT-FLAP	NA	NA	0.353	>0= UP
TAT	TOTAL OR OUTSIDE AIR TEMPERATURE	DC	FNSG1/3-2/3	211	1/2	0.25	NA
TAXI1	FLIGHT PHASE TAXI	NA	FWC1	270/11-12-13-14	1	NA	NA
TAXI2	FLIGHT PHASE TAXI2	NA	FWC1	270/11-12-13-14	1	NA	NA
TERNDC	TERRAIN ON CAPTAIN ND	NA	(E)GPWS	NA	1	NA	1=TERRAIN IMAGE DISPLAYED
TERNDF	TERRAIN ON FIRST-OFFICER ND	NA	(E)GPWS	NA	1	NA	1=TERRAIN IMAGE DISPLAYED
TEROFF	TERRAIN MODE OFF	NA	(E)GPWS	NA	1	NA	0=ENHANCED FUNCTIONS INHIBITED
TERRAHDPUP	TERR. AHEAD PULL UP OR OBST. AHEAD PULL UP	NA	(E)GPWS	270/22	1	NA	1= WARNING ON
TERRAHEAD	TERRAIN AHEAD	NA	(E)GPWS	270/27	1	NA	1= WARNING ON
TERRX2	TERRAIN-TERRAIN	NA	(E)GPWS	270/13	1	NA	1= WARNING ON
TESTC	TEST INITIATE CAPT	NA	FNCP1	272/29	1/4	NA	1= SELECTED
TESTF	TEST INITIATE F/O	NA	FNCP2	272/29	1/4	NA	1= SELECTED
TLA1G	THRUST LEVER ANGLE ENG.1 GE	DA	PMC	133	1	0.125	NA
TLA2G	THRUST LEVER ANGLE ENG.2 GE	DA	PMC	133	1	0.125	NA
TOOLOWFLP	TOO LOW FLAPS	NA	(E)GPWS	270/17	1	NA	1= WARNING ON
TOOLOWGEAR	TOO LOW GEAR	NA	(E)GPWS	270/15	1	NA	1= WARNING ON
TOOLOWTERR	TOO LOW TERRAIN	NA	(E)GPWS	270/16	1	NA	1= WARNING ON
TOWPT	BEARING TO WAYPOINT	DA	FMC1/2	115	1	0.70313	NA
TRA1PG	THRUST RESOLVER OR THRUST LEVER ANGLE ENG.1	DA	EEC/ECU	133	1	0.04395	NA
TRA2PG	THRUST RESOLVER OR THRUST LEVER ANGLE ENG.2	DA	EEC/ECU	133	1	0.04395	NA
TRAFFICADV	TCAS TRAFFIC ALERT VISUAL ANNONCIATOR ** ModifiÅ le 28/04/2006 remplacÅ mot10 par mot74 ** MP	NA	TCAS	DISC	1	NA	0=ALERT
TTQKG	TRIM TANK QUANTITY	KG	NA	NA	NA	1.81	NA
TTQLB	TRIM TANK QUANTITY	LBS	NA	NA	NA	4	NA
UNLOCK1	REVERSER UNLOCK ENG.1	NA	AMBER LIGHT	NA	1	NA	0= UNLOCK
UNLOCK2	REVERSER UNLOCK ENG.2	NA	AMBER LIGHT	NA	1	NA	0= UNLOCK
UPADVCOR	TCAS R-A COMBINATED CONTROL UP ADVISORY CORRECTIVE	NA	TCAS	270	1	NA	NA
UTC	GMT ED55F2	NA	NA	NA	NA	NA	NA
UTCH	HEURE BCD GMT ED55F2	NA	CLOCK	150	1/64	3600	NA
UTCM	MINUTE GMT ED55F2	NA	CLOCK	150	1/4	60	NA
UTCS	SECONDE GMT ED55F2	NA	CLOCK	150	1/4	1	NA
VFE180	OVERSPEED VFE MAX 180	NA	FWC	NA	1	NA	1= WARNING
VFE195	OVERSPEED VFE MAX 195	NA	FWC	NA	1	NA	1= WARNING
VFE210	OVERSPEED VFE MAX 210	NA	FWC	NA	1	NA	1= WARNING
VFE245	OVERSPEED VFE MAX 245	NA	FWC	NA	1	NA	1= WARNING
VHF1	V.H.F1 KEING	NA	RADIO TRANSMITTER	NA	1	NA	0= EMITTING
VHF2	V.H.F2 KEING	NA	RADIO TRANSMITTER	NA	1	NA	0= EMITTING
VHF3	V.H.F3 KEING	NA	RADIO TRANSMITTER	NA	1	NA	0= EMITTING
VLE255	OVERSPEED VLE MAX 255/.65	NA	FWC	NA	1	NA	1= WARNING
VLE270	OVERSPEED VLE MAX 270	NA	FWC	NA	1	NA	1= WARNING
VMO340	OVERSPEED VMO/MMO340/.84	NA	FWC	NA	1	NA	1= WARNING
VMO360	OVERSPEED VMO/MMO360/.84	NA	FWC	NA	1	NA	1= WARNING
VOR1BG	VOR.1 BEARING	DA	VOR1	222	1	0.70313	NA

MNEMO	LABEL	UNIT	SOURCE	LABEL	PPS	RESOL info	SIGN CONV
VOR2BG	VOR.2 BEARING	DA	VOR	222	1	0.70313	NA
VORCPT	VOR CAPTURE MODE	NA	FCC	275/22-21	1	NA	1= SET
VORCS	VOR MODE CAPT	NA	FNCP1	272/25	1/4	NA	1=VOR
VORDME	NAVIGATION MODES INERTIAL VOR/DME	NA	FMC	270/13-15	1	NA	NA
VORF1	VOR 1 FREQUENCY	MHZ	VOR	34	1/4	NA	NA
VORF2	VOR 2 FREQUENCY	MHZ	VOR	34	1/4	NA	NA
VORFS	VOR MODE F/O	NA	FNCP2	272/25	1/4	NA	1=VOR
VORTRK	VOR TRACK MODE	NA	FCC	275/22-23	1	NA	1= SET
VRTG	BODY NORMAL ACCELERATION	G	3 AXIS ACCEL	NA	8	0.00229	>0= UP
VS	VERTICAL SPEED	NA	FCC	274/14	1	NA	1= SET
VSIRS	VERTICAL SPEED	FT/MN	IRS1/3	365	1	8	>0=UP
WAI1COR	WING ANTI-ICING.1	NA	TCC	273/13	1/4	NA	1=CORR THRUST APPLIED
WAI2COR	WING ANTI-ICING.2	NA	TCC	273/14	1/4	NA	1=CORR THRUST APPLIED
WAIALT	WING ANTI-ICE PUSH BUTTON ALTERNATE	NA	A-I VALVE	NA	1/4	NA	1=NO ALT
WAILA	WING ANTI-ICE VALVE LH ALTERNATE UNCLOSED	NA	A-I VALVE	NA	1/4	NA	1= UNCL
WAILN	WING ANTI-ICE VALVE LH NORMAL UNCLOSED	NA	A-I VALVE	NA	1/4	NA	1= UNCL
WAION	WING ANTI-ICE PUSH BUTTON ON	NA	A-I VALVE	NA	1/4	NA	1=OFF
WAIRA	WING ANTI-ICE VALVE RH ALTERNATE UNCLOSED	NA	A-I VALVE	NA	1/4	NA	1= UNCL
WAIRN	WING ANTI-ICE VALVE RH NORMAL UNCLOSED	NA	A-I VALVE	NA	1/4	NA	1= UNCL
WD	WIND DIRECTION	DA	IRS 1/3	316	1	0.3516	NA
WGD	WINDSHIELD GUIDANCE DISPLAY (HUD?)	NA	NA	NA	1/4	NA	1= ON
WHEEL	WHEEL PAGE SELECTED	NA	ECAM SGU	NA	1/4	NA	1= SELECTED
WS	WIND SPEED	KT	IRS 1/3	315	1	1	NA
WSHAHEAD	WINDSHEAR AHEAD 1 OR 2	NA	WEATHER RADAR	NA	1	NA	1= NO WARNING
WSHALERT	WINDSHEAR ALERT	NA	FWC	NA	1	NA	1= WARNING
WSHRW	WINDSHEAR WARNING	NA	FNSG 1/3-2/3	270/25	1	NA	1= WARNING
XFV	X FEED VALVE CLOSED	NA	SDAC	145/24	1/4	NA	1= CLOSED
YAWFD	YAW FD	DA	FCC1/2	143	1	0.08789	NA
YAWTO	YAW TAKE-OFF MODE	NA	FCC	275/17	1	NA	1= SET
YD1F	YAW DAMPER 1 FAULT	NA	FWC	126/25	1/4	NA	1= FAULT
YD2F	YAW DAMPER 2 FAULT	NA	FWC	126/26	1/4	NA	1= FAULT

AIRBUS

APPENDIX 3



A/C : -	MSN 0841	FLIGHT	No 1354

CG (%) 28.66
WGT (LBS) 302480
WGT (KG) 137203

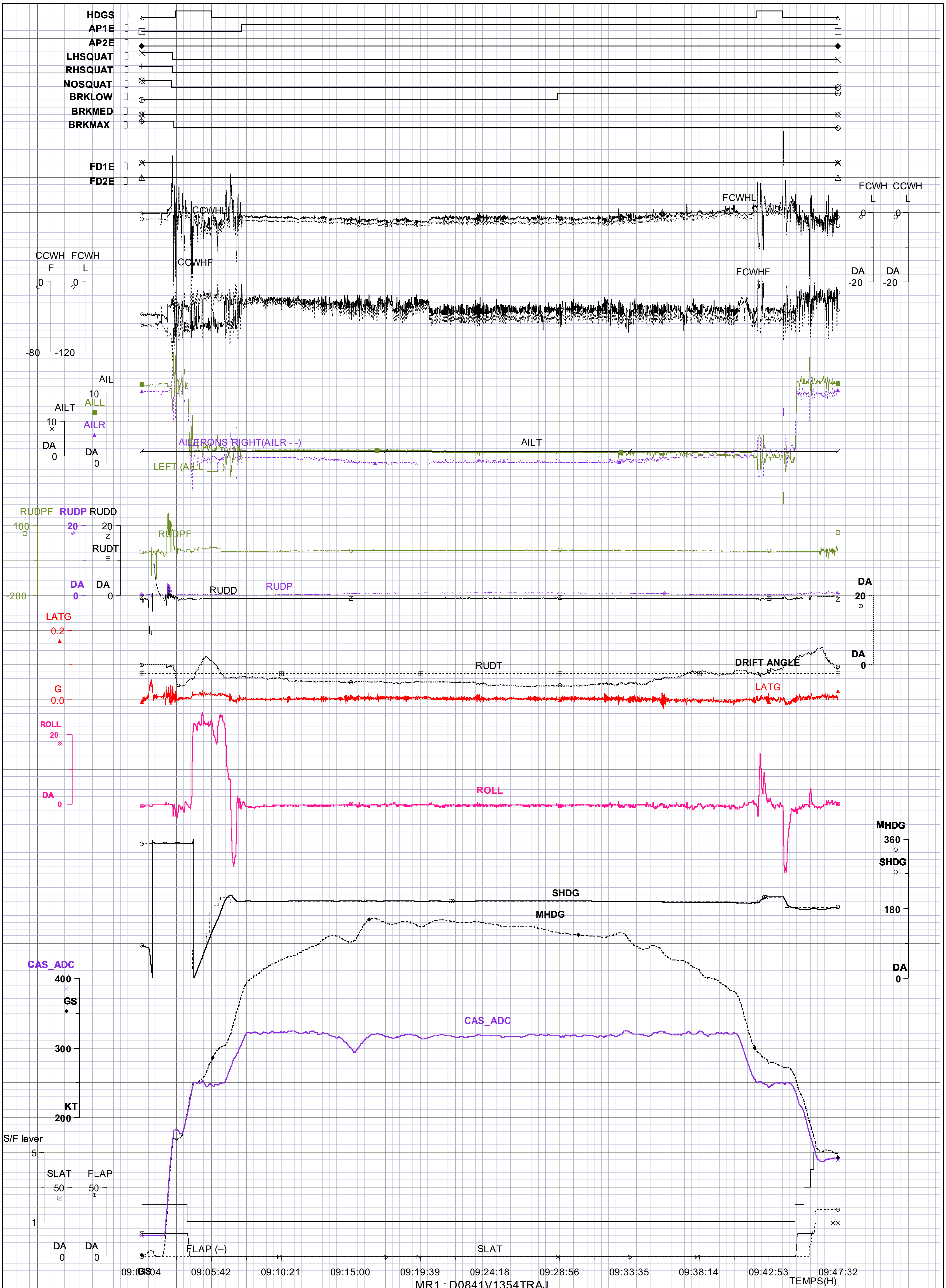
FLIGHT (LONGITUDINAL)

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.1

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Flight-Longi.ilv



A/C : - MSN 0841 FLIGHT No 1354

CG (%) 28.66
WGT (LBS) 302480
WGT (KG) 137203

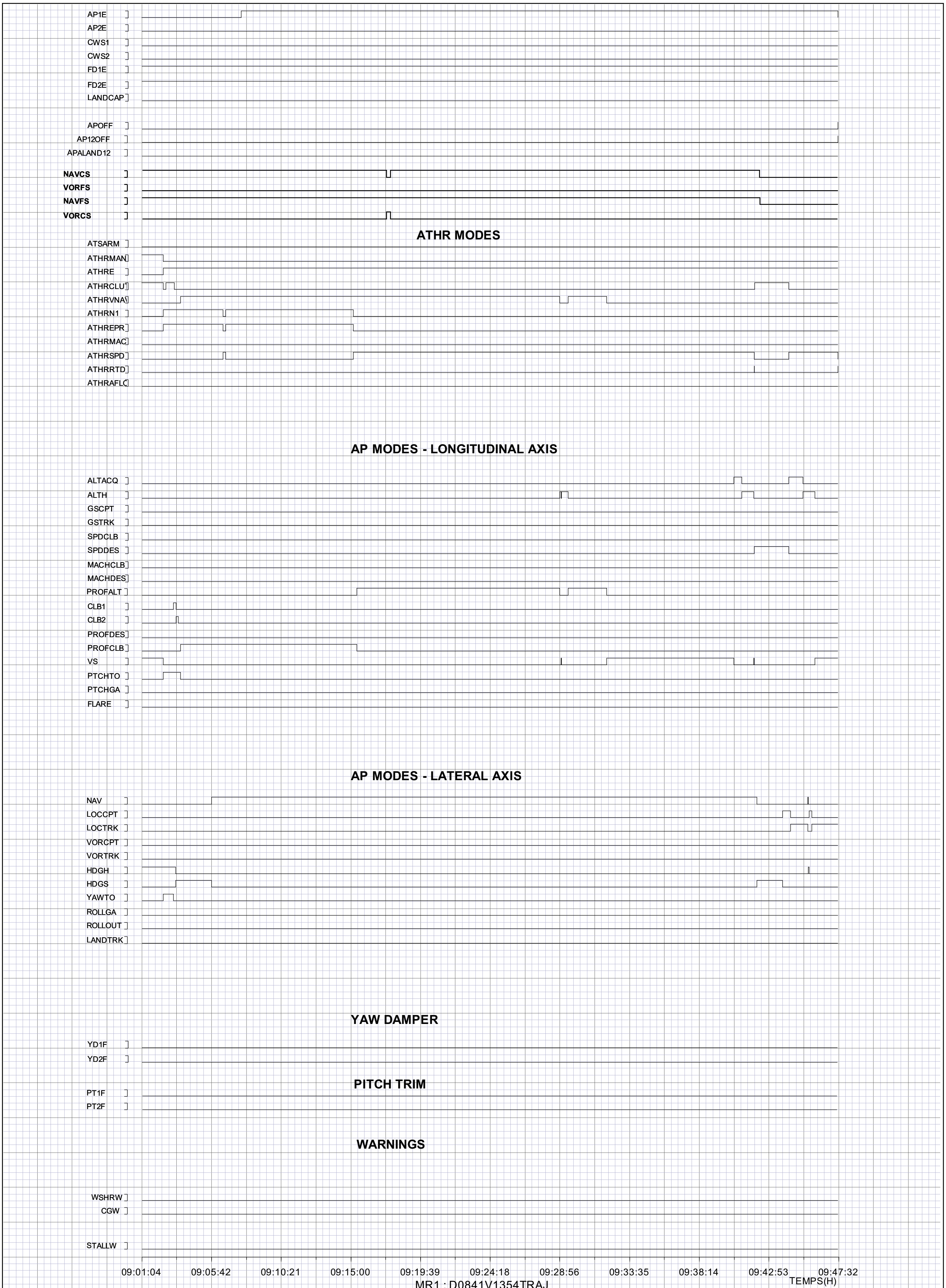
APPROACH (LATERAL AXIS)

© Airbus
AIRBUS
Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.2

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Flight-Lat.ilv



A/C : - MSN 0841 FLIGHT No 1354

ATHR MODES-AP MODES-YAW DAMPER-PITCH TRIM

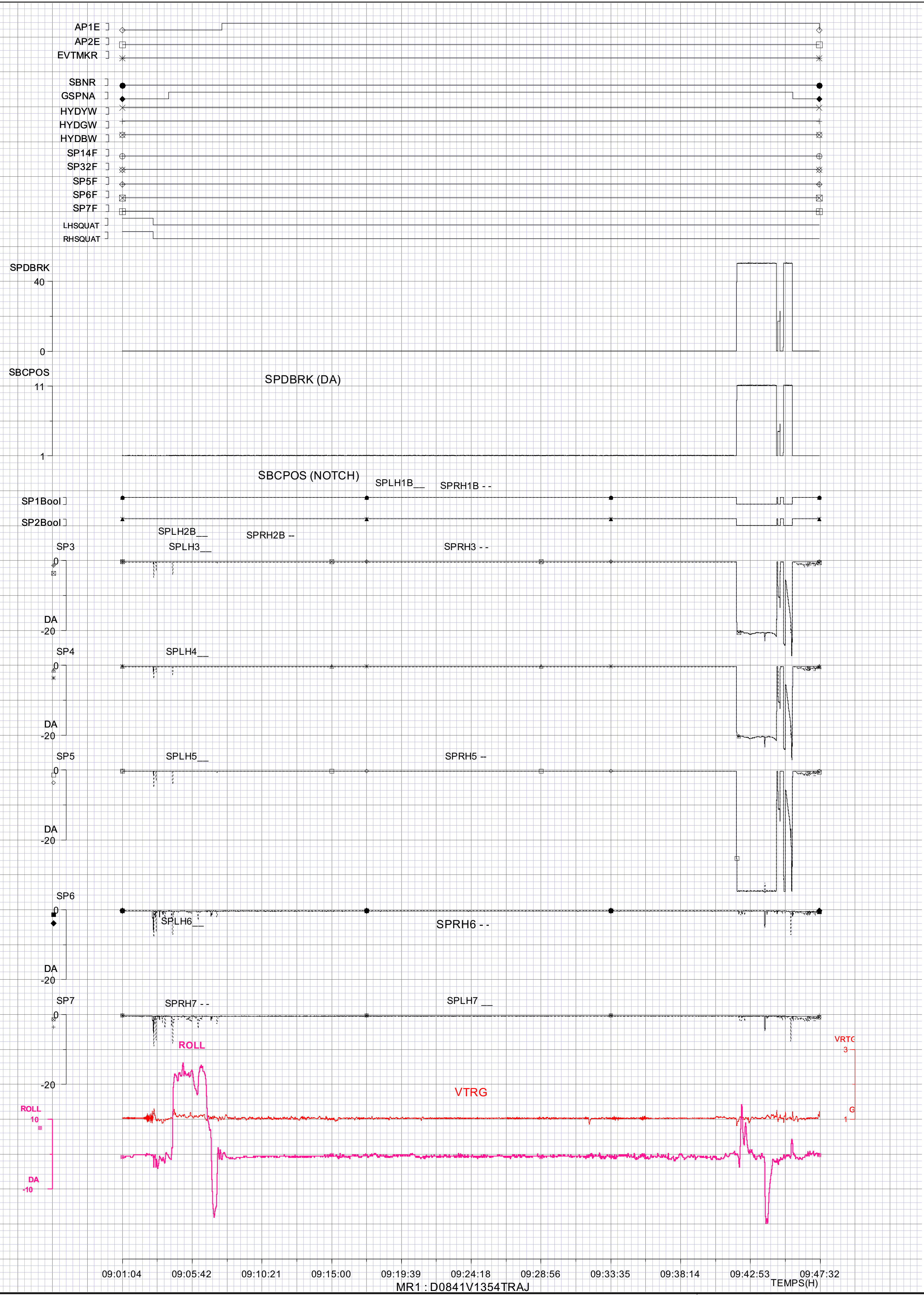
WGT (LBS) 302480.00
CG (%) 28.66

/workgroup/operation/dfdr/visage/virginie/WB/UPS/AP-modes.ilv

AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.3



A/C : - MSN 0841 FLIGHT No 1354

CG (%) 28.66
WGT (LBS) 302480.00
WGT (KG) 137202.61

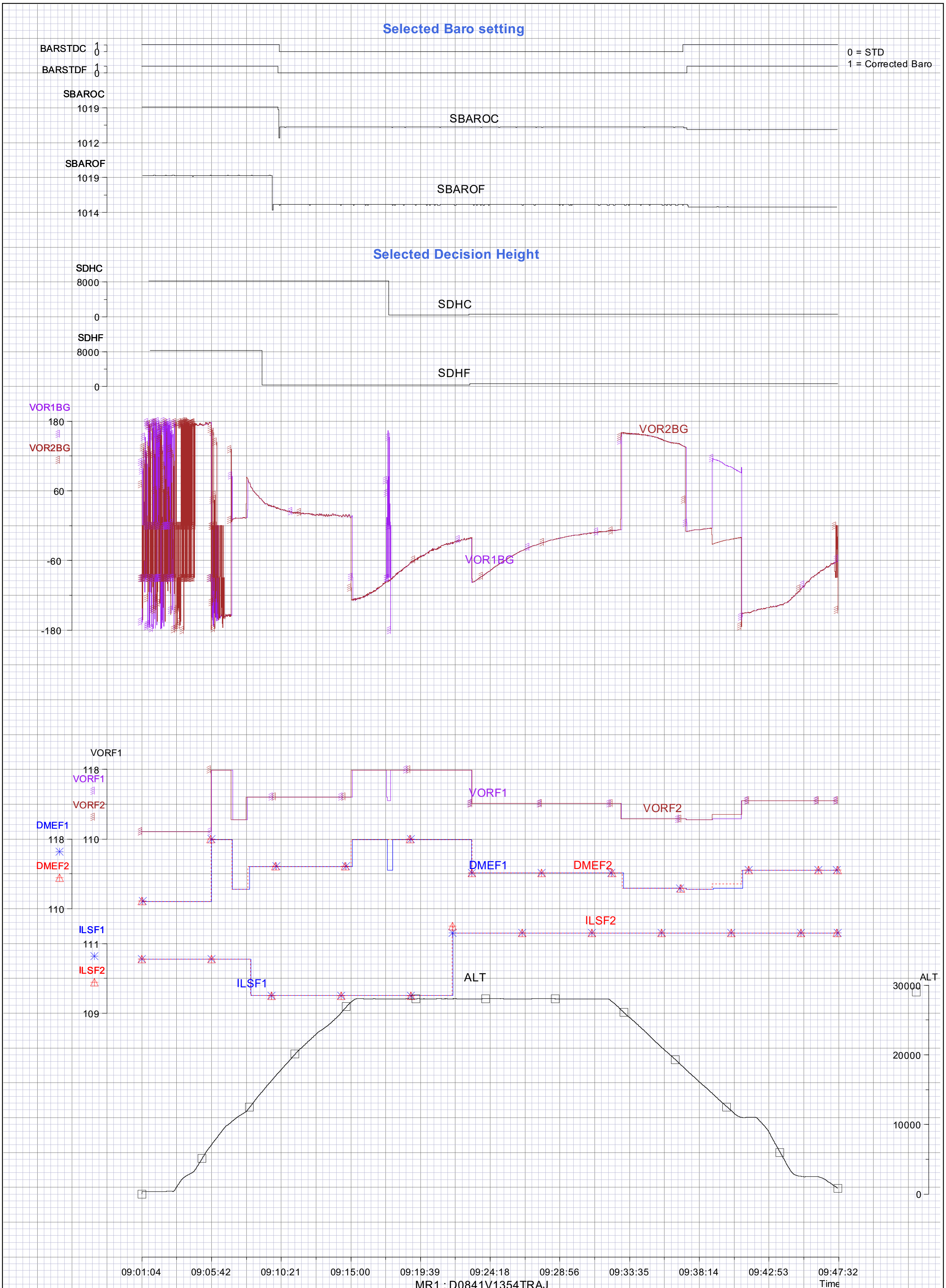
SPOILERS

AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.4

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Spoilers-2.ilv



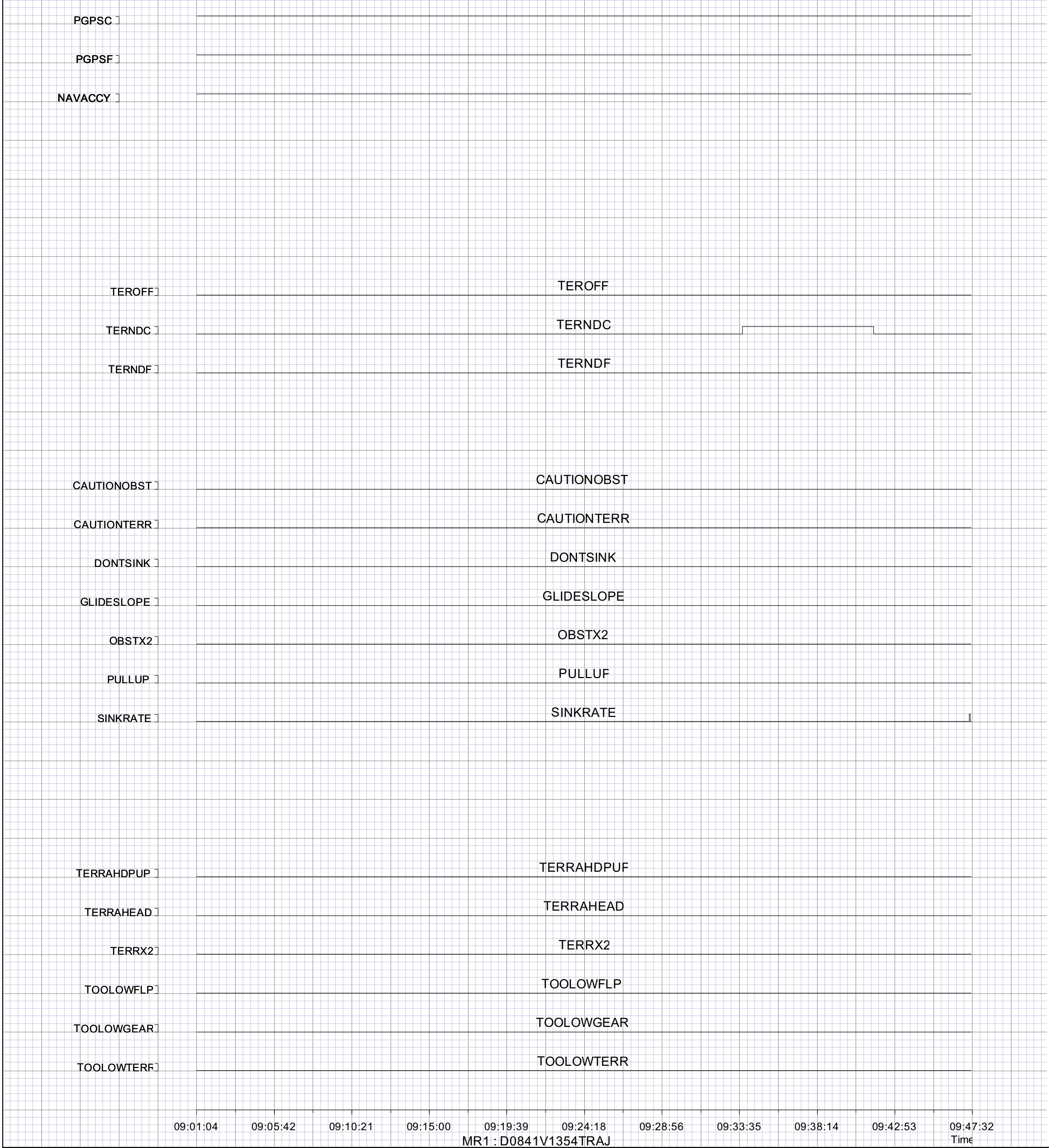
A/C : - MSN 0841 FLIGHT No 1354 Test date : 0/0/2000

DME 1-2 OPERATION F1

Edited : 16/9/2013

Figure 1.1.5

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Flight-DME.ilv



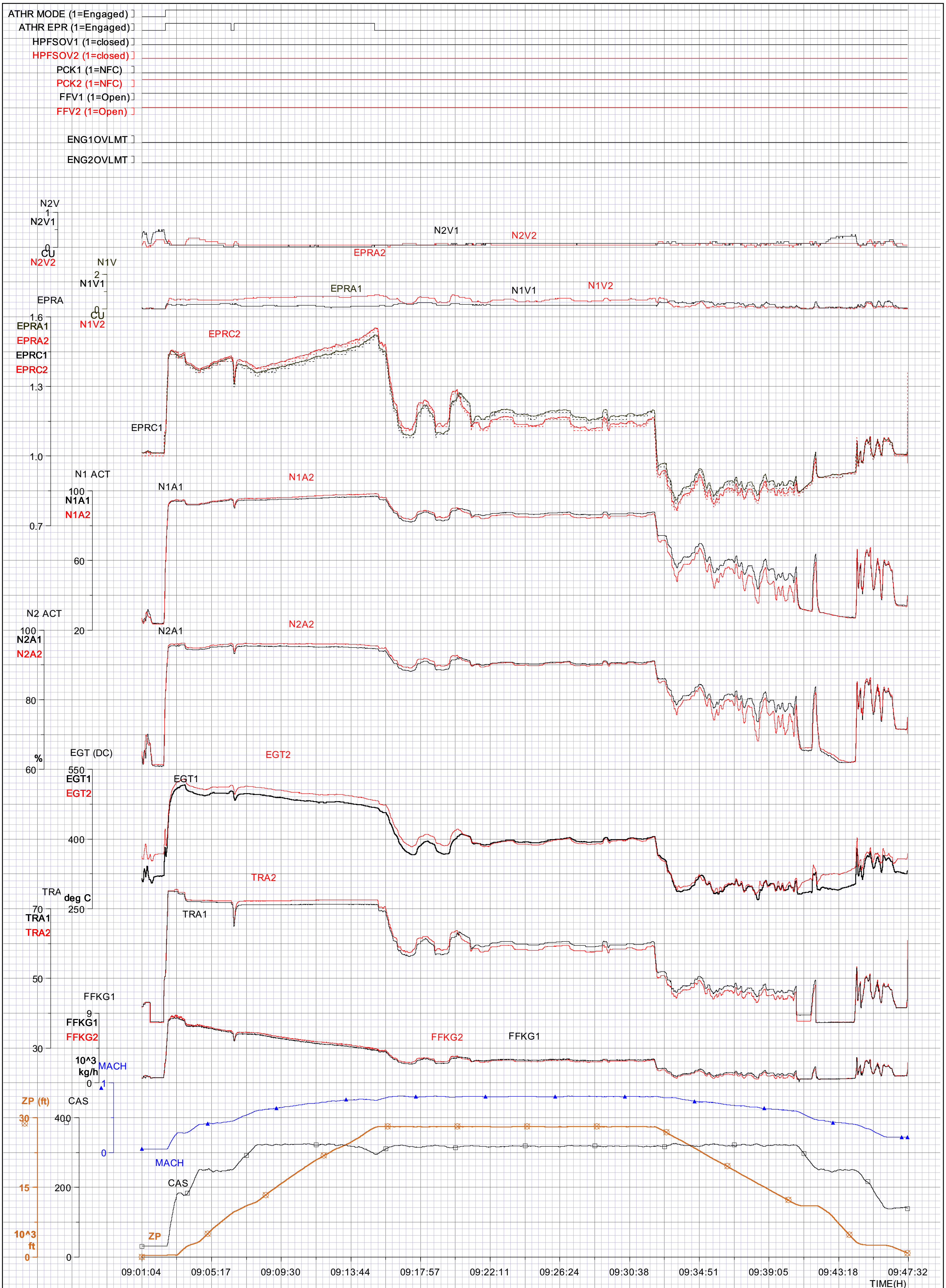
A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
			(E)GPWS	

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.6

/workgroup/operation/dfdr/visage/virginie/WB/UPS/EGPWS-2.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	MR1 : D0841V1354TRAJ

Engine 12 - Main Parameters - DFDR

FLIGHT CONDITIONS AT GMT START

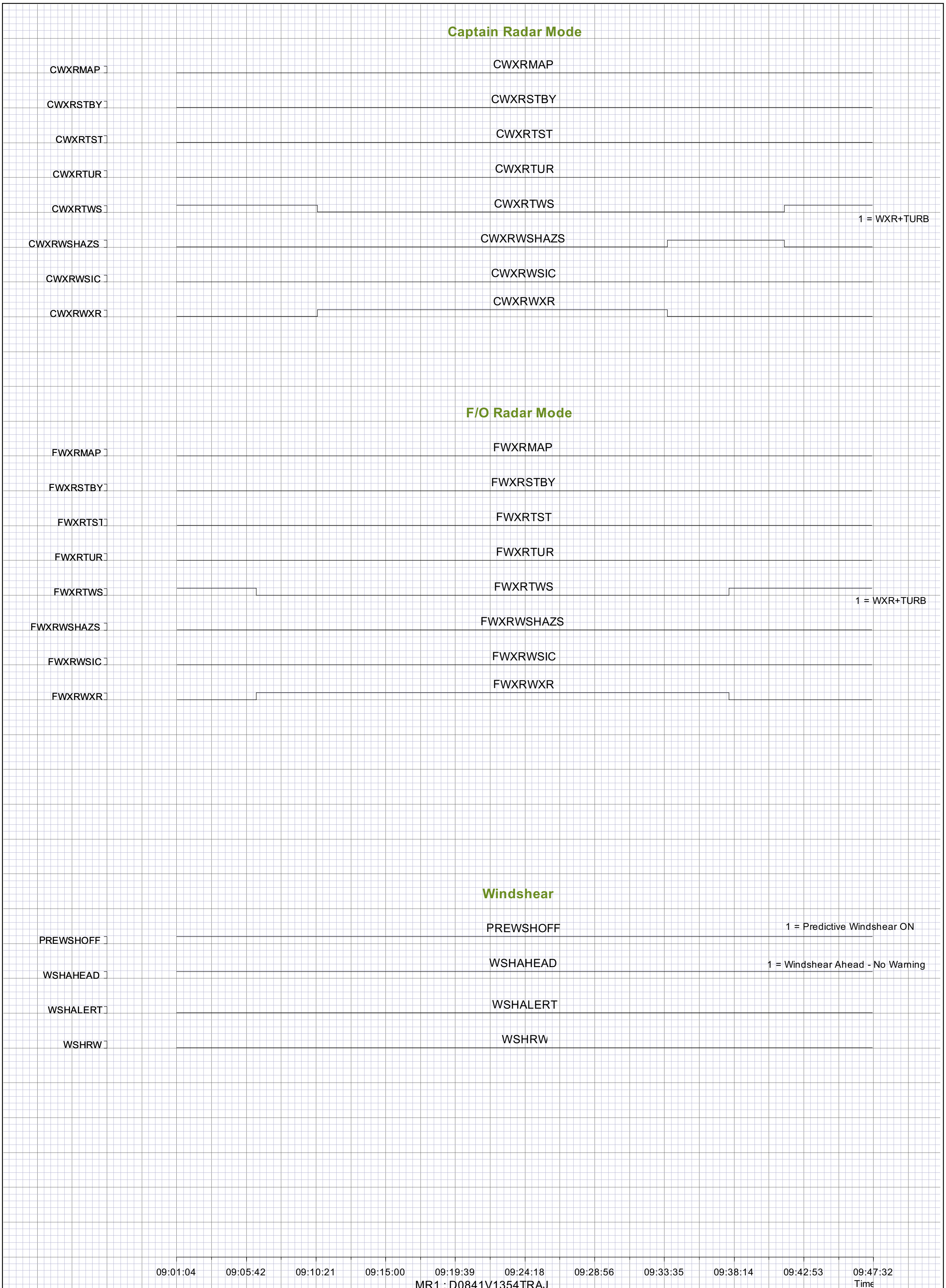
ZP = 0 FT
TAT = 16.5 DC
VC = 30 KT

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.7

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Flight-Eng.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
			RADAR	

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.8

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Radar-mode.ilv

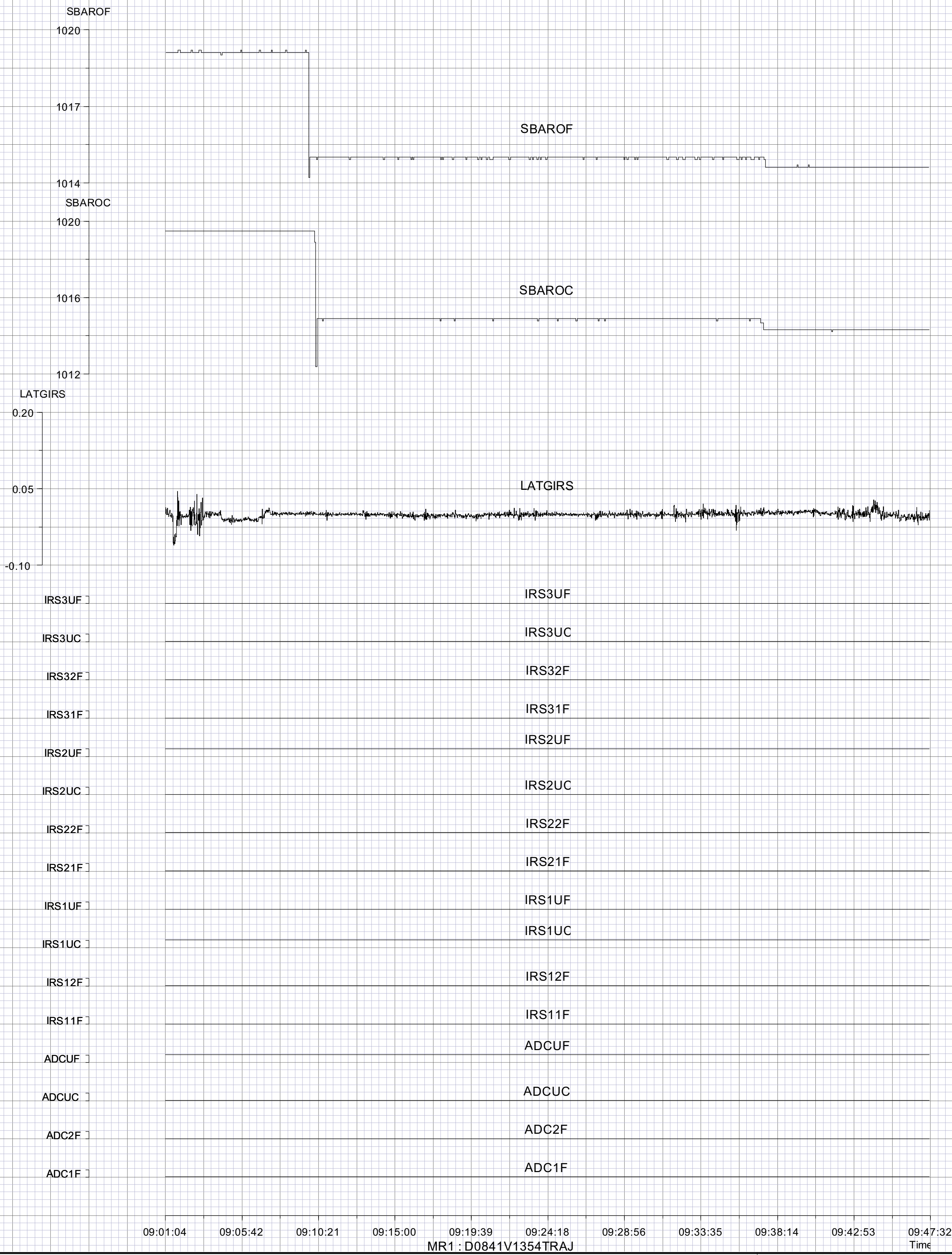
A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
			TRIM	

© Airbus — AIRBUS — Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.9

/workgroup/operation/dfdr/visage/virginie/WB/UPS/STAB-PTWS.ilv



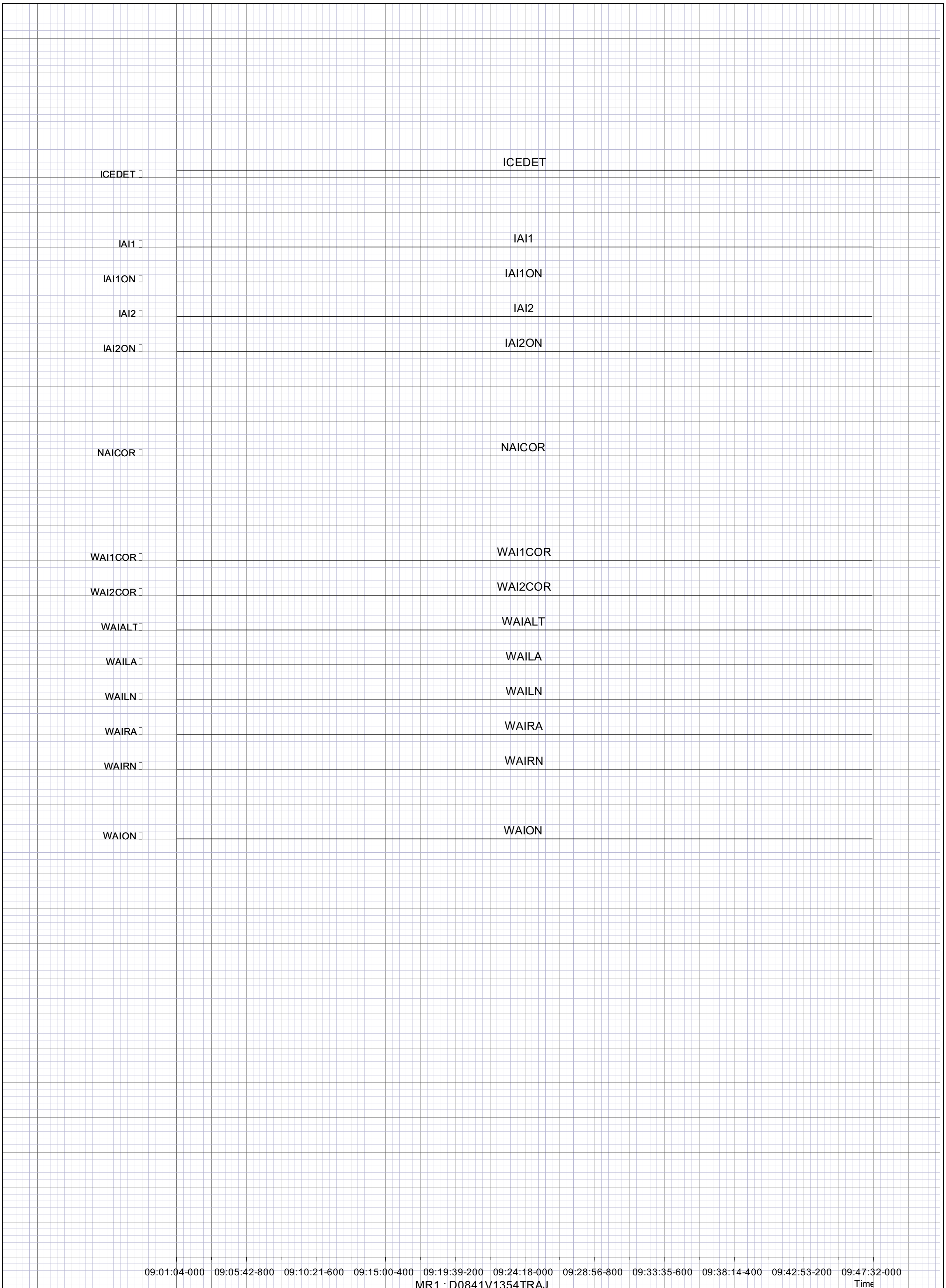
A/C : -	**MSN 0841**	**FLIGHT**	**No 1354**	**Test date : 0/0/2000**
			ADC-IR Parameters	

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.10

/workgroup/operation/dfdr/visage/virginie/WB/UPS/ADC-IRS-Parameters.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354** **Test date : 0/0/2000**

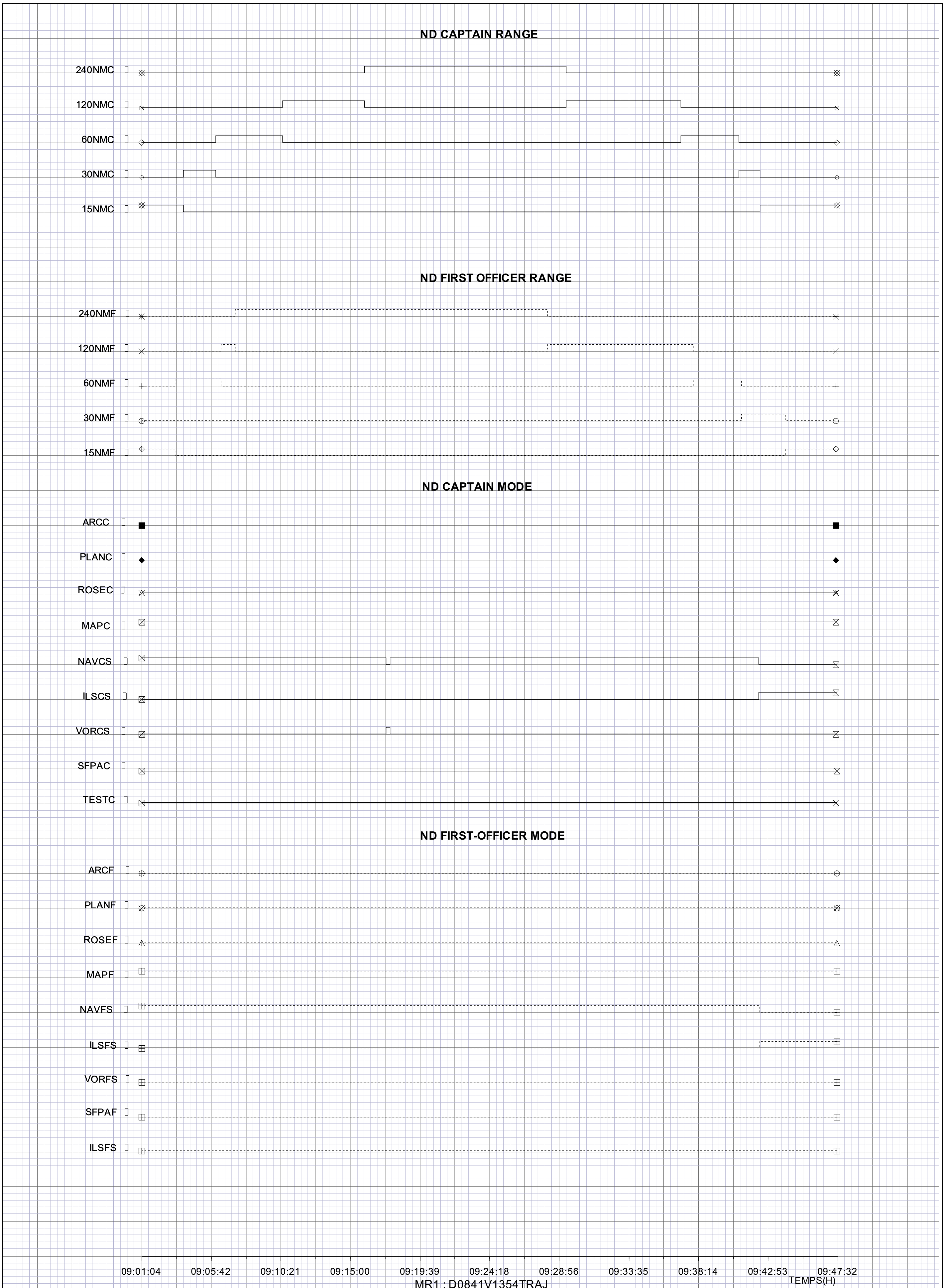
Anti-Ice

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.11

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Anti-Ice.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354**

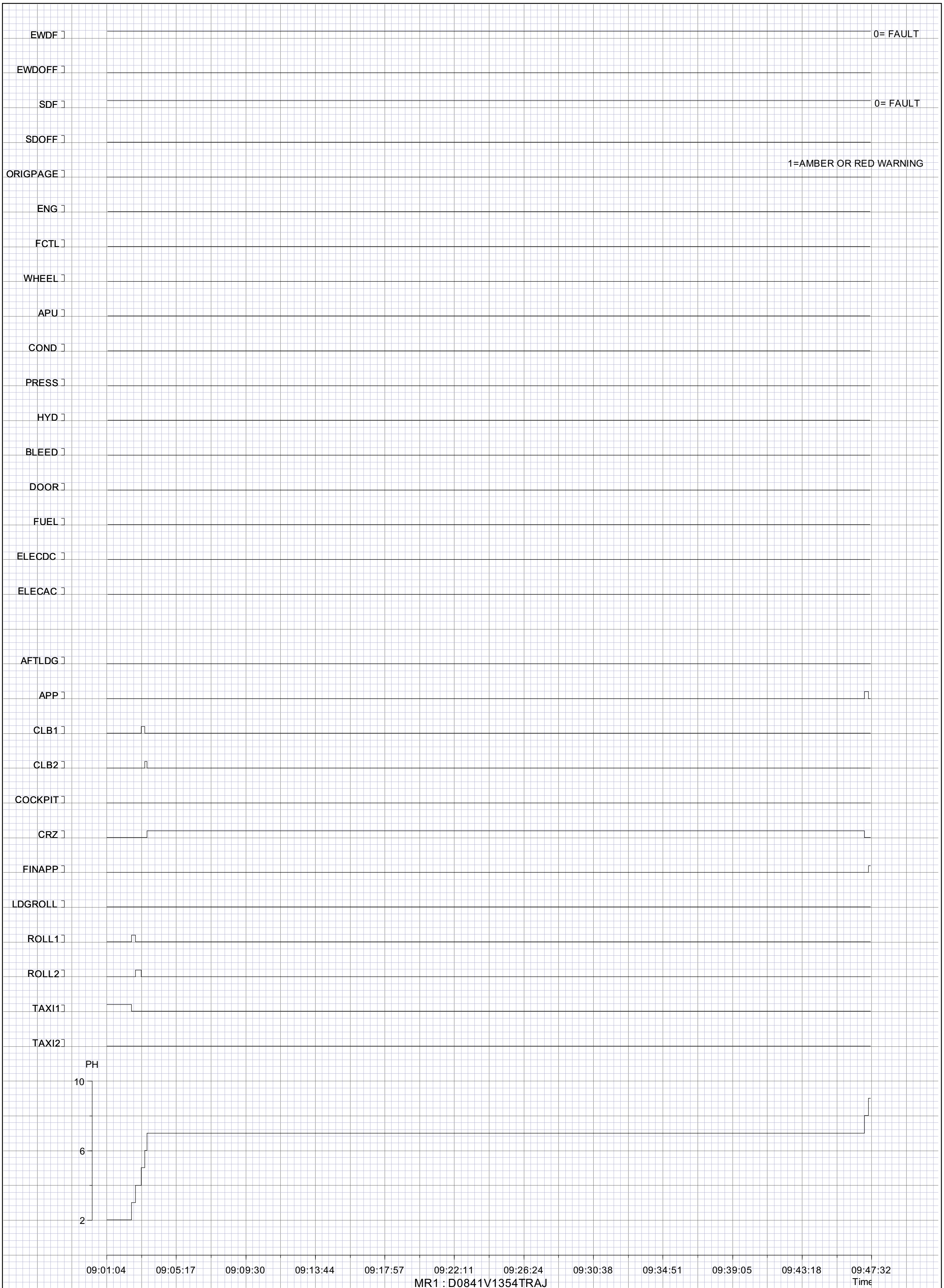
DMC_MODE_RANGE

AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.12

/workgroup/operation/dfdr/visage/virginie/WB/UPS/DMC-mode-range.ilv



A/C : -	MSN 0841	FLIGHT	No 1354

ECAM PAGE WIDE BODY

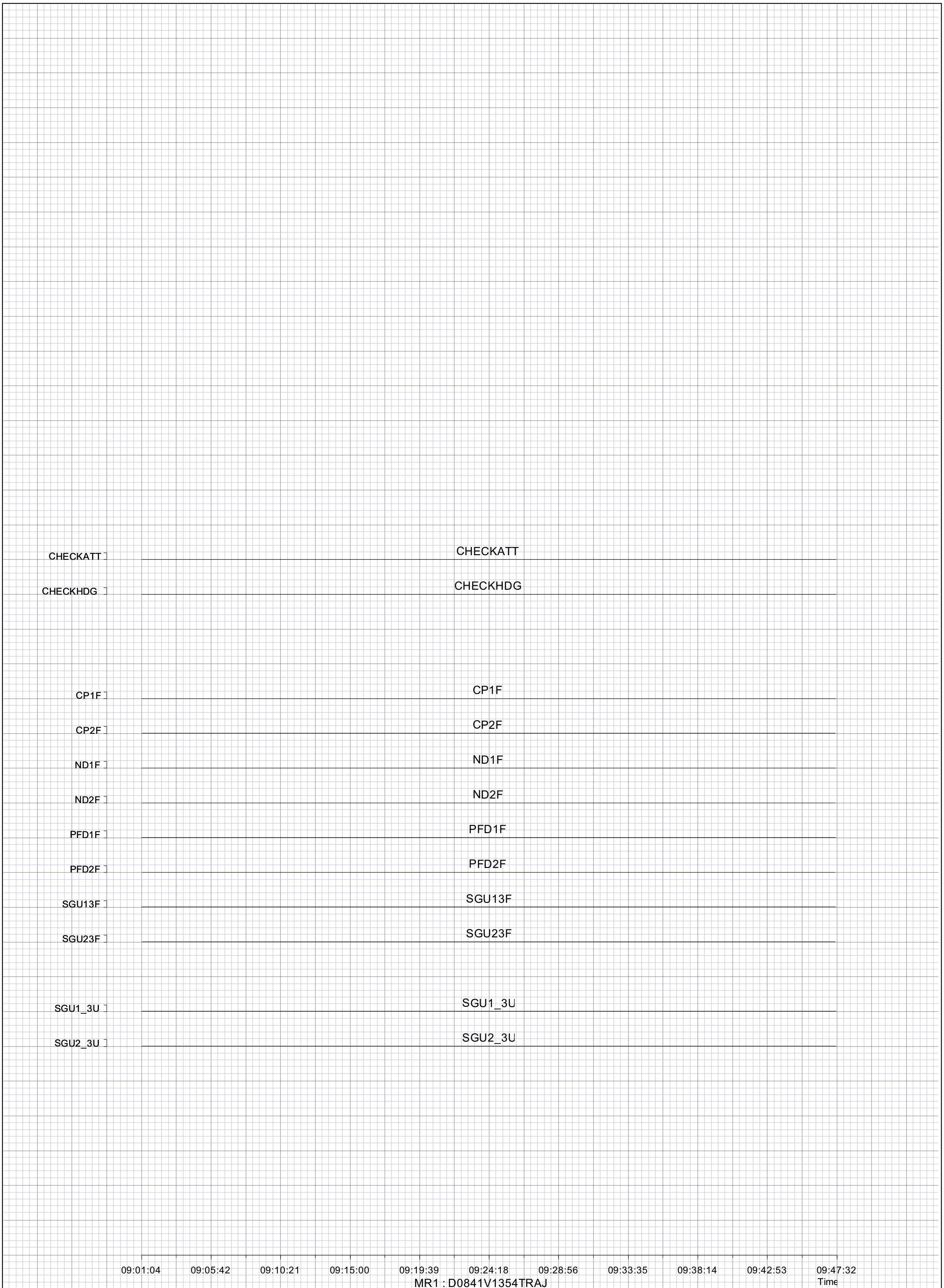
AIRBUS

Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.13

/workgroup/operation/dfdr/visage/virginie/WB/UPS/ECAM.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354** **Test date : 0/0/2000**

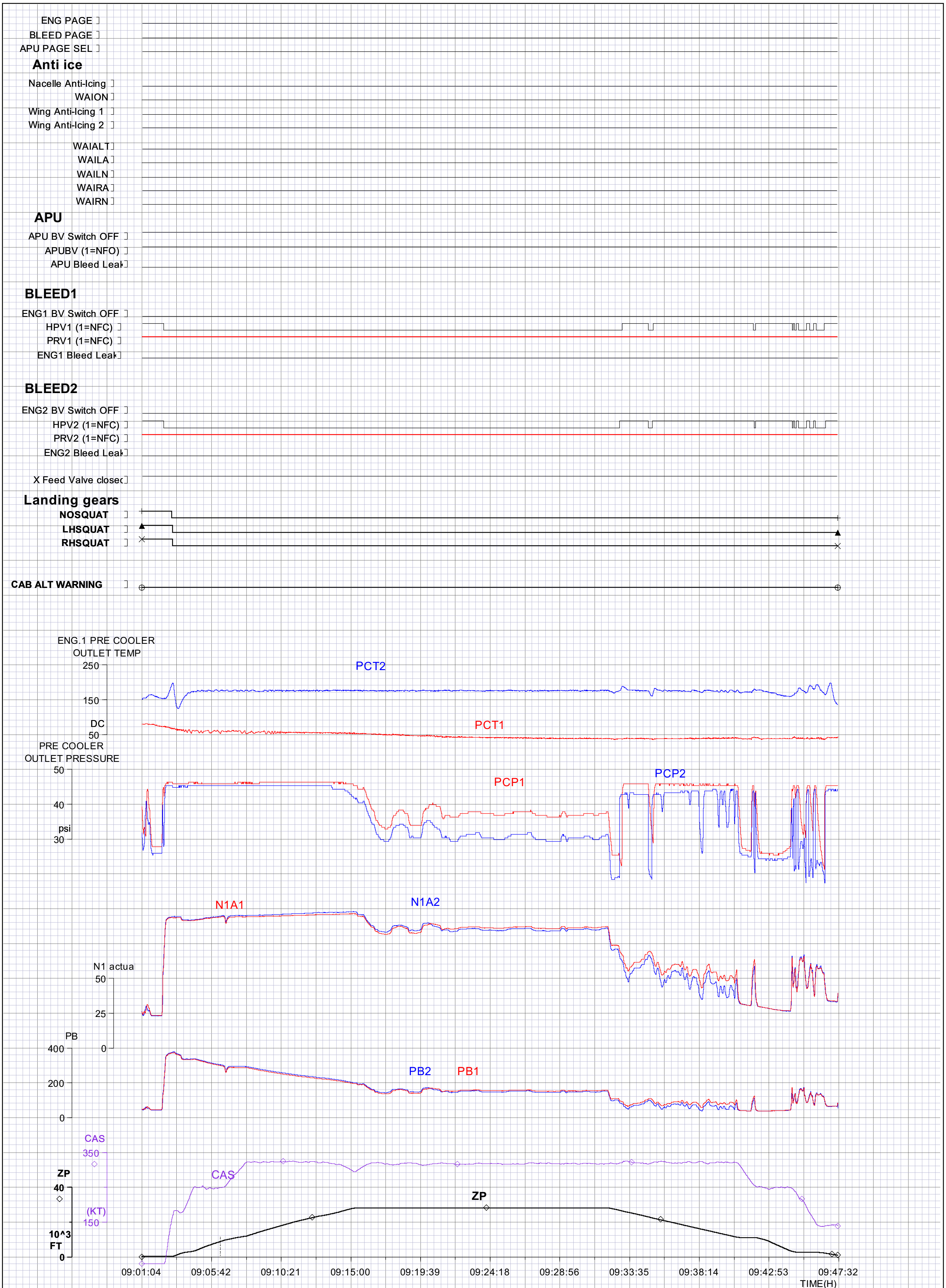
EFIS

© Airbus AIRBUS **Flight And Integration Tests Centre**

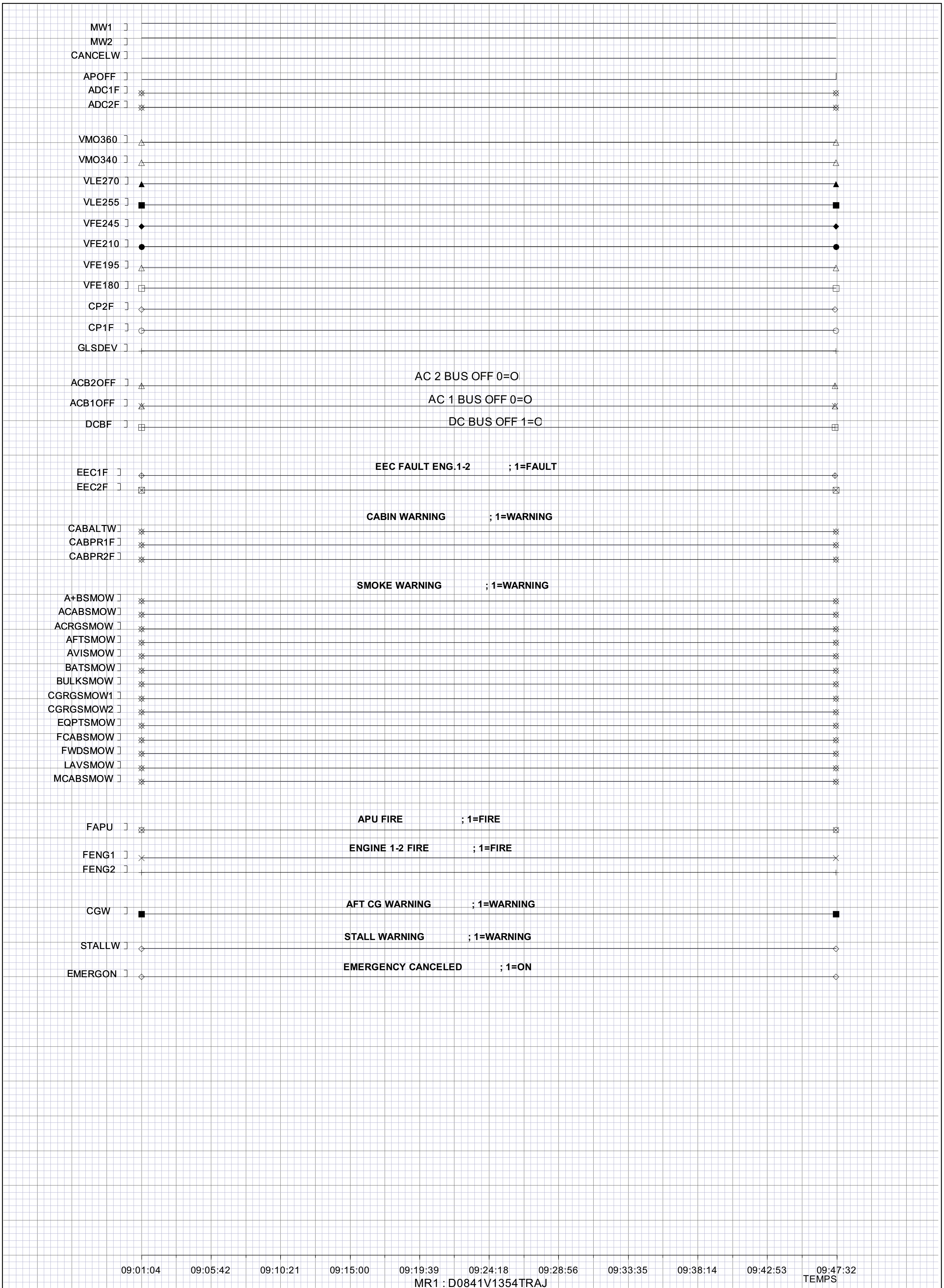
Edited : 16/9/2013

Figure 1.1.14

/workgroup/operation/dfdr/visage/virginie/WB/UPS/EFIS.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	MR1 : D0841V1354TRAJ	
TK21/DFDR ENGINE/BLEED PARAMETERS				AT GMT START	© Airbus — Flight And Integration Tests Centre
				ZP (FT)= 0.0(	
				SAT (DC)= -3.94 TAT (DC)= 16.5(VC (KT)= 30.0(	Edited : 16/9/2013 — Figure 1.1.15
/workgroup/operation/dfdr/visage/virginie/WB/UPS/Eng-Bleed-PW.ilv					



A/C : - MSN 0841 FLIGHT No 1354

FWS CONFIGURATION&WARNINGS-(VERSION ED55)

WGT (KG) 137202.61 WGT (LBS) 302480.00
CG (%) 28.66

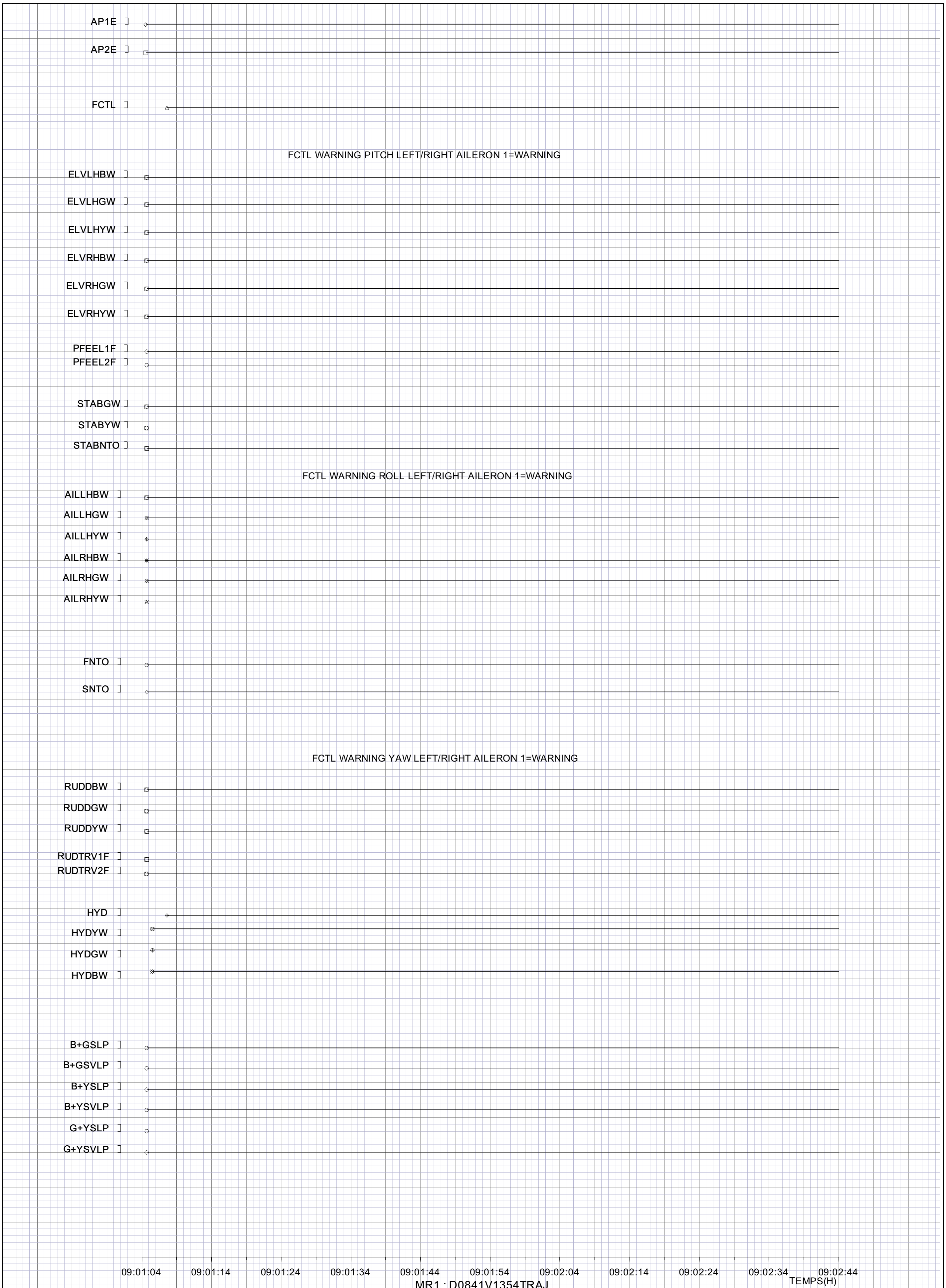
/workgroup/operation/dfdr/visage/virginie/WB/UPS/FWS.ilv

AIRBUS

Flight And Integration Tests Centre

Edited : 16/9/2013

Figure
1.1.16



A/C : - MSN 0841 FLIGHT No 1354

FLIGHT CONTROLS AND HYDRAULICS-DISCRETS STATUS

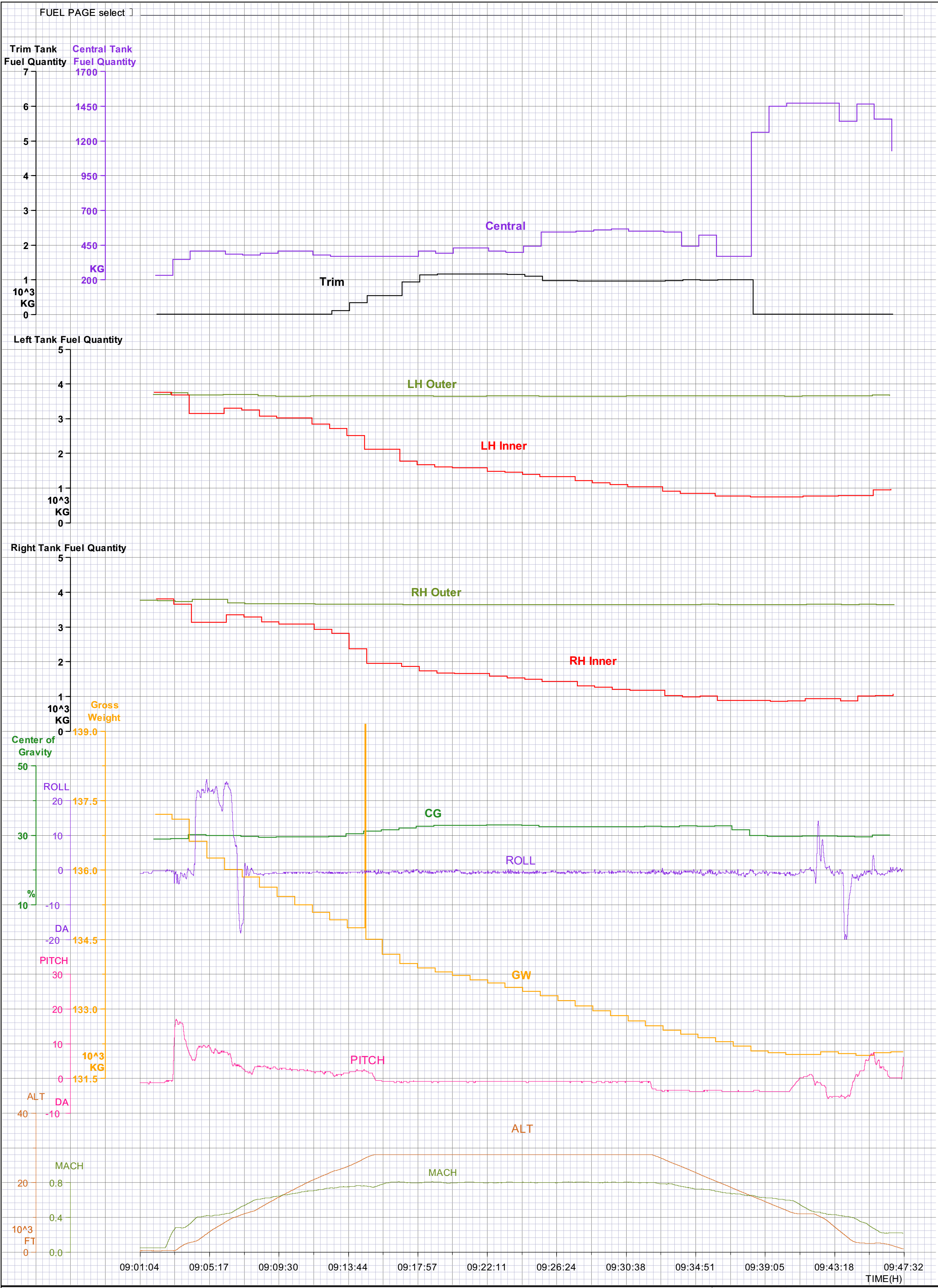
CG(%) 28.66 WGT (LBS) 302480.00 WGT (KG) 137202.61

/workgroup/operation/dfdr/visage/virginie/WB/UPS/FlightControl-Hydraulic.ilv

AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.17



A/C : - MSN 0841 FLIGHT No 1354

MR1 : D0841V1354TRAJ

DFDR - Wide Body - FUEL QUANTITY PARAMETERS

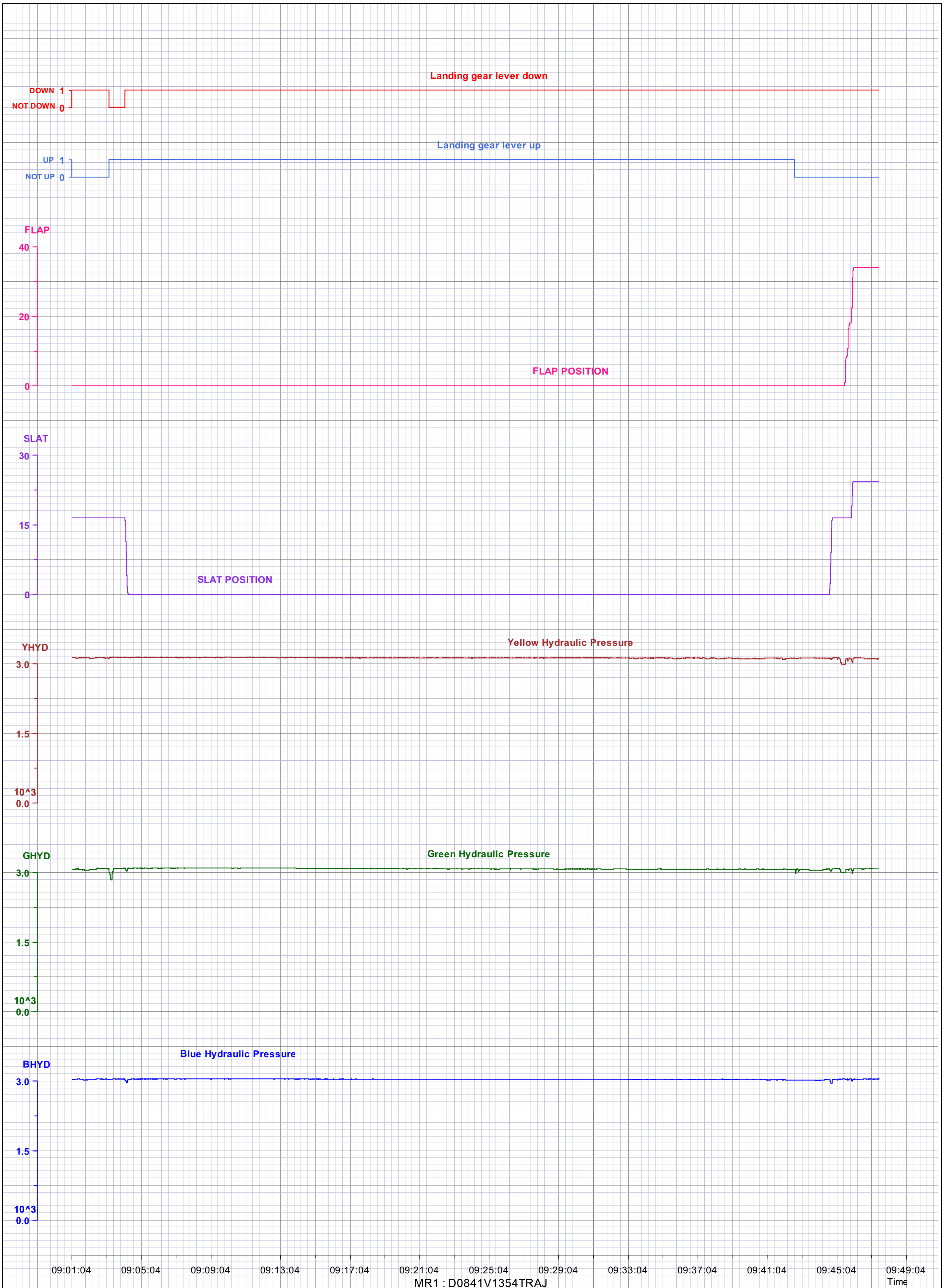
AT GMT START
ZP (FT)= 0.0(
VC (KT)= 30.0(
TAT (DC)= 16.5(

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.18

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Fuel-Quantities.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
		EATON EDP EA2A		

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.19

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Hydraulic-Pressures.ilv

A/C : - **MSN 0841** **FLIGHT** **No 1354** **Test date : 0/0/2000**

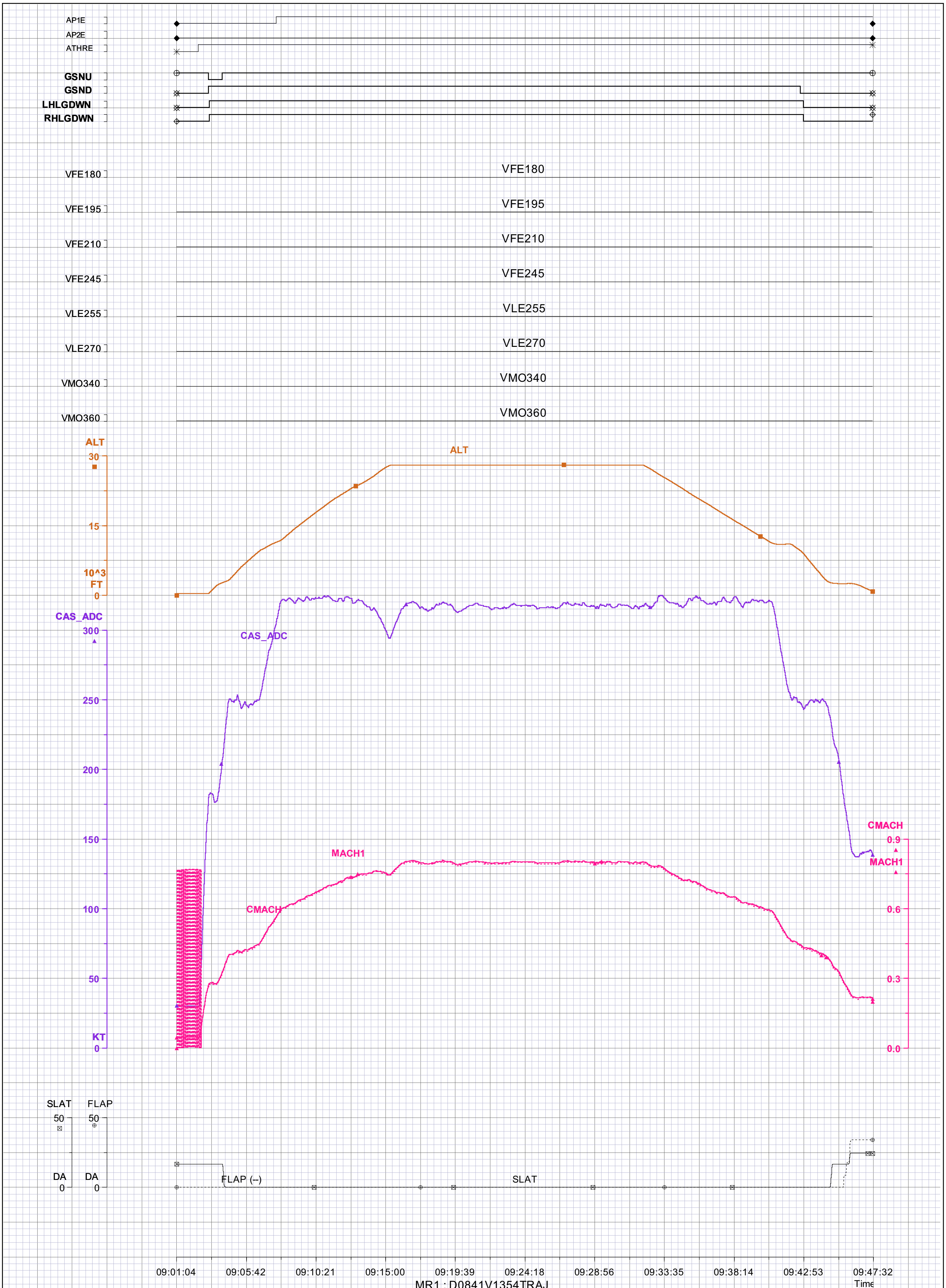
OIL Parameters

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.20

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Oil-Parameters.ilv



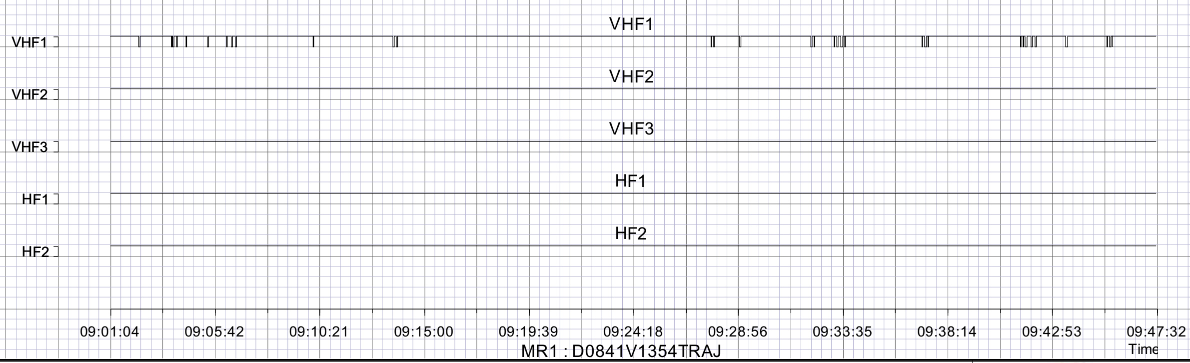
A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
			VFE / VLE / VMO	

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.21

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Overspeed.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354** **Test date : 0/0/2000**

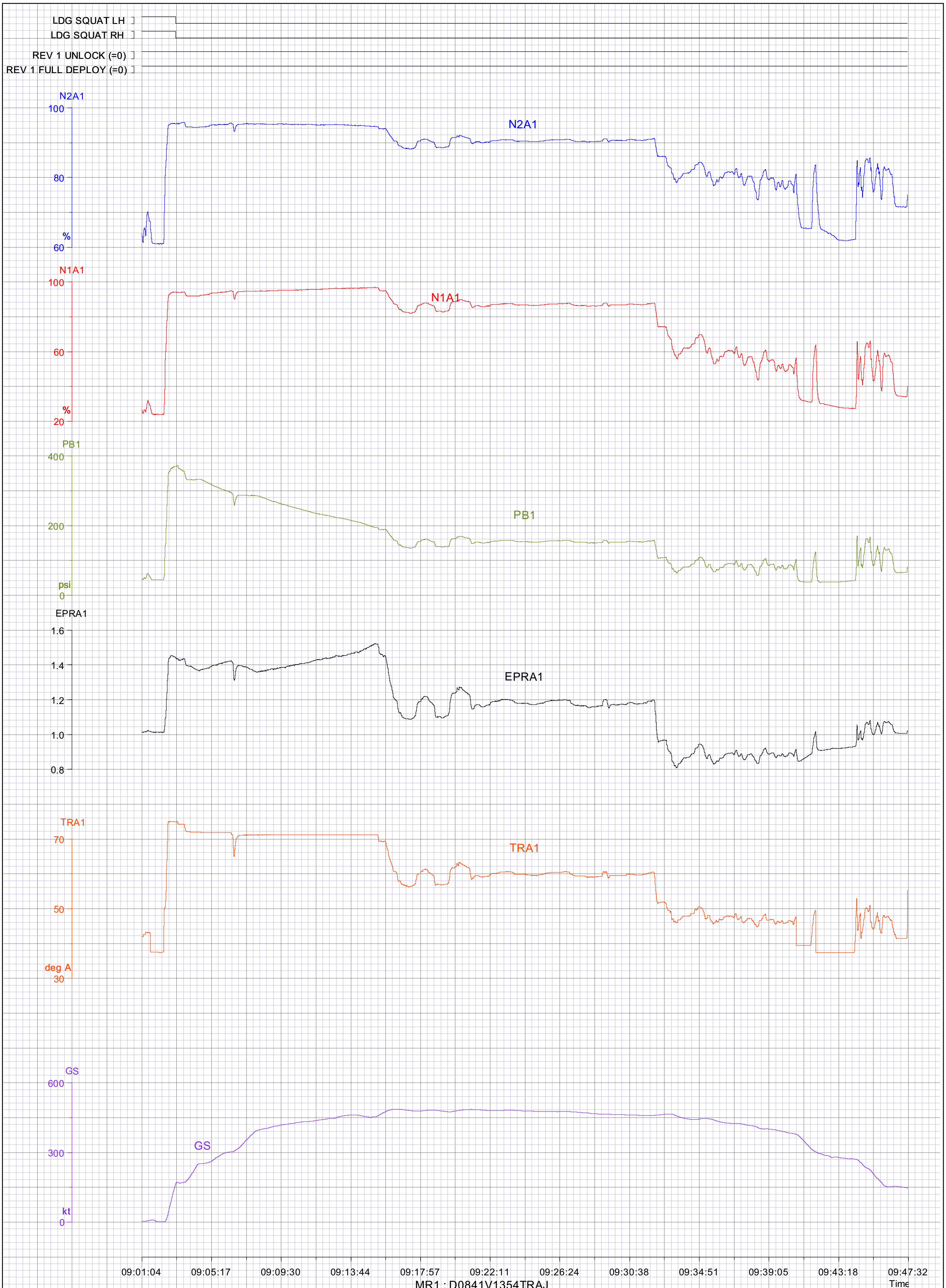
RADIO TRANSMITTER

AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.22

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Radio.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000

WideBodies PW4000 REVERSE/ENGINE 1 PARAMETERS

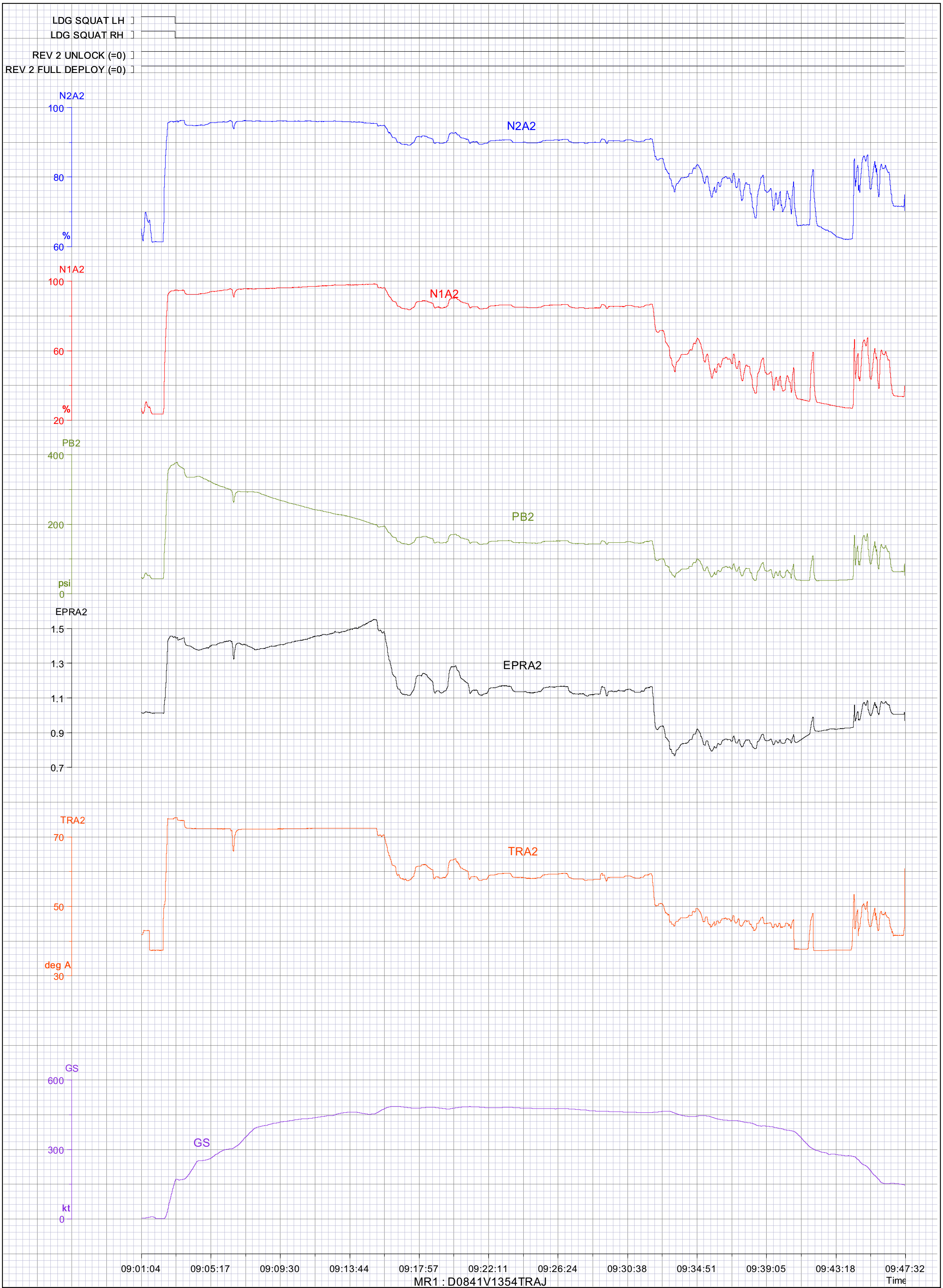
AIRBUS

Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.23

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Reverse-Eng1.ilv



A/C : - MSN 0841 FLIGHT No 1354 Test date : 0/0/2000

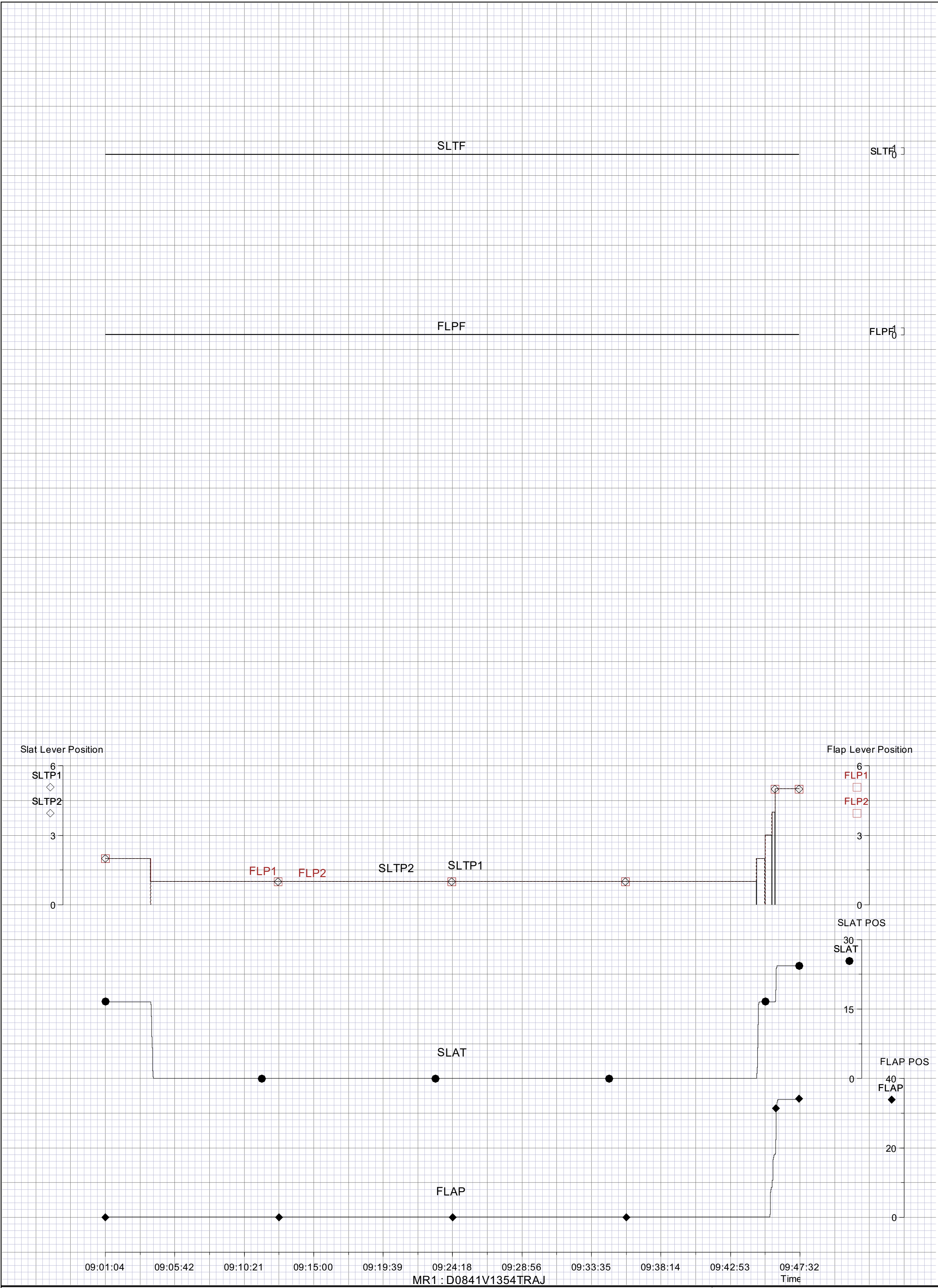
WideBodies PW4000 REVERSE/ENGINE 2 PARAMETERS

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.24

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Reverse-Eng2.ilv



A/C : - MSN 0841 FLIGHT No 1354 Test date : 0/0/2000

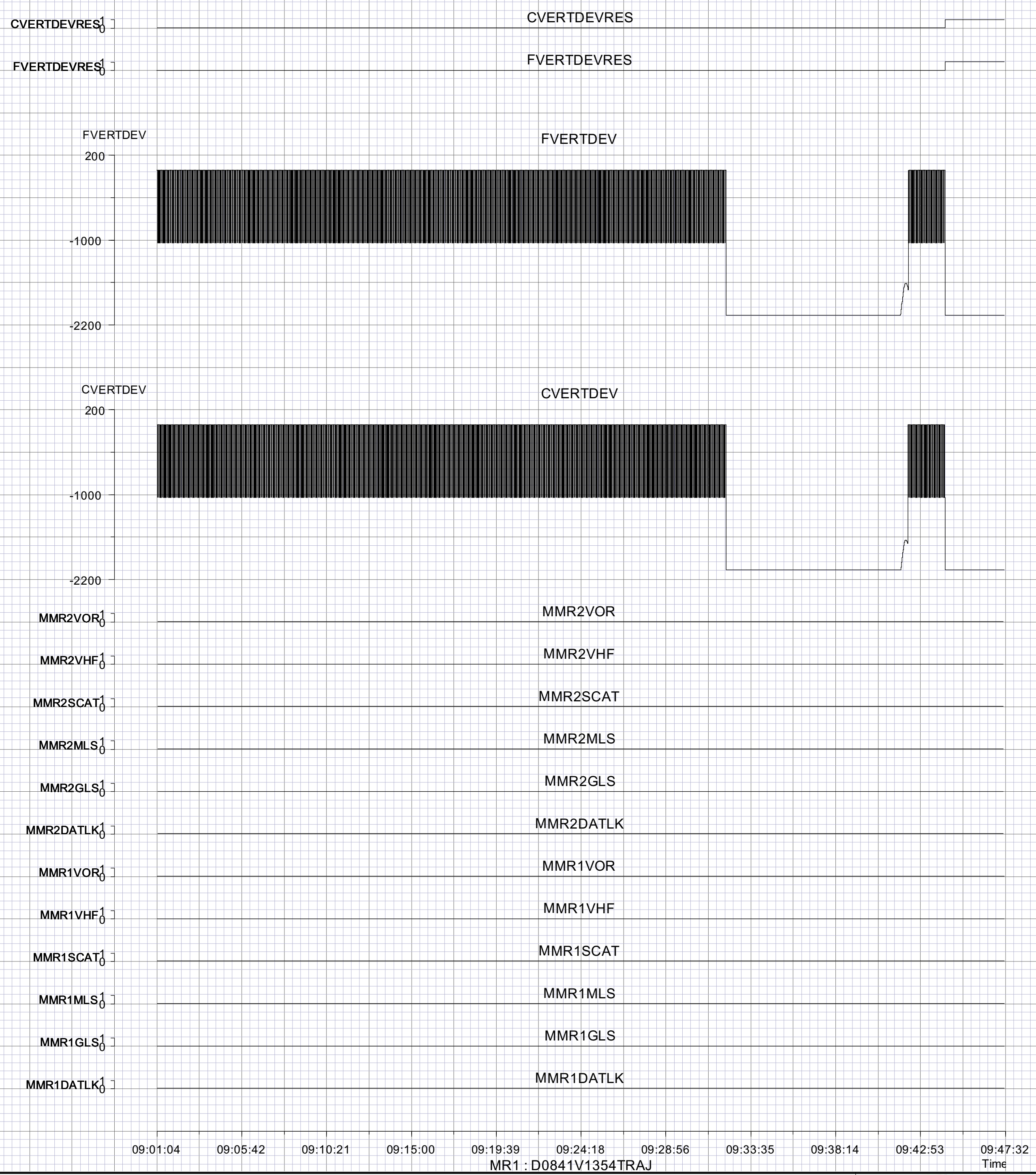
SLAT-FLAP

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 16/9/2013

Figure 1.1.25

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Slat-Flap.ilv



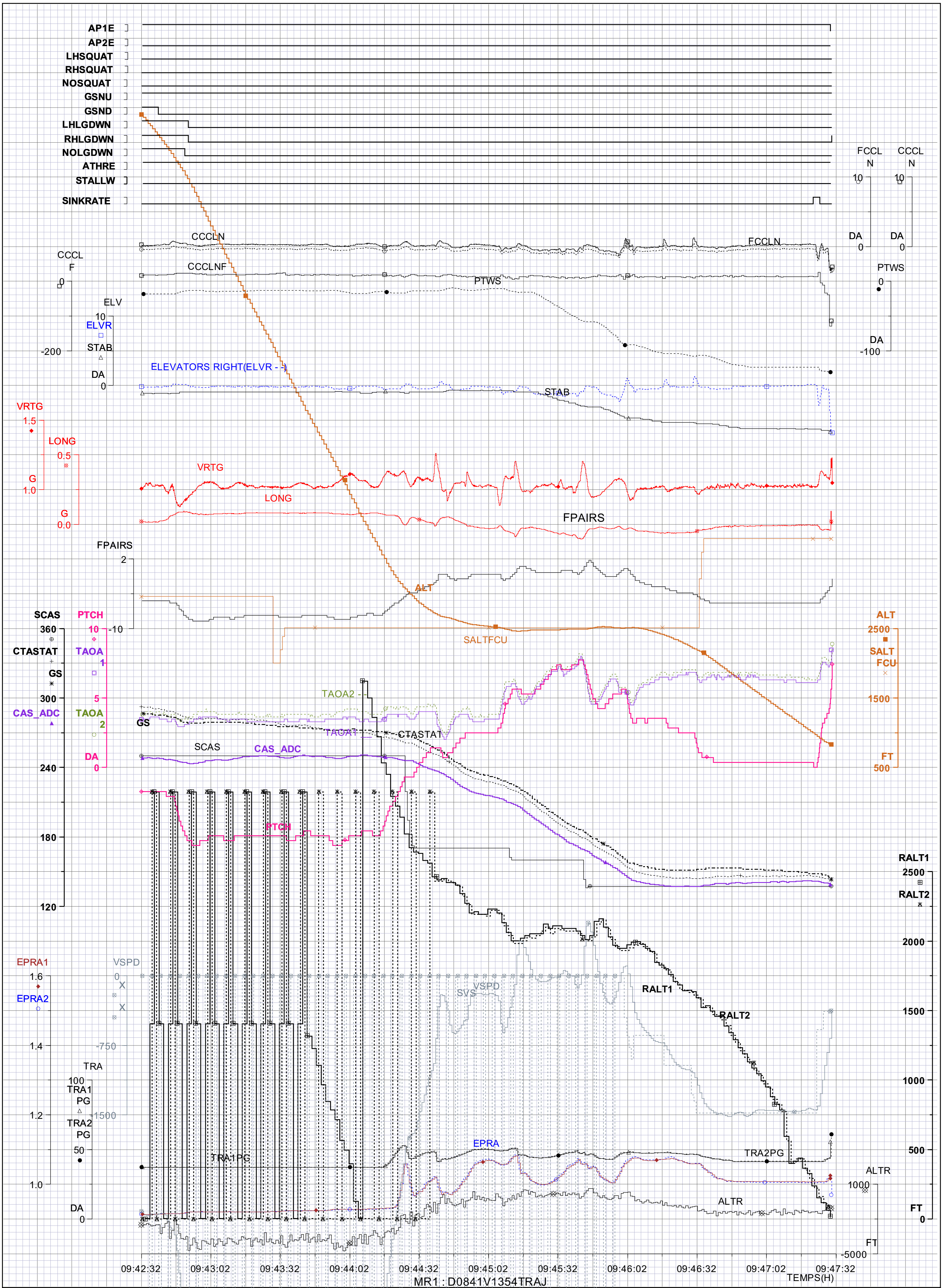
A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
			MMR	

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 16/9/2013

Figure 1.1.26

/workgroup/operation/dfdr/visage/virginie/WB/UPS/MMR.ilv



A/C : -	MSN 0841	FLIGHT	No 1354

CG (%) 29.32
WGT (LBS) 291160
WGT (KG) 132068

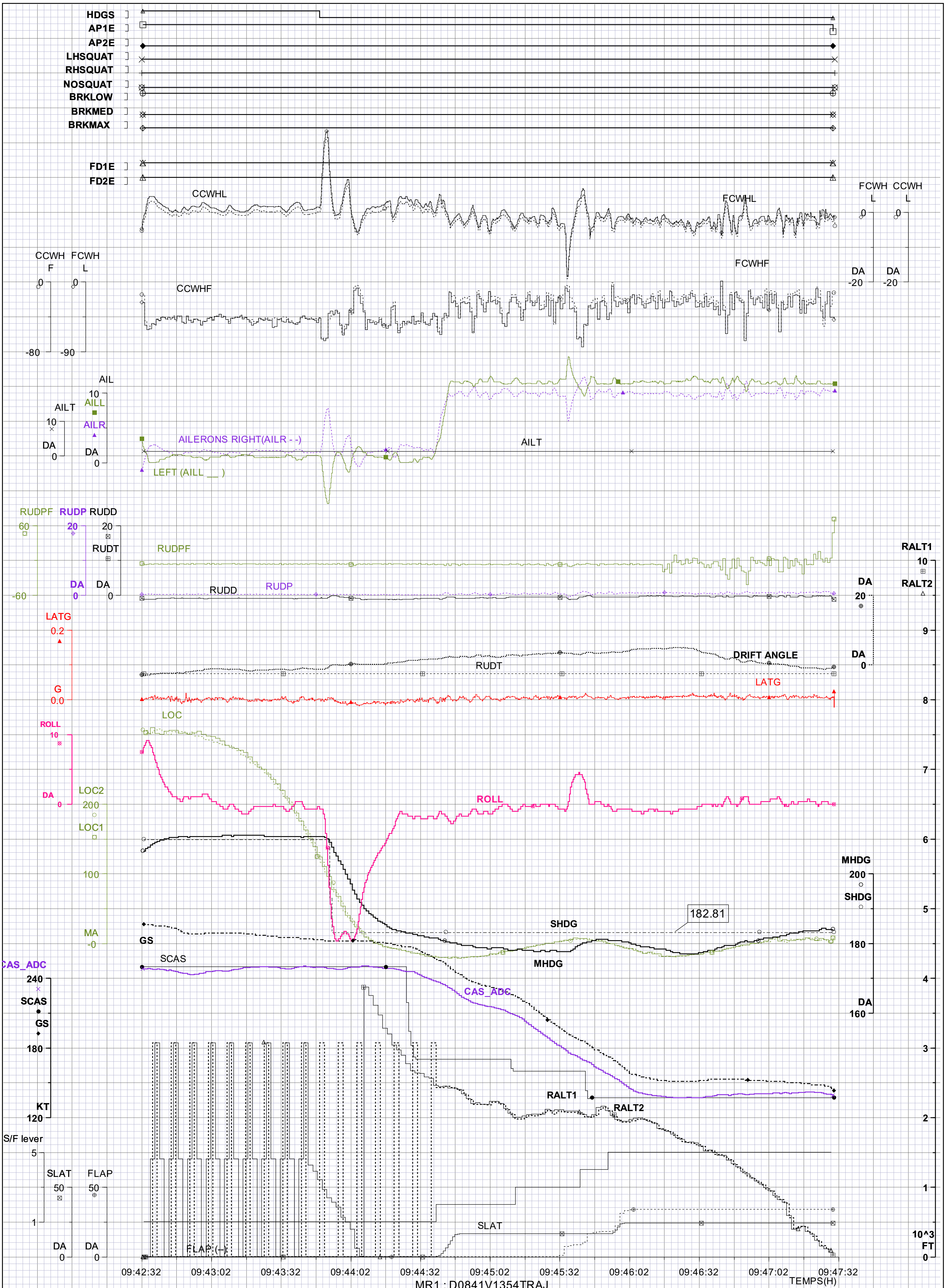
APPROACH (LONGITUDINAL)

AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.1

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Approach-Longi-Overview.ilv



A/C : -	MSN 0841	FLIGHT	No 1354

CG (%) 29.32
WGT (LBS) 291160
WGT (KG) 132068

APPROACH (LATERAL AXIS)

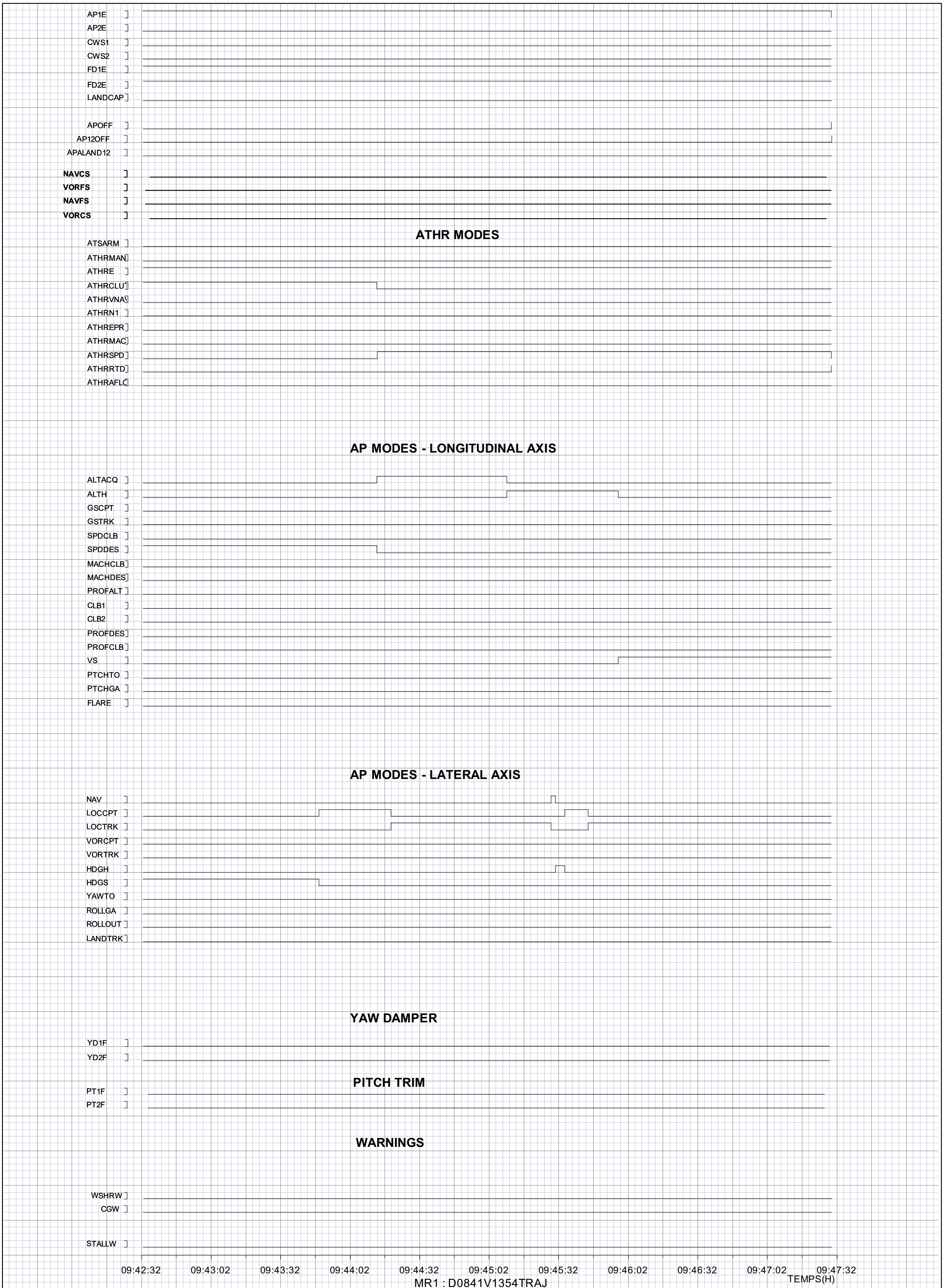
© Airbus

AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.2

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Approach-Lat-Overview.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354**

ATHR MODES-AP MODES-YAW DAMPER-PITCH TRIM

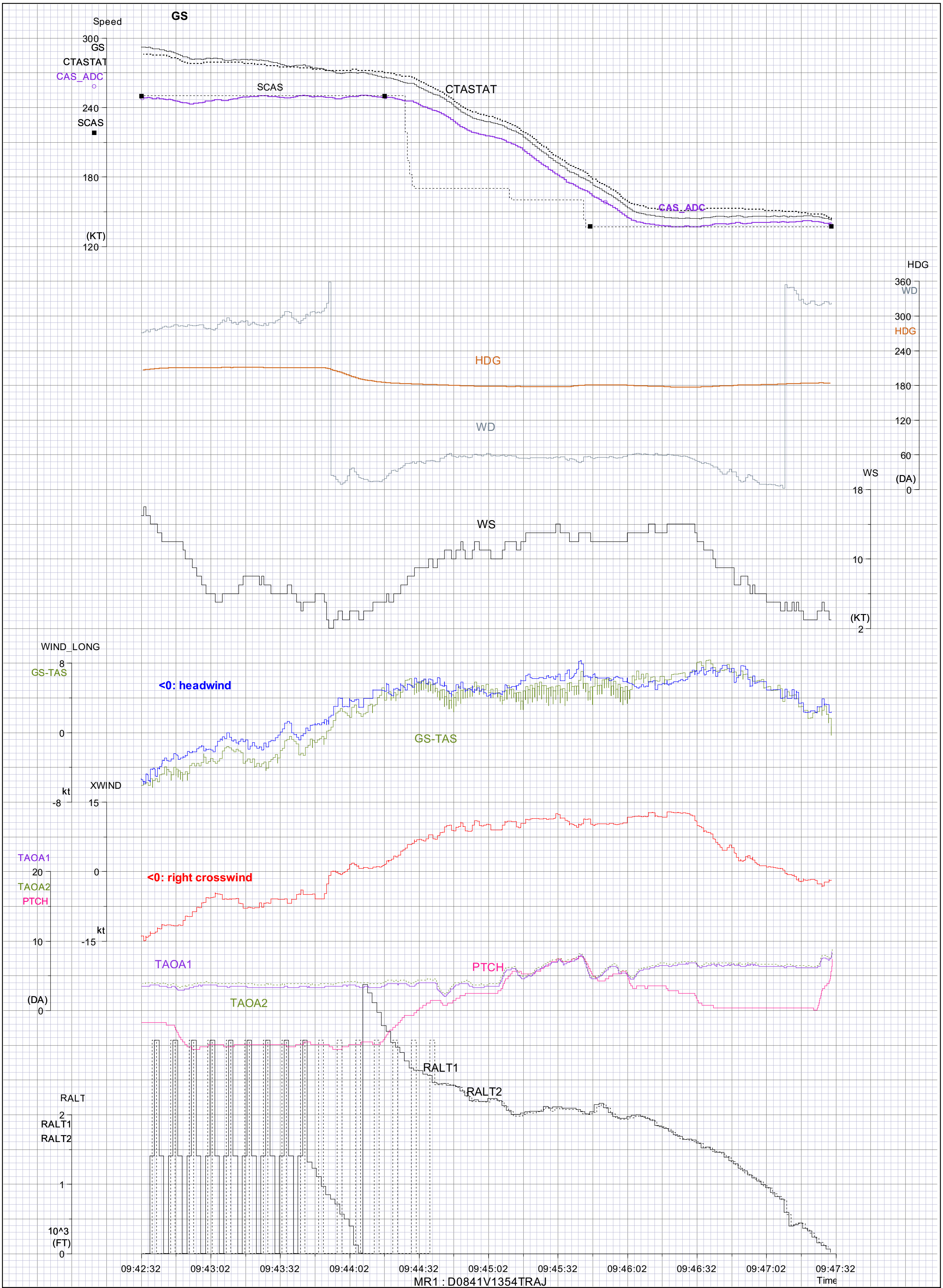
WGT (LBS) 291160.00
CG (%) 29.32

/workgroup/operation/dfdr/visage/virginie/WB/UPS/AP-modes.ilv

AIRBUS
Flight And Integration Tests Centre

Edited : 4/9/2013

Figure
1.1.3



A/C : - **MSN 0841** **FLIGHT** **No 1354** **Test date : 0/0/2000**

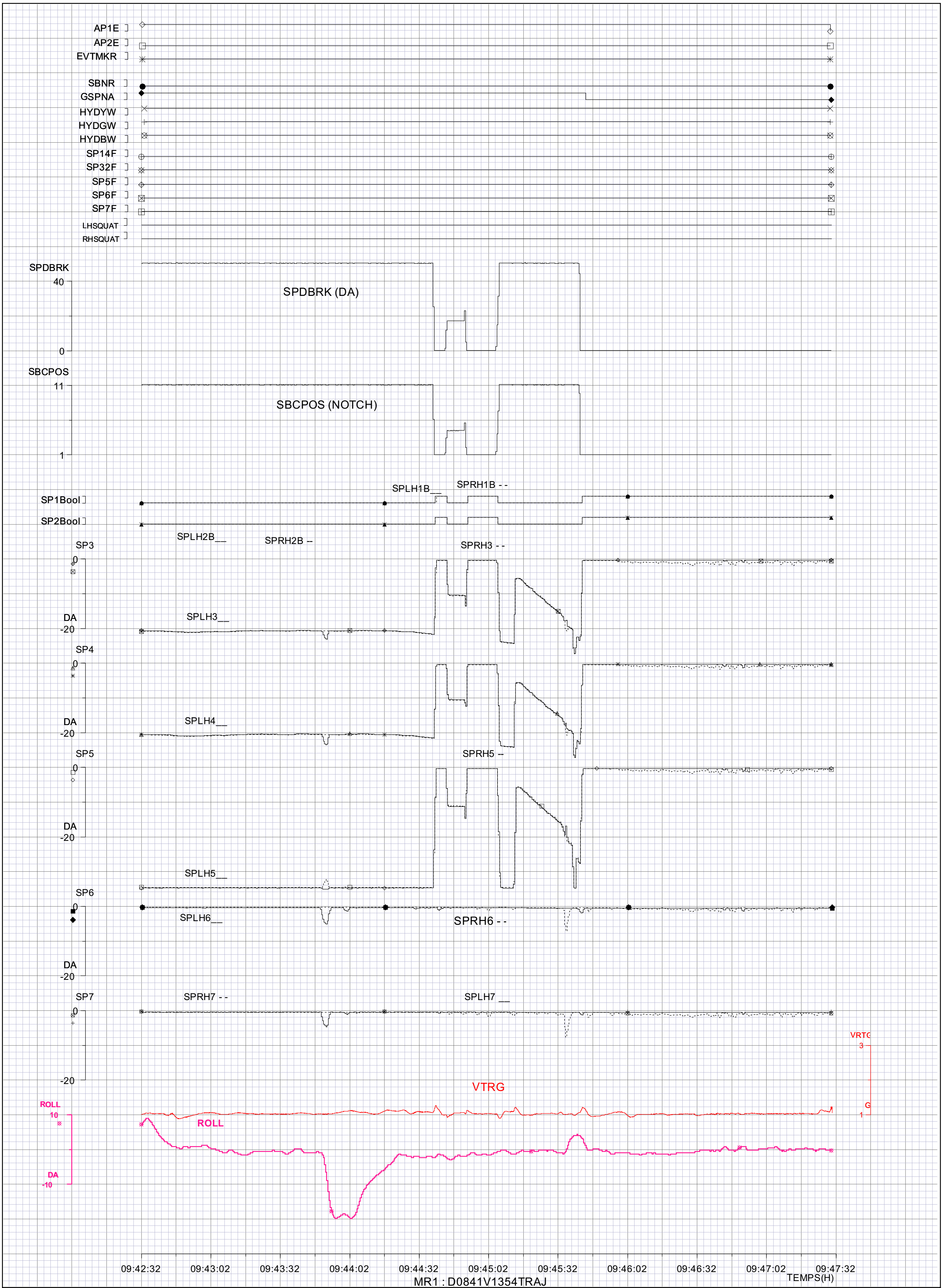
WIND SPEED

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 4/9/2013

Figure 1.1.4

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Vent.ilv



A/C : - MSN 0841 FLIGHT No 1354

CG (%) 29.32
WGT (LBS) 291160.00
WGT (KG) 132067.95

SPOILERS

© Airbus

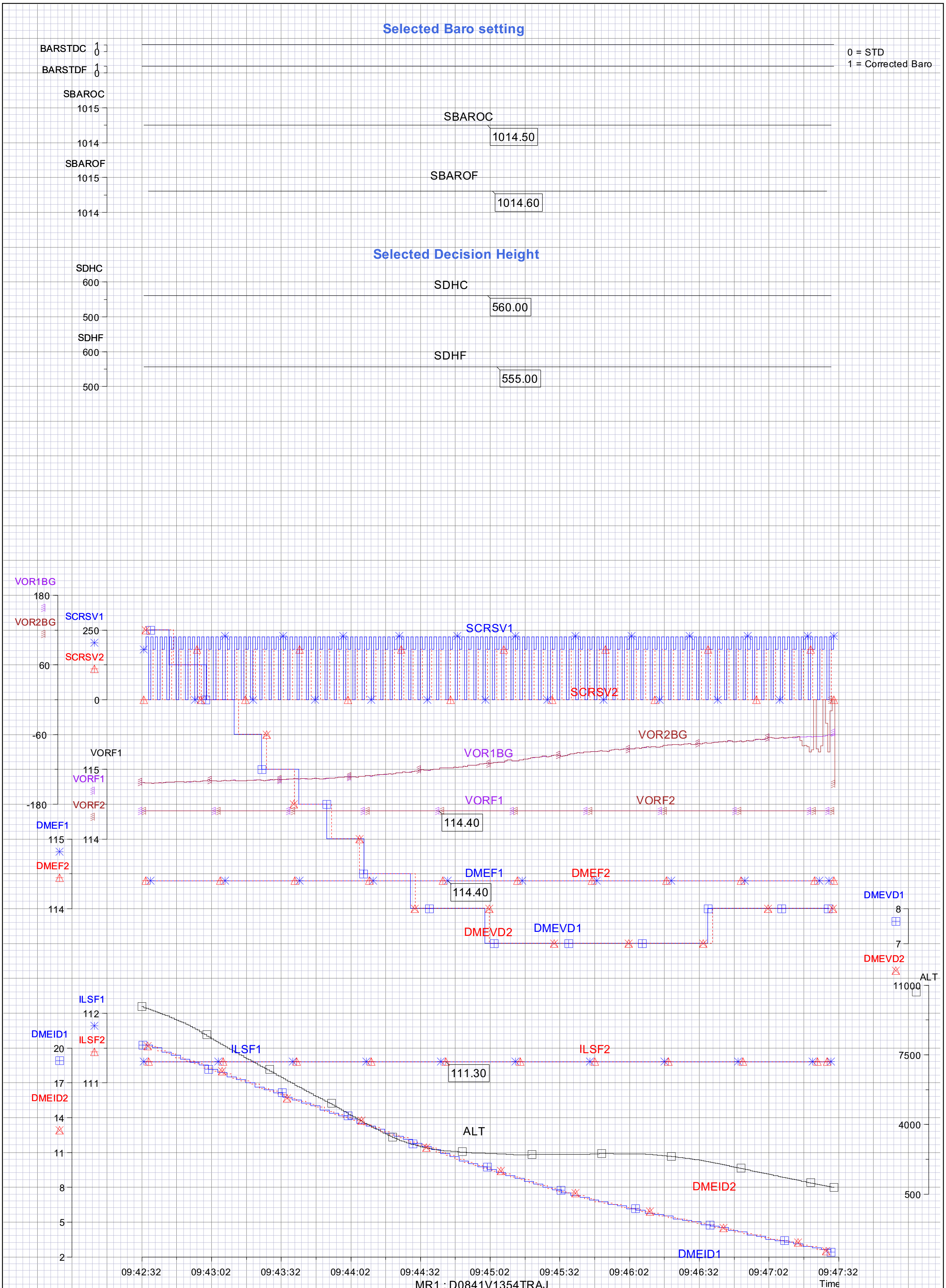
AIRBUS

Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.5

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Spoilers-2.ilv



A/C : - MSN 0841 FLIGHT No 1354 Test date : 0/0/2000

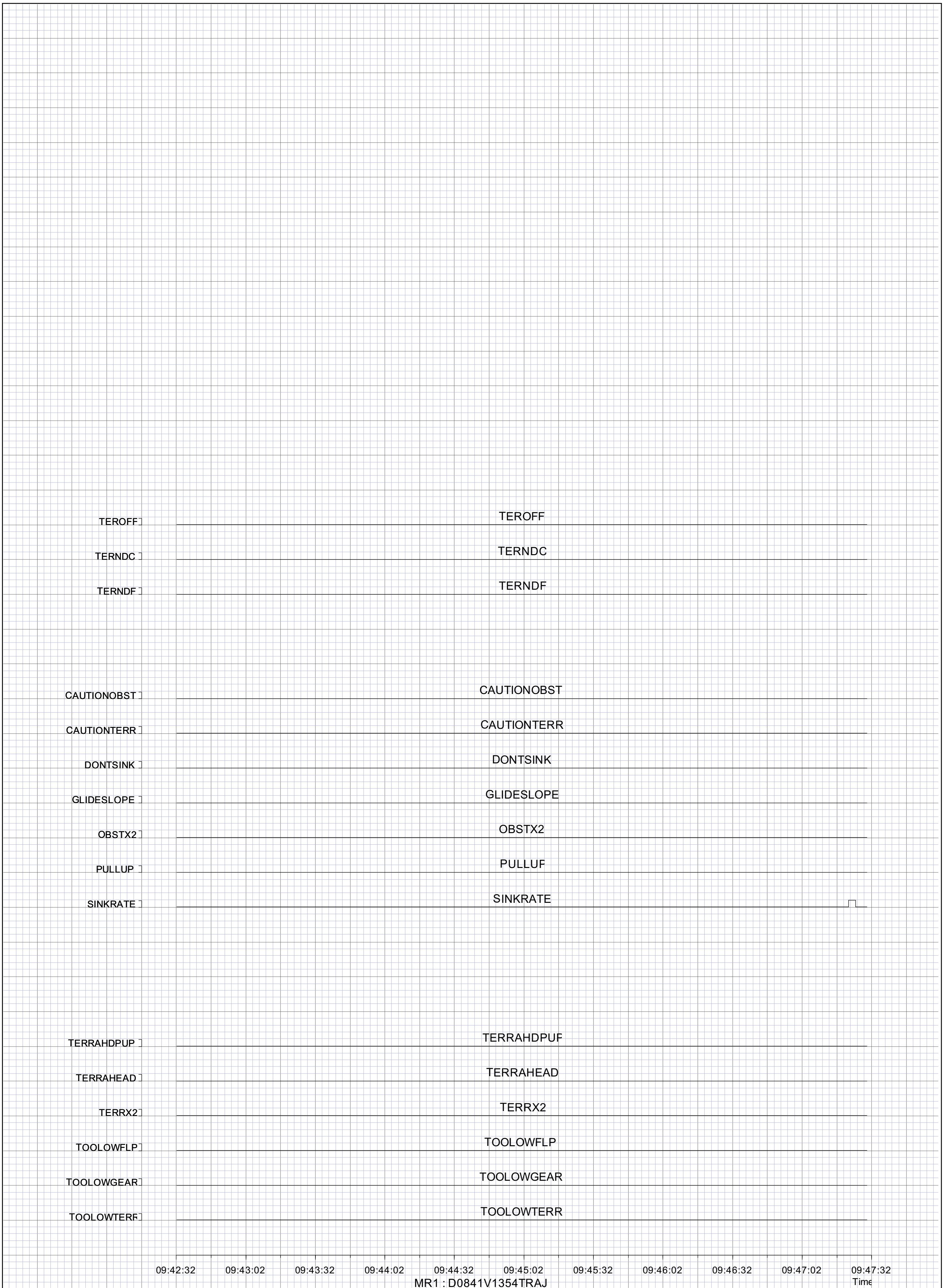
DME 1-2 OPERATION F1

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.6

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/DME-VOR-ILS-Overview.ilv



A/C : - MSN 0841 FLIGHT No 1354 Test date : 0/0/2000

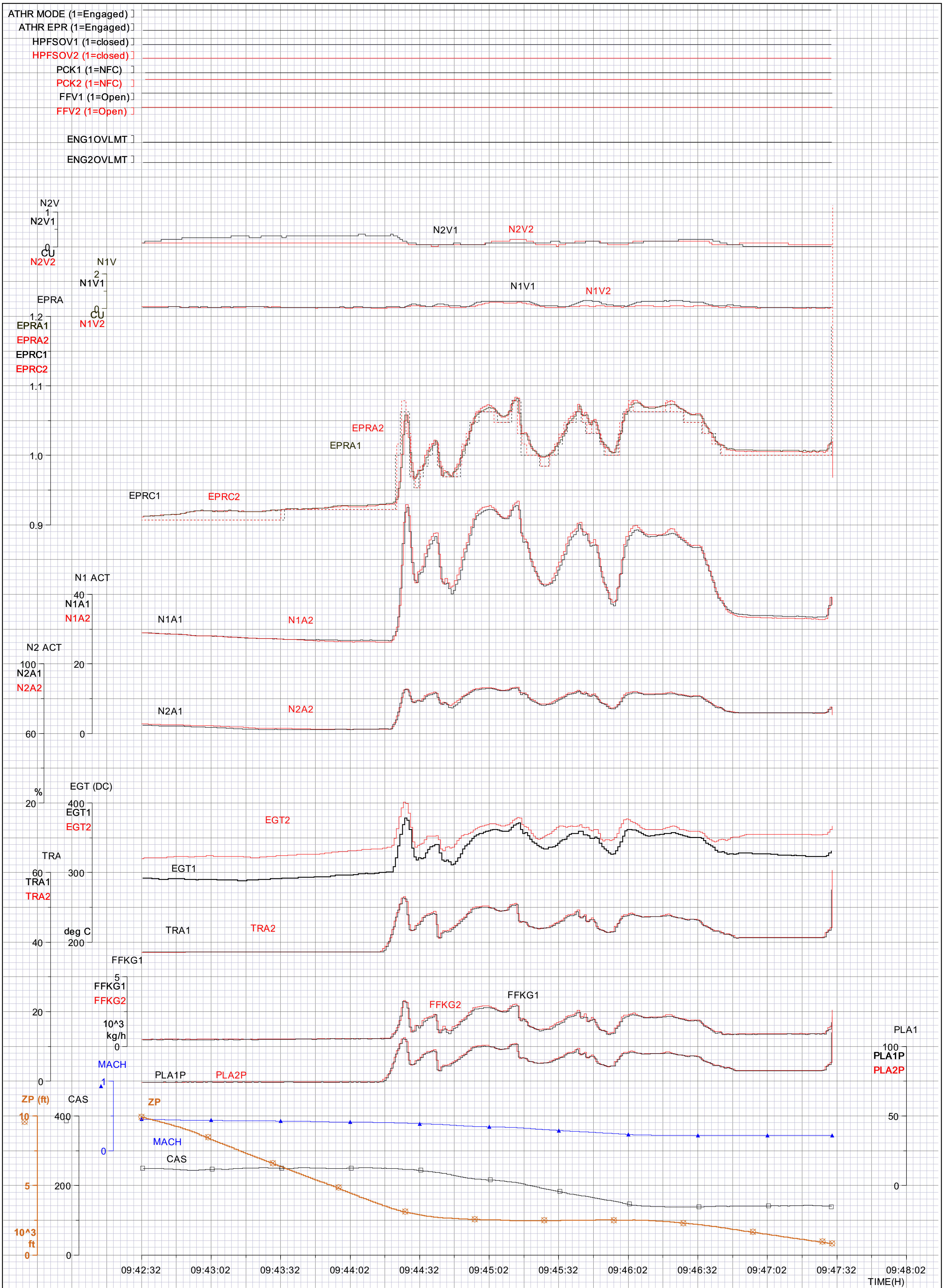
(E)GPWS

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.7

/workgroup/operation/dfdr/visage/virginie/WB/UPS/EGPWS-2.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	MR1 : D0841V1354TRAJ

Engine 12 - Main Parameters - DFDR

FLIGHT CONDITIONS AT GMT START

ZP = 9888 FT
TAT = 18.8 DC
VC = 248 KT

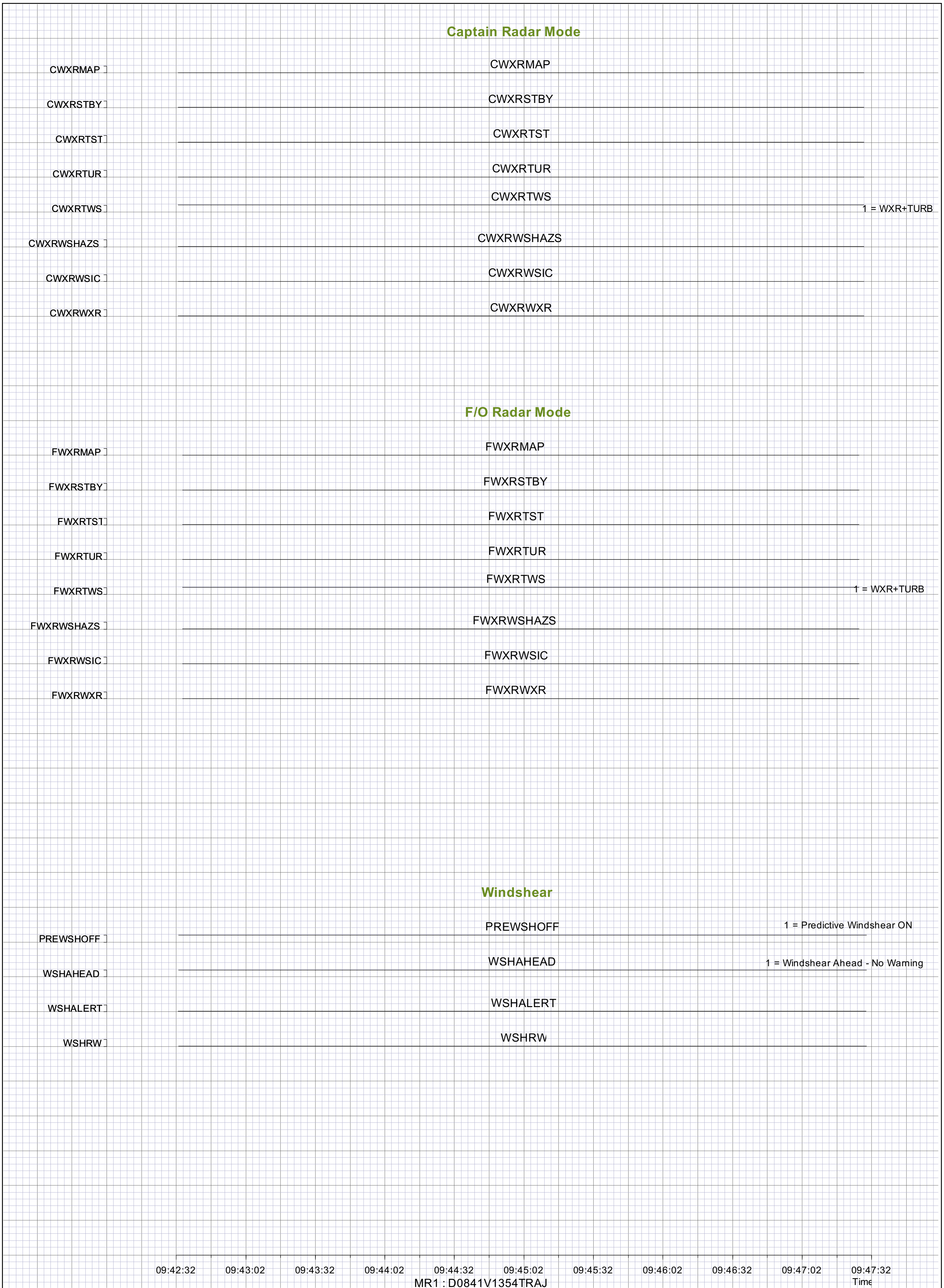
AIRBUS

Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.8

/workgroup/operation/dfdr/visage/virginie/WB/UPS/PW4000-MainParameters-Eng12.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354** **Test date : 0/0/2000**

RADAR

AIRBUS **Flight And Integration Tests Centre**

Edited : 4/9/2013

Figure 1.1.9

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Radar-mode.ilv

A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000
			TRIM	

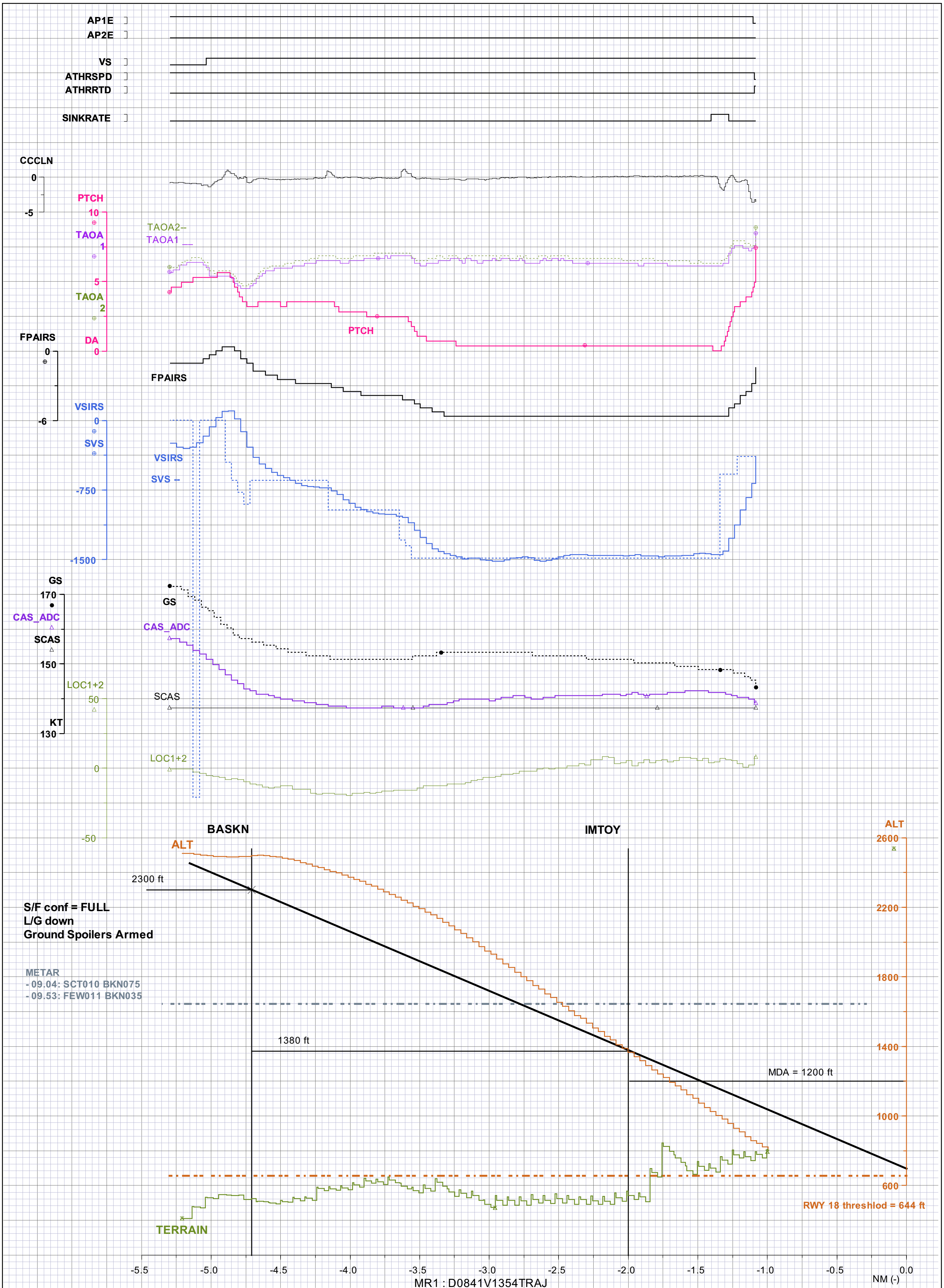
AIRBUS

Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.1.10

/workgroup/operation/dfdr/visage/virginie/WB/UPS/STAB-PTWS.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	Test date : 0/0/2000

APPROACH (LONGITUDINAL AXIS)

CG (%) 29.70
WGT (LBS) 291120
WGT (KG) 132050

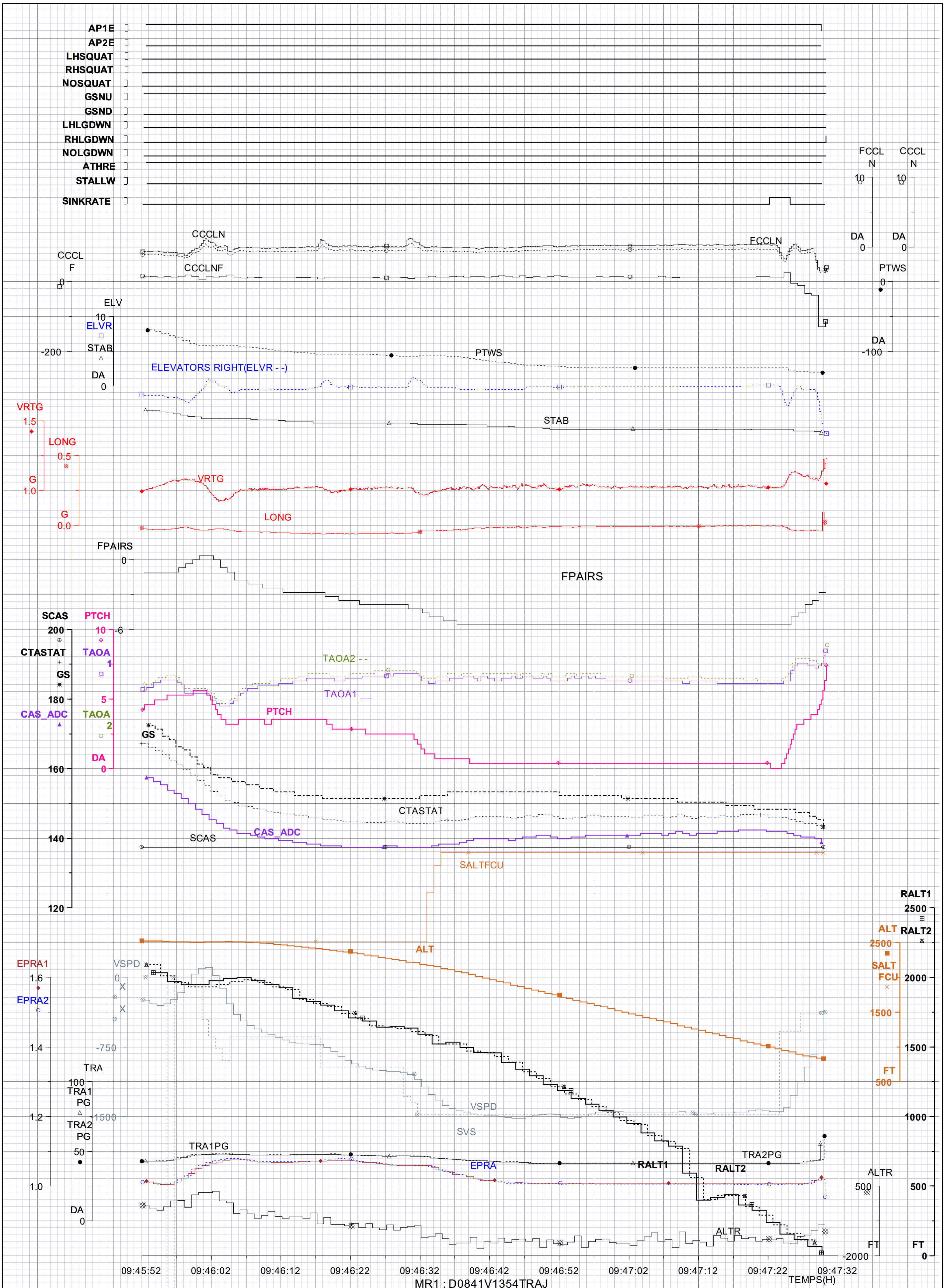
/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Traj.ilv

AIRBUS

Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.2.1



A/C : - MSN 0841 FLIGHT No 1354

CG (%) 29.70
WGT (LBS) 291120
WGT (KG) 132050

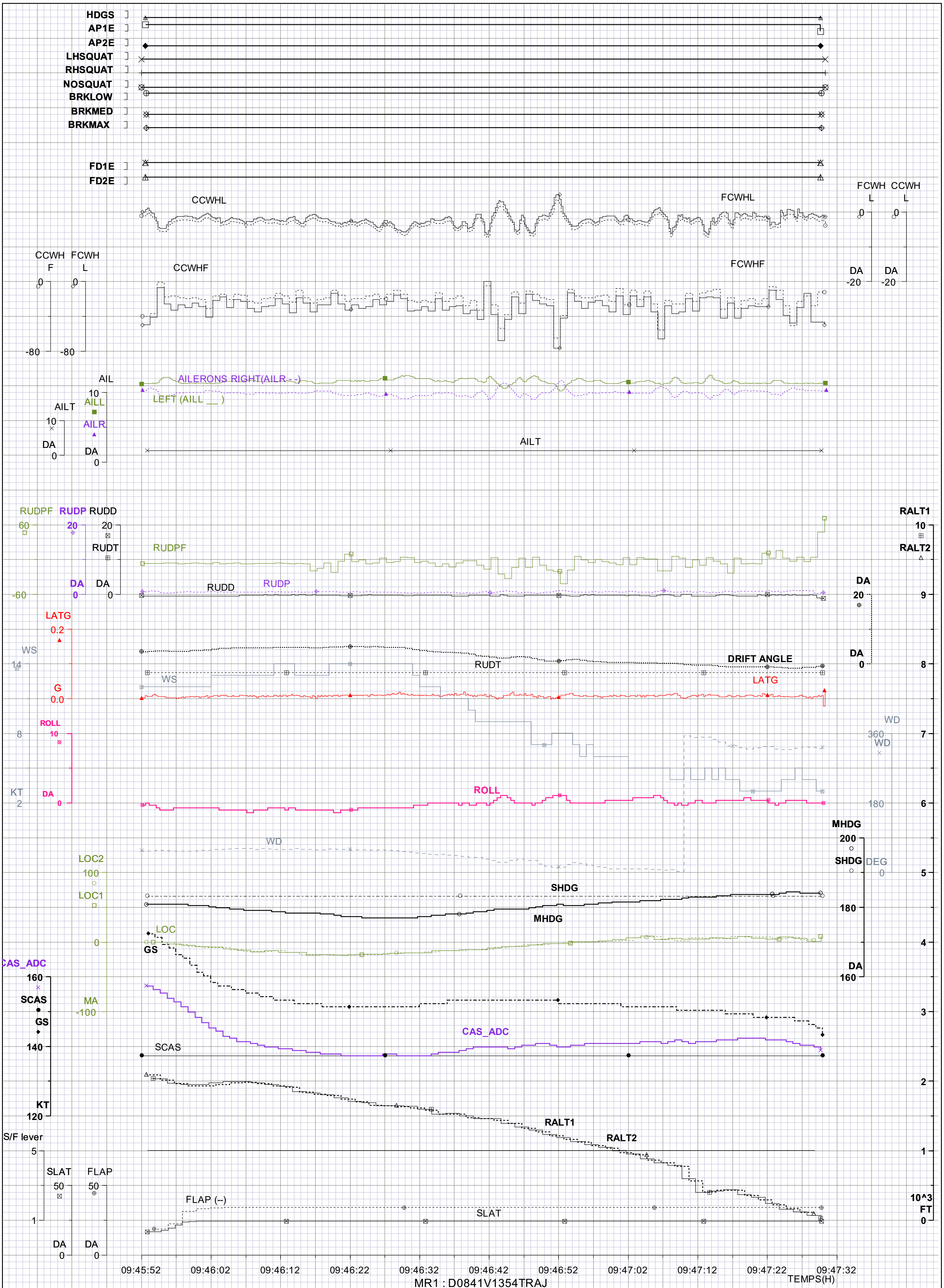
APPROACH (LONGITUDINAL)

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.2.2

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Approach-Longi.ilv



A/C : -	MSN 0841	FLIGHT	No 1354

CG (%) 29.70
WGT (LBS) 291120
WGT (KG) 132050

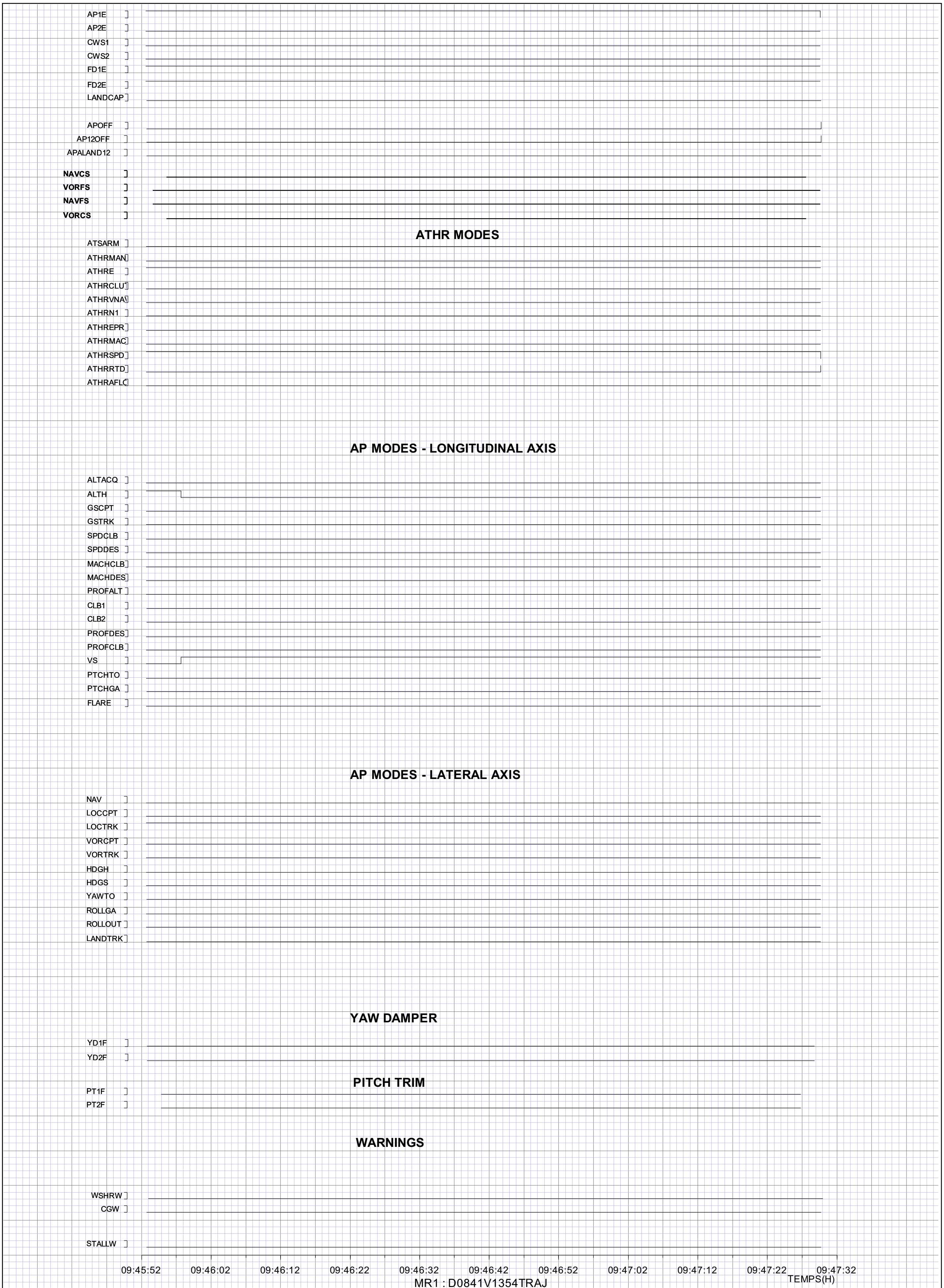
APPROACH (LATERAL AXIS)

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.2.3

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Approach-Lat.ilv



A/C : - MSN 0841 FLIGHT No 1354

ATHR MODES-AP MODES-YAW DAMPER-PITCH TRIM

WGT (LBS) 291120.00
CG (%) 29.70

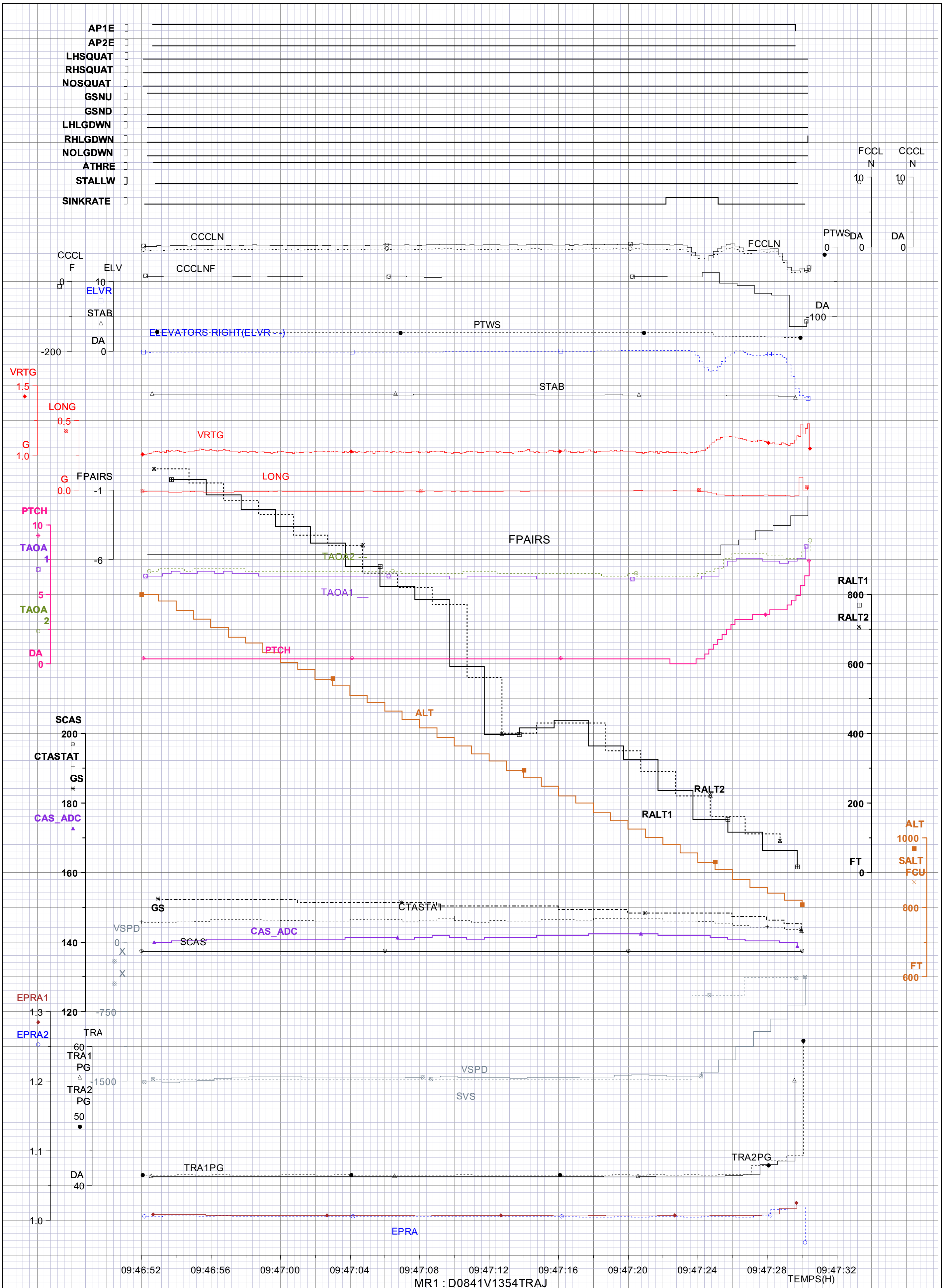
/workgroup/operation/dfdr/visage/virginie/WB/UPS/AP-modes.ilv

© Airbus

Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.2.4



A/C : - MSN 0841 FLIGHT No 1354

WGT (LBS) 291160
WGT (KG) 132068

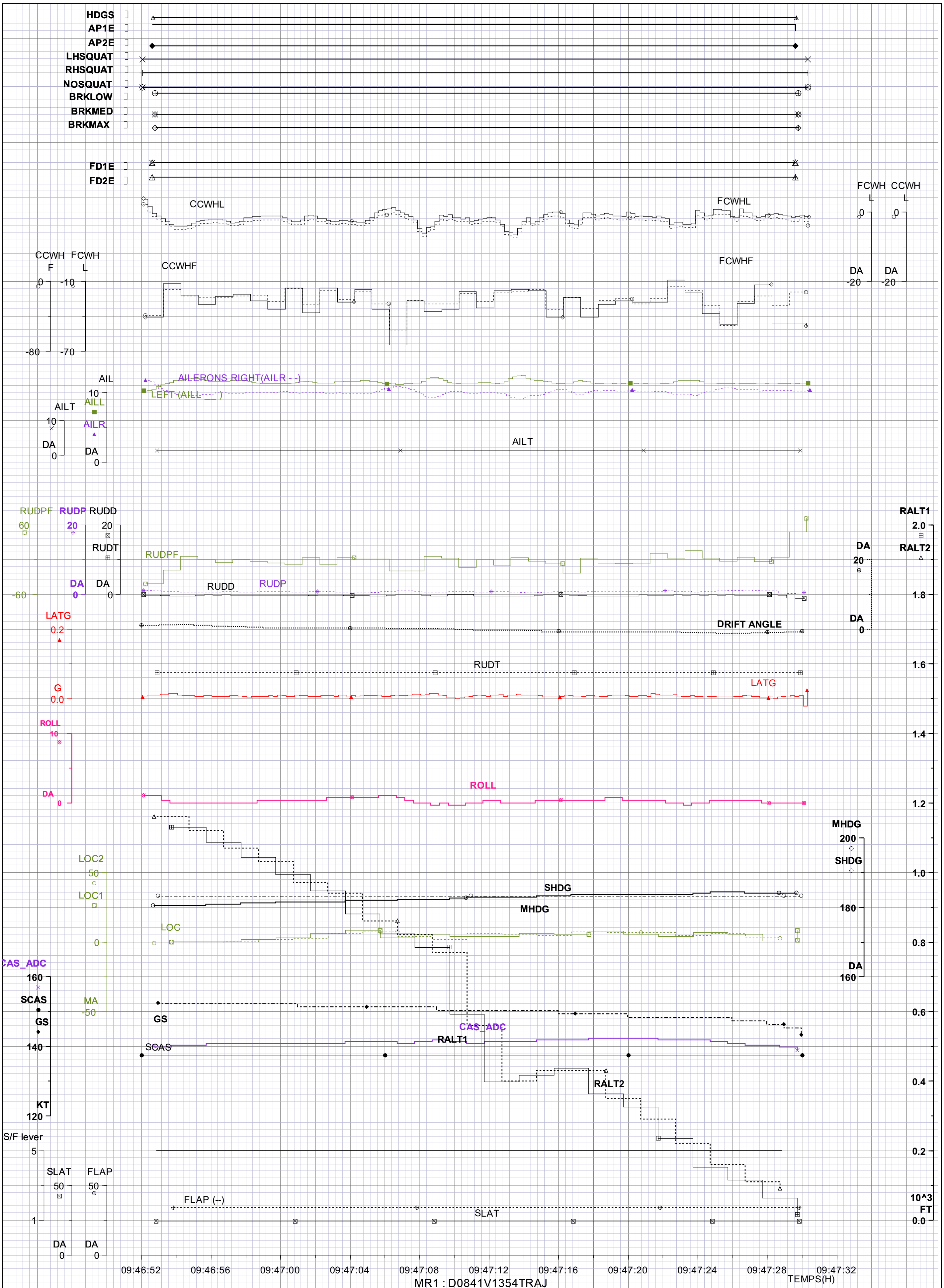
APPROACH (LONGITUDINAL)

© Airbus AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.3.1

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Approach-Longi-Zoom.ilv



A/C : -	MSN 0841	FLIGHT	No 1354

WGT (LBS) 291160
WGT (KG) 132068

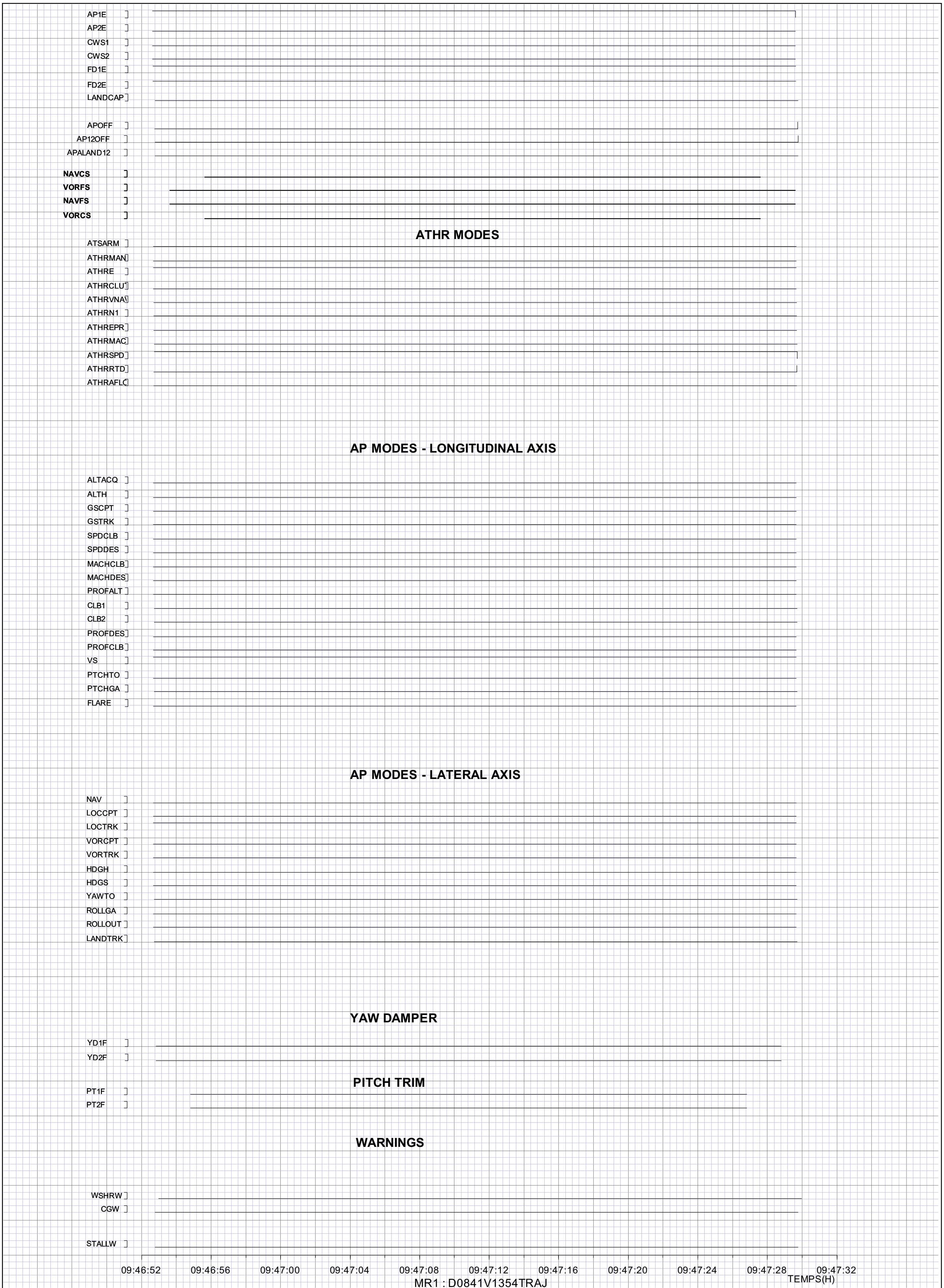
APPROACH (LATERAL AXIS)

AIRBUS Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.3.2

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Approach-Lat-Zoom.ilv



A/C : - MSN 0841 FLIGHT No 1354

ATHR MODES-AP MODES-YAW DAMPER-PITCH TRIM

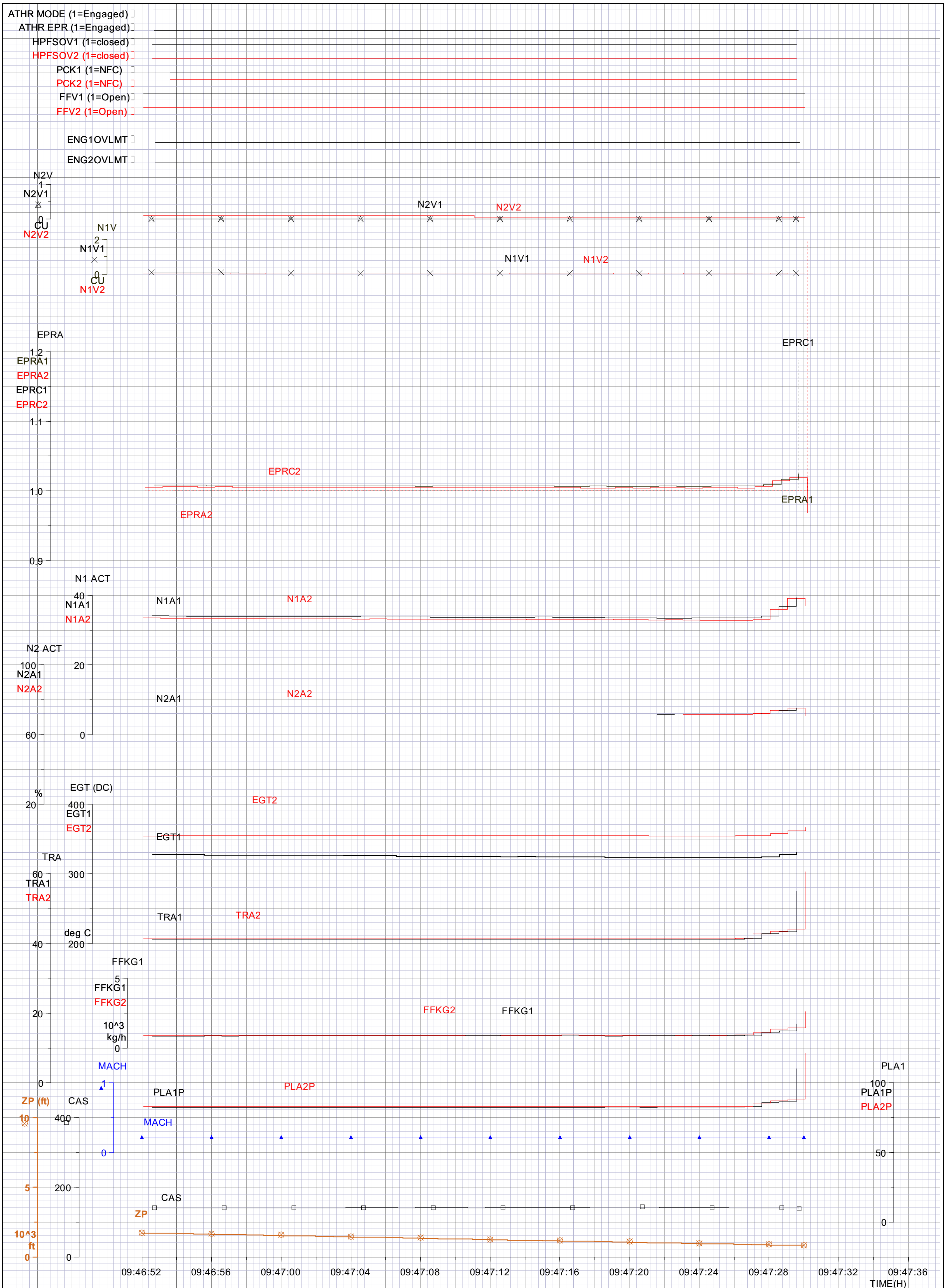
WGT (LBS) 291160.00

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 4/9/2013

Figure 1.3.3

/workgroup/operation/dfdr/visage/virginie/WB/UPS/AP-modes.ilv



A/C : -	MSN 0841	FLIGHT	No 1354	MR1 : D0841V1354TRAJ

Engine 12 - Main Parameters - DFDR

FLIGHT CONDITIONS AT GMT START

ZP = 1700 FT
TAT = 24.0 DC
VC = 140 KT

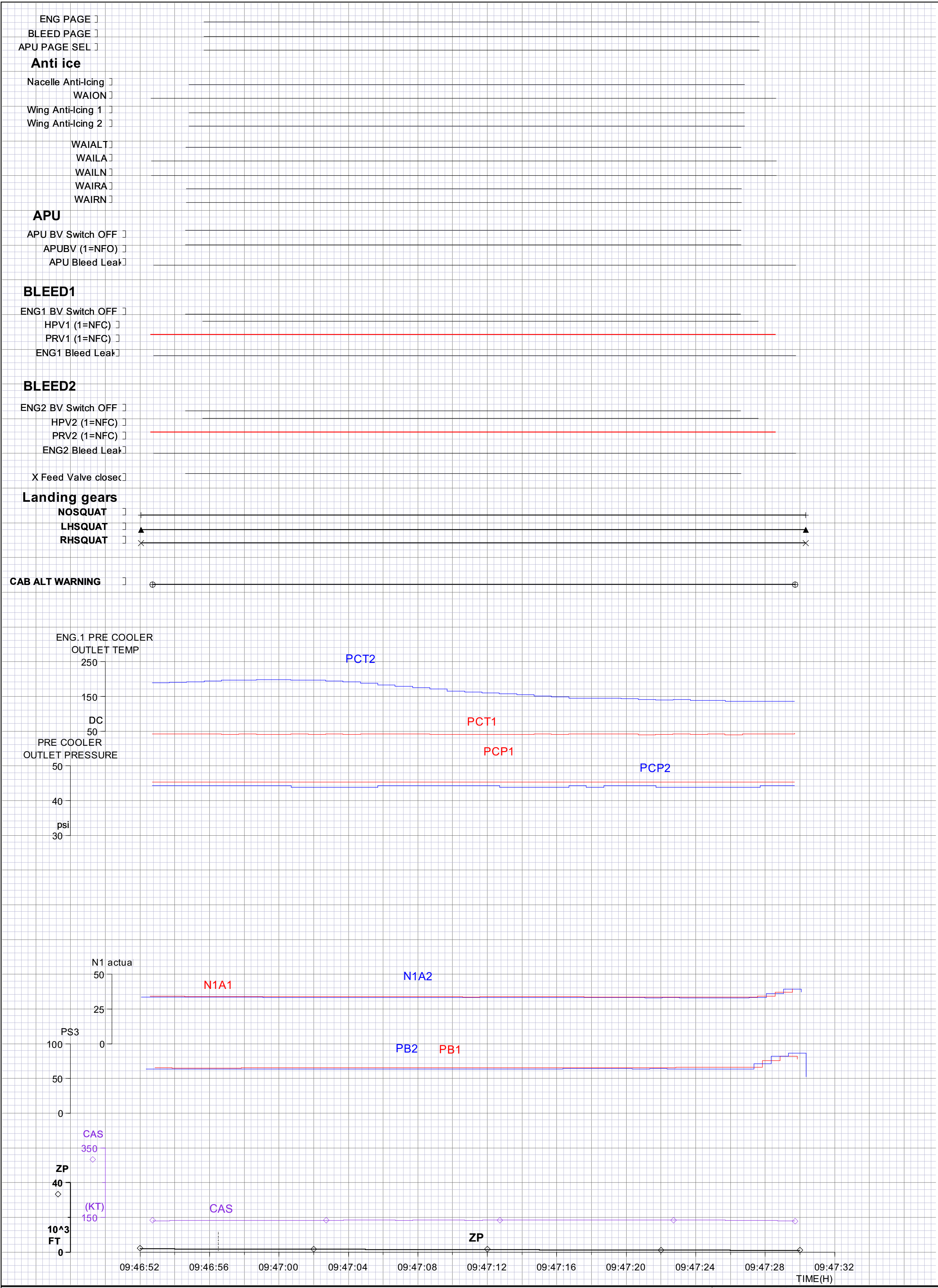
AIRBUS

Flight And Integration Tests Centre

Edited : 4/9/2013

Figure 1.3.4

/workgroup/operation/dfdr/visage/virginie/SA/Q1408/Eng12-MainParameters.ilv



A/C : - **MSN 0841** **FLIGHT** **No 1354** MR1 : D0841V1354TRAJ

TK21/DFDR ENGINE/BLEED PARAMETERS

AT GMT START

ZP (FT)= 1700.0(

SAT (DC)= 21.2

TAT (DC)= 24.0(

VC (KT)= 139.5(

© Airbus AIRBUS **Flight And Integration Tests Centre**

Edited : 4/9/2013

Figure 1.3.5

- TYPE 001 -

/workgroup/operation/dfdr/visage/virginie/WB/UPS/Eng-Bleed-PW.ilv

APPENDIX 4

INTRODUCTION

This procedure contains recommendations that are specific to Non Precision Approaches.

The standard approach procedure steps have not been repeated. They must be completed before the Final Approach Fix.

This procedure provides general guidelines which may be adapted according to the airline policy and/or the actual flight conditions.

R *Note : When operating in low OAT, consider FPA corrections*
R *defined in 2.08.10 p.11*

CAUTION

The procedure for use of PROFILE mode after the Final Approach Fix (FAF) applies only to aircraft equipped with the FMS Final Approach function activated.

APPLICABILITY

This procedure applies to all non-ILS approaches, e.g. NDB, VOR, VOR-DME, LOC ONLY, LOC-DME, RNAV (GPS).

APPROACH GUIDANCE

Non Precision Approaches can be performed using two different AP/FD guidances :

- FMS guidance :
  - NAV mode down to the MDA or until LOC interception (lateral)
  - PROFILE mode down to the MDA provided FINAL APP state is active after the FAF (vertical).
- Selected guidance :
  - HDG SEL mode down to the MDA (lateral) or until LOC interception
  - V/S mode down to the MDA (vertical)

NAV and PROFILE modes can be used in final approach provided :

- The approach stored in the NAV database has been validated and is approved by the operator and
- GPS PRIMARY is available (required for RNAV (GPS) approach) or HIGH accuracy is displayed with the appropriate RNP, or the navaids raw data are tuned and monitored.

Otherwise, selected guidance must be used.
For selected guidance, the recommended flight reference display for a Non Precision Approach is the FPV/FPR.

R For FMS guidance, the recommended flight reference
R display is FD.

APPROACH SPEED TECHNIQUE

The standard speed technique is a stabilized approach using AP engaged in CMD mode and A/THR engaged in SPD or P.SPD mode. This enables the aircraft to intercept the final descent path in the landing configuration and at VAPP, thrust above idle.

INITIAL APPROACH

NAVIGATION ACCURACY . . . . CHECK

Unless GPS PRIMARY is available check navigation accuracy using navaids raw data to determine approach strategy.

REFERENCE NAVAIDS . . . . . . TUNED/CHECKED

- **If RNAV (GPS) approach**

  GPS 1+2 mode (GPS MONITOR page) . CHECK NAV
  GPS PRIMARY (PROG page) . . . . CHECK

For VOR (resp. LOC) approach, tune frequency and course on VOR (resp. ILS) control panel and check VOR (resp. LOC) is also tuned on CDU.

For NDB approach, set final approach course on ILS R
control panel. R

MDA . . . . CHECK/SET

Set MDA using the altimeter amber index, set and check MDA is correct on the CDU APPROACH page.

- **If GPS PRIMARY or accuracy check is positive :**

  ND . . . . both in MAP

  FMS GUIDANCE . . . . USE

  VOR/NAV/ILS switches . . . . BOTH IN NAV

  For a LOC approach, revert both VOR/NAV/ILS switches to ILS position prior to LOC interception.

  PNF CDU . . . . APPROACH

  Vapp . . . . CHECK/ADJUST
  Vapp may be adjusted on the CDU APPROACH page to control aircraft approach speed.

  FINAL X.X° (LS key 6R) . . . . SELECT

  FINAL X.X° prompt is only displayed in ALT, V/S or LVL CHG vertical guidance mode provided Vapp is valid.

  Selecting the FINAL X.X° prompt activates the FINAL APP state of the PROFILE mode.

- **If accuracy check is negative :**

  PF ND . . . . ROSE or ARC

  PNF ND . . . . MAP or ROSE or ARC

  SELECTED GUIDANCE . . . . USE

  PF VOR/NAV/ILS switch . . . . VOR or ILS

  PNF VOR/NAV/ILS switch . . . . AS RQRD

FPA/CRS target . . . . SET

In FMS guidance, the FPA is set in anticipation to a R
possible reversion to selected guidance R

FD/FPV switch . . . . AS RQRD R

If FMS guidance is used in final approach, select FD. R
If selected guidance is used in final approach, select FPV R
just before the FAF at the latest. R

APPROACH CHECKLIST . . . . COMPLETE

R Code : 0218

INTERMEDIATE APPROACH

The STANDARD APPROACH steps to prepare the aircraft for landing (L/G down, spoilers armed, Flaps 40, speed Vapp) should be performed before reaching the FAF.

The objective is to be stabilized at 500 ft AGL minimum in VMC (1000 ft AGL in IMC) by ensuring that :
- the aircraft is on the correct lateral and vertical flight path,
- the power is stabilized and the aircraft is trimmed to maintain VAPP on the desired approach path,
- no excessive flight parameter deviation.

If not stabilized when reaching 500 ft AGL minimum in VMC (1000 ft AGL in IMC), a Go Around must be initiated.

- **Before FAF, if FMS vertical guidance is used :**

  FINAL APP . . . . CHECK ACTIVE
  Check FINAL APP X.X° (title) and VDEV (LS key 6R) are displayed on CDU APPROACH page.

  TRP in AUTO . . . . CHECK
  If not in AUTO select TOGA on TRP

  - **When cleared for approach :**

    PROFILE . . . . ARM
    R For approach using LOC guidance, P.DES must be
    R armed only after LOC* engagement.

    P. DES . . . . CHECK ARMED
    R
    R

    P.DES armed mode will be lost in case of FCU altitude capture.

    NAV, LOC or LOC* . . . . CHECK
    PROFILE will automatically engage only in NAV, LOC or LOC* lateral guidance mode, when in capture condition.

    VDEV . . . . CHECK
    Check VDEV is decreasing.

CAUTION

> If FINAL APP state is active, the FMS PROFILE mode does not consider vertical constraints. It is pilot's responsibility to ensure safe altitude margin for obstacle clearance.

FINAL APPROACH

- **At FAF :**
  - **If FMS vertical guidance is used :**

    P. DES . . . . CHECK ENGAGEMENT
    FCU altitude is disregarded.
    According to vertical transients (external perturbations, flaps extension,...) PDES may engage earlier than point of final descent but A/C will be guided in level-off up to the point of descent. No anticipated descent is guaranteed.

  - **If selected vertical guidance is used :**

    V/S . . . . SELECT
    Set pre-calculated V/S required to obtain desired FPA.

- **GA ALTITUDE . . . . SET**
  Set when below the go around altitude.

Code : 0202

- **During final approach :**

  POSITION and FLIGHT PATH . . . CHECK/ADJUST
  - Monitor reference navaid raw data.
  - Monitor altitude in relation with the published descent profile and the distance to the runway.
  - Adjust HDG SEL and V/S accordingly, in selected guidance.
  - If FMS NAV is not satisfactory, revert to HDG/SEL.
    Note that if FMS vertical guidance is used, the R
    reversion to HDG/S disengages AP and FMA reverts R
    to basic modes. R

  LANDING CHECKLIST . . . . COMPLETE

  FLIGHT PARAMETERS . . . . CHECK
  PF announces any FMA modification.
  PNF calls out if :
  - Speed becomes lower than VAPP – 5 kt or greater than speed target + 10 kt.
  - Pitch attitude becomes lower than – 2.5° or greater than 10° nose up.
  - Bank angle becomes greater than 7°.
  - Descent rate becomes greater than 1000 ft/min.
  - VDEV exceeds one dot in FMS vertical guidance.
  - Any significant changes in ground speed that might indicate windshear.
  - Excessive LOC deviation for a LOC approach.

When the PNF calls flight parameter exceedance, the R
suitable PF response is : R
- Acknowledge the PNF call out, for proper crew coordination R
  purposes R
- Take immediate corrective action to control the exceeded R
  parameter back into the defined stabilized conditions R
- Assess whether stabilized conditions will be recovered R
  early enough prior to landing, otherwise initiate a R
  go-around. R

- **At MDA (MDH) + 100 ft :**

  HUNDRED ABOVE . . . . ANNOUNCE

- **Reaching MDA (MDH) and VDP :**
  - **When visual references are acquired and confirmed by both PF/PNF :**

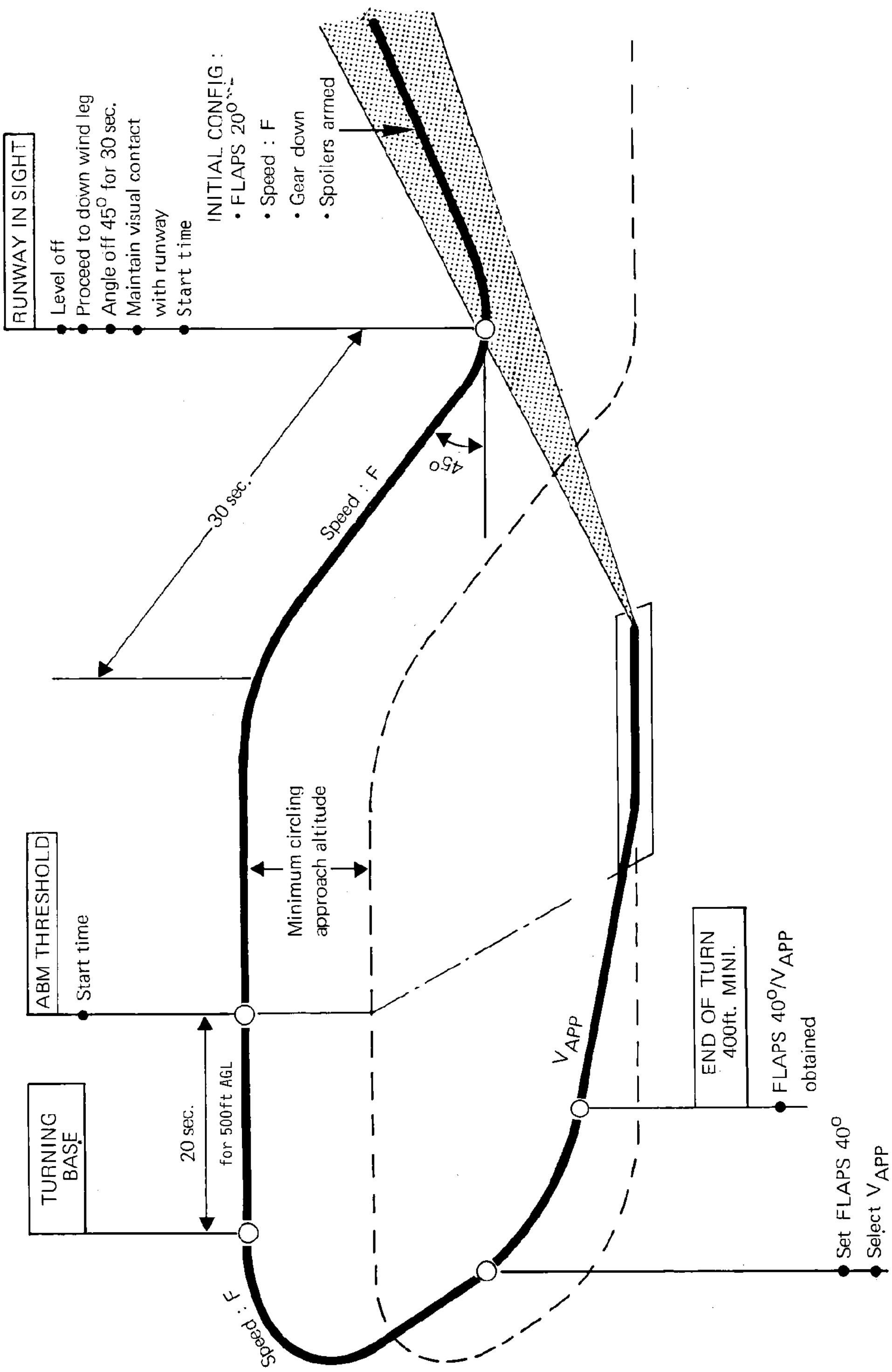
    CONTINUE . . . . ANNOUNCE
    Continue as visual approach with the standard call outs.

    AP . . . . OFF
    Note : *Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.*

  - **If no visual references are acquired :**

    GO AROUND/FLAPS . . . . ANNOUNCE
    Initiate go around.
    Note : *In selected guidance, if ground references are not visible when the aircraft reaches MDA, an immediate go around must be initiated.*
    However, if the distance to the runway is not properly assessed, a step descent approach may be considered and a level off at MDA may be performed, using ALT HOLD to level off not lower than MDA, while searching for visual references. If the pilot has no visual reference at MAPt at the latest, he must begin a go around.

R R *Note :* *This pattern illustrates a low visibility circling approach and does not refer to a non precision approach as described in 2.03.20 p 1 and 2.*



COFC-02-0320-003-A001AA - R

LEFT BLANK INTENTIONALLY

APPENDIX 5

GENERAL

Refer to : FCOM 2.02.03 p 25-26, 2.02.26 p4-6 and 2.03.20 p1-2).

This chapter applies to non-ILS instrument approach procedures, for which the reference navaids may be :

VOR, VOR/DME, NDB, NDB/DME, LOC, LOC/DME, or LOC-BC with or without DME. The techniques are also applicable to GPS "overlay" approaches, associated with any of these navaids, provided the associated navaid is serviceable.

R-NAV approaches are covered separately.

APPROACH STRATEGY

Provided a Final Approach Fix (FAF) is defined in the approach procedure, the recommended technique for performing a NPA is to fly an ILS-like procedure, i.e. stabilized on a constant-angle final approach path from the FAF, with no level-off at intermediate waypoints or on reaching MDA.

The use of AP in CMD mode and A/THR is recommended for all NPAs to reduce crew workload and to facilitate monitoring of the procedure and flight path.

FLYING REFERENCE

Recommended flying reference on PFD for monitoring flight path by both pilots during final approach is the FPV with FPR ("bird and cage"), except in Managed lateral and vertical guidance (NAV + PROFILE) where FD bars are recommended.

GUIDANCE MODES

The techniques described below apply to VOR, NDB, LOC-BC, approaches with or without DME. For LOC approaches (ILS without G/S), LOC mode is used for lateral guidance, with vertical guidance as described for non-precision approaches on p5.

1. Selected Lateral and Vertical (HDG/S-V/S)

   If any of the conditions for use of NAV mode is not met, HDG/S mode must be used to maintain tracking on the reference navaid, together with selected vertical guidance (V/S mode).

2. Managed Lateral, Selected Vertical (NAV-V/S)

   Provided the required conditions are met, standard technique is to use managed lateral guidance referred to the FMS F-PLN (NAV mode), cross-checked by raw data received from the reference navaid, and pilot-selected vertical guidance (V/S mode) to maintain the required profile.

   Conditions required for the use of NAV mode are that :

   - The approach procedure is defined in the FMS navigation data-base, is inserted without modification in the F-PLN, and is cross-checked with the published procedure by the crew,
   - FMS navigation accuracy is HIGH with the appropriate RNP*, or verified as better than 1 nm if no RNP is specified, or, for a/c with GPS installed, GPS is PRIMARY.

     **Note* : for VOR/DME approach the RNP is 0.61 (refer to FCOM 1.20.31 p1).*

3. Managed Lateral and Vertical (NAV-PROFILE)

   For aircraft in which FMS VNAV standard (mod 12454 or 12455 or later) is installed, Final Approach function may be used from FAF down to MDA, provided that its use is approved by the operator, and the above conditions for use of NAV mode are met.

   Note : For previous FMS standards, PROFILE mode must be deselected not later than the FAF (Refer to FCOM 2.02.26 p4 Limitations).

APPROACH PREPARATION/BRIEFING

The Approach Preparation and Briefing should be made as per SOPs, and should include the following items :

- Appr procedure in F-PLN, initial altitude at FAF and Vapp entered as SPD CSTR at the FAF altitude corrected for temperature if necessary, (refer to next paragraph).
- FMS navigation accuracy check,
- Reference navaid(s) tuned manually (VOR/NAV/ILS switch to VOR) and remotely via CDU PROGRESS page (switch to NAV)
- MDA checked and set on barometric altimeter, altitude corrected for temperature if necessary, (refer to next paragraph),
- Technique to be used (AP guidance modes, ND selection, VOR/NAV/ILS switching)
- Use of FPV/FPR; FPR set to final approach descent angle (as published), and VOR course set to the final approach course (with VOR/NAV/ILS switch to VOR)
- If reference navaids include DME, its location relative to runway threshold, and Distance/Altitude call-outs to be made by PNF, altitude corrected for temperature if necessary, (refer to next paragraph).

ALTITUDE TEMPERATURE CORRECTION

Altitude temperature corrections are particularly important for Non Precision Approaches due to lack of vertical guidance.

Refer to CAUTION in FCTM 2.32.70 ″Approach General p1″.

NAVIGATION ACCURACY

The FMS navigation accuracy check is performed during the Approach Preparation before descent, and should be confirmed again during Initial Approach. It is essential since it determines :

- The AP guidance modes to be used
- The ND mode selection
- Which raw data to be monitored (VOR/NAV/ILS switching).

AP/FD and ND mode selection according to NAV ACCURACY

Nav Accuracy	PF ND	PNF ND	AP mode final appr	VOR/NAV/ILS switching	FD/FPV
GPS PRIMARY or HIGH or checked < 1NM	MAP or ARC or ROSE to monitor raw data on ND (1)	MAP	NAV+ V/S	Both switches to NAV (2), or to VOR to enable display of FPR. For LOC and NDB app, both switches to ILS	FPV
	MAP (3)		If FINAL APPROACH function installed and approved by airline : NAV+ P.DES	Both switches to NAV (2). For LOC app, both switches to ILS.	FD
LOW or >1NM	ARC or ROSE (1)	MAP, ARC or ROSE	HDG/S + V/S	Both switches VOR For LOC app, both switches ILS	FPV

(1) When ND in MAP mode, VOR and/or ADF bearings are monitored on RMIs

When ND in ARC mode, VOR course deviation is monitored on ND, ADF bearings on RMI

When ND in ROSE mode, VOR course deviation and ADF bearings are monitored on ND

(2) FPR cannot be displayed on PFD if switch is to NAV position.

(3) ND must be in MAP mode to display V/DEV. VOR and/or ADF bearings should then be monitored on RMIs

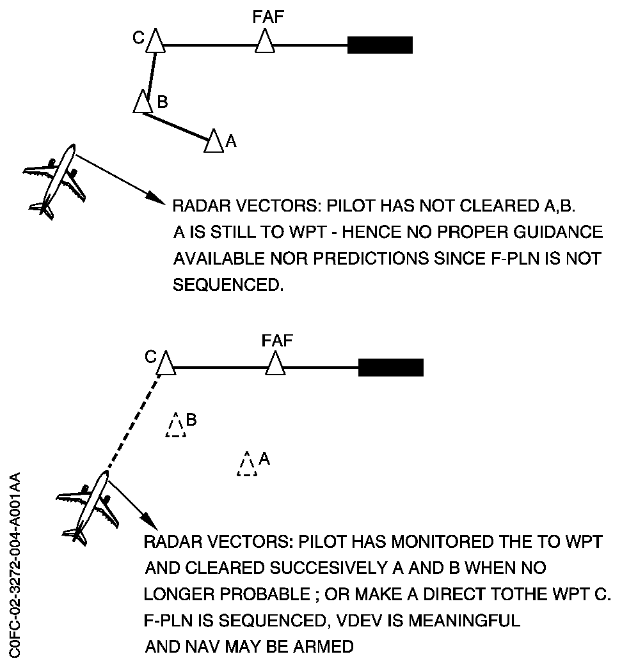
Note : Refer to FCOM 2.03.18 for details on required NAV ACCURACY for applicable flight phase.

INTERMEDIATE APPROACH

F-PLN SEQUENCING

It is essential for the F-PLN to be correctly sequenced. The crew should therefore check that the TO WPT indicated on the upper righthand corner of the ND (in MAP mode) corresponds to the next WPT ahead. This may not be the case if HDG/S mode is used to intercept the final approach course (e.g. when under radar vectors), so that one or more WPTs are by-passed ; these WPTs should then be cleared from the F-PLN, or a DIRECT TO the next WPT on the final approach course should be performed.

Note : *If the F-PLN is not correctly sequenced, it will not be possible to use NAV mode for the approach, and the distance to dest (PROG page) and VDEV will not be realistic ; furthermore, in the event of a go-around it will not be possible to use NAV mode to follow the missed approach routing.*



USING HDG/S + V/S

Selected lateral and vertical modes must be used if the conditions for using NAV are not satisfied.

INTERCEPTION OF FINAL APPR COURSE

The recommended configuration and speed for interception of final approach course is 15/15 at F+20kt, or 180kt

Use HDG/S for interception and tracking the final approach. Cross-check the interception by reference to raw data on RMIs.

Selection of FPV/FPR assists tracking. When established on final approach course, adjust heading to keep ″bird″ aligned vertically with ″cage″ ; drift is then automatically corrected.

SETTING GO-AROUND ALTITUDE

On reaching level-off altitude before FAF, set G/A altitude on FCU if higher.

If G/A altitude is lower, set any higher altitude to prevent an unwanted ALT capture as V/S is engaged approaching FAF. In this case, do not set G/A altitude until below the G/A altitude on final approach.

APPROACHING FAF

It is important to be at the published FAF-crossing altitude, in landing configuration at Vapp shortly before the FAF, so that a stabilized final approach is established as the FAF is overflown. The following distances to FAF for flap and L/G extension are given for guidance, and may be varied to suit the conditions :

5 NM . . . . Flaps 20
3 NM . . . . L/G down
1 NM . . . . Flaps 40

Note : *If MDA is set on FCU, AP would engage in altitude capture mode (ALT*) approaching MDA, with thrust increasing as a/c levels off, thus destabilising the approach at a critical stage. Therefore MDA should not be set on FCU.*

To initiate final approach, V/S mode should be engaged and set so as to place the FPV down into the center of the FPR symbol (″bird into cage″) at a distance of 0.3 – 0.5 nm before the FAF. This allows for the lag in pitch response due to inertia, and ensures that the final approach path is smoothly intercepted as the FAF is overflow.

FINAL APPROACH

During final approach :

- Complete Landing C/L.
- Check G/A altitude set on FCU
- Keeping ″bird″ centered vertically and laterally in ″cage″ enables required slope and track respectively to be maintained with respect to the ground, automaticaly compensating for variations in wind.

CAUTION

The Flt Path Reference symbol (″cage″) is not a command symbol (Flt Director). If the a/c is not already on the required approach slope and/or course, keeping ″bird in cage″ would only result in a parallel slope and/or course being flown. It is therefore essential to initiate the final descent accurately at the specified altitude and fix.

- The crew should closely monitor the flight path, PNF calling the required DME/ALT cross-checks on final approach, as published on approach chart.

  Note : *If DME/ALT checks are not published, an approximate profile cross-check may be made using distance to threshold shown on PROGRESS page and applying the usual 300 ft/nm rule.*

- Small adjustments to V/S and to heading may be needed to correct to profile and to approach course, then to return ″bird″ to centre of cage.

USING NAV + V/S

If conditions for use of NAV mode are met :

INTERCEPTION OF FINAL APPR COURSE

Recommended configuration and speed as for using HDG/S + V/S described above.

When cleared for final approach course interception, if F-PLN leads onto the final approach course, use NAV mode for the interception. Otherwise (e.g. following radar vectors), use HDG/S to intercept, then engage NAV mode when established on this course.

Set G/A Altitude as for using HDG/S + V/S described above.

Approaching FAF, select configurations and speeds, initiate and monitor Final Approach using V/S as above.

Note : With VOR/NAV/ILS switch set to NAV, the "cage" is not show on PFD. The crew may restore display of cage by switching momentarily to VOR. Refer to "use of FPV" in Supplementary Information.

Monitor tracking by reference to navaid (on RMI, or on ND if set to ARC or ROSE); bird should stay centered in cage.

The Flt Path Reference symbol ("cage") is not a command symbol (refer to above Caution).

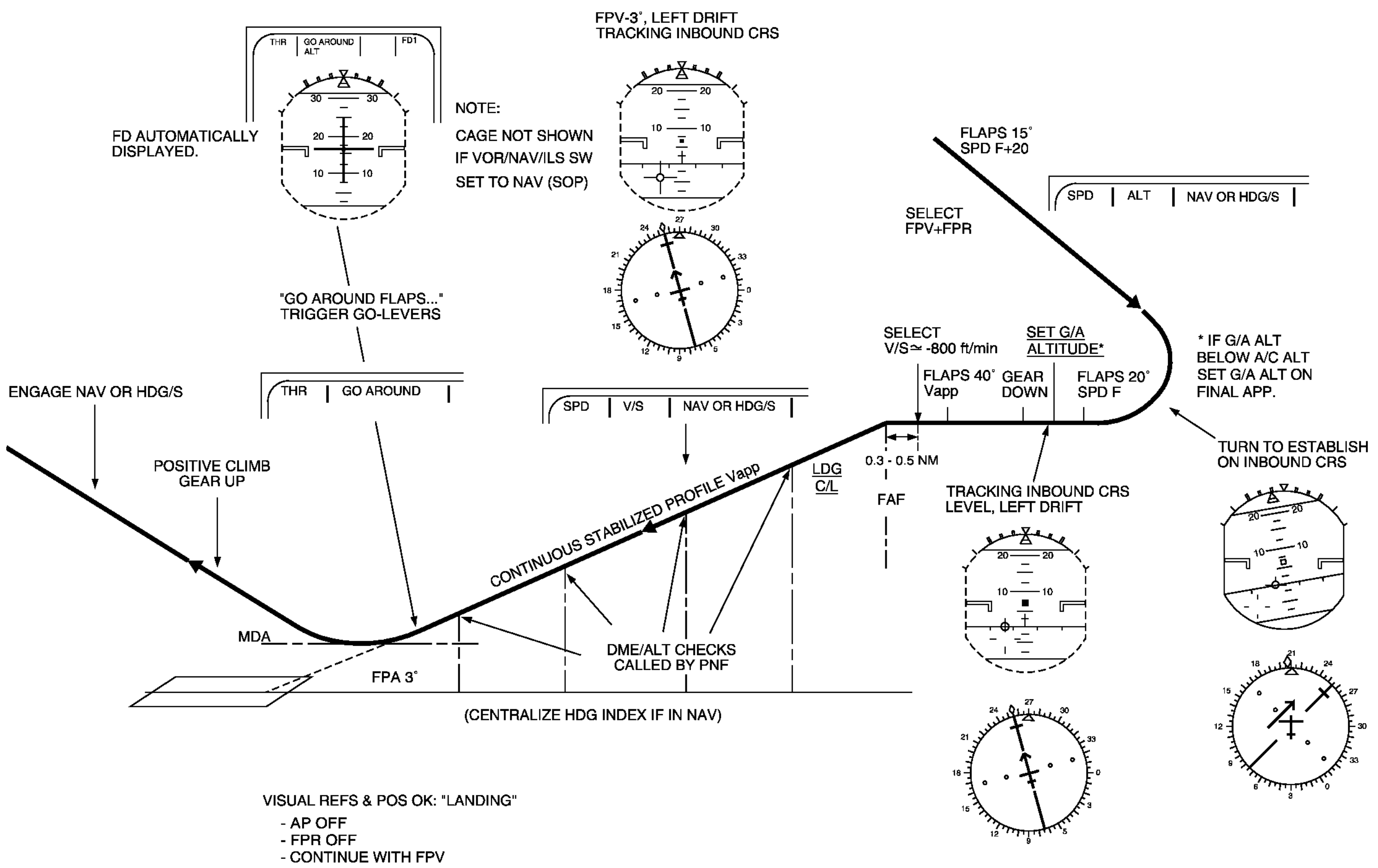
If a NAV ACCURACY DOWNGRADE or GPS PRIMARY LOST on both sides using NAV mode, revert to HDG/S.

If GPS PRIMARY lost on one side only, approach may be continued using AP on side on which GPS PRIMARY is available.

NPA PATTERN USING NAV+ V/S OR USING HDG/S + V/S

EXAMPLE: VOR/DME USING V/S + NAV OR HDG/S

C0FC-02-3272-007-A001AA



USE OF AP + A/THR RECOMMENDED

USING PROFILE MODE (FINAL APPROACH FUNCTION INSTALLED*)

* Mod 12454 or Mod 12455 or later.

LIMITATIONS

Refer to FCOM 2.01.30 p2 for limitations. AP or FD must be engaged (the recommended technique is to use AP and FD bars for the flying reference).

CAUTION

When it is necessary to correct approach altitude for the effect of low temperature, the use of PROFILE mode is not permitted. In such a case use V/S – NAV modes as described page 5.

WHEN LANDING DATA HAVE BEEN OBTAINED

Approach procedure on RWY . . . . Insert

Select CDU approach page

Wind correction . . . . Insert

Note : *On these FMS standards, Vapp can be directly inserted on the CDU.*

MDA . . . . Insert

Deselect PROFILE mode if engaged by pressing the PROFILE pushbutton or pulling the V/S knob, after that, use ALT or V/S or LVL/CH as required (FINAL APP can only be activated if engaged vertical mode is ALT, V/S or LVL/CH).

As a result the prompt FINAL X.X° appears on the CDU APP page.

Arm FINAL Approach by pressing the FINAL X.X° prompt on CDU.

Note : *The final approach slope X.X° is specific to each approach procedure and is in NAV database for that procedure. It cannot be modified by crew.*

INTERMEDIATE APPROACH

Plan the deceleration so that VAPP and Landing configuration are obtained before the FAF.

V/DEV :

– Replaces the FINAL X.X° prompt on the CDU,

– Switches to the Final Approach Segment as reference,

– Is displayed on the ND (1 dot = 100 ft).

When pressing FINAL X.X° prompt and in PROFILE, the flight path is programmed to go below the FCU altitude at the pseudo glide-slope intercept point (), displayed on ND in white as a Top of Descent.

CLEARED FOR APPROACH

PROFILE must be armed after levelling off at the FAF altitude : if not, P.DES armed mode will be lost in case of altitude capture.

Check NAV, LOC or LOC* lateral mode active : if not, PROFILE mode will not automatically engage at the pseudo Glide Slope intercept point.

Check V/DEV decreasing and engagement of P.DES at FAF (or shortly before). P.DES blue flashes 30 sec before reaching the Descent Point. G/A altitude must be set after FAF when P.DES is engaged.

FMA in final approach : P.SPD-P.DES-NAV (or LOC)

CAUTION

After selecting FINAL X.X° (FINAL APP function active), the FMS PROFILE mode does not consider vertical constraints. It is pilot's responsibility to ensure safe altitude margin for obstacle clearance.

FINAL APPROACH :

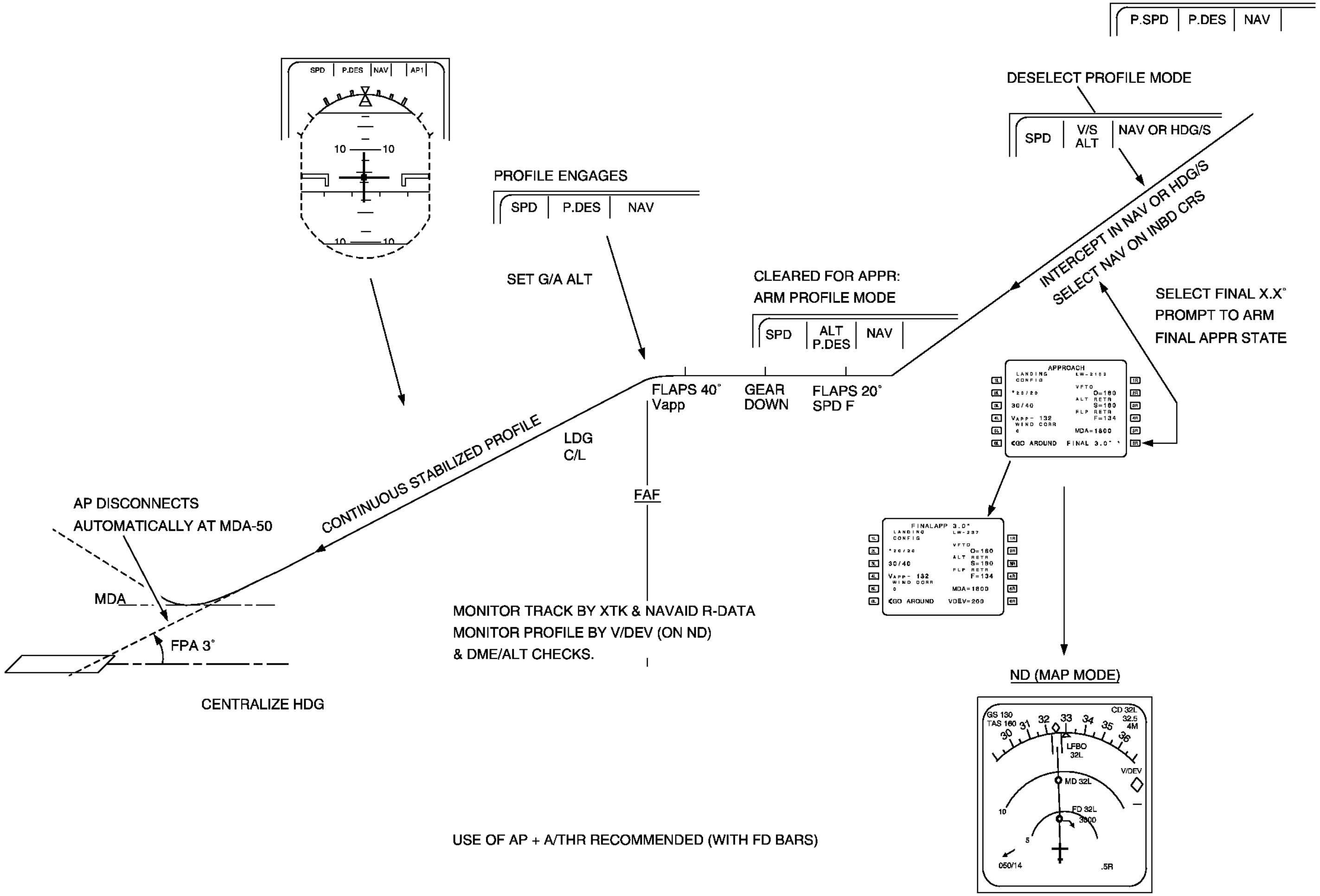
Both VOR/NAV/ILS switches should be set to NAV (required by SOPs).

- Complete Landing C/L
- Check G/A alt set on FCU
- Monitor track and profile by :
  (a) XTK and VDEV, showing deviations from computed track and profile,
  (b) Reference navaid raw data and DME/altitude checks, as published on approach chart.
- If a significant deviation of the profile occurs, revert to V/S + NAV modes (and select FPV).
- If a significant deviation of track occurs, revert to V/S + HDG/S modes (and select FPV, VOR/NAV/ILS switch to VOR and ND in ARC or ROSE) and continue or go-around. (P.DES automatically reverts to V/S if NAV cancelled).
- If a NAV ACCURACY DOWNGRADE or GPS PRIMARY LOST on both sides using NAV mode, revert to HDG/S + V/S modes as well.
  If GPS PRIMARY lost on one side only, approach may be continued using AP on side on which GPS PRIMARY is available.

NPA PATTERN USING FINAL APP FUNCTION

C0FC-02-3272-010-A001AA

NON - PRECISION APPROACH EX: VOR/D APPR USING FINAL APPROACH FUNCTION



REACHING MDA

When approaching the MDA, the PF should expand the instrument scan to include external visual cues.

- If the required conditions are not met approaching MDA, a missed approach must be initiated. Execute the standard Go-Around procedure, keeping AP engaged.

  Note : *To avoid going below the published MDA during go-around initiation, due to aircraft inertia, some authorities may require operators to add a specific margin to the published MDA.*

- If required conditions are met (sufficient visual references and a/c correctly positioned),
  - Disengage AP; if FINAL APP function is used, AP disengages automatically at MDA - 50 ft,
  - Push FPA p/b to remove ”cage”
  - Continue visual approach and landing ; retain ”bird” to assist tracking runway center line, and continuing on a 3° approach path.

LOC ONLY APPROACH

Note : *This chapter considers LOC ONLY APPR with V/S use. For LOC ONLY APPR with VNAV, refer to ”Using PROFILE MODE” paragraph.*

LOC ONLY approaches are flown using the localiser signal for lateral navigation, and bird with cage, set to the specified slope, for vertical guidance. General recommendations mentioned above still apply, i.e. stabilized approach technique, and use of the bird as the flying reference.

Approach preparation and briefing, navaid selection, FMS accuracy check, etc... as described for the NPA.

INITIAL APPROACH

Select VOR/NAV/ILS switch to ILS.

INTERMEDIATE APPROACH

When cleared to intercept localiser, Press V/L p/b on the FCU to arm LOC mode, and check FMA (LOC blue) ; then monitor localiser capture (LOC*) and localiser tracking (LOC green) as for an ILS.

FINAL APPROACH

Approaching FAF at the specified altitude and established in landing configuration at Vapp, the crew will select FPA to display the cage, and initiate final approach using V/S mode to place bird in cage as described for the NPA. When established on the final path, the crew will monitor :

- Lateral displacement with LOC deviation
- Vertical displacement with DME/ALT, cross-checks, (or using distance to threshold on PROGRESS page with 300ft/nm rule) adjusting V/S as needed to stay on profile.

LOC BACK-COURSE APPROACH

(Refer to FCOM 2.02.03 p14B)

GENERAL

The LOC-BC approach uses the LOC signal of the opposite runway for lateral guidance.

HDG/S and V/S modes are used in conjunction with the ″bird″ to track the LOC back-course and fly a stabilized constant-angle final approach profile.

As for all NPAs, it is recommended to use AP and A/THR, until adequate visual references are acquired and correctly positioned for landing.

Approach Preparation/Briefing
Approach preparation and briefing, navaid selection, FMS accuracy check etc... as described above for NPA.
If the LOC-BC approach is stored in the FMS data-base, it should be inserted in the F-PLN :

– Select the ILS frequency and the final approach ILS Front CRS on ILS control panel.

– Check approach slope if published on the Approach Chart.

INITIAL APPROACH

Select VOR/NAV/ILS switch to ILS, and both NDs to ROSE or ARC.

INTERMEDIATE APPROACH

– When cleared to intercept the localiser back course, use HDG/S mode to establish and track the back beam as displayed on ND. Heading adjustments to maintain the back-course are towards the deviation bar on the ND (If the LOC-BC approach is in the F-PLN, and NAV ACCUR is HIGH or checked by raw data, NAV mode may be used for lateral tracking.)

CAUTION

On the PFD, localiser deviation indications are reversed, and must be disregarded. Refer to illustration of PFD and ND indications below.

– When on back-course track adjust heading to keep the ″green diamond″ (which indicates inertial track) on ND at the required inbound track, thus automatically compensating for drift.

FINAL APPROACH

– Approaching the FAF, at the specified altitude and established in landing configuration at Vapp, initiate final approach using V/S mode to place the bird at the correct flight path angle by reference to the pitch scale, so that final descent is started at the FAF.

Note : The ″cage″ cannot be used since it is referenced to the front-course selected on the ILS control panel, and would therefore be out of view on PFD.

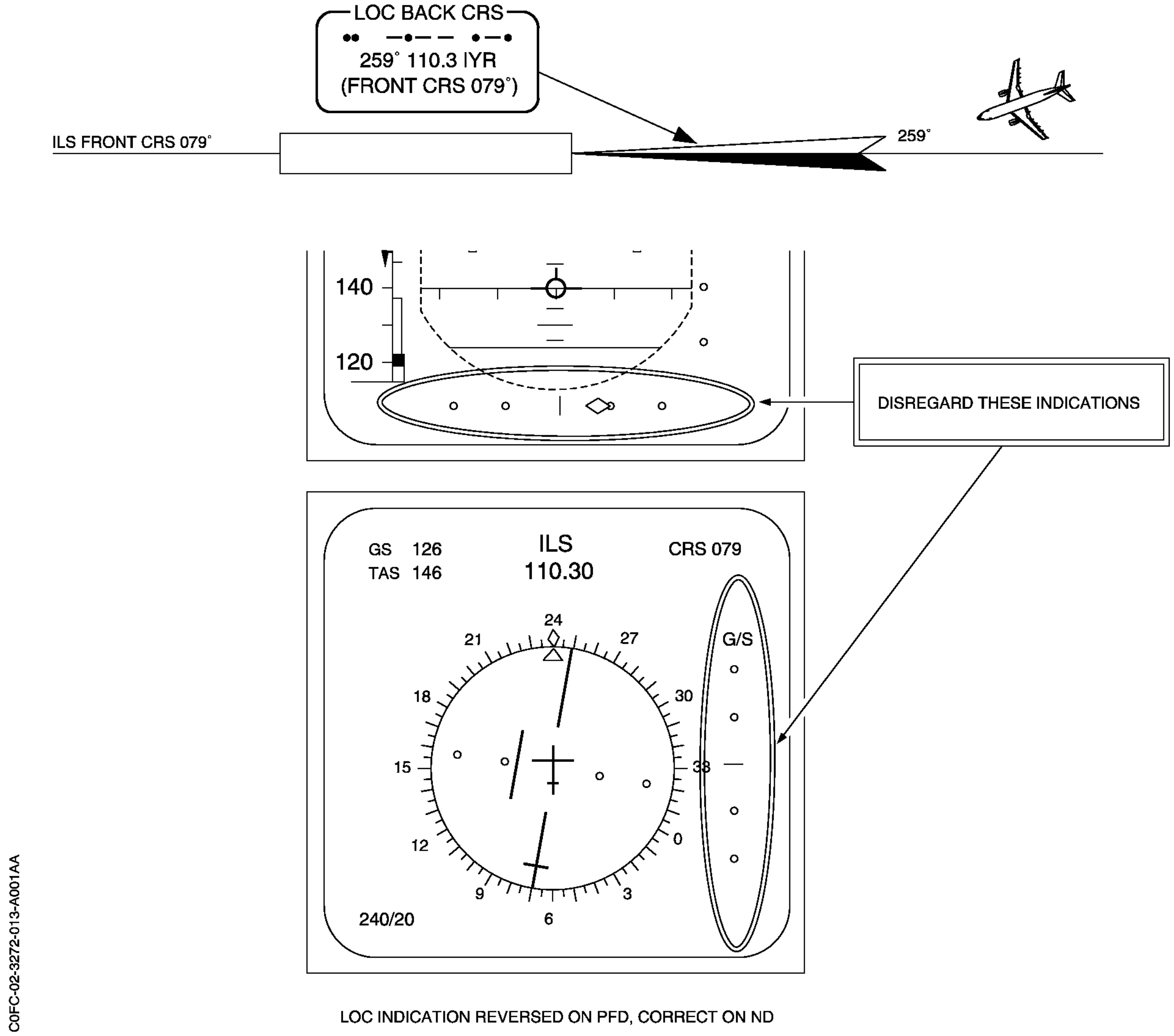
– When established on the final path, the crew monitors and maintains tracking as explained in the paragraph LOC-BC intermediate approach.

The vertical profile is monitored by DME/ALT cross-checks (or using distance to threshold on PROGRESS page with 300ft/nm rule)

Any deviation from the required profile should be corrected by a small adjustment of the position of the bird on the pitch scale.

Disregard G/S indications.

LOC-BC APPROACH (EXAMPLE CYQX RYW 26)



LOC INDICATION REVERSED ON PFD, CORRECT ON ND

INTENTIONALLY LEFT BLANK

APPENDIX 6

FUNCTION

- The PROFILE mode couples the Flight Management System (FMS) to the AP/FD and to the A/THR (AUTO mode on TRP) for vertical guidance along the FMS vertical flight plan (F-PLN).
- In PROFILE mode, the vertical guidance orders and the thrust are computed by the Flight Management Computer (FMC) and executed by :
  - the AP/FD (P.CLB, P.ALT, P.DES modes) for maintaining the required speed, altitude, flight path or vertical speed,
  - the A/THR (P.THR, P.SPD, RETARD modes) for maintaining the required thrust or speed.
- The PROFILE mode may be used without the A/THR being engaged (i.e. with MAN THR setting).

ENGAGEMENT AND OPERATION

- The PROFILE mode can be armed (at takeoff) or engaged at any time by pressing the PROFILE pushbutton.
- When PROFILE mode is armed at takeoff (P.CLB blue on FMA), PROFILE (P.THR / P.CBL green on FMA) automatically engages at the thrust reduction altitude (i.e. at 1500 ft AGL or higher, as set in the FMS TAKEOFF page).
- If not initially armed, PROFILE mode can be manually engaged after passing the thrust reduction altitude at any time during climb (P.CLB on FMA), cruise (P.ALT on FMA) and descent (P.DES on FMA).
- When PROFILE mode is engaged, altitude changes are initiated by setting the new cleared altitude on the FCU, and by pulling the ALT SEL knob.
- When PROFILE mode engages,
  - the SPD/MACH window is dashed (speed/Mach is controlled by the FMS, the FMS target speed is indicated on the PFD speed scale by the blue index),
  - the TRP AUTO key illuminates (TRP thrust limit is controlled by the FMS).
  - In climb or descent the TRP TARGET window displays the FMS-computed target thrust.
- The A/THR modes associated to the PROFILE mode are :
  - P.THR in climb and for descent initiation, to maintain the target thrust commanded the FMS,
  - P.SPD in cruise to maintain the target speed commanded by the FMS or in descent if speed or altitude constraints have to be achieved,
  - RETARD during idle descent.
- PROFILE mode arming/engagement is indicated on the FMA and by the illumination of the PROFILE pushbutton switch.
- The operating envelope of the PROFILE mode is from 1500 ft AGL at takeoff to :
  - GS capture (GS*), for a precision approach,

  or

  - MDA for Non Precision Approach
- PROFILE mode is allowed for use on final approach provided FINAL APPR state is active (refer to FCOM 2.03.20 NON PRECISION APPROACH).
- In PROFILE mode, the speed is controlled to remain between VLS (Green Dot, if in ECON mode) and below VMAX provided speed brakes are R
  retracted at the end of descent R

DISENGAGEMENT

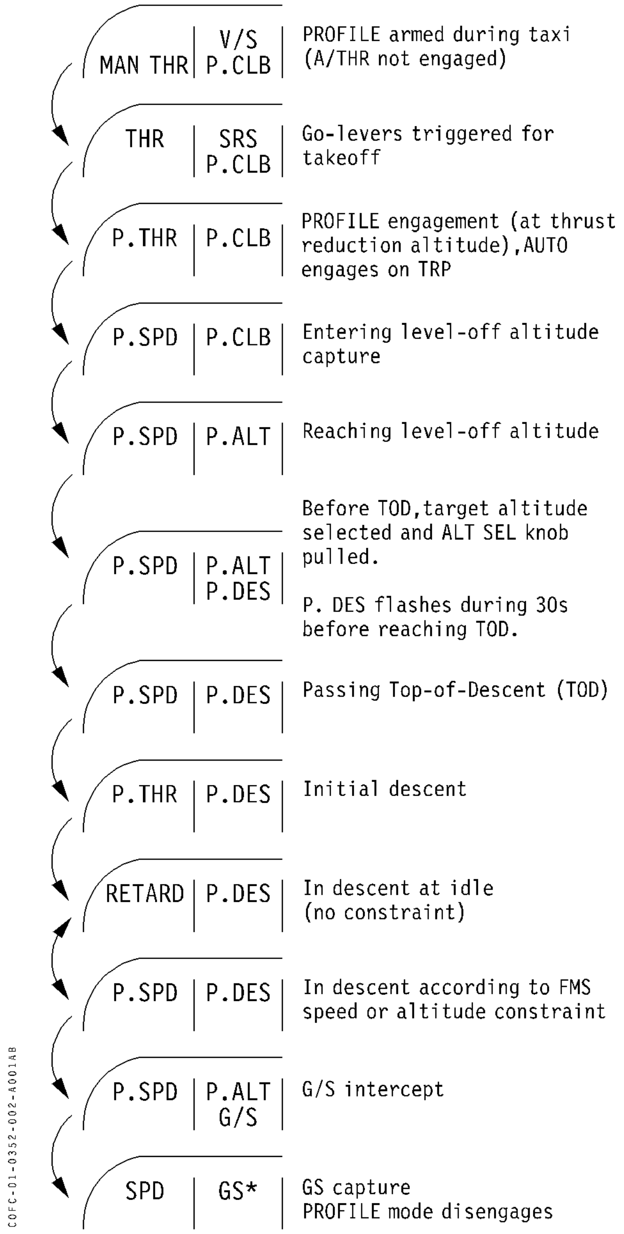
- The PROFILE mode is disengaged by pulling the SPD/MACH knob (SPD/MACH window synchronizes on the present aircraft speed).

  Pulling the SPD/MACH knob results in a manual reversion from **managed modes** to **selected modes :**
  - LVL/CH mode in climb or descent,
  - ALT mode in level flight.
- The SPD knob can then be turned to select the desired target speed.
- If used in final approach, PROFILE mode will disengage automatically at MDA-50ft.

Mod : 12454 or 12455

MODES TRANSITIONS

- The automatic mode transitions sequence over a complete flight conducted in PROFILE mode, is as follows :

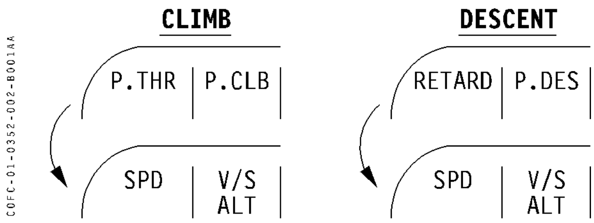


- The altitude capture range (automatic transition from P.THR / P.CLB to P.SPD / P.CLB) varies depending on the aircraft vertical speed (the capture range increases with increasing vertical speed).

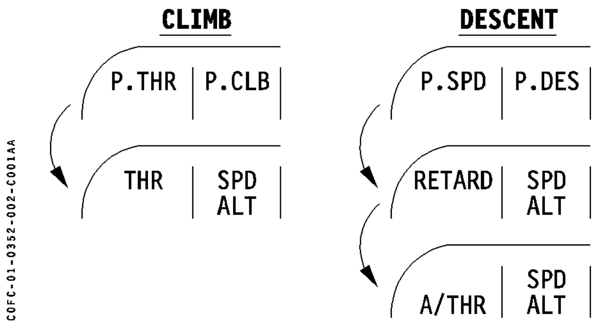
  In PROFILE climb with 2000 ft/mn vertical speed, the capture phase is initiated approximately 300 ft before the selected altitude.

- A manual mode transition can be initiated by selecting another vertical mode, the transition sequence is as follows :

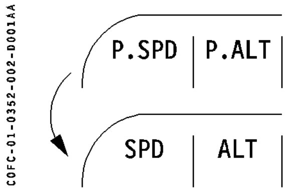
  – If V/S mode is selected by pulling the V/S knob :



  – If LVL/CH mode is selected by :
    - pulling the SPD/MACH knob in climb or descent,
    - or by pressing the LVL/CH pushbutton.



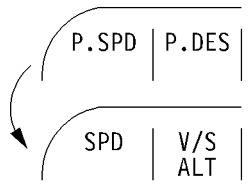
  – If ALT HLD mode is selected by :
    - pulling the SPD/MACH knob in level flight,
    - or by pressing the ALT.HLD pushbutton.



MODE REVERSIONS

- A manual mode reversion from PROFILE to V/S (basic vertical mode) can be performed by pressing the PROFILE pushbutton.

  The FMA mode reversion sequence is as follows :



COFC-01-0352-003-A001AA

- In descent, automatic reversions from RETARD / P.DES to P.SPD / P.DES or from P.PSD / PDES to RETARD / P.DES occur when speed or altitude constraints have to be met or if the airspeed is below or above defined guidance limits.

- In P.DES mode, depending on the prevailing constraint or condition, the vertical guidance :

  – maintains the computed flight path (Path),

  or

  – maintains the computed target speed (SPD),

  or

  – maintains the present aircraft vertical speed (V/S).

  In the FMA illustrations provided hereafter, (Path), (V/S) or (SPD) indicates the applicable guidance - but is not displayed on the FMA.

- An automatic reversion from RETARD / P.DES to P.SPD / P.DES occurs if :

  – an ALT CSTR must be met,

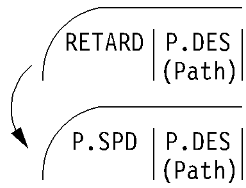
  – a SPD CSTR must be met,

  – IAS is greater than the target speed + 20 kt,

  – IAS is lower than the target speed – 20 kt,

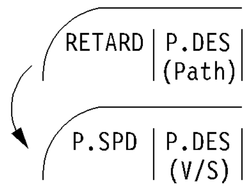
  – IAS is lower than Green Dot – 10 kt.

  The FMA mode reversion sequence is as follows :



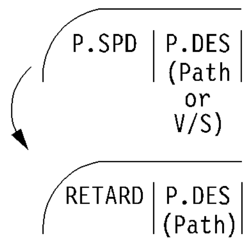
COFC-01-0352-003-B001AA

- An automatic mode reversion from RETARD / P.DES to P.SPD / P.DES occurs if a revision of the F-PLN is performed (as temporarily, the FMS cannot refer to any flight profile reference for flight path guidance) :



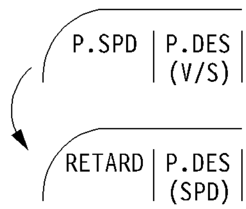
COFC-01-0352-003-C001AA

- When the conditions requiring a tight speed control (P.SPD mode) no longer exist, an automatic reversion from P.SPD / P.DES to RETARD / P.DES occurs :



COFC-01-0352-003-D001AA

- An automatic reversion from P.SPD / P.DES to RETARD / P.DES occurs if the airspeed exceed VMO – 5 kt, when in IMM DES :

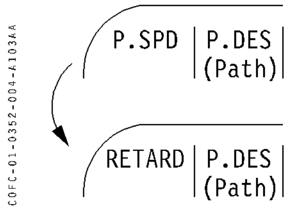


COFC-01-0352-003-E001AA

- A similar automatic reversion from P.SPD / P.DES to RETARD / P.DES occurs if :
  - IAS is greater than the target speed + 15 kt,

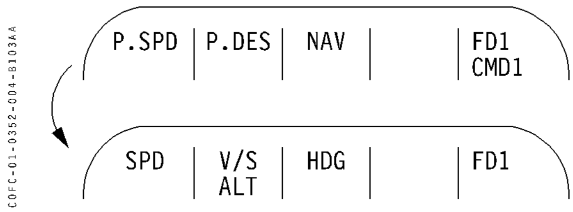
  or
  - IAS is greater than VMAX – 2 kt

R or
  - R Speed brakes extended



- An automatic mode reversion from PROFILE to V/S mode occurs if the FMC associated to the engaged AP fails.

  The AP disengages, the FD remains engaged in V/S mode.



FINAL APPROACH STATE

- For Non Precision Approaches, the FMS provides a vertical guidance down to the MDA through the activation of the FINAL APP state on APPROACH page.
- When FINAL APP state is active, vertical guidance is defined as a geometric path with a constant angle. This vertical path begins at a point 50 ft above the runway threshold or at the MAP, if located before runway threshold, and projects back infinitly at a constant angle, crossing the FAF.
- This final approach path is independant of vertical constraints or aircraft performance.
- Final approach state can only be activated when :
  - an MDA has been entered,
  - VAPP is valid,
  - current vertical guidance mode is ALT, V/S or LVL CHG.
- Thus, if already engaged, PROFILE mode must be disengaged on FCU to activate the final approach state and change FMS path computation reference.
- The X.X° (e.g. FINAL APP 3.0°) is specific for each approach and is loaded from the navigation database. It cannot be modified by the pilot.
- Activation of final approach state is confirmed by :
  - APPROACH page title changes into FINAL APP X.X°
  - LSK 6R prompt changes into VDEV = ± XXXX.
- With FINAL APP state activated, when in capture condition, PROFILE mode will automatically engage only in NAV, LOC or LOC* lateral guidance mode.

Mod : 12454 or 12455

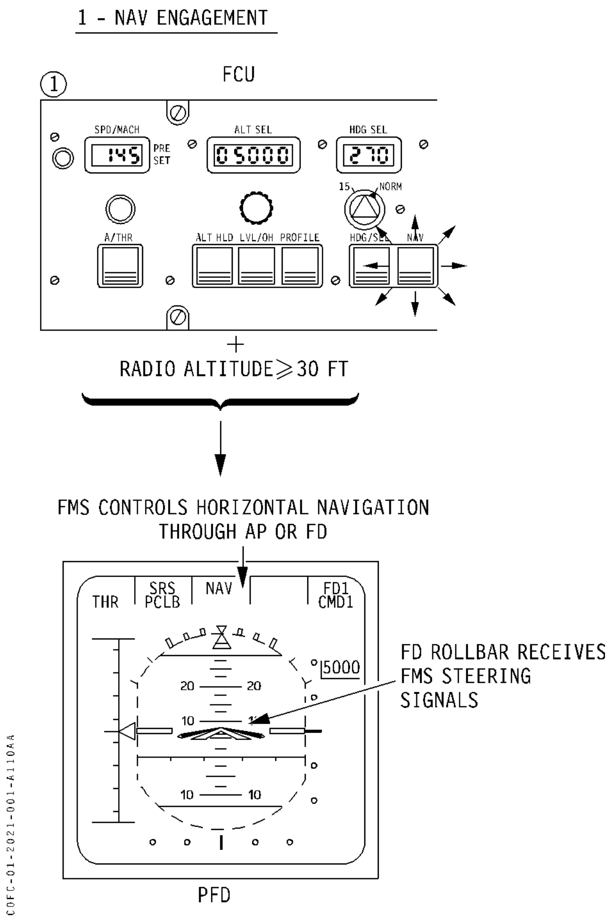
APPENDIX 7

The FMS can be coupled to the AFS in three modes, with different levels of automation :

NAV, PROFILE and AUTO modes.

1 – NAV MODE

- The NAV mode allows to couple the FMS to the AP/FD in lateral axis, so that the FMS automatically controls the lateral navigation (from 30 ft to LOC capture).
  Parameters of this lateral navigation are defined and entered into the FMS flight plan through the CDU.



2 – PROFILE MODE

- The PROFILE mode allows to couple the FMS to the AP/FD in longitudinal axis and to the ATS, so that the FMS automatically controls the VERTICAL PROFILE (altitude, speed, thrust and time), from THR RED ALT to G/S capture or MDA for a non-precision approach.

Mod : 12100 + 12454 or 12100 + 12455

- In PROFILE mode, the vertical guidance orders and the thrust are computed by the Flight Management Computer (FMC) and executed by :
  - the AP/FD (P.CLB, P.ALT, P.DES modes) for maintaining the required speed, altitude, flight path or vertical speed.
  - the A/THR (P.THR, P.SPD, RETARD modes) for maintaining the required thrust or speed.

- Parameters of this vertical profile are defined and entered into the FMS flight plan through the CDU.

Note : 1. *Coupling to the ATS (for speed or thrust control) is effective if, in addition, A/THR function has been engaged.*

2. *PROFILE engagement automatically activates AUTO mode on TRP (Thrust Rating Panel).*

- The PROFILE mode may be used without the A/THR being engaged (i.e. with MAN THR setting).

- The main rules in FMS vertical guidance of the aircraft are :
  - Altitude acquisition by FMS is always limited by altitude selected on the FCU (clearance altitude).
  - During cruise phase, the FMS holds the clearance altitude within a band of ± 50 ft (soft hold) in order to minimize throttle activity.
  - If the FCU selected altitude is greater than the CRZ FL (entered on CDU ″INIT″ page) the FMS automatically changes this CRZ FL into the FCU altitude.
  - The FMS cannot command an altitude change without at least two ″positive″ actions of the crew. This means that the pilot must :
    - select the new altitude on the FCU (ALT knob).
    - pull the ALT knob to allow the altitude change.

  See chapter 1.03.52 for more details.

3 – AUTO MODE

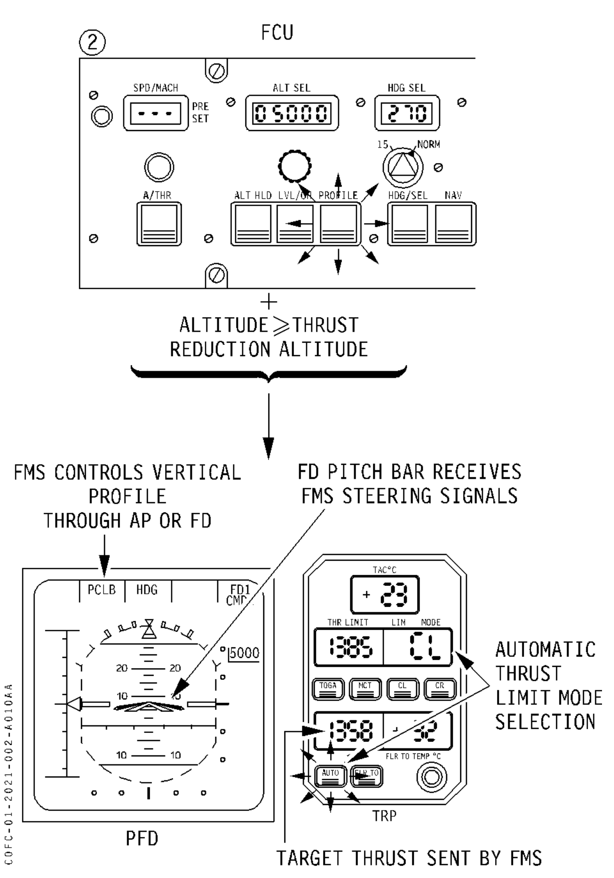
- The AUTO mode enables to couple the FMS to the Thrust Rating Panel : the FMS automatically selects the thrust limit mode and displays the target thrust on the TRP.
- AUTO can be manually selected on the TRP (independently of NAV or PROFILE engagement). It is automatically selected when PROFILE is engaged.

  Note : *When AUTO is engaged with PROFILE, it is no longer possible to manually disengage it on TRP. When PROFILE is disengaged, AUTO remains engaged. But it can be disengaged by selecting another mode on the TRP.*

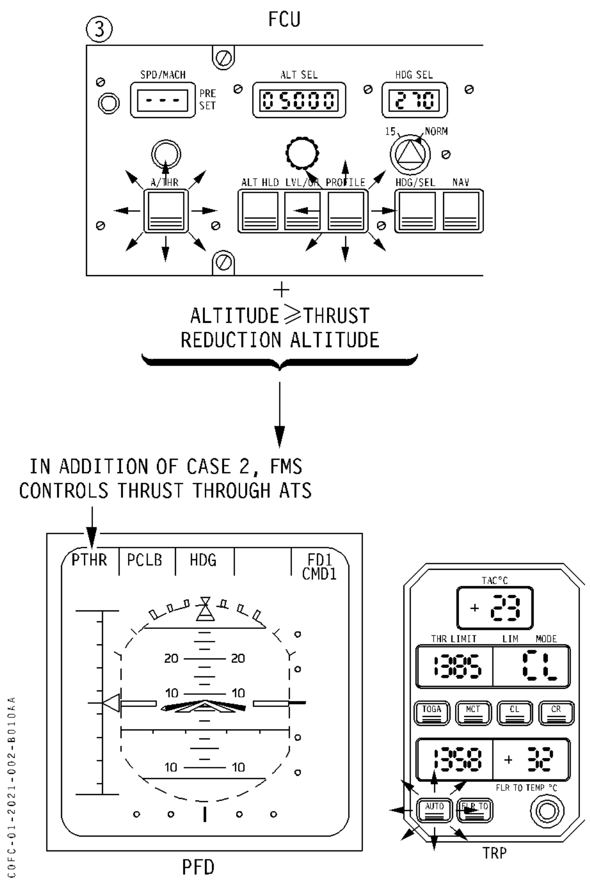
- The limit thrust mode selection is made by the FMS, but the corresponding limit thrust (displayed in the THR LIMIT window of the TRP) is still calculated by the TCC (Thrust Control Computer).
- In addition, when PROFILE is engaged, a target thrust is calculated by the FMS and displayed on the TRP. This target thrust, which cannot be greater than the limit thrust displayed at the same time, will be maintained by the ATS.
- When the PROFILE or AUTO mode is selected, the A/THR pushbutton illuminates on the FCU.

  See chapter 1.03.21 for more details.

2 – PROFILE ENGAGEMENT – WITHOUT A/THR



3 – PROFILE ENGAGEMENT – WITH A/THR



Mod : 12100

4 – FMC FAILURE

- An FMC failure causes disengagement of NAV and PROFILE modes on the side where the FMC has failed.
  Moreover, if PROFILE or NAV mode is in active phase, AP/FD disengages.
  On the other side AP/FD remains engaged in PROFILE and NAV modes.

- Refer to chapter 1.03.52 : AP/FD profile mode for modes transitions and modes reversions.

INTENTIONALLY LEFT BLANK

APPENDIX 8

Descent preparation and approach briefing take approx 10 minutes. So they should be initiated approx 80-100 miles before top of descent.

ECAM MEMO PAGE . . . . Check

– Check STATUS on MEMO page. Review if required. Take particular note of any landing capability downgrade or any other aspect affecting the approach and landing.

WEATHER AND LANDING INFORMATION . . . Obtain

– Check weather at alternate and destination, including runway in use.

LANDING ELEVATION . . . . Set

Note 1 : If QFE is used set O on LANDING ELEVATION counter.

Note 2 : In case the destination field elevation is higher than the actual cruise CAB ALT, combined with low aircraft cruise FL, set the LANDING ELEVATION counter to landing field elevation before initiating the descent, in order to permit CAB ALT to reach the landing field elevation before landing.

HIGH LDG ELEVATION . . . . As req

– If landing field elevation above 9200 ft, check HIGH LDG ELEVATION switch on.

FUEL . . . . Check

– If flight has been performed below FL 200, check on ECAM FUEL page that there is less than 2000 kg (4400 lbs) of fuel in trim tank. If there is more than 2000 kg (4400 lbs) of fuel in trim tank, check TRIM TK PUMPS are selected ON and select TRIM TK MODE push-button to FWD position.

FMS

LANDING DATA . . . . Prepare

– Set speed bugs on STBY ASI, VAPP and Green Dot.

On FMS APPR page

– **LANDING CONFIG . . . . Check**
  If landing in 15/20 config, select 15/20 on FMS APPR page.
– **MDA . . . . Insert**

R *Note : some authorities may require operators to add*
R *a certain number of feet to the MDA.*

DESCENT WIND PROFILE . . . . INSERT

This insertion, on the DES FORECAST page should be made early to ensure optimum Top of Descent point can be re-computed and ensure that it is ahead of the present position.
If no wind is inserted, wind is computed by interpolation between CRZ wind and no wind at destination.

For CAT II or CAT III approach :

– **DH . . . . Set on FCU**

F-PLN . . . . Check/Modify

STAR/APPROACH . . . . Insert

The FMS computes VAPP based on the predicted landing weight, it is equal to VREF + WIND CORR (entered by crew) + 5 kt (This assumes A/THR is engaged for landing).
The DECEL point, where the aircraft should start to decelerate is computed based on the inserted flight plan route and wind profile.

NAVAIDS . . . . Check

Set Navaids as required and check idents.

If a VOR/DME exists close to the airfield, it should be selected systematically and its ident should be set on PROG page BRG/DIST TO field for navigation accuracy monitoring during descent.

GO AROUND page . . . . Check/Modify

Check/modify the THR RED ALT and ACC ALT.

SEC F-PLN page . . . . As req

If weather is OK, SEC F-PLN can be used for setting another possible approach and/or RWY as a backup at destination airfield.
If there is a last minute RWY change, it is then only necessary to activate SEC F-PLN not forgetting to set new MDA/DH and navaids.

APPROACH BRIEFING

It is recommended to use FMS pages and ND as a guide for descent and approach briefing. Main points to be covered are :

Navaid	– ILS, VOR selection procedures and crossing altitudes.
F-PLN page	– STAR, APPR, TRANS, MISSED APPROACH
APPR page	– Landing Config, speeds, MDA,
FUEL PRED	– Fuel needed for diversion, holding fuel available.

– Runway conditions, lighting and dimensions
– Ground Spoiler, reverse operation and autobrake selection
– Terminal area topography, transition level and minimum safe altitudes to ensure a proper terrain awareness.
– Weather at destination
– Go Around :
  · Standard call/task sharing
  · Diversion decision

Note : If AP disengaged, it is recommended to descend at Mach 0.8 or below to avoid alpha-trim activation.

DESCENT CLEARANCE . . . . Obtain

WHEN DESCENT CLEARANCE IS GIVEN BY ATC

– **FCU ALT KNOB . . . TURN to select cleared altitude**
– **FCU ALT KNOB . . . . Pull**
– **P. THR/P. DES armed . . . . Check FMA**
  · IMM DES prompt is displayed on FMS CDU.

ANTI ICE . . . . As req

During descent ENG ANTI ICE should be ON when icing conditions are met, or when moderate to severe precipitation is encountered.

IGNITION . . . . As req

Ignition should be selected to CONT RELIGHT prior to ENG ANTI ICE selection.

Mod : 4801 + 12211

LEFT BLANK INTENTIONALLY

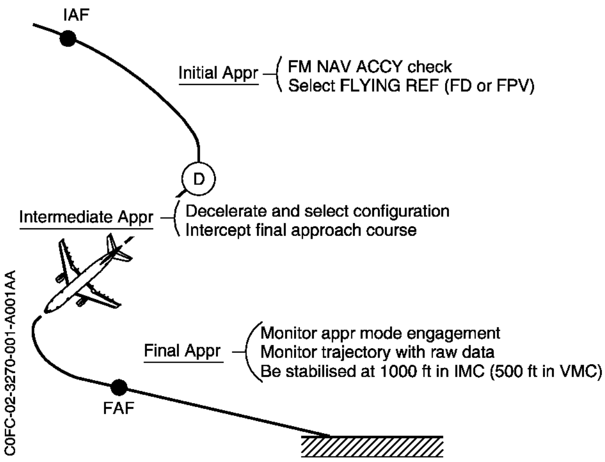
APPENDIX 9

GENERAL

This section covers general information applicable to all approach types. Techniques, which apply to specific approach types, will be covered in dedicated chapters.

All approaches are divided into three segments (initial, intermediate and final) where associated procedures must be performed.

THE APPROACH SEGMENTS AND ASSOCIATED ACTIONS



Note : For determination of applicable minima, published for the specific approach type, A310 and A300-600 are in Category C.

CAUTION

When OAT is below ISA, the barometric altimeters will indicate high. Temperature corrections should be added to all reference altitudes of the approach procedure (initial approach altitude, distance/altitude checks on final aproach profile, MDA and G/A altitude) when OAT is significantly below ISA (below ISA-15°), in order to preserve obstacle clearance margins. These corrections are given as a function of OAT at the aerodrome, and height above aerodrome level in FCOM 2.08.10 p4, table ″For Low Altitude Use″.

INITIAL APPROACH

NAVIGATION ACCURACY

If the aircraft is GPS-equipped with GPS PRIMARY, there is no need for a navigation accuracy check as long as GPS PRIMARY is available.

Note : For RNAV GPS or overlay approach with reference navaid(s) unserviceable, a navigation accuracy check is required. Refer to FCTM 2.32.72.

Without GPS PRIMARY, the flight crew should check the navigation accuracy before performing any approach. The navigation accuracy determines which AP/FD modes the flight crew should use and the type of display mode to be selected on the ND.

NAVIGATION ACCURACY	ND mode PF	ND mode PNF	AP/FD mode
GPS PRIMARY NAV ACCUR HIGH*, or R/I (a/c without GPS) NAV ACCUR LOW* or I (a/c without GPS) and NAV ACCUR check OK**	MAP (with navaid raw data on RMIs)		NAV
GPS PRIMARY LOST AND ACCUR LOW* AND ACCUR check not OK**	ARC or ROSE with navaid raw data	ARC or ROSE with navaid raw data	HDG/S

* With appropriate RNP value verified on PROGRESS page (aircraft with FMS ″GPS capable″ or later standards).

** For the Approach phase the NAV ACCURACY check is OK if the difference between FMS position and position determined by raw data (DME) is less than 1 NM.

If ″NAV ACCURACY DOWNGRAD″ is displayed, the crew should use raw data for navigation accuracy check.

Note : For navigation accuracy check in the case of RNP approaches, refer to FCOM 2.18.95.

FLYING REFERENCE

It is recommended to use the FD bars for ILS approaches and the FPV (the ″bird″) with FPR (the Flight Path Reference, or ″cage″) for non-precision approaches. For non-precision approaches flown with NAV + PROFILE (only on aircraft fitted with FMS VNAV or later standard), FD bars are recommended. For visual circling approaches the FPV is recommended, without FPR. Both pilots should have the same flying reference selected to enable crossmonitoring.

APPROACH TECHNIQUES

There are two approach techniques :

- The decelerated approach when there is a vertical guidance available (ILS or MLS).
- The stabilized approach for non precision approach.

Decelerated approach

This technique refers to an approach where the aircraft reaches 1000 ft AGL in the landing configuration stabilized at VAPP. In most cases the aircraft should therefore start the deceleration from S speed in config 15/0 from 2000 ft AAL.

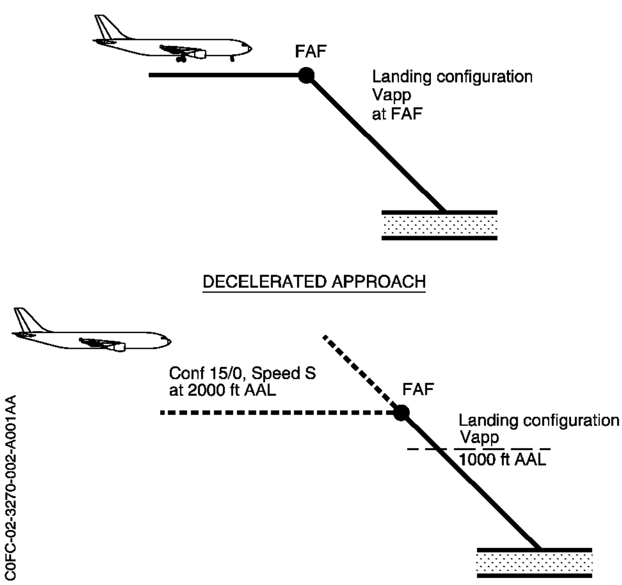
This is the preferred technique for an ILS approach.

Stabilized approach

This technique refers to an approach where the aircraft reaches the FAF in the landing configuration at VAPP. This technique is recommended for non-precision approaches.

To ensure a timely deceleration, the flight crew should enter VAPP as a speed constraint at the FAF.

STABILIZED AND DECELERATED APPROACHES



F-PLN SEQUENCING

In NAV mode, the F-PLN automatically sequences. In HDG/S mode, the F-PLN waypoints will automatically sequence only if the aircraft flies close to the prepared route.

Correct F-PLN sequencing is important to ensure that :

- The programmed missed approach route is available in case of go-around
- The predictions are correct.

A good cue to monitor the proper F-PLN sequencing is the TO waypoint on the upper right side of the ND, which should be the next WPT ahead of the aircraft.

If under radar vectors and if automatic waypoint sequencing does not occur, it is recommended to sequence the F-PLN by either using the DIR TO function, or by deleting the FROM WPT on the F-PLN page until the next WPT to be overflown is displayed as the TO WPT on the ND.

This ensures :

- A coherent ND display
- Assistance for lateral interception
- VDEV computed on reasonable distance assumption.
- In case of go-around, NAV mode can be engaged to follow missed approach routing as programmed in F-PLN.

INTERMEDIATE APPROACH

The purpose of the intermediate approach is to bring the aircraft to the FAF at the required speed, altitude and configuration.

DECEL POINT

The DECEL POINT is computed by the FMS to provide a deceleration from the programmed descent speed (normally 250 kt below 10000 ft), at a descent rate of 1000 ft/min to reach the programmed speed at the FAF. This speed is computed assuming a Decelerated Approach will be flown (to be stabilized at Vapp at 1000 ft AGL). If a Stabilized Approach is required from the FAF, as for a NPA, the crew should insert Vapp at the FAF on F-PLN page A ; the DECEL POINT will then be shifted backwards.

When a WIND CORR is entered and/or the LANDING CONFIG changed on the APPROACH page, the Vapp and DECEL POINT are re-computed. If no entries are made on the APPROACH page, the DECEL POINT is computed assuming the default values (WIND CORR 0 kt, LANDING CONFIG 30/40, 5 kt standard increment).

DECELERATION AND CONFIGURATION CHANGES

When it is not possible to follow the programmed lateral F-PLN in PROFILE mode (e.g. radar vectoring, positioning for a visual circuit, etc), selected speed should be used throughout the approach.

To achieve a constant deceleration and to minimize thrust variation, the flight crew should select the slats/flaps progressively as the speed is decreased through maneuvering speed of the actual configuration +10 kt (IAS must be lower than VFE next), i.e.

- At G.dot +10, select 15/0, set S spd
- At S +10, select 15/15, set F spd
- At F +10, select 20/20 (A310), 15/20 (A300-600)

Using this technique, the mean deceleration rate at MLW is approximately 12 kt/NM for A300-600 or 15 kt/NM for A310 in level flight, idle thrust, zero wind. This deceleration rate is increased by about 50% with speedbrakes extended.

If there are no ATC restrictions and if able to follow the lateral F-PLN, PROFILE mode may be retained for deceleration. In this case, on passing the DECEL POINT, the target speed decreases to the computed Vapp, and the FMS manages the descent and deceleration. Slats/flaps should be selected progressively as described above.

Note that the displayed target speed displayed on PFD speed scale remains throughout at Vapp.

In case of an overweight landing it may be necessary to select a speed below the manoeuvring speed of the actual configuration to avoid exceeding VFE for the next configuration. In such a case the bank should be limited to 15°. The speed should never be selected below VLS. In certain circumstances, e.g. tail wind or heavy weight, the deceleration rate may be insufficient. In this case, the landing gear may be lowered, preferably below 220 kt (to avoid gear doors overstress) and in any case below VLE = 270 kt.

Speedbrakes can also be used to increase the deceleration rate but the crew should be aware of :

- The increase in VLS with the use of speedbrakes
- The limited effect at low speeds
- Use of speedbrakes is prohibited in 30/40 configuration

TRIM CHANGES

If flying manually, PF should anticipate trim changes associated with slats/flaps extension as follows and adjust pitch trim setting as needed :

- At slat extension from clean to 15/0 with speed reducing there is a slight nose up pitching moment.
- At flaps extension to 15/15 there is a significant nose down pitching moment due to flaps extension and continuing speed reduction.

– At flaps extension to 15/20 (A300-600), or 20/20 (A310) there is a further slight nose down pitching moment.

PF should nevertheless avoid overtriming.

RADIO ALTIMETER

As soon as RA indications are displayed on PFD at 2500 ft RA, ″RADIO ALTIMETER ALIVE″ should be called. The RA indication should then be included in the instrument scan by both pilots throughout the remainder of the approach, and during the initial stage of any go-around.

INTERCEPTION OF FINAL APPROACH COURSE

Speed and intercept Angle

To ensure a smooth interception of final approach course, the aircraft ground speed should be appropriate, depending on interception angle and distance torunway threshold. Flap 15 at speed F+20, or 180 kt is generally appropriate for a 45° intercept at 8.5 nm for an instrument approach. For greater intercept angles, or closer distances, flap 20 at speed F or 160 kt is recommended (refer to FCOM 2.02.03 p11 for ILS Loc beam capture envelope).

To anticipate final approach course interception, the flight crew should monitor raw data (e.g. LOC and RMI indications, XTK information and wind indicated on ND).

If ATC gives a new wind for landing, the flight crew should update the wind correction on CDU APPR page.

FINAL APPROACH

CONFIGURATION

Normal configuration for final approach is 30/40. However in certain circumstances it is necessary to land with 15/20 (A300-600), 20/20 (A310), for example :

- Overweight landing in case of go-around with 1 engine inoperative being performance-limited,
- If a significant wind-shear is expected, when max climb capability might be needed.

In some other circumstances and if Landing Distance Available permits, the flight crew may prefer 15/20 (A300-600), 20/20 (A310) for landing, for example if company SOPs recommend this configuration for fuel saving, or during a visual circling approach when it may be preferred to avoid a late selection of 30/40.

Before starting an approach with Flaps 20, the GPWS Landing Flap switch should be set to 15/20 (A300-600), or 20/20 (A310), to avoid a nuisance GPWS ″TOO LOW FLAPS″ warnings. For aircraft not fitted with this GPWS landing Slats/Flaps switch, select the GPWS Selector Switch to Flaps Override.

TRIM CHANGE

When a final landing configuration 30/40 is selected, with speed reducing to Vapp, there is a marked nose down pitching moment, requiring a positive nose up trim adjustment if flying manually.

FINAL APPROACH MODE ENGAGEMENT MONITORING

The flight crew must monitor the engagement of *G/S** for ILS approach, or will select the appropriate V/S on reaching FAF for a selected NPA. For a NPA using FINAL APPR mode, monitor the engagement of P.DES at the FAF. If the capture or engagement is abnormal, either revert to selected modes (V/S and HDG/S) or take over manually. (Refer to FCTM 2.32.71 and FCTM 2.32.72)

FINAL APPROACH MONITORING

The final approach must be monitored by the available data, depending on the approach type and on the result of the navigation accuracy check. (Refer to FCTM 2.32.71 and FCTM 2.32.72).

PNF should call any significant deviations, as required by SOPs (refer to ″Trajectory Stabilization″ below and FCOM 2.03.18 p3).

APPROACH SPEED : Vapp

(Refer to FCOM 2.02.01 p2, or QRH p15.05, for Vapp determination.)

Approach speed is a function of landing weight, configuration, A/THR on or off, icing and any other significant weather factors.

It is normally based on the FMS-computed Vref, which is 1,3Vs in 30/40 configuration.

Approach Correction for 30/40 Configuration

- The Wind Correction to be added to Vref is 1/3rd of the average headwind component, or headwind component of gust increment if higher, up to a limit of 15 kt.

- When using A/THR, and/or with ice accretion, the minimum approach correction is taken as 5 kt (even in case of tailwind component). This compensates for the small speed excursions below target speed which may occur due to the lag in A/THR response, or for aerodynamic degradation due to icing.

Note : *The 5 kt correction for A/THR or icing is not cumulative : with both A/THR and icing present, min correction is still 5 kt.*

Vref + Approach Corr for Flap 20 Config

For landing in this configuration, a Vref correction for the reduced slat/flap is added to the Vref, as follows :

– A300-600 : Vref corr = 11 kt

– A310 Vref corr = 8, 10 or 12 kt, depending on variant (refer to FCOM 2.02.01 p2 or QRH p15.05).

The Approach correction (including minimum +5 kt for A/THR or icing) is as above for 30/40 config, but the total of Approach plus Vref corrections must not exceed 20 kt.

CDU APPROACH PAGE

The FMS-computed value of Vapp displayed on CDU APPROACH page provides a defaulted WIND CORR of 0 kt and assumes A/THR is engaged (i.e., + 5 kt). The defaulted LANDING CONFIG is 30/40. Prior to final approach the crew should enter LANDING CONFIG to be used, and the WIND CORR, as determined above. Vapp is then recomputed.

Note : *For an approach with manual thrust, zero headwind component, and no icing, the target Vapp should therefore be the speed displayed on APPROACH page reduced by 5 kt.*

The flight crew cannot directly modify the Vapp on APPROACH page (except for aircraft equipped with FMS VNAV or later standard), but may increase it by inserting a higher Wind Corr, if strong windshear or gusts are anticipated ; this increment should be limited to 15 kt.

In case of a strong or gusty crosswind greater than 20 kt, the Wind Corr should be at least equal to the headwind component of the gust factor, and may be increased up to 15 kt at the flight crew's discretion, except in case of a tail-wind component.

Note : *The wind direction provided by ATIS and tower is based on the same reference as therunway direction (magnetic except in polar regions) whereas the wind provided by VOLMET, METAR or TAF is always true-referenced.*

The minimum Vapp is 120 kt on A300-600, 115 kt on A310, due to minimum control speed in case of a go-around with engine failure.

VLS versus Vref

Note that the VLS indicated by the top of the amber strip on the PFD speed scale is 1.3 Vs in the actual configuration, derived from air data and computed by the associated FAC. It is normally equal or close to the Vref, when in 30/40 config and close to Vapp without correction when in 20/20.

If there is a significant difference between Vref and VLS with 30/40, there may be an error in the weights entered in the FMS, or erroneous air data. In such a case it is recommended to take the higher of these speeds as the basis for Vapp, unless the source of error is positively identified.

Wind-shear

If a significant wind-shear is anticipated, use 15/20 (A300-600), 20/20 (A310) config for landing as stated above.

Refer to FCOM 2.02.13 p13 and to FCTM 2.34.01 for precautions and recommended technique. Ground speed indicated on ND should be closely monitored, and airspeed should be adjusted to keep a minimum GS equal to Vapp -10 kt.

USE OF A/THR

If A/THR is used for approach, PF must keep one hand on the throttles so as to be prepared to react if there is excessive lag in A/THR response to speed deviations.

If manual thrust is used for landing, the A/THR should be disconnected by 1000 ft AAL, or sufficiently early for the thrust to be stabilised manually on final approach.

GO-AROUND ALTITUDE SETTING

When established on final approach, the go-around altitude must be set on FCU. This can be done at engagement of GS capture or GS track mode for an ILS. However, on a Non Precision Approach, the missed approach altitude must only be set when the current aircraft altitude is below the missed approach altitude, in order to avoid unwanted ALT* (refer to FCTM 2.32.72).

RESIDUAL BRAKE PRESSURE CHECK

When landing gear is down, PNF should check there is no residual Yellow system brake pressure on the Brake Triple Indicator. If residual Y pressure is indicated (one needle width) proceed as per SOPs (refer to FCOM 2.03.18 p3).

LANDING CHECK-LIST

(Refer to QRH 20.01 on back-cover, or as per airline SOP)

As soon as final landing configuration is achieved, all items of the Landing Check-List should be completed (challenge by PNF, response by PF). Among the different items to be checked the following should be noted :

– ANTI-SKID : check Brake/Anti-skid switch set to NORMAL/ON, and all 8 main gear wheels indicate anti-skid units released on ECAM system display.

– AUTO-BRAKE : check selected as required for runway conditions (refer to FCTM 2.32.80 p3 for recommended use of Auto-Brakes).

Note : Brake fans should be off for landing to avoid risk of foreign object damage during the landing roll. (Refer to FCTM 2.32.90 p2 for use of brake fans after landing).

TRAJECTORY STABILIZATION

The first prerequisite for safe final approach and landing is to stabilize the aircraft on the final approach flight path laterally and longitudinally, in landing configuration, at Vapp speed, i.e :

- Only small corrections are necessary to rectify minor deviations from stabilized conditions
- The thrust is stabilized, to maintain the target approach speed along the desired final approach path.

Airbus policy requires that stabilized conditions be reached at 1000 ft above airfield elevation in IMC and 500 ft above airfield elevation in VMC

If, for any reason, one flight parameter deviates from stabilized conditions, the PNF will make a callout as stated below :

Exceedance and associated PNF callout				
Parameter		**Exceedance**		**Callout**
IAS		VAPP +10 kt/-5 KT		"SPEED"
V/S		< -1000 ft/min		"SINK RATE"
Pitch attitude		>+10°, <0°		"PITCH"
Bank angle		> 7°		"BANK
ILS only	Localizer	Excess deviation on PFD	1/4 dot	"LOCALIZER"
ILS only	Glide slope	Excess deviation on PFD	1 dot	"GLIDE SLOPE"
NPA only	Course	Excess deviation : 1/2 dot on ND (or 2.5° VOR or 5° ADF)		"COURSE"
NPA only	Altitude at check points	Deviation		"x FT HIGH (LOW)"

(Refer to FCOM 2.03.18 p3).

Following a PNF flight parameter exceedance callout, the suitable PF response will be :

- Acknowledge the PNF callout, for proper crew coordination purposes
- Take immediate corrective action to control the exceeded parameter back into the defined stabilized conditions
- Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around.

REACHING MINIMUM

Decision to land or go-around must be made at MDA/DH at the latest. Reaching the MDA/DH, at the "MINIMUM" callout :

- If suitable visual reference can be maintained and the aircraft is properly established, continue and land.
- If not, go-around

The MDA/DH should not be set as target altitude on the FCU. If the MDA/DH were inserted in the altitude window of the FCU, this would cause a spurious ALT* when approaching MDA/DH, resulting in the approach becoming destabilised at a critical stage.

(Also refer to FCTM 2.32.72)

AP DISCONNECTION

During the final approach with the AP engaged in the desired mode, the aircraft is stabilized. Therefore, when disconnecting the AP for a manual landing, the pilot should continue to maintain the stabilized approach, avoiding any tendency to make excessive control inputs.

The pilot should disconnect the autopilot early enough to resume manual control of the aircraft and to evaluate the drift before flare.

Some common errors include :

- Descending below the ILS G/S or the required final approach path, and/or
- Reducing the drift too early in crosswind conditions, and failing to stay on runways axis.

INTENTIONALLY LEFT BLANK

APPENDIX 10

COMMUNICATIONS AND STANDARD TERMS

Standard phraseology is essential to ensure effective crew communication. The phraseology should be concise and exact. The following chapter lists calls that should be used as standard. They supplement the call outs identified in the SOP.

R These Airbus standard calls are designed to promote situational awareness, particularly each time one crewmember adjusts or changes information and/or equipment on the flight deck (e.g. FMA change, FMS alteration, change in speed or Mach, tuning navaids, flight path modification, system selection). These Airbus standard calls are also designed to ensure that the flight crew understands the systems and their use in line operation.

CHECKLIST CALLS

– "CHECK" : a command for the other pilot to check an item.
– "CHECKED" : a response that an item has been checked.
– "CROSS-CHECKED" : a call verifying information from both pilot stations.

If a checklist needs to be interrupted, announce "HOLD CHECKLIST AT ___" and "RESUME CHECKLIST AT ___" for continuation.

At the completion of a checklist announce "__CHECKLIST COMPLETED".

ACTIONS COMMANDED BY PF

The following commands do not necessarily initiate a change in a guidance mode. The intend is to ensure clear, consistent, standard communication between crew members.

R All actions made on the FCU and CDU must be verified on the PFD and ND as follows :

a. First, ensure that the correct FCU knob is used, then verify indications on the PFD/ND.

b. Mode changes should be confirmed by calling the color when appropriate – e.g. BLUE.

SET

The command "SET" means to use a knob to set a value, but not to change a mode. SET is accomplished by only rotating the appropriate selection knob :

e.g. : "SET GO AROUND ALTITUDE__"

e.g. : "SET QNH __"

e.g. : "SET ALTITUDE __"

ENGAGE

The command "ENGAGE" means to PUSH the specified FCU button or set the specified lever or switch to "ON" that causes an immediate FMA change.

e.g. : "ENGAGE NAV"
e.g. : "ENGAGE PROFILE"
e.g. : "ENGAGE ALT HOLD"

ARM

The command "ARM __" means to arm a system, such as by pushing the specified FCU button.

e.g. : "ARM LAND"

e.g. : "ARM LOC."

PULL

The command "PULL" means to use a FCU knob to engage a mode.

e.g. : "ALTITUDE 8000 PULL"

e.g. : "VERTICAL SPEED SET - 1000$^{FT}/_{MN}$ AND PULL"

PUSH

The command "PUSH" means to use a FCU knob to synchronize or preset a value.

e.g. : "HEADING PUSH"

e.g. : "SPEED PUSH PRESET 250"

Note : *Whenever there is no requirement for PULL/PUSH, and if a new setting is required, simply command SET the specific selector knob followed by the required value.*

e.g. : existing mode is lateral mode heading of 140 degrees and a new heading of 100 degrees is required ; command should be "SET HEADING 100". R

FMA

Unless listed otherwise (e.g. CAT II & III task sharing), all FMA changes will be normally called by the PF and checked by the PNF :

– All armed modes are announced by calling their associated color e.g.: "G/S BLUE", "LOC BLUE".
– All active modes are announced without calling the color (green, white) e.g. : "NAV", "ALT".

Note : *If the FMA change is not announced by the PF, the PNF should announce it.* R

ALTITUDE

The PNF calls "ONE THOUSAND TO GO" when passing 1000 feet before the cleared altitude or FL, and the PF calls "CHECKED".

SLATS/FLAPS CONFIGURATION

After selection of the Slats/Flaps lever position, the PNF replies when the correct selection is shown on SFPI.

EXTENSION

R PNF Checks the speed below V_{FE} next and decelerating (approach).

SLATS/FLAPS CONFIGURATION	PF	PNF
0/0 to 15/0	SLATS EXTEND	SPEED CHECKED SLATS EXTENDED
15/0 to 15/15	FLAPS 15	SPEED CHECKED FLAPS 15
15/15 to 15/20	FLAPS 20	SPEED CHECKED FLAPS 20
15/20 to 30/40	FLAPS 40	SPEED CHECKED FLAPS 40

RETRACTION

R PNF Checks the speed above the S or F speed and accelerating (takeoff).

SLATS/FLAPS CONFIGURATION	PF	PNF
R SLATS/FLAPS 15/20 passing ″F″ speed 15/20 to 15/0	FLAPS 0	SPEED CHECKED FLAPS 0
SLATS 15 passing ″S″ speed 15/0 to 0/0	SLATS RETRACT	SPEED CHECKED SLATS RETRACTED

GEAR CONFIGURATION

EVENT	PF	PNF
To rectract the landing gear	GEAR UP	GEAR UP/NEUTRAL The PNF selects the gear lever position and replies when lights are extinguished and gear lever set to Neutral.
To extend the landing gear	GEAR DOWN	GEAR DOWN The PNF selects the gear lever position and replies after checking 3 green lights on the landing gear main indication panel.

FLIGHT PARAMETERS

PNF will make calls for the following conditions during final approach. Attitude callouts are also to be made through to landing.

CONDITIONS	PNF
When airspeed becomes less than Vapp – 5 or more than speed target + 10.	SPEED
When V/S is greater than – 1000 ft/min.	SINK RATE
When bank angle becomes greater than 7°.	BANK
When pitch attitude becomes lower than 0° or higher than + 10° nose up. R For non precision approach, when pitch attitude becomes lower than –2.5° or higher R than 10° nose up.	PITCH
When excessive LOC or GLIDE deviation occurs : – 1/4 dot LOC – 1 dot GS.	LOC or GLIDE
When greater than 0,5 dot (VOR) or 5 degrees (ADF).	COURSE
At altitude checks points.	__FT HIGH (LOW)

PF/PNF DUTIES TRANSFER

To tranfer control, flight crewmembers must use the following calls :

To give control : The pilot calls "YOU HAVE CONTROL". The other pilot accepts this transfer by calling "I HAVE CONTROL", before assuming PF duties.

To take control : The pilot calls "I HAVE CONTROL". The other pilot accepts this transfer by calling "YOU HAVE CONTROL", before assuming PNF duties.

ABNORMAL AND EMERGENCY CALLS

ECAM Procedures

1. "ECAM ACTION" is commanded by PF when required.

2. "CLEAR __ (title of the system) ?" is asked by the PNF for confirmation by the PF, that all actions have been taken/reviewed on the present ECAM WARNING/CAUTION or SYSTEM PAGE.
   e.g. : "CLEAR HYDRAULIC ?"

3. "CLEAR __ (title of the system)" is the command by the PF that the action and review is confirmed. For status page, the call "REMOVE STATUS" is used.

4. "ECAM ACTIONS COMPLETED" is the announcement by the PNF that all APPLICABLE ACTIONS have been completed and system pages have been reviewed.

5. Should the PF requires an action from the PNF during ECAM procedures, the order "STOP ECAM" is used. When ready to resume the ECAM the order/statement "CONTINUE ECAM" is used.

MEMORY ITEMS

The following commands allow the crew to be aware of a situation that requires or will require actions to be done by memory. Crew will be prepared to properly react in terms of crew coordination, task sharing and communication.

CALLS	CONDITIONS
PULL UP TOGA	When GPWS warning require an avoidance maneuver.
WINDSHEAR TOGA	When windshear conditions required to select maximum takeoff power
UNRELIABLE SPEED	When an unreliable speed indication is detected
TCAS, I have control	"TRAFFIC" warning is triggered by TCAS
EMERGENCY DESCENT	When EMERGENCY DESCENT has to be initiated
R LOSS OF BRAKING	In case of loss of braking at landing or during taxi.

SUMMARY FOR EACH PHASE

EXTERNAL POWER DISCONNECTION		
EVENT	**PF**	**GND Mech**
Initial ground contact	GROUND (from) COCKPIT	COCKPIT (from) GROUND
External __ disconnection	REMOVE EXTERNAL __	EXTERNAL __ REMOVED

BEFORE ENGINE START		
EVENT	**PF**	**PNF**
Before start up clearance received	BEFORE START C/L	R DOWN TO THE LINE
After start up clearance received	BELOW THE LINE	R BEFORE START C/L COMPLETED

PUSH BACK		
EVENT	**PF**	**GND Mech**
When ready for push back and push back clearance received from ATC	GROUND, (from) COCKPIT READY FOR PUSH	COCKPIT, (from) GROUND RELEASE PARKING BRAKE
Start of push	BRAKES RELEASED CLEARED TO PUSH	
When push back completed	R PARKING BRAKES SET	SET PARKING BRAKES
When ready to disconnect (engine parameters are stabilized)	CLEAR TO DISCONNECT (hand signals on left/right)	DISCONNECTING (hand signals on left/right)

ENGINE START			
EVENT	**PF**	**PNF**	**GND**
When start up clearance obtained When fan starts to rotate	CLEAR TO START? STARTING ENGINE(S)__		CLEAR TO START ROTATION

AFTER ENGINE START		
EVENT	**PF**	**PNF**
All engines started and stabilized and GND is disconnected	AFTER START C/L	AFTER START C/L COMPLETED

TAXI/BEFORE TAKEOFF		
EVENT	**PF**	**PNF**
When taxi clearance obtained	CLEAR LEFT (RIGHT) SIDE	CLEAR RIGHT (LEFT) SIDE
Checking Brakes	BRAKE CHECK	PRESSURE ZERO
Flight controls check in following sequence (can be done before start of taxi)	FLIGHT CONTROL CHECK	
1. Elevators		FULL UP FULL DOWN NEUTRAL
2. Ailerons/spoilers		FULL LEFT FULL RIGHT NEUTRAL
3. Rudder *Note : the PNF should follow pedal movement with feet*	RUDDER	FULL LEFT FULL RIGHT NEUTRAL
During taxi	BEFORE TAKEOFF C/L	R DOWN TO THE LINE
Lining up on the runway	BELOW THE LINE	R BEFORE TAKEOFF C/L COMPLETED

TAKEOFF		
EVENT	**PF**	**PNF**
When triggering go levers	TAKEOFF ANNOUNCE FMA	CHECKED
R Before passing 80 kts		THRUST SET
At 100 kts	CHECKED	ONE HUNDRED
At V1		V1
At VR		ROTATE
When positively clear from the ground (+ V/S and RAD ALT increase)	GEAR UP	POSITIVE CLIMB
If AP is required	ENGAGE AP__ Followed by confirmation on FMA	AP__ENGAGED
When gear retracted		GEAR UP/NEUTRAL
When F Speed and accelerating	FLAPS 0	SPEED CHECKED FLAPS 0
When S Speed and accelerating	SLATS RETRACT	SPEED CHECKED SLATS RETRACTED
After TAKEOFF/CLIMB checklist	AFTER TAKEOFF C/L DOWN TO THE LINE	AFTER TAKEOFF C/L DOWN TO THE LINE COMPLETED
At transition altitude	AFTER TAKEOFF C/L BELOW THE LINE	AFTER TAKEOFF C/L COMPLETED

REJECTED TAKEOFF		
EVENT	**CAPTAIN**	**F/O**
RTO decision	STOP	
Ground spoiler extension		SPOILERS (see note 1 below)
Max reverse thrust selection		REVERSE GREEN (see note 2 below)
Deceleration		DECEL (see note 3 and 4 below)

R R

R *Note 1 : If ground spoiler deployment is not as expected, call "NO GROUND SPOILER".*
R *Note 2 : If reverse deployment is not as expected, call "NO REVERSE ENGINE __" or "NO REVERSE", as appropriate.*
R *Note 3 : "DECEL" call means that the deceleration is felt by the crew and confirmed by the speed trend on the PFD.*
R *Note 4 : If Autobrake is armed and NO flow BAR green light observed, call "NO AUTOBRAKE".*

CLIMB, CRUISE, DESCENT PHASES

During climb, cruise and descent phases communication should be standardized as mentioned in paragraph COMMUNICATIONS AND STANDARD TERMS of this section 2.03.30 (page 1)

ALTIMETER SETTING CHANGES TO/FROM QNH/QFE-STD		
EVENT	**PF**	**PNF**
Barometric setting change and subsequent altimeter cross-check	PULL STANDARD CHECKED	STANDARD CROSS-CHECKED PASSING FL__NOW
	SET QNH/QFE__ CHECKED	QNH/QFE __CROSS-CHECKED PASSING __ FT NOW

R

APPROACH AND LANDING		
EVENT	**PF**	**PNF**
When cleared below transition level or as appropriate.	APPROACH C/L	APPROACH C/L COMPLETED
Initial Approach	SET GREEN DOT SPEED (see note 3 below)	GREEN DOT SPEED SET
Beginning of Radio Altimeter indication	CHECKED	RADIO ALTIMETER ALIVE (see note 1 and 2 below)
At Green Dot Speed (or below VFE)	SLATS EXTEND SET ″S″ SPEED (see note 3 below)	SPEED CHECKED SLATS EXTENDED
At ″S″ speed (or below VFE)	FLAPS 20 SET ″F″ SPEED (see note 3 below)	SPEED CHECKED FLAPS 20
INTERCEPTION HEADING	ARM LAND (see note 3 below)	LAND ARMED
LOCALIZER CAPTURE	LOC STAR SET RWY HEADING (see note 3 below)	__° SET
2 DOTS (1 DOT) SINGLE ENGINE	GEAR DOWN	GLIDE SLOPE ALIVE GEAR DOWN
When gear is down	FLAPS 40 SET VAPP (see note 3 below)	SPEED CHECKED FLAPS 40 VAPP SET
GS CAPTURE	GLIDE SLOPE STAR SET GO AROUND ALTITUDE (see note 3 below)	__ FT SET
FAF or OM if applicable	PASSING__(Fix name) or OM__ FT/TIMING	CHECKED (TIMING)
When FLAPS 40	LANDING CHECK LIST	LANDING C/L COMPLETED

Note 1 : Crew should now keep RA in scan to landing.
Note 2 : PNF monitors auto callouts or announces if inoperative (as often as practical – CAT I and lower only).
Note 3 : This call is recommended in manual flying.

APPROACH AND LANDING			
	EVENT	**PF**	**PNF**
R	1000^{FT} AGL	CHECKED	ONE THOUSAND (see note 1 and 2 below)
R R	700^{FT} AGL (for precision approach and NPA) Each pilot checks the ILS selected course on his ND.		COURSE SET (see note 1 below)
R R	400^{FT} AGL (for precision approach)	LAND	CHECKED (see note 1 below)
R	100^{FT} above MDA/DH	CHECKED	ONE HUNDRED ABOVE
R	MDA/DH visual reference	CONTINUE	MINIMUM
R	MDA/DH no visual reference	GO AROUND FLAPS	MINIMUM
			ONE HUNDRED FIFTY (see note 2 below)
	After touch down		SPOILERS REVERSE GREEN (See the note 3 below)
	When autobrake armed		DECEL (See note 4 and 5 below)
	At 80kts ground speed or IAS fluctuations		EIGHTY KNOTS

R *Note 1 : Crew should keep RA in scan to landing.*

Note 2 : PNF monitors auto callouts or announces if inoperative (as often as practical – CAT I and lower only).

R *Note 3 : If ground spoilers extension is not as expected, call NO GROUND SPOILERS.*
If reverse deployment is not as expected, call NO REVERSE ENGINE__ or NO REVERSE, as appropriate.

Note 4 : "DECEL" call means that the deceleration is felt by the crew and confirmed by the speed trend on the PFD.

Note 5 : if Autobrake is armed and NO flow BAR green light observed, call NO AUTOBRAKE

GO AROUND		
EVENT	**PF**	**PNF**
GO AROUND decision	GO AROUND – FLAPS	
R Flaps retraction one step		FLAPS__
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
Checklist	AFTER TAKEOFF C/L	R DOWN TO THE LINE
At transition altitude	BELOW THE LINE	R AFTER TAKEOFF C/L COMPLETED

AFTER LANDING		
EVENT	**PF**	**PNF**
Checklist	AFTER LANDING C/L	AFTER LANDING C/L COMPLETED

PARKING		
EVENT	**PF**	**PNF**
Checklist	PARKING C/L	PARKING C/L COMPLETED

SECURING THE AIRCRAFT		
EVENT	**PF**	**PNF**
Checklist	SECURING THE AIRCRAFT C/L	SECURING THE AIRCRAFT C/L COMPLETED

APPENDIX 11

This Temporary Revision has been issued after REV N° 34

Remove this TR only when instructed to do so by the FILING INSTRUCTIONS TEMPORARY REVISIONS and the LIST OF EFFECTIVE TEMPORARY REVISIONS.

VALIDITY : A300-600 all models

SUBJECT : GOLDEN RULES FOR PILOTS

REASON FOR ISSUE : This TR is issued to introduce the new Airbus Operational Philosophy of GOLDEN RULES FOR PILOTS.

INSTRUCTIONS :

Insert the following pages in the Flight Crew Training Manual (FCTM), FCOM 2.31.10

TR N° 032-1 page 1 of 4 after the LIST OF EFFECTIVE TEMPORARY REVISION (LETR) in FCOM 2.00.40
TR N° 032-1 page 2 of 4 facing FCOM 2.31.00 page 1
TR N° 032-1 page 3 of 4 facing FCOM 2.31.10 page 1
TR N° 032-1 page 4 of 4 facing FCOM 2.31.10 page 2

2.31.00 CONTENT

2.31.10 INTRODUCTION

2.31.20 FLIGHT CONTROLS

2.31.30 USE OF AFS

2.31.40 ECAM/QRH

INTRODUCTION

The Airbus cockpit is designed to achieve pilot operational needs throughout the aircraft operating environment. The cockpit design objectives are driven by three criteria :

- Reinforce the safety of flight
- Improve efficiency of flight
- Answer pilot requirements in a continuously changing environment.

Airbus operational rules result from the design concept, more particularly from the following systems :

- An integrated Auto Flight System comprising :
  - The FMS interfaced through the CDU
  - The AP/FD interfaced through the FCU
  - The A/THR interfaced through the thrust levers
  - The FMA providing Guidance targets and information, to monitor the AFS.
- A set of display units (DU) providing information and parameters required by the crew :
  - To operate and to navigate the aicraft (the EFIS)
  - To communicate (the ACP)
  - To manage the aircraft systems (the ECAM)
  - FMA interface to provide Guidance targets and information to monitor the AFS/FD.
- A Forward Facing Cockpit Layout with "Lights out" or "Dark Cockpit" concept assisting the crew to properly control the various aircraft systems.

The operational rules applicable to these specific features are given in the other sections of this chapter.

GOLDEN RULES FOR PILOTS

INTRODUCTION

The Airbus "Golden Rules for Pilots" are operational guidelines, based on all of the following :

- Basic flying principles
- The adaptation of these basic flying principles to modern technology aircraft
- The provision of information about required crew coordination for the operation of Airbus aircraft. The objective of these Golden Rules is to also take into account the principles of flight crew interaction with automated systems, and the principles of Crew Resource Management (CRM), in order to help prevent the causes of many accidents or incidents and to ensure flight efficiency.

GENERAL GOLDEN RULES

The following four Golden Rules for Pilots are applicable to all normal operations, and to all unexpected or abnormal/emergency situations :

1. ***Fly. Navigate. Communicate*** : *In this order and with appropriate tasksharing.*

   Fly! Navigate! Communicate! The flight crew must perform these three actions in sequence and must use appropriate tasksharing in normal and abnormal operations, in manual flight or in flight with the AP engaged.
   The following explains each of the three actions, and the steps associated with the performance of these actions :

   - ***Fly***

     "**Fly**" indicates that :
     - **The Pilot Flying (PF)** must concentrate on **"flying the aircraft"** to monitor and control the pitch attitude, bank angle, airspeed, thrust, sideslip, heading, etc., in order to achieve and maintain the desired targets, vertical flight path, and lateral flight path.
     - **The Pilot Not Flying (PNF)** must assist the PF and must **actively monitor** flight parameters, and call out any excessive deviation. The PNF's role of "actively monitoring" is very important.

     Therefore, both flight crewmembers must :
     - Focus and concentrate on their tasks to ensure appropriate tasksharing
     - Maintain situational awareness and immediately resolve any uncertainty as a crew.

   - ***Navigate***

     "**Navigate**" refers to and includes the following four "***Know where...***" statements, in order to ensure situational awareness :
     - Know **where you are...**
     - Know **where you should be...**
     - Know **where you should go...**
     - Know **where the weather, terrain, and obstacles are.**

- ***Communicate***

  "Communicate" involves effective and appropriate crew communication between the :

  – PF and the PNF

  – Flight crew and Air Traffic Control (ATC)

  – Flight crew and the cabin crew

  – Flight crew and the ground crew.

  Communication enables the flight crew to safely and appropriately perform the flight, and enhance situational awareness. To ensure good communication, the flight crew should use **standard phraseology** and the **applicable callouts.**

  In abnormal and emergency situations, the PF must recover a steady flight path, and the flight crew must identify the flight situation. The PF must then inform ATC and the cabin crew of :

  – The flight situation

  – The flight crew's intentions.

  The flight crew must therefore always keep in mind the key message :

  Fly the Aircraft, Fly the Aircraft, Fly the Aircraft...

  To safely and appropriately perform a flight, both flight crewmembers must have basic flying skills, and must be able to fly with appropriate tasksharing in all situations.

2. ***Use the appropriate level of automation at all times.***

Aircraft are equipped with several levels of automation, used to perform specific tasks. The flight crew must determine the appropriate level of interaction with automated systems, based on the flight situation (e.g. Visibility, incapacitation, system malfunction, etc.), and the task to be performed.

To use the appropriate level of automation at all times, the flight crew must :

– **Determine and select** the appropriate level of automation that can include manual flight

– **Understand** the operational effect of the selected level of automation

– **Confirm that the aircraft reacts as expected.**

3. ***Understand the FMA at all times.***

The flight crew must confirm the operational effect of all actions on the FCU, or on the CDU, via a crosscheck of the corresponding annunciation or data on the PFD and on the ND.

At all times, the flight crew should be aware of the following :

– Guidance modes (armed or engaged)

– Guidance targets

– Aircraft response in terms of attitude, speed, and trajectory

– Transition or reversion modes.

Therefore, to ensure correct situational awareness, at all times, the flight crew must :

– Monitor the FMA

– Announce the FMA

– Confirm the FMA.

– Understand the FMA.

4. ***Take action if things do not go as expected***

If the aircraft does not follow the desired vertical or lateral flight path, or the selected targets, and if the flight crew does not have sufficient time to analyze and solve the situation, the flight **crew must immediately take appropriate or required actions,** as follows :

The PF should change the level of automation :

– From managed guidance (PROFILE/NAV) to selected guidance, or

– From selected guidance to manual flying.

The PNF should perform the following actions in sequence :

– Communicate with the PF

– Challenge the actions of the PF, when necessary

– Take over, when necessary.

GOLDEN RULES FOR PILOTS
1. Fly, navigate and communicate :   In this order and with appropriate tasksharing
2. Use the appropriate level of automation at all times
3. Understand the FMA at all times
4. Take action if things do not go as expected

APPENDIX 12

The following approach procedure assumes AP engaged in PROFILE mode and A/THR engaged, which is the recommended procedure.

INITIAL APPROACH

IGNITION . . . . CONT RELIGHT

SIGNS

SEAT BELTS sw . . . . ON/AUTO

EXT LTS . . . . As req

R – Set RWY TURN OFF lights and LAND lights ON at FL 100. Use LAND lights as per company policy/regulatory recommendation

POSITIONING

Check aircraft positioning for a smooth transition to the approach.

Rule of thumb : 9000 ft at 250 Kt - 30 NM to touchdown

NAV/COM FREQ . . . . Check/Set

Set VHF as required

Set ILS frequency and course

Set VOR/NAV/ILS switch to ILS as required

APPROACH SPEED

If ATC requires a particular speed to be flown then use selected speed. When ATC speed constraint no longer applies, return to profile mode.

NAVIGATION ACCURACY . . . . Check

Monitor navigation accuracy and be prepared to change approach strategy, particularly when IRS ONLY NAVIGATION is displayed.

Refer to the FCOM 2.03.15 page 1 for the navigation accuracy check method.

If navigation accuracy is greater than 1 NM

ND must be used in ROSE or ARC mode by PF.

NAV mode should not be used, use HDG SEL.

Switch off the enhanced functions of the EGPWS via the TERR MODE pushbutton switch located on the Captain's switching panel.

RADAR TILT . . . . Adjust

Increase tilt as required to keep the ND clear of ground clutter.

ND . . . . Set/Check

PF ND MODE . . . . MAP for ILS approach otherwise depending on the FMS accuracy

PNF ND MODE . . . . MAP may be kept

ND RANGE . . . . Select 15 NM

DH . . . . Check

Both CM1 and CM2 confirm DH setting on EFIS control box in accordance with company policy.

APPROACH CHECK LIST . . . . Complete

FINAL APPROACH

The following procedure assumes an ILS approach with one AP engaged in CMD and A/THR engaged which is the recommended procedure.

Conducting a stabilized approach is recommended. The objective is to be stabilized on the final descent path at VAPP in the landing configuration, at 1000 ft AAL in IMC, or at 500 ft AAL in VMC after continuous deceleration on the glide slope.
To be stabilized, all of the following conditions must be achieved prior to, or upon reaching this stabilization height :
- the aircraft is on the correct lateral and vertical flight path,
- the aircraft is in the desired landing configuration,
- the power is stabilized and the aircraft is trimmed to maintain VAPP on the desired glide path,
- no excessive flight parameter deviation.

The advantages are :
- Lower fuel consumption
- Lower noise levels
- Time saving
- Flexibility and ability to vary speed to suit ATC.

If the aircraft is not stabilized on the approach path in landing configuration at 1000 ft AAL in IMC, or at 500 ft AAL in VMC, or as restricted by Operator policy/regulations, a go-around must be initiated unless the crew estimates that only small corrections are necessary to rectify minor deviations from stabilized conditions due, amongst others, to external perturbations.

FCU . . . . **Green dot speed**

HDG SEL . . . . **As req**

Airspeed . . . . **check below VFE**
Order . . . . **"SLATS extend"**
Announce . . . . **"Speed checked"**
SLATS 15 . . . . **Select**

Slats 15 should be extended not later than 3NM prior to the FAF (Final Approach Fix)
When SLATS 15 on SFPI
Announce . . . . **"SLATS extended"**

FCU . . . . **S Speed**

Check deceleration towards S speed.
The aircraft should be established on the glide slope with Slats 15 at S Speed at or above 2 000 ft AGL.

- In the event that a/c speed is significantly higher than S on the G/S, or the a/c does not decelerate on the G/S, extend the L/G in order to slow the a/c down.

GPWS

If landing is planned to be performed in S 15°/F 20° landing configuration select GPWS LANDING FLAPS switch to 20.
Landing with Flaps 20 is recommended in windshear conditions or if approach climb requirements cannot be met with Flaps 40.

WHEN CLEARED FOR FINAL APPROACH

LAND pb on FCU . . . . **Press**

This enables LOC and G/S capture.

Note : Arm the LAND mode only when ATC gives clearance for the ILS approach (clearance for both LOC and G/S capture).
If only LOC capture required, use V/L mode until clearance for full ILS received.

2ND AP . . . . **As req**

AUTOLAND lights . . . . **Test**

For CAT 2 or 3 autolands only, check the AUTOLAND lights illuminate. This test checks the flight warning computer monitoring of autoland functions.

FMA . . . . **Check/announce**

TCAS (If installed) . . . . **Set TA/AS REQ**

TA only mode should be selected in the following cases :
- known nearby traffic which is in visual contact
- at particular airports and during particular procedures identified by an operator as having a significant potential for unwanted or inappropriate RAs (closely spaced parallel runways, converging runways, operation in airport with low terrain along the final approach...)

LOC CAPTURE . . . . **Monitor**

Announce . . . . **"LOC*"**

At LOC capture, NAV or HDG is disengaged automatically.

Check correct ILS course set.

RWY HDG . . . . **Set**

G/S CAPTURE . . . . **Monitor**

- If above the glideslope

  V/S mode . . . . Select
  FCU altitude . . . . Set above A/C altitude

Announce . . . . **"GS*"**

GO AROUND ALT . . . . **Set**

Note : TOGA thrust limit is automatically selected on TRP when slats are extended and at least one AP/FD engaged. Then, at light weights, another thrust limit (CLB or CRZ) can be manually selected to avoid excessive pitch attitude and rate of climb. R R R R R

Between 2500 ft and 2000 ft AGL

RAD ALT . . . . **CHECK**

Announce . . . . **"RAD ALT ALIVE"**
Note : Crew should now keep RA in scan to landing.

At 2000 ft AGL Minimum

Final deceleration sequence from SLATS 15/S speed to FLAPS 40/VAPP

SPD BRK . . . . **Check retracted**
Airspeed . . . . **check below VFE**
Order . . . . **"FLAPS 20"**
Announce . . . . **"Speed checked"**

FLAPS 20 . . . . **Select**

Mod : 5697 + 7172 + 11900

FCU . . . . VAPP

If A/THR is OFF
THROTTLES . . . . Idle

When FLAPS 20 on SFPI

Announce . . . . ″FLAPS 20″
Order . . . . GEAR DOWN

L/G LEVER . . . . DOWN

GND SPOILERS . . . . ARM

When L/G down

Announce . . . . ″GEAR DOWN″

Check ″3 green″ on landing gear main indication panel.

BRAKE YELLOW HYDRAULIC PRESSURE . . . . CHECK

- If residual pressure is indicated :
  - Depress several times the brake pedals until release of residual pressure
  - If residual pressure remains :
    - Select preferably the AUTOBRAKE system or apply brakes at touchdown.
    - A slight brake deflection (3°) will supersede any previous yellow pressure.

    Note : *If antiskid is inoperative maintain a symmetrical braking as soon as aircraft touchdown.*

AUTO BRK . . . . As req

- The use of autobrake is recommended. Select the appropriate pushbutton according to the runway length and conditions and check related ON light illuminated.
  The use of MAX is not recommended at landing.
- When landing on short or contaminated runway or when operating in low visibility weather conditions use MED mode.
- On a normal runway length LO mode is recommended. It is recommended to use max reverse thrust until 80 kt. Then idle reverse and brakes, as necessary, according to the remaining distance.

Note : *If, on very long runways, the pilot anticipates that braking will not be needed, use of the autobrake is unnecessary.*

Order . . . . ″FLAPS 40″
FLAPS 40 . . . . Select

BRK/A-SKID . . . . Check NORM/ON position

ECAM wheel page . . . . Check

Check 8 brake release indications

When Flaps 40 on SFPI

Announce . . . . ″FLAPS 40″
Check speed approaching VAPP

The approach must be stabilized with FLAP 40/VAPP by 500 ft minimum in VMC, 1000 ft in IMC, otherwise a Go around must be initiated.

If A/THR is not engaged :

THROTTLES . . . . Adjust

WING ANTI-ICE . . . . OFF

Only use WING ANTI ICE in case of severe icing conditions

EXT LTS . . . . ON

Set NOSE sw to TAXI
Selecting lights on even in daylight will minimize bird strike hazard.

SUPERNUMERARY REPORT . . . . Received

Obtain supernumerary report and advise supernumeraries of landing.

LANDING CHECKLIST . . . . Completed

FLIGHT PARAMETERS . . . . Check

PF announces any FMA modification
PNF calls out :
- Pitch attitude becomes lower than 0° or greater than 10° nose up
- Bank angle becomes greater than 7°
- V/S greater than 1 000 ft/min
- Airspeed deviations of more than + 10 kt or – 5kt
- Excessive LOC or GLIDE deviation occurs :
  1/4 dot LOC
  1 dot GS
- Any significant changes in ground speed that might indicate windshear.

When the PNF calls flight parameter exceedance, the suitable PF response is : R
- Acknowledge the PNF call out, for proper crew coordination purposes R
- Take immediate corrective action to control the exceeded parameter back into the defined stabilized conditions R
- Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around. R

AT OUTER MARKER, OR FINAL APPROACH FIX

Announce, cross check altitude and start clock.

At 400 ft AGL

Check/Announce . . . . ″LAND″

At DA + 100 ft
Announce . . . . ″ONE HUNDRED ABOVE″

At DA
Monitor or Announce . . . . ″MINIMUM″

Announce . ″CONTINUE″ or ″GO AROUND FLAPS″

Do not ″duck under″ the G/S. Maintain a stabilized flight path down to the flare

Note : *Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.*

AUTO CALL-OUT . . . . Monitor

or announce appropriate heights as per company policy
At 50 ft, aircraft one dot below G/S is 7 ft below G/S.

Mod : 12917 or (12073 + 12175)

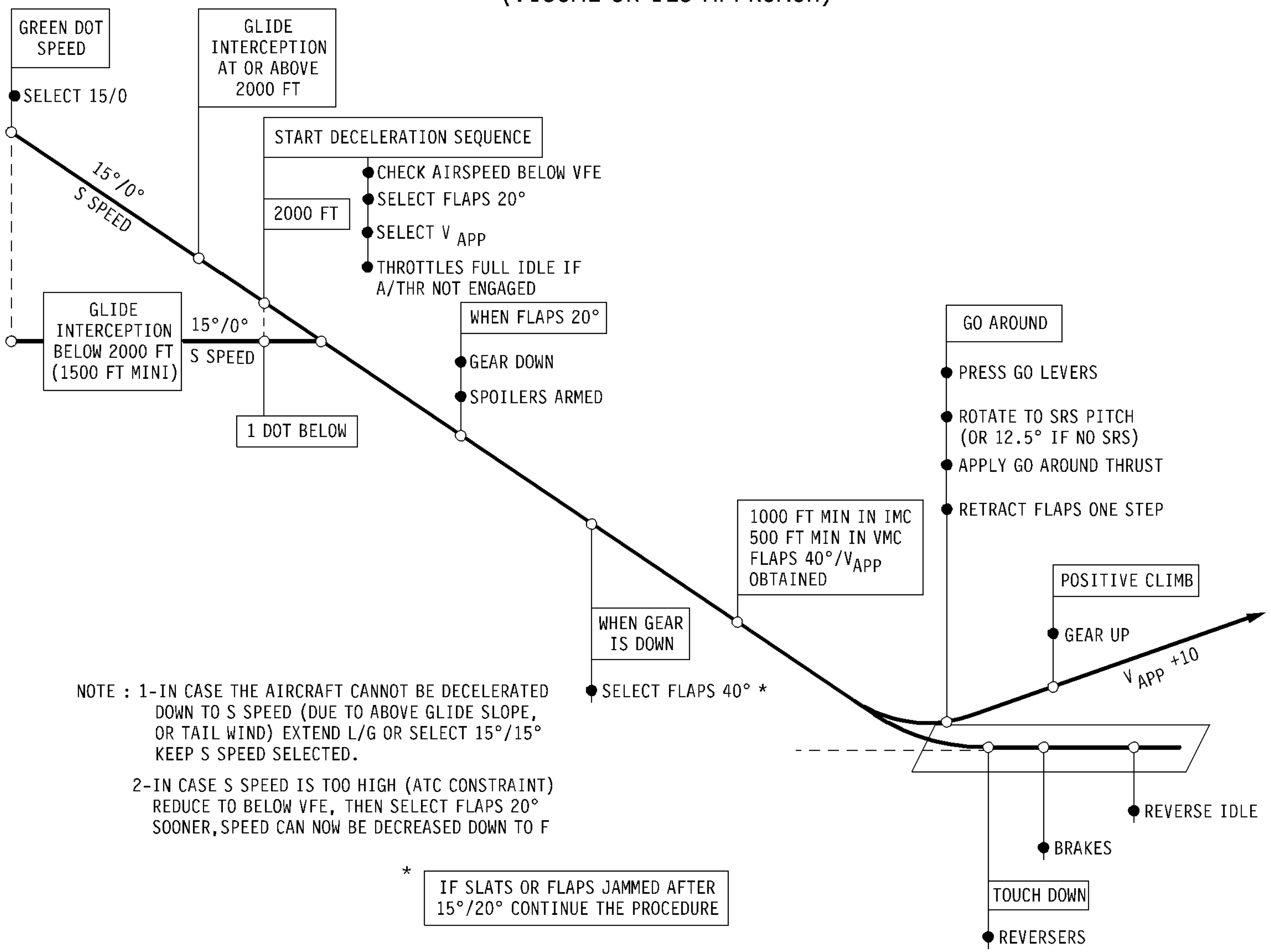
AI / V-F 1000

R R R R R R R R R R R R R R R R R R R R R R R R R R R

COFC-02-0318-004-A001AA

STANDARD APPROACH

PERFORMED MANUALLY OR WITH AP ENGAGED ON A STABILIZED FINAL SLOPE OF ABOUT 3°
(VISUAL OR ILS APPROACH)



NOTE : 1-IN CASE THE AIRCRAFT CANNOT BE DECELERATED DOWN TO S SPEED (DUE TO ABOVE GLIDE SLOPE, OR TAIL WIND) EXTEND L/G OR SELECT 15°/15° KEEP S SPEED SELECTED.

2-IN CASE S SPEED IS TOO HIGH (ATC CONSTRAINT) REDUCE TO BELOW VFE, THEN SELECT FLAPS 20° SOONER, SPEED CAN NOW BE DECREASED DOWN TO F

* IF SLATS OR FLAPS JAMMED AFTER 15°/20° CONTINUE THE PROCEDURE

APPENDIX 13

Flight Operations Briefing Notes

Standard Operating Procedures

Standard Calls

I Introduction

Standard phraseology is essential to ensure effective crew communication, particularly in today's operating environment, which increasingly features:

- Two-crewmember operation; and,
- International and worldwide contexts involving crewmembers with different native languages.

Standard calls are intended and designed to enhance the efficiency of crew coordination and update the flightcrew situational awareness (e.g., including aircraft position, altitude, speed, status and operation of aircraft systems, …).

Standard calls may vary among:

- Aircraft models, based upon flightdeck design and systems interfaces; or,
- Airlines, to suit their operating philosophy (SOPs).

II Statistical Data

Insufficient horizontal or vertical situational awareness or inadequate understanding of prevailing conditions is a causal factor in more than 50 % of approach-and-landing accidents (Source – Flight Safety Foundation – 1998-1999).

III Use of Standard Calls

Standard calls should be defined to be alerting, in order to be :

- Clearly identified by the PF or PNF; and,
- Distinguished from other intra-cockpit or ATC communications.

Use of standard calls and acknowledgements reduces the risk of tactical (short-term) decision making errors (e.g., in selecting modes, setting targets or selecting aircraft configurations).

The importance of using standard calls increases with increasing workload or flight phase criticality.

Standard calls must convey the required information with a minimum of words that have the exact same meaning for all crew members.

Standard calls should be practical, concise, unambiguous and consistent with the aircraft design and operating philosophy.

Standard calls should be included in the flow sequence of company' SOPs (or summarized at the end of the SOPs) and should be illustrated in the Flight Patterns published in the company' AOM or QRH (as applicable).

Command and response calls should be performed in accordance with the defined PF / PNF task sharing (i.e., task sharing for hand flying and for autopilot operation, task sharing for normal operation and for abnormal / emergency condition).

Nevertheless, if a call is omitted by one crewmember, the other crewmember should perform the call, per good crew resource management (CRM) practice.

The other crewmember should accomplish the requested command or verify the requested condition and respond accordingly.

Standard calls may be generated automatically by aircraft systems (i.e., auto callouts) using synthetic voice messages (e.g., radio-altimeter callouts, GPWS/TAWS alert messages, reactive or predictive windshear alert messages, …).

In the absence of such auto callouts (i.e., due a system malfunction), the PNF should make verbally the appropriate standard call.

The absence of a standard call at the appropriate time or the absence of acknowledgement may :

- Result in a loss of situational awareness for the other crewmember;
- Be an indication of a system or indication malfunction; or,
- Indicate a possible incapacitation of the other crewmember.

Standard calls are used to:

- Give a command (i.e., task delegation) or transfer an information;
- Acknowledge a command or an information transfer;
- Give a response or ask a question (i.e., feedback);
- Callout a change of indication (e.g., a mode transition or reversion); or,
- Identify a specific event (e.g., crossing an altitude or a flight level).

IV Defining Generic Standard Calls

The following generic standard calls often are used to express a command or response:

- **Check (or Verify):**
  - a command for the other pilot to check an item;
- **Checked:**
  - a confirmation that an item has been checked;
- **Cross-check(ed):**
  - a call (response) confirming that an information has been checked at both pilot stations;
- **Set:**
  - a command for the other pilot to set a target value or a configuration;
- **Arm:**
  - a command for the other pilot to arm an AP/FD mode (or to arm a system);
- **Engage:**
  - a command for the other pilot to engage an AP/FD mode (or to engage a system);

- **ON / OFF:**
  - ON or OFF following the name of a system is either:

    - a command for the other pilot to select / deselect the related system; or,

    - a response confirming the status of the system.

V Specific Standard Calls

Appropriate standard calls should be defined, based on instrument indications or observation of cockpit effects, for the following events:

- Flightcrew/ground mechanics communications;
- Engine start sequence;
- Trust setting;
- Specific event-markers along the takeoff phase;
- Landing gear and slats/flaps selection (retraction or extension);
- Initiation, interruption, resumption and completion of normal checklists;
- Initiation, sequencing, interruption, resumption and completion of abnormal and emergency checklists (paper or electronic checklist);
- Autopilot or flight director engagement (i.e., FMA annunciation);
- Mode engagement (i.e., FMA annunciation);
- Mode transitions and reversions (i.e., FMA changes);
- Target selections confirmation (i.e., on PFD and/or ND scales);
- Capture phases (e.g., navigation leg, radial, localizer, glide-slope, …);
- Changing the altimeter setting;
- Approaching the cleared altitude or FL;
- TCAS / TA or RA events;
- PF/PNF transfer of controls;
- Specific points / targets along the instrument approach procedure;
- Excessive-deviation from a nominal flight parameter;
- Unstabilized approach when reaching the applicable stabilization height or if becoming destabilized below the applicable stabilization height;
- Approaching and reaching minimums;
- Acquisition of visual references;
- Loss of visual references;

- Landing or go-around decision; and,
- Specific event-markers during the landing roll.

Use of standard calls is of paramount importance for optimum use of automation (i.e., for awareness of arming or engagement of modes by calling FMA changes, target selections, FMS entries, …) :

- The standard calls should trigger immediately the question " what do I want to fly now? ", and thus clearly indicates :
  - which mode the pilot wishes to arm or engage; and/or,
  - which target the pilot wishes to set.
- When the pilot's (PF) intention is clearly transmitted to the other pilot (PNF), the standard call will also:
  - facilitate the cross-check of the FMA and PFD/ND, as applicable; and,
  - facilitate the cross-check and backup between both pilots.

Standard calls should be defined for cockpit crew / cabin crew communications in both:

- Normal conditions (departure and arrival); and,
- Abnormal or emergency situations (e.g., cabin depressurization, on-ground emergency / evacuation, crew incapacitation, forced landing or ditching, etc).

VI Harmonization of Standard Calls

The harmonization of standard calls across various aircraft fleets (from the same or from different aircraft manufacturers) is desirable but should not be an overriding demand.

Standard calls across fleets are only essential for crewmembers operating different fleets (i.e., for communications between cockpit and cabin or between cockpit and ground).

Within the cockpit, pilots need to use standard calls appropriate for the flightdeck and systems design.

With the exception of aircraft models with cockpit commonality, cockpit layouts and systems are not the same and, thus, similarities as well as differences should be recognized alike.

When defining standard calls, standardization and operational efficiency should be balanced carefully.

VII Summary of Key Points

Standard Calls ensure effective crew interaction and communication.

The Call / Command and the Response / Acknowledgement are of equal importance to guarantee a timely action or correction.

VIII Associated Briefing Notes

The following Briefing Notes can be reviewed along with the above information in order to expand a particular topic:

- **Operating Philosophy – SOPs,**
- **Optimum Use of Automation,**
- **Use of Normal Checklists,**
- **Effective Pilot / Controller Communications,**
- **Intra-cockpit Communications - Managing Interruptions and Distractions.**

IX Regulatory references

- ICAO – Annex 6 – Operation of Aircraft, Part I – International Commercial Air transport – Aeroplanes, Appendix 2, 5.13.
- ICAO – Preparation of an Operations Manual (Doc 9376).
- JAR-OPS 1.1045 and associated Appendix 1 – Operations Manuals – structure and contents.

X Other References

- U.S. National Transportation Safety Board (NTSB) – Special Report NTSB-AAS-76-5 – Special Study: Flightcrew Coordination Procedures in Air Carrier Instrument Landing System Approach Accidents.

Airbus Customer Services
Flight Operations Support and Line Assistance

1 Rond Point Maurice Bellonte - 31707 BLAGNAC CEDEX FRANCE

FOBN Reference : FLT_OPS – SOP - SEQ04 - REV03 – MAR. 2004

APPENDIX 14

GENERAL

- The Enhanced Ground Proximity Warning System (EGPWS) includes :
  - one EGPWS computer,
  - two GPWS-G/S warning light/pushbutton switches on the Captain and First Officer's instrument panels,
  - one GPWS FAULT light and a GPWS selector switch on the CAPT SWITCHING panel,
  - one TERR MODE light/pushbutton switch on the CAPT SWITCHING panel,
  - one TERR light/pushbutton switch on the right side of the Captain's Navigation Display, and one on the left side of the First Officer's Navigation Display.
  - an audio warning system.
- The EGPWS provides visual and audio synthetic voice warnings to alert the flight crew about potential terrain conflicts.
- The basic GPWS warning modes are :
  - Mode 1 : excessive sink rate,
  - Mode 2 : excessive terrain closure rate,
  - Mode 3 : descent after take-off,
  - Mode 4 : inadvertent proximity to terrain,
  - Mode 5 : descent below ILS glide slope.

Note : *Mode 5 is active only when a valid ILS glide slope signal is being received. Mode 5 warnings are inhibited for ILS "Back Course".*

- In addition to the five warning modes, a call out warning "BANK ANGLE" is triggered in case of excessive bank angle (three thresholds : 35° then 40° then 45°).
- The enhanced functions are :
  - A Terrain Awareness and Display (TAD) function which can predict a potential conflict with terrain ahead of the aircraft and display terrain data on the ND.
  - A Terrain Clearance Floor (TCF) function which alerts the flight crew of excessive terrain closure during approach.
- Visual alerts (on Captain and F/O's GPWS-G/S warning lights and ND) :
  - Modes 1 to 4 : red "GPWS" lights illuminate,
  - Mode 5 : amber "G/S" lights illuminate,
  - TAD : red "GPWS" lights illuminate and the appropriate colour is displayed on the ND
  - TCF : both red "GPWS" and amber "G/S" lights illuminate.
- Audio warnings : specific synthetic voice phrases are given for each individual alert.
- All EGPWS audio warnings can be cancelled with the EMER AUDIO CANCEL switch.
- A 3-position (NORM - FLAP OVRD - OFF) GPWS selector switch is located on the Captain's instrument panel.
  - If landing with flaps 20 or less, selecting FLAP OVRD inhibits the "TOO LOW FLAPS" warnings (mode 4B).
  - Modes 1 to 5 alerts can be inhibited by selecting the switch to the OFF position.
    Enhanced functions are not inhibited.
  - When the selector switch is in the FLAP OVRD position, the GPWS OVRD light illuminates.
- Illumination of the amber GPWS FAULT light on the CAPT SWITCHING panel indicates GPWS mode 1 to 5 failure.
- A TERR MODE pushbutton switch, when released, inhibits TAD and TCF functions.
  The white OFF light illuminates.
- A TERR MODE FAULT light indicates a failure of TAD and/or TCF functions.
- Captain and F/O TERR pushbutton switches allow the crew to select or deselect terrain data display on the onside ND, only in ARC or MAP mode.
  The ON ND green light illuminates.

  Note 1 : *If a CAUTION or a WARNING alert is triggered, and there is no PREDICTIVE WINDSHEAR warning, terrain data is automatically displayed on the ND and the ON ND light illuminates.*

R Code : 0319

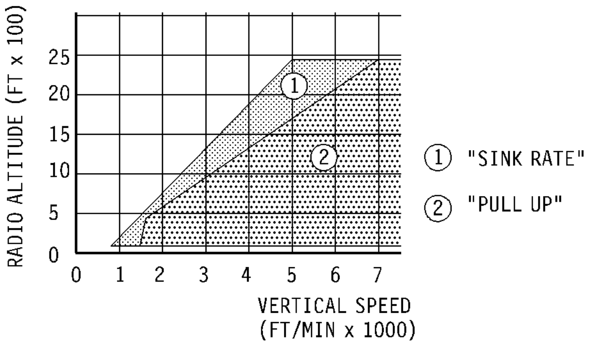
Note 2 : The terrain data display is characterized by the message TERR on the left side of the ND and the TILT value is forced at "+ 00.0".

- The EGPWS can be tested on ground by pressing either the Captain or the F/O's GPWS-G/S pushbutton switch.
- Mode 5 (below glide slope) warnings can be momentarily inhibited (for example, for a non-precision
R approach) by pressing the GPWS-G/S pushbutton switch.
- A GPWS LANDING SLATS/FLAPS switch is used to inform the EGPWS of the selected landing configuration.
- All EGPWS alerts are inhibited if the stall warning or windshear warning (if installed) is activated.
- The EGPWS is electrically supplied from the AC BUS 1.

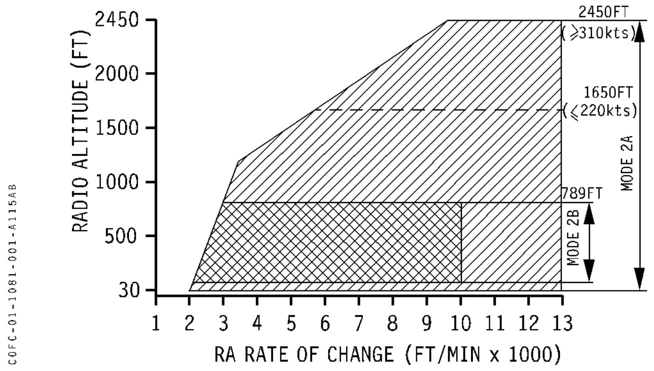
Note 1 : Several airports around the world have terrain located on their approach or departure flight path which penetrates the standard EGPWS warning profiles. When operating to/from these airports, the IRS position is used to modify the warning profile and avoid nuisance warnings.

Note 2 : EGPWS processes information from ADC 1, ILS 1, IRS 1, FMC 1, Radio Altimeter 1, SFCC 1 and SFCC 2, SYS 2 nose gear down lock sensor, stick shakers 1 and 2, Predictive W/S (if installed) PWS 1 and 2, CAPT and F/O EFIS control panel.

MODE 1:EXCESSIVE SINK RATE



MODE 2:EXCESSIVE TERRAIN CLOSURE RATE



MODE 2A

R • This mode is activated when flaps are less than
R 20° when GPWS LANDING SLATS/FLAPS switch
R is set to 15/20 or less than 40° when GPWS
R LANDING SLATS/FLAPS switch is set to 30/40.

• Inside the envelope boundary conditions, the message is ″TERRAIN, TERRAIN″ followed by ″PULL UP″.

• After boundary is departed ″TERRAIN″ persist as long as in the warning area and a 300 ft BARO altitude gain is not obtained.

MODE 2B

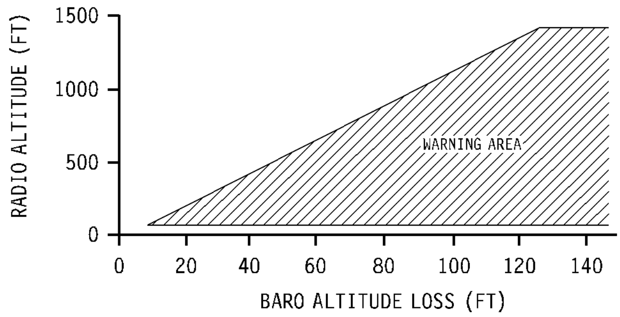
• Lowering the flaps to the landing position automatically switches the EGPWS to Mode 2B. The lower part of the Mode 2B boundary is controlled as a function of Radio Altitude and Altitude Rate when Flaps are in full landing configuration.

• Mode 2B is also selected when the aircraft is performing an ILS approach and the Glideslope and Localizer deviations are less than 2 dots. In this case the lower boundary is controlled only as a function of Radio Altitude (and not RA + Altitude Rate), having a constant lower cutoff of 30 feet AGL. When the Flaps are selected to landing configuration on the ILS Glideslope beam, the lower boundary is activated.

• Inside the envelope boundary conditions, the message is ″TERRAIN, TERRAIN″ followed by ″PULL UP″ if the condition persists (and while gear up). With both, gear down and flaps extended, only ″TERRAIN, TERRAIN, TERRAIN″ is used.

Code : 0102

MODE 3:DESCENT AFTER TAKE-OFF

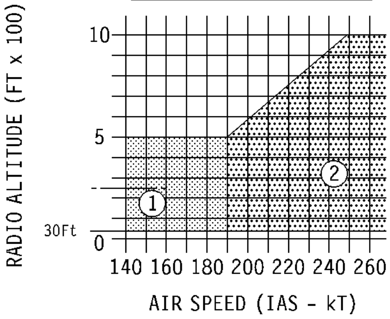


IF A DESCENT IS MADE DURING THE INITIAL TAKE-OFF CLIMB, OR DURING A GO AROUND A REPEATED ORAL ALERT IS GENERATED:

- "DON'T SINK" (GEAR UP) OR "DON'T SINK GEAR" (GEAR DOWN) THEN "TOO LOW"

MODE 4:INADVERTENT PROXIMITY TO TERRAIN

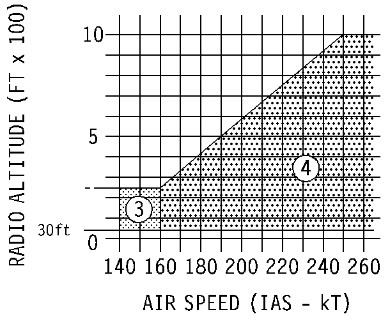
R 4A-GEAR UP AND FLAPS UP



1 "TOO LOW GEAR"

2 "TOO LOW TERRAIN"

4B-GEAR DOWN OR FLAPS DOWN

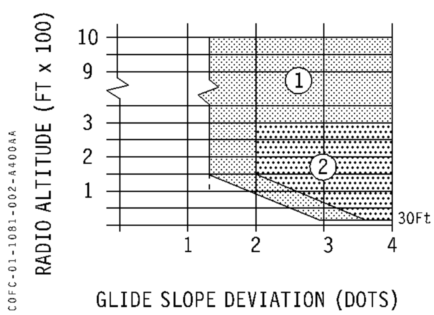


3 "TOO LOW FLAPS" (IF FLAPS NOT IN LANDING CONFIGURATION *) OR "TOO LOW GEAR" (IF GEAR NOT EXTENDED) R

4 "TOO LOW TERRAIN" R

(*) DEPENDING ON THE GPWS LANDING SLATS/FLAPS SWITCH POSITION (if installed) R

MODE 5:DESCENT BELOW GLIDE SLOPE



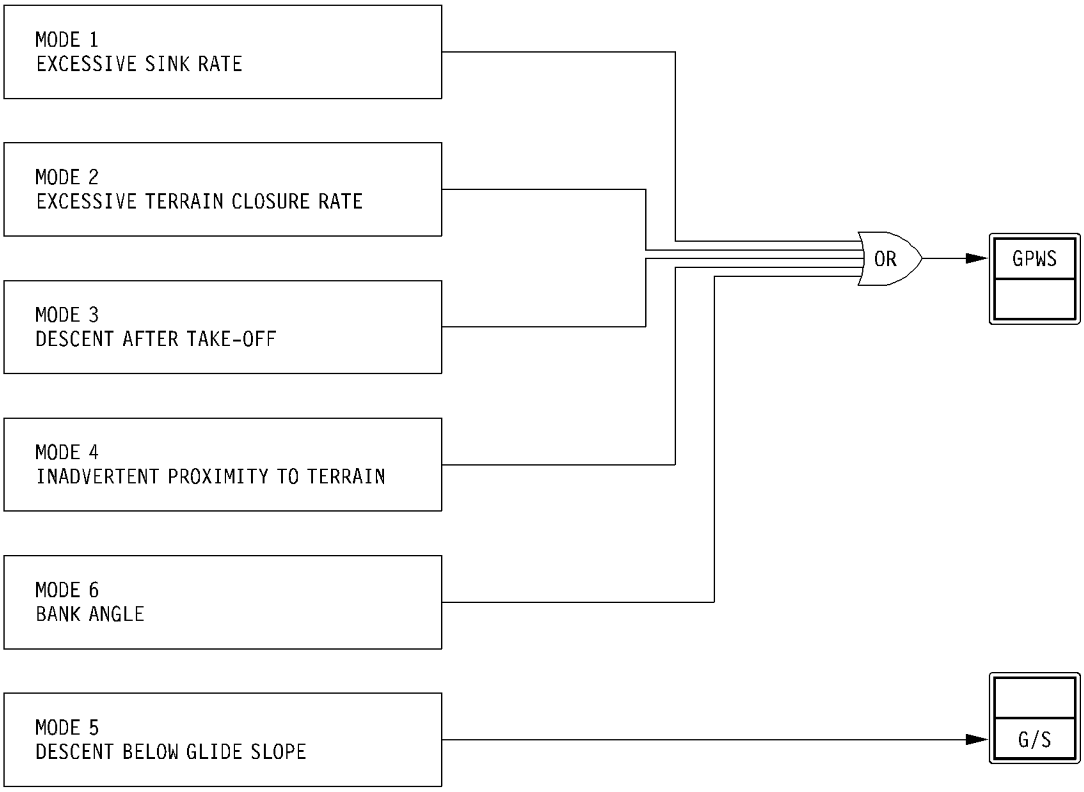
1 "GLIDE SLOPE" SOFT ALERT

2 "GLIDE SLOPE" HARD ALERT (INCREASED LEVEL)

MODE 6:BANK ANGLE

1 IF ROLL ANGLE MORE THAN 35° "BANK ANGLE BANK ANGLE"

Mod : 5697 + 8960 + 11893 + 12164



WARNING PRIORITIES

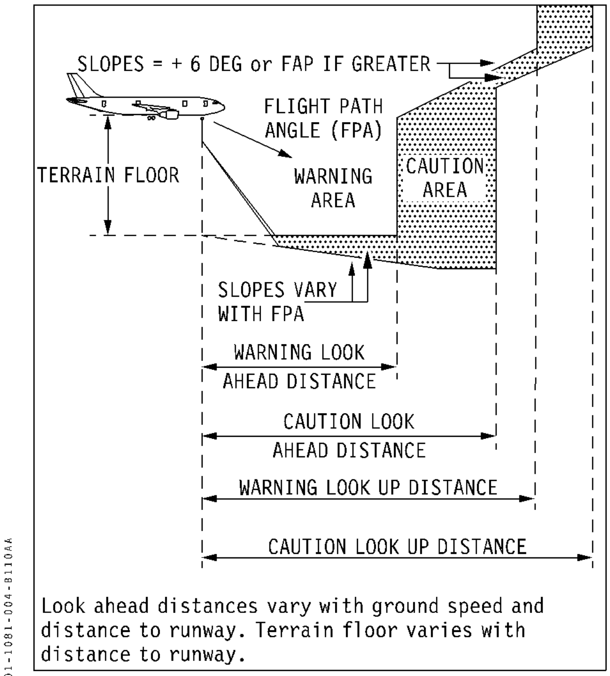
1 - PULL UP
2 - TERRAIN
3 - TOO LOW TERRAIN
4 - TOO LOW GEAR
5 - TOO LOW FLAPS
6 - SINK RATE
7 - DON'T SINK
8 - GLIDE SLOPE
9 - BANK ANGLE

COFC-01-1081-003-A300AA

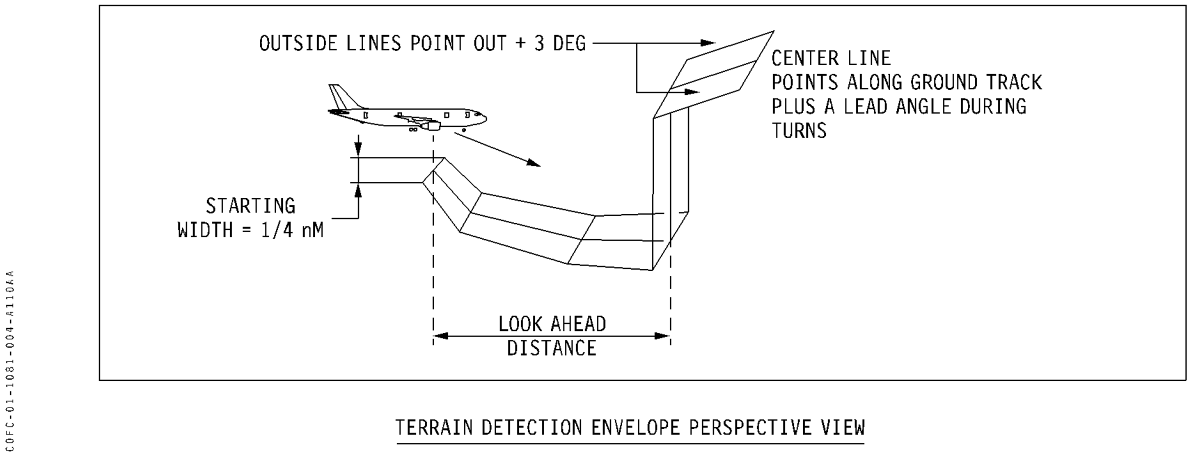
Mod : 8960 + 11893 + 12164

TERRAIN CAUTION AND WARNING ENVELOPES

- The EGPWS continuously computes two envelopes ahead of the aircraft :
  - the first one corresponds to a CAUTION alert,
  - the second one corresponds to a WARNING alert.
- Both envelopes are calculated as a function of :
  - the aircraft altitude,
  - the ground speed,
  - the turn rate.
- Both envelopes are defined by :
  - a look-ahead distance,
  - an altitude offset below the aircraft
  - a lateral distance on either side of the aircraft.
- Both envelopes are :
  - vertically aligned with the aircraft flight path,
  - horizontally aligned with the aircraft ground track.
- The look-ahead distance is computed as a function of the aircraft ground speed so that :
  - the CAUTION alert is activated between 40 and 60 seconds before the predicted conflict,
  - the WARNING alert is activated between 20 and 30 seconds before the predicted conflict.



TERRAIN CAUTION AND WARNING ENVELOPE BOUNDARIES

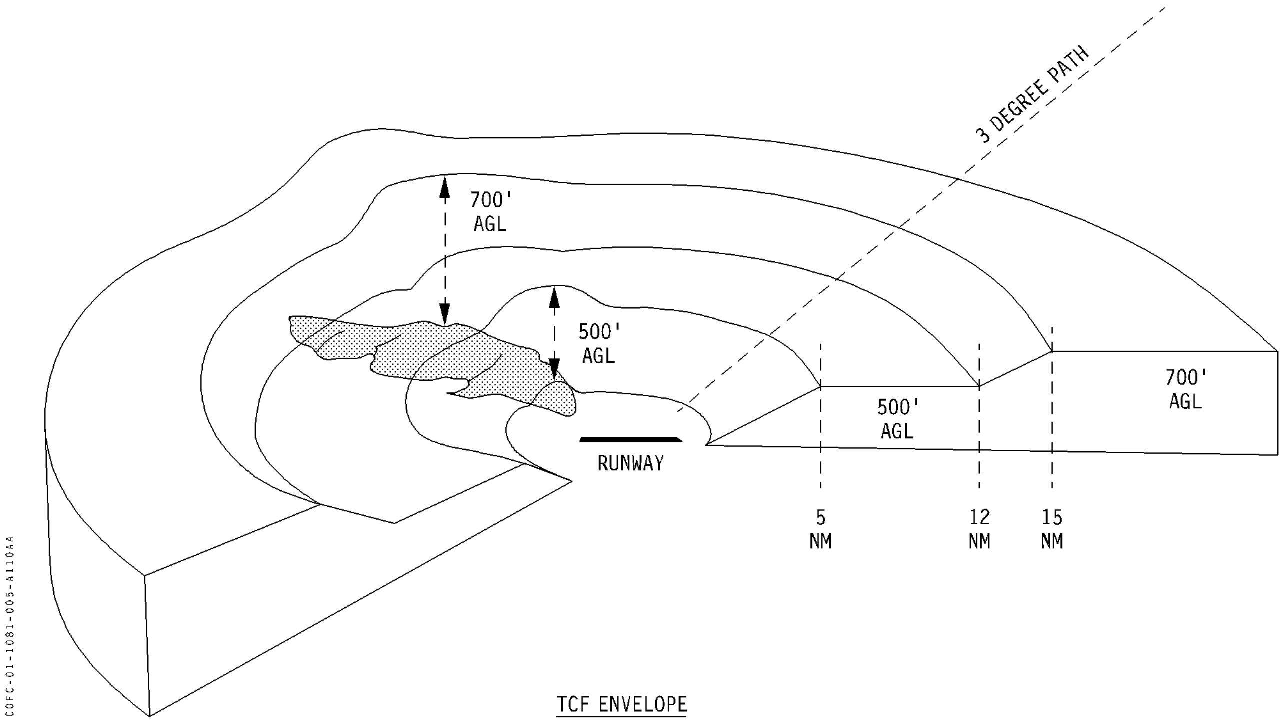


TERRAIN DETECTION ENVELOPE PERSPECTIVE VIEW

Code : 0006

TERRAIN CLEARANCE FLOOR

- The EGPWS computes a Terrain Clearance Floor (TCF) which is an envelope surounding the nearest runway.
- The TCF is active during the take-off, cruise and final approach flight phases.
- The TCF is based on the radio altitude and may generate an alert as a fonction of the barometric altitude or the radio altitude in case of a barometric altitude discrepancy.



TCF ENVELOPE

Code : 0006

TERRAIN CAUTION ALERT

- If the CAUTION envelope conflicts with terrain in the EGPWS database, a CAUTION alert is activated.
- The CAUTION alert consists of :
  - a vocal message TERRAIN AHEAD, repeated every 7 seconds until conditions disappear,
  - the illumination of the GPWS red light,
  - the display of TERR amber and a solid yellow area in front of the aircraft symbol on the ND (refer to 1.10.83 page 1)

TERRAIN WARNING ALERT

- If the WARNING envelope conflicts with terrain in the EGPWS database, a WARNING alert is activated.
- The WARNING alert consists of :
  - a vocal message TERRAIN AHEAD, PULL UP repeated continuously until conditions disappear,
  - the illumination of the GPWS red light,
  - the display of TERR red and a solid red area in front of the aircraft symbol on the ND (refer to 1.10.83 page 1).

TERRAIN CLEARANCE FLOOR ALERT

- If the aircraft radio or barometric altitude conflicts with the TCF, a TCF alert is activated.
- The TCF alert consists of :
  - a vocal message TOO LOW TERRAIN, activated at first TCF penetration and repeated each time the radio altitude decreases by 20 %.
  - the illumination of both GPWS red light and G/S amber light.
- The TCF alert is activated even if the aircraft is in a landing configuration.
- The TCF alert is inhibited below a radio altitude of 30 ft.

Code : 0006

APPENDIX 15

EGPWS ALERTS

***CAUTION* : During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis.**
During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert ceases or a safe trajectory is ensured.

■ **"PULL UP" – "TERRAIN TERRAIN PULL UP" – "TERRAIN AHEAD PULL UP"**

● **Simultaneously** :

AUTOPILOT . . . . DISCONNECT
PITCH ATTITUDE . . . . . INITIALLY 20° NOSE UP
– Use Stick Shaker boundary as upper limit of pitch

A/THR . . . . DISCONNECT
THROTTLES . . . . FULL FORWARD
SPEED BRAKES LEVER . . . . CHECK RETRACTED
BANK . . . . WINGS LEVEL OR ADJUST

● **When flight path is safe and GPWS warning ceases :**

– Decrease pitch attitude and accelerate.

● **When speed above V_{LS} and V/S positive** :

– Clean up aircraft as required.

■ **"TERRAIN TERRAIN" – "TOO LOW TERRAIN"**

– Adjust the flight path or initiate a go around.

■ **"TERRAIN AHEAD"**

– Adjust the flight path. Stop descent. Climb and/or turn as necessary based on analysis of all available instruments and information.

■ **"SINK RATE"**

– Adjust pitch attitude and thrust to silence the warning.

■ **"DON'T SINK"**

– Adjust pitch attitude and thrust to maintain level or climbing flight.

■ **"TOO LOW GEAR" – "TOO LOW FLAPS"**

– Perform a go-around.

■ **"GLIDE SLOPE"**

– Establish the airplane on the glide slope

or

– Switch off the G/S mode pushbutton switch if flight below glide slope is intentional (non precision approach).

■ **"BANK ANGLE-BANK ANGLE"**

– Correct the roll angle to regain a safety roll

EGPWS ALERTS

A nuisance EGPWS "TOO LOW GEAR" warning may be generated if the Nose Landing Gear downlock system 2 is inoperative.

Best climb performance is obtained when close to wings level. Then depending on the situation, a turn will be performed. Flight crew should initiate climbing maneuver R
even if the wings are not level. R

Mod : 5697 + 8960 + 11894 + 12164

INTENTIONALLY LEFT BLANK

APPENDIX 16

EGPWS ALERTS

CAUTION ***: During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis.***
During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert ceases or a safe trajectory is ensured.

■ "PULL UP" – "TERRAIN TERRAIN PULL UP" – "TERRAIN AHEAD PULL UP"

● **Simultaneously** :

AUTOPILOT . . . . DISCONNECT
PITCH ATTITUDE . . . . INITIALLY 20° NOSE UP
– Use Stick Shaker boundary as upper limit of pitch

A/THR . . . . DISCONNECT
THROTTLES . . . . FULL FORWARD
SPEED BRAKES LEVER . . . . CHECK RETRACTED
R BANK . . . . WINGS LEVEL or ADJUST

● **When flight path is safe and GPWS warning ceases** :
– Decrease pitch attitude and accelerate.

● **When speed above V_{LS} and V/S positive** :
– Clean up aircraft as required.

■ "TERRAIN TERRAIN" – "TOO LOW TERRAIN"

– Adjust the flight path or initiate a go around.

■ "TERRAIN AHEAD"

– Adjust the flight path. Stop descent. Climb and/or turn as necessary based on analysis of all available instruments and information.

■ "SINK RATE"

– Adjust pitch attitude and thrust to silence the warning.

■ "DON'T SINK"

– Adjust pitch attitude and thrust to maintain level or climbing flight.

■ "TOO LOW GEAR" – "TOO LOW FLAPS"

– Perform a go-around.

■ "GLIDE SLOPE"

– Establish the airplane on the glide slope
or
– Switch off the G/S mode pushbutton switch if flight below glide slope is intentional (non precision approach).

■ "BANK ANGLE-BANK ANGLE"

– Correct the roll angle to regain a safety roll

APPENDIX 17

APPENDIX 06 – TAWS – GPWS (MOD 11894)

1. GENERAL

This supplement contains the additional limitations and procedures for operation of an aircraft fitted with Enhanced Ground Proximity Warning System (EGPWS).

A list of areas where no terrain data are available along the scheduled route should be made available to the flight crew.

2. LIMITATIONS

The limitations in chapter 2 of this Flight Manual are applicable except as amended by this supplement.

- Aircraft navigation is not to be predicated upon the use of the terrain display.
- The Terrain Display is intended to serve as a situation awareness tool only, and may not provide the accuracy on which to solely base terrain avoidance maneuvering.
- The EGPWS database, display and alerting algorithms currently do not account for man made obstructions.
- R The EGPWS enhanced function should be inhibited (TERR pushbutton set to OFF on the Captain's switching panel) for operations from/to runways not incorporated into the EGPWS database when the aircraft position is less than 15 NM from the airfield.
- R The EGPWS enhanced function should be inhibited (TERR pushbutton set to OFF on the Captain's switching panel) when QFE Procedures are used.

3. PROCEDURES

Procedures in this Flight Manual remain applicable except as amended below.

The following procedures replace the GPWS procedures published in chapter 4.03.00 of this Flight Manual.

- When a warning occurs, pull up using the maximum load factor or the stick shaker as the limit of the input on the elevator, apply takeoff thrust and climb maintaining airspeed close to VSS if necessary until the warning ceases.
  For enhanced function, in addition to climbing, a turning maneuver can be initiated after verifying the aircraft position and if the crew concludes turning is the safest way of action.

  Note : *The EGPWS does not take account of specific aircraft configuration and climb performance and a "pull up" maneuver on its own, for certain situations, may not ensure terrain clearance.*

  Warnings may be considered cautionary during daylight VMC conditions provided the cause of the warning can be identified immediately.

- When a caution occurs, adjust the flight path/configuration so that the caution alert ceases. Climb and/or turn as necessary based on analysis of all available instruments and information.

- During climb, descent, approach and go-around, when the FMS navigation accuracy check prevents the crew from using NAV mode in a phase of flight, the EGPWS enhanced function must be switched OFF through the TERR push-button located on the Captain's switching panel.

APPENDIX 18

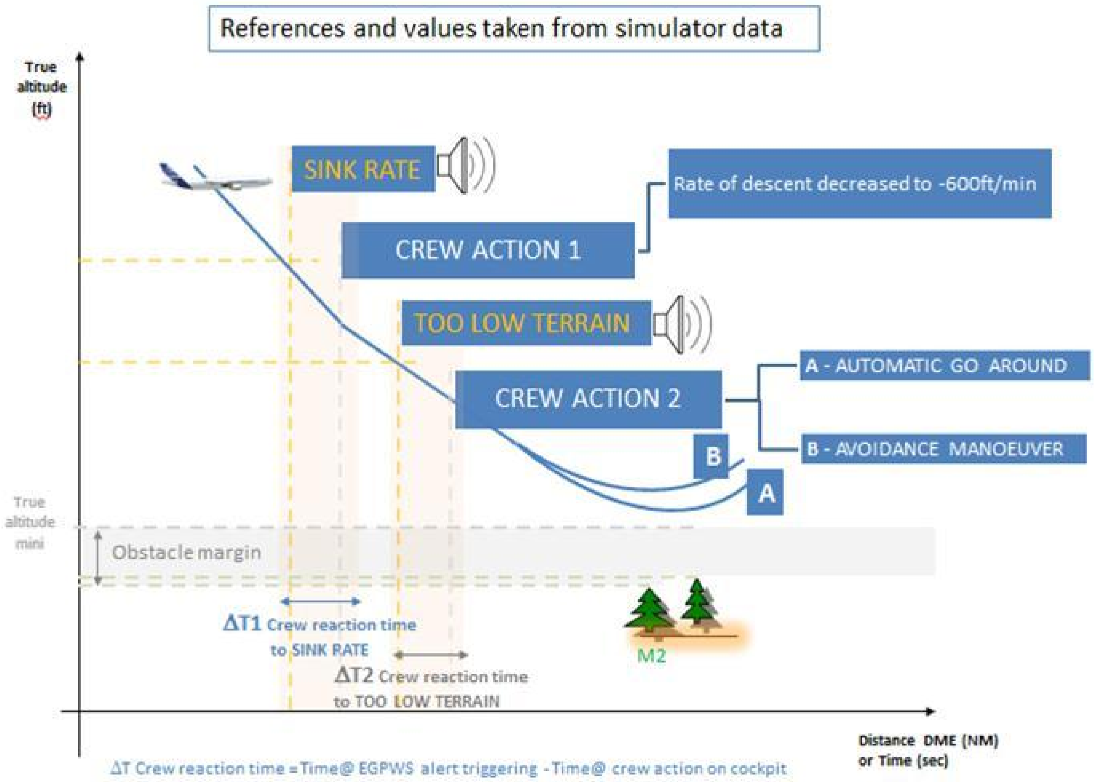
Simulator session plots
Airbus laboratory facilities January 2014

Second part of the session was dedicated to the replay of UP1354 sequence of events was introducing an Airbus EGPWS P/N -002 with an extended TCF mode envelope.

Two runs were performed:

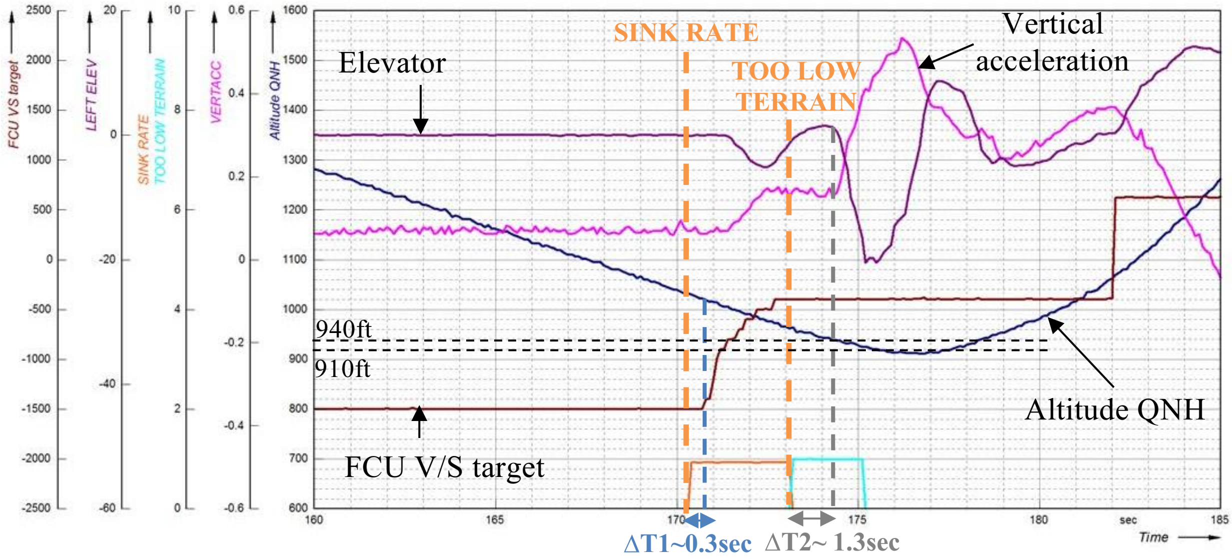
-Run 2.1: Crew response to TOO LOW TERRAIN alert by A/ automatic Go Around.

-Run 2.0: Crew response to TOO LOW TERRAIN alert by B/ manual avoidance maneuver.

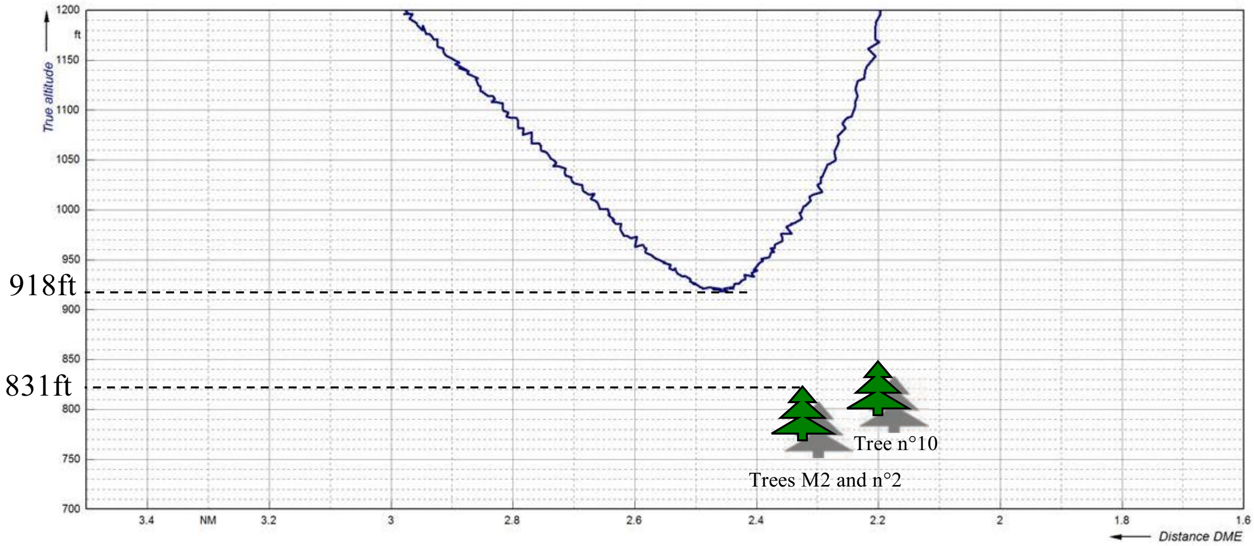


Run 2.0 plots:

Main parameters function of time:

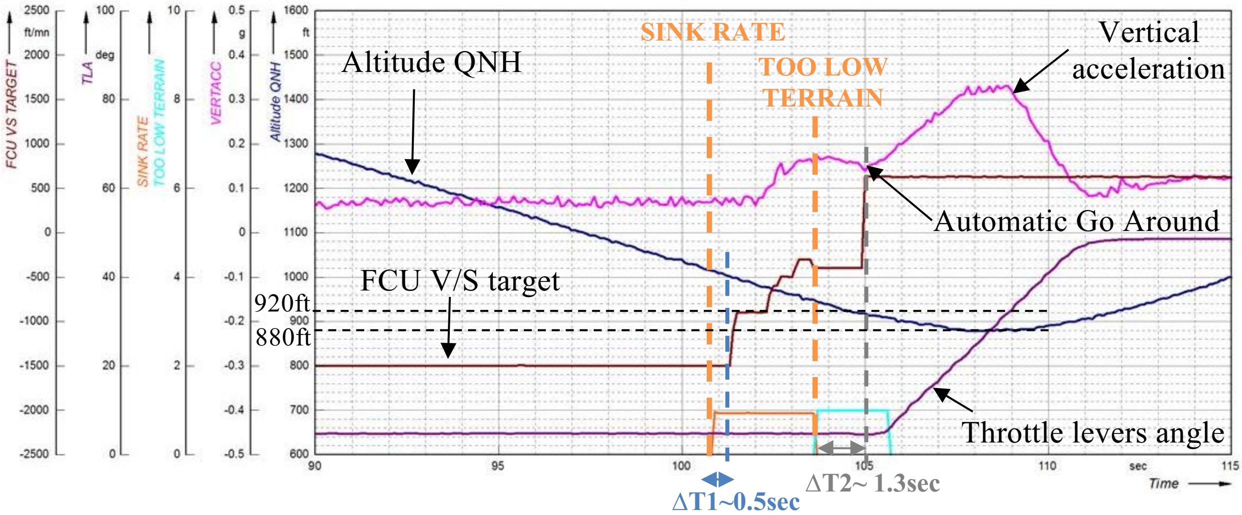


Aircraft true altitude function of DME distance compared with the highest altitude of impacted trees published into NTSB Performance study:

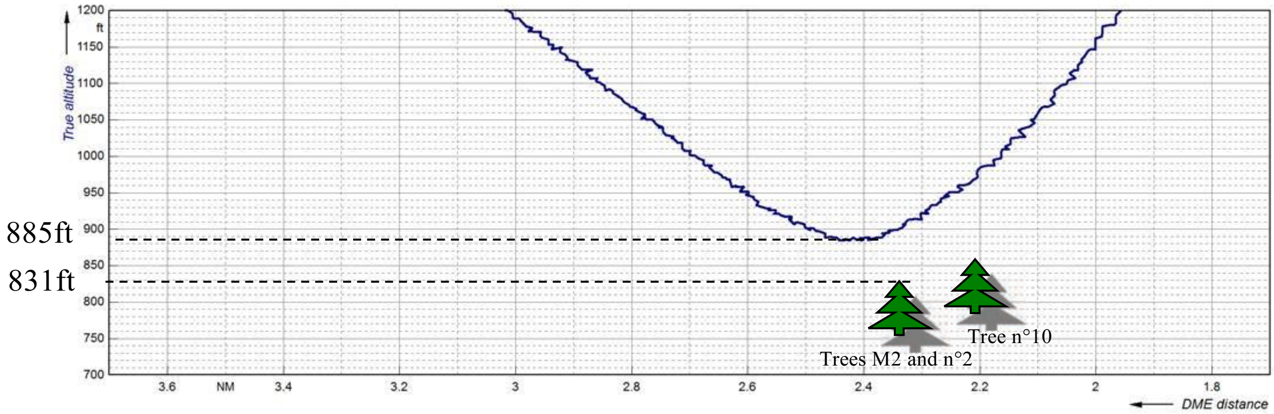


Run 2.1 plots:

Main parameters function of time:



Aircraft true altitude function of DME distance compared with the highest altitude of impacted trees published into NTSB Performance study:



APPENDIX 19

CUSTOMER SERVICES DIRECTORATE
1 ROND POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX FRANCE
TELEPHONE + 33 (0)5 61 93 33 33
TELEX AIRBU 530526F

AIRBUS

SERVICE INFORMATION LETTER

SUBJECT: **"TERRAIN AWARENESS AND WARNING SYSTEM" (TAWS) ON AIRBUS AIRCRAFT**

ATA CHAPTER: 34-48 (EGPWS) / 34-43 or 34-44 (T2CAS)

AIRCRAFT TYPE: A300, A300-600, A310, A318, A319, A320, A321, A330, A340, A340-500, A340-600

APPLICABILITY: All

1. PURPOSE

The purpose of this Service Information Letter is to give the operators the technical solutions proposed by Airbus concerning the installation of the TAWS on production and in service aircraft.

The purpose of the revision 7 of this SIL is to inform the operators about:

- the availability of standard Service Bulletins for replacing T2CAS Standard 1 (PN 900000-10110) by T2CAS Standard 2 (PN 900000-11111) as per EASA recommendation.

Changes in subject SIL are highlighted by a vertical bar in the left hand margin of the respective page.

2. BACKGROUND

The TAWS (Terrain Awareness and Warning System) is an improved system over the existing GPWS (Ground Proximity Warning System). It is also known as the "Enhanced Ground Proximity Warning System" (EGPWS) or “Traffic and Terrain Collision Avoidance System” (T2CAS).

TAWS improves on existing systems by providing the flight crew with automatic advanced aural and visual display of impending terrain, much earlier warning, forward looking capability, and operability in landing configuration. These improvements provide more time for the flight crew to make smoother and gradual corrective action.

Airbus was the first aircraft manufacturer to certify the TAWS on its products (A319/A320/A321 EGPWS certification in September 1997). The EGPWS type certification was obtained in March 1999 for the Long-Range aircraft (A330/A340) and October 1998 for the Wide-Body aircraft (A310/A300-600).
The EGPWS (Honeywell) has been installed as the standard configuration on every new Single Aisle and Long-Range aircraft manufactured after mid year 1999.

Airbus was the first aircraft manufacturer to certify the T2CAS on its products. The T2CAS type certification was obtained in May 2005 for the Single-Aisle (A318/A319/A320/A321), and in March 2005 for the Long-Range aircraft (A330/A340) and Wide-Body aircraft (A310/A300-600). Then, T2CAS has been proposed for production aircraft since May 2005, in addition to the EGPWS among the TAWS equipments range proposed by Airbus.

3. REGULATIONS

The GPWS (TSO-C92) has been required by operational regulations in nearly all countries. Although this system helped to reduce the number of "Controlled Flight Into Terrain" accidents, it still has some limitations. The FAA and EASA determined that even more accidents could be avoided if the TAWS was installed.

Therefore the FAA and EASA mandated the TAWS (TSO-C151a) with the following consequence for the Airbus aircraft:

FAA: (Refer to FAR 121.354) on every US registered aircraft (or used by an US operator) with six-passenger seat (or more) arrangement.

- TAWS mandatory for the aircraft manufactured after 29 March 2002
- TAWS mandatory after 29 March 2005 for the aircraft manufactured on or before 29 March 2002.

EASA: (Refer to JAR-OPS 1.665, NPA-OPS 23)

- TAWS mandatory from 1 October 2001 for aircraft with a certificate of airworthiness issued on or after 1 October 2001.
- TAWS mandatory from 1 January 2005 for aircraft with a certificate of airworthiness issued before 1 October 2001.

FAA and EASA, Altitude call-out issue (500ft call-out): (Refer to JAA TGL 12)
FAA Position:
FAA has issued a favourable interpretation of the Terrain Awareness and Warning System requirements for use by Airbus operators. The FAA confirmed that Airbus operators could use a custom-tailored call-out altitude in Airbus aircraft, and that implementation of the systems delivered and scheduled for delivery (in conjunction with the FWC functions) is fully acceptable without any deviation from FAA rules or operating requirements.

EASA Position, only for aircraft fitted with EGPWS PN 965-1676-001 and onwards:
EASA has requested these aircraft to have, at least, one Radio-Altitude auto call-out activated through FWC pin-programming, among those three:
- 400 ft, or
- 500 ft, or
- 500 ft smart call-out.

Airbus Upgrade Services is proposing a batch of Service Bulletins to perform the FWC pin-programming, according to the operator's choice among the three call-outs.
Please contact Airbus Upgrade Services for additional information on these Service Bulletins (e-mail: upgrade.services@airbus.com).

4. RECOMMENDATIONS

4.1. TAWS Service Bulletins

The operators willing to install the TAWS on their Airbus aircraft are invited to refer to the following tables and to submit the appropriate Request For Change/Retrofit Modification Order (RFC/RMO) to Airbus Upgrade Services (e-mail: upgrade.services@airbus.com) and/or to their respective Customer Service Director.

4.2. New MMR retrofit policy

Please refer to OIT ref. SE 999.0015/04/VHR dated 05 February 2004.

To achieve the new Terrain functions, the TAWS computer uses the aircraft position to locate the aircraft on its internally loaded Terrain Database. This aircraft position is currently provided by the Flight Management System (FMS) that computes it:

1) from the ADIRUS and GPS position source for aircraft equipped with GPS sensor unit (GPSSU) or multimode receiver (MMR), when GPS primary is available, or

2) from the ADIRUS and radio position update, for aircraft not equipped with GPS, when ground radio Navaids are available, or

3) from the ADIRUS only, for aircraft not equipped with GPS receiver when radio position update is not available

In the frame of the Airbus policy for improvement of TAWS operations, Airbus would strongly encourage the use of a GPS source in the global architecture of the TAWS system.
As a consequence, Airbus highly recommends to associate TAWS operations with the use of GPS receivers, through the installation of Multi-Mode Receivers (MMR).

The main advantages of the MMR solution are that both Navigation and Surveillance functions (TAWS) are improved. The dual MMR architecture ensures high navigation functions availability, and renders the aircraft compliant with the current navigation regulations without time limitation (RNP10, BRNAV, PRNAV). This architecture will also help to anticipate future Navigation regulations.

The MMRs embodiment is a mature solution that has accumulated several years of experience.

Airbus will not certify any of the solutions that are using a GPS card internally installed in the TAWS computer. So Airbus invites the Operators interested by the MMR retrofit campaign to contact Airbus Upgrade Services for a complete study and a customized offer.

4.3. New EGPWS PN 965-1676-002 capable of using direct GPS data and associated functions

Please refer to OIT ref. SE 999.0050/06/VHR dated 18 April 2006.
Please refer to the previous Paragraph 4.2.

For the benefit of Airbus operators, Airbus and Honeywell agreed on very attractive conditions for the conversion to EGPWS PN 965-1676-002 and the activation of the associated new functions. The EGPWS PN 965-1676-002 can be installed in place of previous EGPWS versions, on every Airbus Aircraft Families, and provides with the following benefits:

♦ The use of GPS data for Lateral Position instead of FMS data on aircraft equipped with a GPS sensor such as MMRs or Honeywell GPSSU PN HG2021GA03.
Once this function is activated by pin-programming, the EGPWS can directly use the GPS data for positioning the aircraft for each Terrain function of the TAWS, i.e. Terrain Awareness and Display (TAD) and Terrain Clearance Floor (TCF), avoiding potential spurious Terrain warnings due to FMS Map-shifts or FMS positioning errors.
The 5 Basic Modes of the EGPWS, also known as the GPWS part, are also improved. The modulation of the envelope protections of Modes 2 and 4 are improved thanks to the better accuracy of the GPS position.

♦ The use of GPS data for Geometric Altitude on aircraft equipped with a GPS sensor in the conditions described here above.
Geometric Altitude uses the GPS altitude, plus an improved pressure altitude calculation, plus Radio Altitude and Terrain and Runway Elevation data to reduce or eliminate errors potentially induced in corrected barometric altitude by extreme temperatures, non-standard altitude conditions and altimeter miss sets.

♦ The availability of Peaks and Obstacles functions for all Airbus Aircraft, equipped whether with EIS1 (CRT) or EIS2 (LCD) display systems.
Obstacles function enables the EGPWS to alert the crew of possible collision with man-made obstacles. The TAD aural warnings are “OBSTACLE AHEAD” (or “CAUTION OBSTACLE” if the optional audio menu is activated), and “OBSTACLE AHEAD PULL-UP” (or “OBSTACLE OBSTACLE PULL-UP ” if the optional audio menu is activated).
Peaks function enables the display of the terrain with the elevation being relative to the Mean Sea Level (MSL). The display features the indication of the lowest and the highest terrain MSL elevation in form of two distinct numbers.

This new EGPWS will also enable a fleet wide Part Number commonality whatever the aircraft various configurations, resulting in a noticeable benefit for the spares and interchangeability management.

As a conclusion, Airbus has developed a set of Standard Service Bulletins for every Airbus Aircraft Family, which will be sent to every operator having aircraft already equipped with EGPWS PN 965-0976-003-206-206 or PN 965-1676-001. Please refer to the referenced OIT for additional details, and to the tables at the end of this SIL to obtain the standard SBs references.

4.4. Use of GPS data for Alternate Lateral and Vertical Positioning for T2CAS

Please refer to OIT ref. SE 999.0034/07/VHR dated 13 March 2007.
Please refer to the previous Paragraph 4.2.

In parallel with here-above EGPWS and GPS strategy, Airbus has developed a set of Standard Service Bulletins for the activation of the same GPS based functions on T2CAS, for A320 Family and A330/340 Family.
As no A300/310 Family aircraft has been equipped with T2CAS plus GPS (MMR) yet, Airbus will only propose Optional Service Bulletins on demand (RFC/RMO process) to cover the same GPS based functions on aircraft where both systems will be installed.

Please refer to the referenced OIT for additional details, and to the tables at the end of this SIL to obtain the standard SBs references.

- Alternate Lateral Position (equivalent to GPS data for Lateral Position on EGPWS): Once this function is activated by pin-programming, the T2CAS directly uses GPS data for positioning the aircraft for every Terrain functions of the T2CAS, i.e. Collision Prediction and Alerting (CPA) and Terrain Hazard Display (THD). This will avoid potential spurious Terrain alerts due to FMS Map-shifts or FMS positioning errors Navaids (VOR/DME/ILS).

- Alternate Vertical Position (equivalent to Geometric Altitude on EGPWS): Once this function is activated by pin-programming, the T2CAS computes an altitude called CPA altitude. It is a computed aircraft altitude designed to ensure optimal operation of the TAWS. It is based on GPS and barometric altitude, static air temperature, aircraft position, and radio altitude and terrain database. This reduce or eliminate errors potentially induced in corrected barometric altitude by extreme temperatures, non-standard altitude conditions and altimeter miss sets.

5. TAWS TERRAIN DATA BASE UPDATE

The TAWS manufacturer is responsible for the permanent update of the Terrain Database. Airbus encourages the operators to report any repetitive difficulties with an airport to Airbus (Customer Services/Engineering services/Navigation Systems).
The update of the TERRAIN database can be done on board using a PC card (PCMCIA) for EGPWS or Compact Flash Card (CF Card) for T2CAS. The procedure is described in the relevant vendor technical publication and is included in the AMM 34-48-00 for EGPWS and 34-43-00 for T2CAS in Pages Block 301 (Servicing).

Copy of the vendor technical publication for the latest database version can be downloaded from the internet web site:
http://www.honeywell.com/sites/aero/Egpws-Home.htm for the Honeywell EGPWS or http://www.acsscustomerservices.com/CustomerServices/ for the ACSS T2CAS.

As the upgrade of the database can be done by the operators at any time, Airbus relies on the operators to make sure that their flight operations / flight crews are informed of the possible nuisance warnings linked to outdated database versions.

Airbus recommends that the latest database be loaded into the TAWS computer as soon as it is available. This is to avoid spurious warnings that may happen at some airports. The list of airports that have been included in the Terrain database (as well as those that may cause spurious warning) can be found in the above Web sites.

6. TAWS OPTIONAL FEATURES PROPOSED BY AIRBUS

Operators may ask for the following options:

For EGPWS before PN 965-1676-001:

- ♦ Alternate lamp format and warning indication:
  - The lamp for the warning indication is labelled “PULL UP//GPWS” instead of “GPWS// G/S”.

  Note: This option became mandatory with the new EGPWS since PN 965-1676-001.

For EGPWS or T2CAS:

- ♦ Alternate audio menu:
  - TAD warnings are changed from “TERRAIN AHEAD” to “CAUTION TERRAIN” and from “TERRAIN AHEAD PULL-UP” to “TERRAIN TERRAIN PULL-UP”.
  - Alternate audio menu is also known as FAA preferred audio menu and is certified by both FAA and EASA.

- ♦ Automatic de-activation of the enhanced modes (TAD/TCF) when the FMS and/or GPS goes to a “Low Accuracy” status:
  - This option enable the automatic inhibition (equivalent of TERR set to OFF) of the enhanced modes (TAD/TCF) when the accuracy of the FMS or GPS computed position (lat/long) is below the selected RNP (Required Navigation Precision).
  - This option had been introduced with the first Single Aisle aircraft delivered with the EGPWS PN 965-0976-003-102-102.
  - This option is basic with EGPWS and T2CAS when GPS data for Lateral Position on EGPWS or Alternate Lateral Position on T2CAS are activated.

7. T2CAS STANDARD 2

7.1. T2CAS Background

The equipment manufacturer ACSS has developed a new system that combines aircraft performances based TAWS function and a TCAS function within a single box, called the T2CAS. This equipment can be installed in place (on the rack) of the current TCAS.

Airbus invites the airlines interested in this new equipment to contact Airbus Upgrade Services for any additional information concerning the T2CAS installation SBs.

7.2. T2CAS Standard 2 certification

Please refer to OIT ref. SE 999.0076/07/VHR dated 13 July 2007.

The T2CAS Standard 2 PN 9000000-11111 is proposed in standard retrofit to replace T2CAS Standard 1 PN 9000000-10110. This new standard has been strongly encouraged by EASA, so is strongly recommended by Airbus.

Please refer to the tables at the end of this document for additional information about subject Standard SBs covering the upgrade to T2CAS Standard 2.

The T2CAS Standard 2 enables to cancel the following OEBs:

- OEB167 (A320 Family)
- OEB 60 (A340)
- OEB 61 (A340-500/-600)
- OEB 54 (A330)

This modification implies only modifications on the T2CAS software.

The main improvements brought by this new T2CAS standard are:

- Improved robustness against nuisance alerts at Take-Off and Landing.
- Excessive descent rate alerting / Steep approach (A318 only).
- TAWS robustness improvement (conditional re-activation of Mode 2).
- Mode 4 improvement.
- Premature descent alerting (introduction of “Too Low Terrain” alert).
- Improvement on runway Database processing (filtering of short runways).
- Improvement of Climb Capability Prediction (accounts for wind effect).
- FLS (FMS Landing System) operations (Mode 5 inhibition).
- Cold temperature compensation.
- Improvement of TAWS availability (loss of LGCIU1, FMGC1, RA1, SFCC1 in flight become transparent for Terrain Functions).

8. SERVICE BULLETINS REVISION POLICY

Implementation of an EGPWS installation on a given aircraft model may be subject to different Airbus service bulletins, although they have the same technical content.
This is intended to shorten the revision cycle of the most frequently ordered SBs and to reduce the number of pre-mod configurations to manage in a same SB.

INSTALLATION OF THE EGPWS ON SINGLE AISLE AIRBUS AIRCRAFT (A319/A320/A321)

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
Wiring provision with connection to the CFDS	A320-34-1026	January-92	22460	MSN 0270	Basic GPWS MKV installation PN 965-0676-020
Installation of the MKV GPWC	A320-34-1042	March-92	22769	MSN 0270	
Install GPWS/GS lights (if not installed as basic)	A320-34-1169	August-98	27638	Option (BAW only)	Wiring and switches in cockpit
EGPWS system provision for Single WX radar installation	A320-34-1139 Superseded by: A320-34-1201 (A319) A320-34-1188 (A320) A320-34-1204 (A321)	July-97 July-99 December-99 December-99	26100	A320 MSN 1134 A321 MSN 1144 A319 MSN 1135	Wiring modification / GPWC MKV installed
EGPWS system provision adaptation for Dual WX radar installation	A320-34-1165	October-98	26527		Additional wiring for dual WX radar
EGPWS Complete wiring provision for Single WX radar installation	A320-34-1145 Superseded by: A320-34-1202 (A319) A320-34-1189 (A320) A320-34-1197 (A321)	December-97 December-99 June-99 December-99	26190		EGPWC 965-0976-003-102-102 (Not QFE capable) Enhanced modes (TCF/TAD) enabled (Not allowed for QFE operations), and automatic deselection by the FMS. (Requires installation of SSFDR 128 W/S)
EGPWS Complete wiring provision for Dual WX radar installation			26528	A320 MSN 1134 A321 MSN 1144 A319 MSN 1135	
Installation of the EGPWC -102-102			26489 (SFE) 26525 (BFE)		
Activation of the Enhanced functions			26526		

INSTALLATION OF THE EGPWS ON SINGLE AISLE AIRBUS AIRCRAFT (A319/A320/A321) *(cont'd)*

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
Modify EGPWS warning indications and lamp format	A320-34-1168	October-98	26935	A320 MSN 2068 (Dec-03) A321 MSN 2021 (Dec-03) A319 MSN 2019 (Nov-03) A318 MSN 1660 (Mar-03)	Mandatory since the EGPWS PN 965-1676-001. Note: MOD 26935 is included in SB A320-34-1278 For the installation of EGPWS PN 965-1676-001
Adapt EGPWC pin programming to the aircraft configuration and airline options	A320-34-1173 Superseded by: A320-34-1203 (A319) A320-34-1190 (A320) A320-34-1205 (A321)	September-98 December-99 Jun-99 December-99	27821 27046	Associated with Mod 26526	Pin program to adapt the EGPWS to aircraft configuration (PWS, QFE/QNH) and airline options (Audio menu, etc.)
Install EGPWC PN 206-206 and inhibit automatic deselection of enhanced functions.	A320-34-1193	August-99	28244	A320 MSN 1134 A321 MSN 1144 A319 MSN 1135 Basic on A318	EGPWC PN 965-0976-003-206-206 with QFE capability and manual deselection of enhanced modes (TAD/TCF)
Activate automatic deselection of the enhanced modes	A320-34-1233	November 2000	30170	Option	See § 6

NEW EGPWS AND ASSOCIATED OPTIONS FOR SINGLE AISLE AIRBUS AIRCRAFT

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
EGPWS PN 965-1676-001	A320-34-1278 *	September 2003 then standardized in May 2006	31374	A320 MSN 2068 (Dec-03) A321 MSN 2021 (Dec-03) A319 MSN 2019 (Nov-03) A318 MSN 1660 (Mar-03)	Former EGPWS Standard.
EGPWS PN 965-1676-002	A320-34-1345 *	May 2006	34634	A320 MSN 2835 (Jun-06) A321 MSN 2868 (Aug-06) A319 MSN 2866 (Jul-06) A318 MSN 2910 (Sept-06)	New EGPWS Standard. Evolution of PN 965-1676-001 capable of using GPS data for Lateral position, and accommodating Peaks and Obstacles functions to EIS 1 and EIS2 display system.
GEOMETRIC ALTITUDE	A320-34-1351 *	Nov 2004	31426	A320 MSN 2376 (Mar-05) A321 MSN 2410 (Apr-05) A319 MSN 2446 (Mar-05) A318 MSN 2523 (Sept-05)	<u>PN 965-1676-001:</u> GPS sensor required (MMR) & Hybrid ADIRU required <u>PN 965-1676-002:</u> Standard in production and retrofit and available with.GPS sensor (MMR or GPSSU) & ADIRU in hybrid or autonomous configuration
PEAKS	A320-34-1345 *	May 2006	31367	A320 MSN 2835 (Jun-06) A321 MSN 2868 (Aug-06) A319 MSN 2866 (Jul-06) A318 MSN 2910 (Sept-06)	<u>PN 965-1676-001:</u> option available with EIS 2 system only. <u>PN 965-1676-002:</u> Standard in production and in retrofit, and available with EIS 1 or EIS 2 systems.
OBSTACLES	A320-34-1345 *	May 2006	31375	A320 MSN 2835 (Jun-06) A321 MSN 2868 (Aug-06) A319 MSN 2866 (Jul-06) A318 MSN 2910 (Sept-06)	<u>PN 965-1676-001:</u> option available with EIS 2 system only. <u>PN 965-1676-002:</u> Standard in production and in retrofit, and available with EIS 1 or EIS 2 systems.
Use of GPS Data for Lateral position	A320-34-1352 *	May 2006	34825	A320 MSN 2835 (Jun-06) A321 MSN 2868 (Aug-06) A319 MSN 2866 (Jul-06) A318 MSN 2910 (Sept-06)	Standard in production and retrofit with EGPWS PN 965-1676-002 if aircraft equipped with GPS Sensor (MMR or GPSSU).

<u>Note:</u> SBs marked with * are part of the Airbus Standard offer for installing EGPWS PN 965-1676-002 and associated new functions – please refer to § 4.3.

INSTALLATION OF THE T2CAS ON SINGLE AISLE AIRBUS AIRCRAFT (A319/A320/A321)

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
Wiring Provisions for T2CAS with Single Weather Radar architecture (GPWC basis)	A320-34-1285	April 2004	33485	SB only	Wiring modifications to adapt GPWS basic installation and Single WXR architecture to T2CAS installation.
Wiring Provisions for T2CAS with Dual Weather Radar architecture (GPWC basis)	A320-34-1288	April 2004	33486	SB only	Wiring modifications to adapt GPWS basic installation and Dual WXR architecture to T2CAS installation.
Install T2CAS Standard 1 PN 900000-10110 for aircraft with GPWS basis	A320-34-1293	March 2005	34637	A320 MSN 2509 (Aug-05) A319 MSN 2568 (Oct-05) A318 MSN 2910 (Oct-06)	T2CAS Standard 1 installed after SB A320-34-1285 or A320-34-1288.
Install T2CAS Standard 1 PN 900000-10110 for aircraft with EGPWS basis	A320-34-1312	June 2005	34637	A320 MSN 2509 (Aug-05) A319 MSN 2568 (Oct-05) A318 MSN 2910 (Oct-06)	T2CAS Standard 1 installed on EGPWS provisions.
Activate Alternate Vertical Position and Alternate Lateral Position based on GPS (MMR)	A320-34-1370*	Feb 2007	35212 35350 35351 35352	A320 MSN 2509 (Aug-05) A319 MSN 2568 (Oct-05) A318 MSN 2910 (Oct-06)	Standard in production and retrofit with T2CAS if aircraft equipped with GPS Sensor (MMR). Includes Automatic Deselection of the Terrain Modes if low Nav accuracy (GPS and FMS) – see § 6.
Install T2CAS Standard 2 PN 900000-11111	A320-34-1365	June 2007	36627	A318 MSN 3238 (Sept-07) A320 MSN 3256 (Oct-07) A321 MSN 3274 (Oct-07) A319 MSN 3346 (Jan-08)	Improved version of T2CAS Standard 1 Strongly encouraged by EASA so strongly recommended by Airbus. Standard in production and retrofit.

Note: SBs marked with ***** are part of the Airbus Standard offer for GPS position based functions on T2CAS– please refer to § 4.4.

INSTALLATION OF THE EGPWS ON LONG RANGE AIRBUS AIRCRAFT (A330, A340)

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
Basic "Classic" GPWS installation	N/A	N/A	40486 (BFE)	ALL MSN<168	GPWS MKV basic installation
			44800 (SFE)	ALL MSN=>168	
System provision for EGPWS	A330-34-3085 or A330-34-3105 A340-34-4075 or A340-34-4115	September-99 January 2002 Jun-99 March 2002	45847 46272	MSN 214 (March-98)	Wiring change/ GPWC MKV installed
Complete wiring provision for the EGPWS (Enhanced functions inhibited)	A330-34-3077 or A330-34-3106 A340-34-4076 or A340-34-4116	July-99 January 2002 July-99 March 2002	46321	MSN 267 (March-99)	Basic EGPWC PN 965-976-003-206-206 With manual deselection of the enhanced modes (TAD/TCF)
Install EGPWC –206-206			46323 (BFE)		
			46322 (SFE)	MSN 269 (April-99)	
Activation of the Enhanced function			46324	MSN 267 (March-99)	
Modify EGPWS warning indications and lamp format	A330-34-3149 A340-34-4133	September 04 July 2003	47241	A330 MSN 570 (Jan-04) A340 MSN 585 (Mar-04) A340-500 MSN 606 (Nov-04) A340-600 MSN 482 (Dec-03)	Mandatory since the EGPWS PN 965-1676-001.
Activate automatic deselection of the enhanced modes	A340-34-4102	October 2000	48121	option	See § 6

NEW EGPWS AND ASSOCIATED OPTIONS FOR LONG RANGE AIRBUS AIRCRAFT

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
EGPWS PN 965-1676-001	A330-34-3148 A340-34-4126 A340-34-5036	August 2003	48834	A330 MSN 496 (Oct-02) A340 MSN 538 (Jun-03) A340-500 MSN 445 (Jul-04) A340-600 MSN 371 (Aug-03)	Former EGPWS Standard.
EGPWS PN 965-1676-002	A330-34-3184 * A340-34-4171 * A340-34-5041 *	May 2006	52349	A330 MSN 713 (Fev-06) A340 MSN 835 (Apr-07) A340-500 MSN 775 (Apr-07) A340-600 MSN 736 (Fev-06)	New EGPWS Standard. Evolution of PN 965-1676-001 capable of using GPS data for Lateral position, and accommodating Peaks and Obstacles functions to EIS 1 and EIS2 display system.
GEOMETRIC ALTITUDE	A340-34-4127 Superseded by: A330-34-3187 * A340-34-4175 * A340-34-5043 *	April 2002 May 2006	48586	A330 MSN 496 (Oct-02) A340 MSN 538 (Jun-03) A340-500 MSN 478 (Dec-03) A340-600 MSN 371 (Aug-03)	PN 965-1676-001: GPS sensor required (MMR) & Hybrid ADIRU required PN 965-1676-002: Standard in production and retrofit and available with.GPS sensor (MMR or GPSSU) & ADIRU in hybrid or autonomous configuration
PEAKS	A330-34-3186 * A340-34-4174 * A340-34-5042 *	May 2006	48968	A330 MSN 496 (Oct-02) A340 MSN 538 (Jun-03) A340-500 MSN 478 (Dec-03) A340-600 MSN 371 (Aug-03)	PN 965-1676-001: option available with EIS 2 system only. PN 965-1676-002: Standard in production and in retrofit, and available with EIS 1 or EIS 2 systems.
OBSTACLES	A330-34-3186 * A340-34-4174 * A340-34-5042 *	May 2006	49026	A330 MSN 496 (Oct-02) A340 MSN 538 (Jun-03) A340-500 MSN 478 (Dec-03) A340-600 MSN 371 (Aug-03)	PN 965-1676-001: option available with EIS 2 system only. PN 965-1676-002: Standard in production and in retrofit, and available with EIS 1 or EIS 2 systems.
Use of GPS Data for Lateral position	A330-34-3188 * A340-34-4176 * A340-34-5044 *	May 2006	53919	A330 MSN 713 (Fev-06) A340 MSN 835 (Apr-07) A340-500 MSN 775 (Apr-07) A340-600 MSN 736 (Fev-06)	Standard in production and retrofit with EGPWS PN 965-1676-002 if aircraft equipped with GPS Sensor (MMR or GPSSU).

Note: SBs marked with * are part of the Airbus Standard offer for installing EGPWS PN 965-1676-002 and associated new functions – please refer to § 4.3.

INSTALLATION OF THE T2CAS ON LONG RANGE AIRBUS AIRCRAFT (A330, A340)

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
Wiring Provisions for T2CAS (GPWS Basis)	A330-34-TBD (pending RFC/RMO) A340-34-4152	August 2004	53334	SB only	Wiring modifications to adapt GPWS basic installation to T2CAS installation.
Wiring Provisions for T2CAS (EGPWS Basis)	A330-34-3160 A340-34-4151	April 2004	52476	SB only	Wiring modifications to adapt EGPWS basic installation to T2CAS installation.
Install T2CAS Standard 1 PN 900000-10110 for aircraft with GPWS basis	A330-34-TBD (pending RFC/RMO) A340-34-4153	April 2005	52992	A330 MSN 658 (May-05) A340 MSN 793 (Nov-06) A340-500 MSN 748 (Aug-06) A340-600 MSN 715 (Aug-06)	T2CAS Standard 1 installed on GPWS provisions.
Install T2CAS Standard 1 PN 900000-10110 for aircraft with EGPWS basis	A330-34-3174 A340-34-TBD (pending RFC/RMO)	Oct 2005	52992	A330 MSN 658 (May-05) A340 MSN 793 (Nov-06) A340-500 MSN 748 (Aug-06) A340-600 MSN 715 (Aug-06)	T2CAS Standard 1 installed on EGPWS provisions.
Activate Alternate Vertical Position and Alternate Lateral Position based on GPS (MMR)	A330-34-3195* A340-34-4184*	Feb 2007	54273 54274 54275	A330 MSN 658 (May-05) A340 MSN 793 (Nov-06) A340-500 MSN 748 (Aug-06) A340-600 MSN 715 (Aug-06)	Standard in production and retrofit with T2CAS if aircraft equipped with GPS Sensor (MMR). Includes Automatic Deselection of the Terrain Modes if low Nav accuracy (GPS and FMS) – see § 6.
Install T2CAS Standard 2 PN 900000-11111	A330-34-3194 A340-34-4183 A340-34-5051	July 2007	55491	A330 MSN 868 (Sept-07) A340-600 MSN 856 (Nov-07)	Improved version of T2CAS Standard 1 Strongly encouraged by EASA so strongly recommended by Airbus. Standard in production and retrofit.

Note: SBs marked with ***** are part of the Airbus Standard offer for GPS position based functions on T2CAS– please refer to § 4.4.

INSTALLATION OF THE EGPWS ON WIDE BODY AIRBUS AIRCRAFT (A300-600, A310)

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
“Classic” GPWS MKV installation	A310-34-2085 A300-600-34-6044	June-92	8960	MSN 691 (October 1991)	Standard classic GPWS installation
Install EGPWC –202-202 with enhanced modes disabled	none		11893		EGPWC PN 965-976-003-202-202 (Superseded by –206-206)
System provision for EGPWS on “Long cockpit” aircraft	A300-600-34-6144	Mid 2002	TBD	SB only	Takes into account long cockpit configuration (2VU, different wiring)
System provision for EGPWS on “short cockpit” a/c	A300-600-34-6125 A310-34-2162	December-99 March 2001 August 2001	11811	Optional from MSN 706 (June 1998)	Wiring modification with GPWC MKV installed
Complete wiring provision for EGPWS	A300-600-34-6126 A310-34-2163	December-99 April 2001	11892		Installation of EGPWS –206-206 with enhanced modes disabled.
Install –206-206 SFE standard EGPWC			12160		
Install –202-202 as BFE			12161		
Manual deselection of the Enhanced modes	A310-34-2144 A300-600-34-6127	January-99 December-99	12062		Activation of the enhanced modes in manual deselection configuration.
Activate the "Enhanced" Functions			11894		
Activate automatic deselection of the enhanced modes	A300-600-34-6127 A310-34-2169	October 2000 September 2001	12335	Optional	
Modify EGPWS warning indications and lamp format	Included in A310-34-2188 And A300-34-6175	July 2003 May 2006	12784	Associated with dedicated SBs	Mandatory since the EGPWS PN 965-1676-001. Note: MOD 12784 is included in SBs for the installation of EGPWS PN 965-1676-001 on Wide Body aircraft

A300B2/B4: Airbus does not plan to develop a Service Bulletin for the EGPWS. The operators may wish to go for a STC solution.

NEW EGPWS AND ASSOCIATED OPTIONS FOR WIDE BODY AIRBUS AIRCRAFT

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
EGPWS PN 965-1676-001	A300-34-6175 * A310-34-2188 *	May 2006 October 2003 then std in May 06	12523	A300-600 MSN 823 (Aug-04)	Former EGPWS Standard
EGPWS PN 965-1676-002	A300-34-6177 * A310-34-2206 *	May 2006	13095	SB only	New EGPWS Standard. Evolution of PN 965-1676-001 capable of using GPS data for Lateral position, and accommodating Peaks and Obstacles functions to EIS 1 and EIS2 display system
GEOMETRIC ALTITUDE	A300-34-6176 * A310-34-2205 *	June 2006	12789	SB only	Standard with EGPWS PN 965-1676-002 if aircraft equipped with GPS Sensor (MMR or GPSSU).
PEAKS	A300-34-6177 * A310-34-2206 *	May 2006	13175	SB only	PN 965-1676-001: option not available. PN 965-1676-002: standard with current SGU-EFIS display system.
OBSTACLES	A300-34-6177 * A310-34-2206 *	May 2006	13174	SB only	PN 965-1676-001: option not available. PN 965-1676-002: standard with current SGU-EFIS display system.
Use of GPS Data for Lateral position	A300-34-6178 * A310-34-2207 *	June 2006	13209	SB only	Standard with EGPWS PN 965-1676-002 if aircraft equipped with GPS Sensor (MMR or GPSSU).

Note: SBs marked with * are part of the Airbus Standard offer for installing EGPWS PN 965-1676-002 and associated new functions – please refer to § 4.3.

A300B2/B4: Airbus does not plan to develop a Service Bulletin for the EGPWS. The operators may wish to go for a STC solution.

INSTALLATION OF THE T2CAS ON WIDE BODY AIRBUS AIRCRAFT (A300-600, A310)

DESCRIPTION	SERVICE BULLETIN	DATE	MOD NBR	PRODUCTION CUT-IN MSN/DATE	COMMENT
Wiring Provisions for T2CAS	A300-34-6156 A310-34-2195	October 2004	12946	SB only	Wiring provision to install the T2CAS system.
Install T2CAS Standard 1 PN 900000-10110	A300-34-6157 A310-34-2196	April 2005	12972	SB only	T2CAS Standard 1 installed on provisions from SB A330-34-6156 or A310-34-2195
Install T2CAS Standard 2 PN 900000-11111	A300-34-6173 A310-34-2203	April 2007	13160	SB only	Improved version of T2CAS Standard 1 Strongly encouraged by EASA so strongly recommended by Airbus. Standard in production and retrofit.

A300B2/B4: Airbus does not plan to develop a Service Bulletin for the T2CAS. The operators may wish to go for a STC solution.

APPENDIX 20

A300-600

SERVICE BULLETIN
REVISION TRANSMITTAL SHEET

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE
Tel : (33) 5 61 93 33 33
Telex : AIRBU 530526F
Fax : (33) 5 61 93 42 51

ATA SYSTEM : 34

TITLE : NAVIGATION - EGPWS - INSTALL ENHANCED GPWS HONEYWELL PN 965-1676-002 AND ACTIVATE PEAKS / OBSTACLE FUNCTIONS OF EGPWS.

MODIFICATION No. : 13095S22586, 13174S22617, 13175S22618

This page transmits Revision No. 02 of Service Bulletin No. A300-34-6177.

ADDITIONAL WORK

No additional work is required by this revision for aircraft modified by any previous issue.

REASON

Revision No. 02 issued to extend the effectivity.

CHANGES

SUMMARY :

- EFFECTIVITY

  . Operators AAW, ABD, AMU, CES, DLH, EGN, IRA, KAC, KAL, LAA, MON, MSR, MXU, OAL, OHY, QTR, SUD, TAR and THA added.

PLANNING INFORMATION :

- EFFECTIVITY

  . Para. 1.A. :

    _ Aircraft models B4-601, B4-603, B4-605R, B4-620 and C4-620 added.

    _ Operators AAW, ABD, AMU, CES, DLH, EGN, IRA, KAC, KAL, LAA, MON, MSR, MXU, OAL, OHY, QTR, SUD, TAR and THA added.

    _ Aircraft MSN 0536, 0559, 0572, 0575, 0579, 0581, 0611, 0613, 0630, 0633, 0668, 0709, 0713 and 0715 added for operator FDX.

    _ Aircraft MSN 0533 added for operator GXY.

    _ Aircraft MSN 0602, 0617, 0621, 0637, 0641, 0670, 0679, 0683, 0703, 0711, 0724, 0729, 0730, 0737, 0740, 0753, 0770, 0783 and 0797 added for operator JAL.

_ Effectivity modified.

- REFERENCES

  . Para. 1.J. Reference to AMM 34-36-00 added.

ACCOMPLISHMENT INSTRUCTIONS :

- TESTS

  . Para. 3.C. Close-up Paragraph added.

FILING INSTRUCTIONS

This Service Bulletin has been generated electronically and is reissued as a complete document. Replace the complete document.

Put this Revision Transmittal Sheet in front of the Service Bulletin.

HISTORY OF PREVIOUS REVISIONS

Revision No. 01 issued to add aircraft MSN 0872 for operator GXY and to add aircraft MSN 0873 to 0878 for operator FDX.

REVISION SEQUENCE

ORIGINAL : Jul 21/06
REVISION No. : 01 - Nov 21/07
REVISION No. : 02 - Jun 30/08

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE
Tel : (33) 5 61 93 33 33
Telex : AIRBU 530526F
Fax : (33) 5 61 93 42 51

This summary is for information only and is not approved for modification of the aircraft

ATA SYSTEM : 34

TITLE : NAVIGATION - EGPWS - INSTALL ENHANCED GPWS HONEYWELL PN 965-1676-002 AND ACTIVATE PEAKS / OBSTACLE FUNCTIONS OF EGPWS.

MODIFICATION No. : 13095S22586, 13174S22617, 13175S22618

REASON/DESCRIPTION/OPERATIONAL CONSEQUENCES

Further to the mandatory installation of the Enhanced Ground Proximity Computer (EGPWC) per International Civil Aviation Organisation (ICAO) Annex 6 Part 1, additional customized Service Bulletin is developed to allow the implementation of additional functions linked to the AIRBUS improved solution (P/N 965-1676-002 which allows direct use of Ground Proximity System (GPS) data) on aircraft with different configurations.

This Service Bulletin installs EGPWC P/N 965-1676-002 and activates the PEAKS and OBSTACLE functions by pin programming. This Service Bulletin recommends modifying the existing EGPWC PN 965-1676-001 into P/N 965-1676-002 by means of the HONEYWELL Service Bulletin No. 965-1676-34-96.

Accomplishment of this Service Bulletin will install EGPWS P/N 965-1676-002, and activate the PEAKS and OBSTACLE functions on aircraft equipped with Symbol Generator Unit - Electronic Flight Instrument System (SGU-EFIS), Electronic Instrument System 1 (EIS 1) Cathode Ray Tube (CRT) and EIS2 Liquid Crystal Display (LCD) display systems.

The new standard P/N 965-1676-002 is capable of all functions of P/N 965-1676-001 and of the following new functions :

- Use of the GPS position preferably to FMS position (Service Bulletin No. A300-34-6178).

- Geometric altitude in hybrid and autonomous configuration (Service Bulletin No. A300-34-6176).

Improvement of the EGPWS situational awareness through the display of PEAKS (terrain always displayed whatever the altitude) and OBSTACLES (man made obstacles database) on the EGPWS terrain display.

EVALUATION TABLE			
COMPLIANCE	Recommended	CANCELS INSPECTION SB	No
POTENTIAL AD	No	A/C OPERATION AFFECTED	Yes

EVALUATION TABLE			
RELIABILITY AFFECTED	No	PAX COMFORT AFFECTED	No
COST SAVING	No	ETOPS AFFECTED	No
STRUCTURAL LIFE EXTN	No	VENDOR SB INVOLVED	Yes
KIT PRICE (USD)	No Kit		

MODIFICATION CLASSIFICATION	
MAJOR	13174S22617 13175S22618
MINOR	13095S22586

As per EASA IR 21, a minor change is one that has no appreciable effect on the mass, balance, structural strength, reliability, operational characteristics affecting the airworthiness of the product. All other changes are major changes.

EFFECTIVITY

This Service Bulletin is applicable to these operators :

AAW ABD AHK AMU CES DLH EGN FDX GXY IRA JAL KAC KAL LAA MON MSR MXU OAL OHY QTR SUD TAR THA UPS

CONCURRENT REQUIREMENTS

Accomplishment of this Service Bulletin requires the prior or simultaneous accomplishment of the following Service Bulletin(s) or the equivalent production modification(s) :

Service Bulletin No. A300-34-6175 — Mod. No. 12523S22208
Mod. No. 12784S22390

REFERENCES/REPERCUSSIONS

TFU : None

OEB : None

AOT : None

SIL : None

LIFE LIMIT : None

LINEMAINTENANCEAFFECTED : No

OTHERS : None

NATURE OF THE WORK

AIRCRAFT : YES

EQUIPMENT : YES

HARD : YES

SOFT : NO

OBRM : NO

MANPOWER

For Config. 01, on aircraft

TOTAL MANHOURS	**5.5**
ELAPSED TIME (HOURS)	**5.5**

For Config. 01, on bench

TOTAL MANHOURS	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**
ELAPSED TIME (HOURS)	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**

For Config. 02, on aircraft

TOTAL MANHOURS	**5.5**
ELAPSED TIME (HOURS)	**5.5**

For Config. 02, on bench

TOTAL MANHOURS	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**
ELAPSED TIME (HOURS)	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**

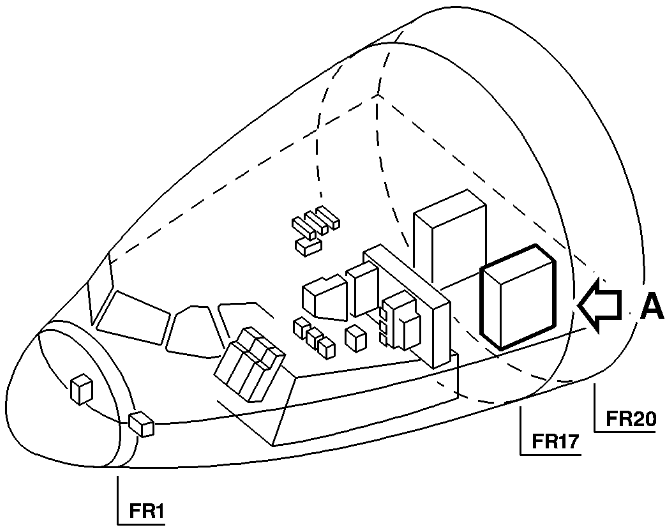
MATERIAL INFORMATION

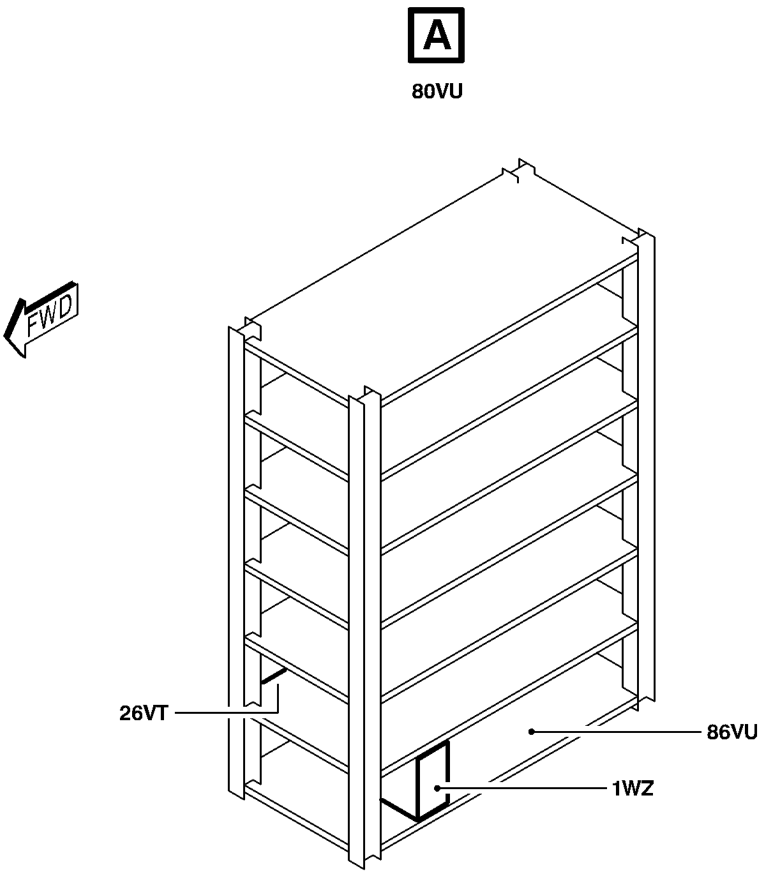
AIRCRAFT DATA

Contacts

APPENDICES

None





ASB5 346177 SU 00 d

This Page Intentionally Left Blank

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE
Tel : (33) 5 61 93 33 33
Telex : AIRBU 530526F
Fax : (33) 5 61 93 42 51

ATA SYSTEM : 34

TITLE : NAVIGATION - EGPWS - INSTALL ENHANCED GPWS HONEYWELL PN 965-1676-002 AND ACTIVATE PEAKS / OBSTACLE FUNCTIONS OF EGPWS.

MODIFICATION No. : 13095S22586, 13174S22617, 13175S22618

1. PLANNING INFORMATION

A. EFFECTIVITY

(1) Models

B4-601 B4-603 B4-605R B4-620 B4-622R C4-620 F4-605R F4-622R

(2) Aircraft

(a) Effectivity by MSN

This Service Bulletin is applicable to aircraft MSN :

0344 0354 0368 0380 0384 0391 0395 0398 0401 0405 0408 0411 0414 0464 0505 0518 0521 0525 0529 0532 0533 0536 0540 0546 0553-0561 0563 0566 0569 0572 0575 0577 0579 0581 0582 0601-0605 0607-0609 0611 0613 0614 0616-0618 0621 0623 0625 0627-0633 0635 0637 0641 0662 0664 0666 0668 0670 0673 0677 0679 0681 0683 0685 0688 0692 0694 0696 0699 0701 0703 0705 0707 0709 0711 0713 0715 0717 0719 0721-0725 0727 0729-0732 0737 0740 0741 0743 0746 0753 0754 0763 0764 0767 0770 0773 0775 0782-0788 0797 0805-0841 0845-0878

(b) Effectivity by Operator

The Operator/MSN relationship is provided for information only and is correct at the time of issue in accordance with the information available to AIRBUS. Any future changes resulting from transfer of an aircraft from one operator to another will not be reflected in this list unless the Service Bulletin is revised for another reason.

OPERATOR	MSN
AAW	0354
ABD	0529 0557
AHK	0855 0856 0857 0858 0859 0860 0870 0871
AMU	0743
CES	0521 0525 0532 0707 0725 0732 0741 0746 0754 0763
DLH	0380 0391 0401 0405 0408 0411 0414 0546 0553 0608 0618 0623 0701 0773
EGN	0555 0625
FDX	0536 0559 0572 0575 0579 0581 0611 0613 0630 0633 0668 0709 0713 0715 0873 0874 0875 0876 0877 0878
GXY	0533 0872
IRA	0632 0696 0723 0727
JAL	0602 0617 0621 0637 0641 0670 0679 0683 0703 0711 0724 0729 0730 0737 0740 0753 0770 0783 0797 0836 0837 0838
KAC	0344 0673 0694 0699 0719 0721
KAL	0582 0609 0627 0631 0662 0685 0692 0717 0722 0731
LAA	0601 0616
MON	0540 0556 0604 0605
MSR	0561 0607
MXU	0767 0788
OAL	0603
OHY	0677 0764
QTR	0554 0560 0614 0664 0688
SUD	0666 0775
TAR	0505 0558 0563
THA	0368 0384 0395 0398 0464 0518 0566 0569 0577 0628 0629 0635 0681 0705 0782 0784 0785 0786 0787

OPERATOR	MSN
UPS	0805 0806 0807 0808 0809 0810 0811 0812 0813 0814 0815 0816 0817 0818 0819 0820 0821 0822 0823 0824 0825 0826 0827 0828 0829 0830 0831 0832 0833 0834 0835 0839 0840 0841 0845 0846 0847 0848 0849 0850 0851 0852 0853 0854 0861 0862 0863 0864 0865 0866 0867 0868 0869

(c) Effectivity by MSN and Kit/Configuration

The Kits and configurations applicable to these MSNs are given at the end of this list

0344 0354 0368 0380 0384 0391 0395 0398 0401 0405 0408 0411 0414 0464 0505 0518 0521 0525 0529 0532-0533 0536 0540 0546 0553-0561 0563 0566 0569 0572 0575 0577 0579 0581-0582 0601-0605 0607-0609 0611 0613-0614 0616-0618 0621 0623 0625 0627-0633 0635 0637 0641 0662 0664 0666 0668 0670 0673 0677 0679 0681 0683 0685 0688 0692 0694 0696 0699 0701 0703 0705 0707 0709 0711 0713 0715 0717 0719 0721-0725 0727 0729-0732 0737 0740-0741 0743 0746 0753-0754 0763-0764 0767 0770 0773 0775 0782-0788 0797 0805-0835 0839-0841 0845-0878

KIT No.	QTY PER A/C	CONFIGURATION
None		01

The Kits and configurations applicable to these MSNs are given at the end of this list

0836-0838

KIT No.	QTY PER A/C	CONFIGURATION
None		02

NOTE : Config. 01 is valid for aircraft on which modification No. 12478S22162 (GENERAL - DEFINE PIN PROGRAMMING FOR JAS04 VERSION) is not embodied.

NOTE : Config. 02 is valid for aircraft on which modification No. 12478S22162 (GENERAL - DEFINE PIN PROGRAMMING FOR JAS04 VERSION) is embodied.

(3) Spares

GPWC 965-1676-001

B. <u>CONCURRENT REQUIREMENTS</u>

Accomplishment of this Service Bulletin requires the prior or simultaneous accomplishment of the following Service Bulletin(s) or the equivalent production modification(s) :

Service Bulletin No. A300-34-6175 — Mod. No. 12523S22208
Mod. No. 12784S22390

C. REASON

(1) History

Further to the mandatory installation of the Enhanced Ground Proximity Computer (EGPWC) per International Civil Aviation Organisation (ICAO) Annex 6 Part 1, additional customized Service Bulletin is developed to allow the implementation of additional functions linked to the AIRBUS improved solution (P/N 965-1676-002 which allows direct use of Ground Proximity System (GPS) data) on aircraft with different configurations.

(2) Objective/Action

This Service Bulletin installs EGPWC P/N 965-1676-002 and activates the PEAKS and OBSTACLE functions by pin programming. This Service Bulletin recommends modifying the existing EGPWC PN 965-1676-001 into P/N 965-1676-002 by means of the HONEYWELL Service Bulletin No. 965-1676-34-96.

(3) Advantages

Accomplishment of this Service Bulletin will install EGPWS P/N 965-1676-002, and activate the PEAKS and OBSTACLE functions on aircraft equipped with Symbol Generator Unit - Electronic Flight Instrument System (SGU-EFIS), Electronic Instrument System 1 (EIS 1) Cathode Ray Tube (CRT) and EIS2 Liquid Crystal Display (LCD) display systems.

The new standard P/N 965-1676-002 is capable of all functions of P/N 965-1676-001 and of the following new functions :

- Use of the GPS position preferably to FMS position (Service Bulletin No. A300-34-6178).

- Geometric altitude in hybrid and autonomous configuration (Service Bulletin No. A300-34-6176).

(4) Operational/Maintenance Consequences

Improvement of the EGPWS situational awareness through the display of PEAKS (terrain always displayed whatever the altitude) and OBSTACLES (man made obstacles database) on the EGPWS terrain display.

D. DESCRIPTION

To accomplish this Service Bulletin it is necessary to :

(1) Config. 01

(a) Modify the GPWC (FIN 1WZ) in the LH electronics rack 80VU.

(b) Modify the pin programming and the parity in the LH electronics rack 80VU.

(2) Config. 02

(a) Modify the GPWC (FIN 1WZ) in the LH electronics rack 80VU.

(b) Modify the pin programming and the parity in the LH electronics rack 80VU.

E. COMPLIANCE

(1) Classification

Recommended

(2) Accomplishment Timescale

Accomplishment of this Service Bulletin is recommended at the earliest opportunity where manpower and facilities are available.

F. APPROVAL

Approved under EASA Design Organization Approval No. EASA.21J.031.

If an aircraft listed in the effectivity has a modification or repair embodied that is not of AIRBUS origin, and which affects the content of this Service Bulletin, the operator is responsible for obtaining approval by its airworthiness authority for any adaptation necessary before incorporation of the Service Bulletin.

G. MANPOWER

The manpower estimates given in this Service Bulletin are based on the direct labor cost to do the work. These estimates assume that the work will be done by experienced personnel, and may need to be revised upwards to suit operator's circumstances. The estimates do not include the time to prepare, plan or inspect the work. Manufacture and procurement of parts and tools, drying times for paints, sealants, etc, and general administration work are also not included.

For Config. 01 , on aircraft

Get access	1.0
Replacement of the equipment in the 80VU	1.5
Modification of the wiring in the 80VU	1.5
Test	0.5
Close-up	1.0
TOTAL MANHOURS	**5.5**
ELAPSED TIME (HOURS)	**5.5**

For Config. 01 , on bench

Modification of the equipment	--
TOTAL MANHOURS	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**
ELAPSED TIME (HOURS)	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**

For Config. 02 , on aircraft

Get access	1.0
Replacement of the equipment in the 80VU	1.5
Modification of the wiring in the 80VU	1.5
Test	0.5
Close-up	1.0
TOTAL MANHOURS	**5.5**
ELAPSED TIME (HOURS)	**5.5**

For Config. 02 , on bench

Modification of the equipment	--
TOTAL MANHOURS	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**
ELAPSED TIME (HOURS)	**Refer to HONEYWELL Service Bulletin No. 965-1676-34-96**

H. **WEIGHT AND BALANCE**

Not changed

I. **ELECTRICAL LOAD DATA**

Not changed

J. **REFERENCES**

Aircraft Maintenance Manual (AMM) : 24-00-00 24-41-00 34-10-00 34-25-00 34-36-00 34-42-00 34-46-00 34-48-11 34-60-00

Elec. Std. Practices Manual (ESPM) : 20-33-00 20-55-00

Service Bulletin No. A300-34-6175

HONEYWELL Service Bulletin No. 965-1676-34-96

K. **PUBLICATIONS AFFECTED**

Aircraft Maintenance Manual (AMM) : 34-48-00

Aircraft Schematic Manual (ASM) : 34-48-00

Aircraft Wiring Manual (AWM) : 34-48-08

Illustrated Parts Catalog (IPC) : 34-48-08

Aircraft Wiring List (AWL)

Flight Crew Operating Manual (FCOM) : VOL. 1 VOL. 2

This Service Bulletin has an operational impact. Please inform AIRBUS, at least four weeks in advance, in case you need of your operational documentation to be amended by an intermediate revision prior to SB embodiment. For this purpose, please request the intermediate revision by fax, telex or mail to :

SDC3, AIRBUS - Customer Services Directorate
Fax No. (33) 5 61 93 28 06
Sita No. TLSBP7X
E-mail sb.reporting@airbus.com

These amendments will be confirmed by the next normal revision of operational documentation, once your Service Bulletin accomplishment report has been sent, as usual, to our Customer Services Directorate (SDC3).

L. INTERCHANGEABILITY/MIXABILITY

DESCRIPTION	OLD PART No.	NEW PART No.	INT	MIXABILITY
GPWC	965-1676-001	965-1676-002	02	See NOTE (01)

NOTE : For definitions of interchangeability codes in column INT. refer to ATA Common Support Data Dictionnary (CSDD), Chapter 2.

NOTE(01) The old PN can replace the new PN if :
- Using of GPS lateral position is not activated.
- PEAKS and OBSTACLE functions are not activated.

This Page Intentionally Left Blank

2. MATERIAL INFORMATION

A. MATERIAL - PRICE AND AVAILABILITY

(1) Material

Modification of removed equipment should be negotiated directly with HONEYWELL as per instructions given in Service Bulletin No. 965-1676-34-96.

(2) Price and Availability

Refer to the vendor Service Bulletin No. 965-1676-34-96 for the equipment modification sales terms.

B. INDUSTRY SUPPORT INFORMATION

Refer to the Vendor Service Bulletin (VSB) for the industry support terms.

C. LIST OF COMPONENTS

None

D. LIST OF MATERIALS - OPERATOR SUPPLIED

(1) Consumable Materials

DESCRIPTION	REFERENCE TO CML MAT No.	QTY PER A/C	INST/DISP
Contact EN3155-016M2222	None	As required	

(2) Components

ITEM	NEW PART No.	QTY	UM	KEYWORD	ITEM	OLD PART No.	INT	INST DISP
	965-1676-002	1		GPWC		965-1676-001	02	NOTE (01)

NOTE : Modification of removed equipment should be negotiated directly with HONEYWELL as per instructions given in Service Bulletin No. 965-1676-34-96.

NOTE : For definitions of interchangeability codes in column INT. refer to ATA Common Support Data Dictionnary (CSDD), Chapter 2.

E. PARTS TO BE RE-IDENTIFIED BY THE OPERATOR

None

F. TOOLING - PRICE AND AVAILABILITY

None

G. SPECIAL TOOLS

None

3. ACCOMPLISHMENT INSTRUCTIONS

A. GENERAL

WARNING : MAKE SURE THAT YOU OBEY ALL THE WARNINGS AND ALL THE CAUTIONS INCLUDED IN THE REFERENCED PROCEDURES.

CAUTION : ALWAYS OBEY THE PRECAUTIONS THAT FOLLOW TO KEEP ELECTRICAL WIRING IN A SATISFACTORY CONDITION (ELECTRICALLY AND MECHANICALLY SERVICEABLE). WHEN YOU DO MAINTENANCE WORK, REPAIRS OR MODIFICATIONS, ALWAYS KEEP ELECTRICAL WIRING, COMPONENTS AND THE WORK AREA AS CLEAN AS POSSIBLE, TO DO THIS :

- PUT PROTECTION, SUCH AS PLASTIC SHEETING, CLOTHS, ETC; AS NECESSARY ON WIRING AND COMPONENTS.
- REGULARLY REMOVE ALL SHAVINGS, UNWANTED MATERIAL AND OTHER CONTAMINATION.

THESE PRECAUTIONS WILL DECREASE THE RISK OF CONTAMINATION AND DAMAGE TO THE ELECTRICAL WIRING INSTALLATION.

IF THERE IS CONTAMINATION REFER TO ESPM 20-55-00.

(1) Preparation

(a) Config. 01

1 Make sure that the aircraft is electrically grounded (Refer to AMM 24-00-00, Page block 301).

2 Do the preparation procedure as specified in the removal/installation of the Ground Proximity Warning Computer (GPWC) (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

3 For wiring parity of the GPWC, before any disconnection, note the figure number of the hook-up chart on which line 1 corresponds to existing aircraft wiring configuration (Refer to figure 5 or figure 7).

(b) Config. 02

1 Make sure that the aircraft is electrically grounded (Refer to AMM 24-00-00, Page block 301).

2 Do the preparation procedure as specified in the removal/installation of the Ground Proximity Warning Computer (GPWC) (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

3 For wiring parity of the GPWC, before any disconnection, note the figure number of the hook-up chart on which line 1 corresponds to existing aircraft wiring configuration (Refer to figure 11 or figure 13).

(2) Standard Practices

(a) Config. 01 and Config. 02

1 Obey the instructions for the general wiring installation, refer to ESPM 20-33-00.

2 Do a continuity test of the modified wires.

B. MODIFICATION

(1) Config. 01

(a) Modify the GPWC (FIN 1WZ) in the LH electronics rack 80VU.
Refer to figure 1
Refer to AMM 34-48-11, Page block 401

NOTE : For the modification of the GPWC (FIN 1WZ), refer to HONEYWELL Service Bulletin No. 965-1676-34-96.

1 Remove :

FIN 1WZ

1	GPWC	965-1676-001

2 Install :

FIN 1WZ

1	GPWC	965-1676-002

(b) Modify the pin programming and the parity in the LH electronics rack 80VU.
Refer to figure 1
Refer to figure 2
Refer to figure 3
Refer to figure 4
Refer to figure 5
Refer to figure 6
Refer to figure 7
Refer to AMM 34-48-11, Page block 401

1 Remove the GPWC (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

2 Modify the pin programming of the GPWC (FIN 1WZ).
Refer to figure 2
Refer to figure 3

a Modify the connection of the wire shown on the lines 1 and 2 (Refer to figure 3).

NOTE : If necessary, use Contact EN3155-016M2222.

3 Modify the wiring parity of the GPWC (FIN 1WZ).
Refer to figure 4
Refer to figure 5

Refer to figure 6
Refer to figure 7

a If during accomplishment of para. 3. A. (1) (a) you noted that the existing aircraft wiring corresponded to line 1 of figure 5 :

- Modify the connection of the wire shown on the lines 1 and 2 (Refer to figure 5).

  NOTE : If necessary, use Contact EN3155-016M2222.

b If during accomplishment of para. 3. A. (1) (a) you noted that the existing aircraft wiring corresponded to line 1 of figure 7 :

- Modify the connection of the wire shown on the lines 1 and 2 (Refer to figure 7).

  NOTE : If necessary, use Contact EN3155-016M2222.

4 Install the GPWC (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

(2) Config. 02

NOTE : For the modification of the GPWC (FIN 1WZ), refer to HONEYWELL Service Bulletin No. 965-1676-34-96.

(a) Modify the GPWC (FIN 1WZ) in the LH electronics rack 80VU.
Refer to figure 1
Refer to AMM 34-48-11, Page block 401

1 Remove :

FIN 1WZ

1	GPWC	965-1676-001

2 Install :

FIN 1WZ

1	GPWC	965-1676-002

(b) Modify the pin programming and the parity in the LH electronics rack 80VU.
Refer to figure 1
Refer to figure 8
Refer to figure 9
Refer to figure 10
Refer to figure 11
Refer to figure 12
Refer to figure 13
Refer to AMM 34-48-11, Page block 401

1 Remove the GPWC (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

2 Modify the pin programming of the GPWC (FIN 1WZ).
Refer to figure 8
Refer to figure 9

a Modify the connection of the wire shown on the lines 1 and 2 (Refer to figure 9).

NOTE : If necessary, use Contact EN3155-016M2222.

3 Modify the wiring parity of the GPWC (FIN 1WZ).
Refer to figure 10
Refer to figure 11
Refer to figure 12
Refer to figure 13

a If during accomplishment of para. 3. A. (1) (b) you noted that the existing aircraft wiring corresponded to line 1 of figure 11 :

- Modify the connection of the wire shown on the lines 1 and 2 (Refer to figure 11).

NOTE : If necessary, use Contact EN3155-016M2222.

b If during accomplishment of para. 3. A. (1) (b) you noted that the existing aircraft wiring corresponded to line 1 of figure 13 :

- Modify the connection of the wire shown on the lines 1 and 2 (Refer to figure 13).

NOTE : If necessary, use Contact EN3155-016M2222.

4 Install the GPWC (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

C. TEST

(1) Config. 01 and Config. 02

(a) Do the test after the removal/installation of the Ground Proximity Warning Computer 1WZ, (Refer to AMM 34-48-11, Page block 401).

NOTE : If the SB reference is not mentioned in the last AMM operator issue do this test :

1 Operational test :

a Procedure

Refer to figure 14, Sheets 1 thru 3

Refer to figure 15

NOTE : Hydraulic pressure will be required during the level 6 test.

- Connect the electrical ground power unit and energize the aircraft electrical network (Refer to AMM 24-41-00, Page block 301).

- Make sure that the electronics racks ventilation is correct.

- Do a check that the ADC1 is energized (Refer to AMM 34-10-00, Page block 501).

- Energize the IRS1 and the IRS2 (Refer to AMM 34-25-00, Page block 501).

- Do a check that the ILS1 and the ILS2 are energized (Refer to AMM 34-46-00, Page block 501).

- Do a check that the RA1 is energized (Refer to AMM 34-42-00, Page block 501).

- Make sure that the LDG GEAR/POSITION DET/SYS1/SYS2 switch (10GA) is in the SYS2 position.

- Make sure that the NORM/FLAP OVRD/OFF switch (12WZ) is in the NORM position and guarded.

- Make sure that the FMS 1 and 2 are in operation (Refer to AMM 34-60-00, Page block 501).

- Make sure that the EFIS NDs are in a mode which supports WXR such as ARC or MAP.

- Make sure that the FAULT legend on TERR MODE pushbutton switch (31WZ) is off.

- On the center pedestal on the weather radar control panel, set the MODE selector to TEST and the SYS switch to 1.

CAUTION : BEFORE THE TEST OF THE EGPWS, MAKE SURE THAT THE BAROMETRIC CORRECTION ON THE ALTIMETER IS SET BETWEEN 22 AND 31 IN HG. IF NOT IN THIS RANGE, THE BAROMETRIC ALTITUDE IS NOT SEEN AS A VALID DATA AND THE TEST IS NOT POSSIBLE.

- Make sure that the following circuit breakers are closed :

PANEL	DESIGNATION	FIN	LOCATION
21VU	NAVIGATION GPWS/CMPTR	6WZ	B11
21VU	NAVIGATION GPWS/WARN	7WZ	B12
133VU	HYDRAULIC/L/G PROX DET/RELAYS SYS 1 AND RETRACT CTL	2GB	U51
133VU	HYDRAULIC/L/G PROX DET AND RELAYS SYS 1 FLT/GND	119GB	U52
133VU	HYDRAULIC/L/G PROX DET/RELAYS SYS 1 GEAR DOWN/CTR PNL POS IND	3GB	U53

PANEL	DESIGNATION	FIN	LOCATION
133VU	HYDRAULIC/L/G PROX DET/RELAYS SYS 2 GEAR DOWN/OVHD PNL POS IND	83GB	V51
133VU	HYDRAULIC/L/G PROX DET AND RELAYS SYS 2 FLT/GND	1GB	V52

b Self test level 1 - operations.

NOTE : The self test aural volume is 6 dB lower than the warning aural volume.

NOTE : During normal maintenance operation, the self test may be initiated via the SELF TEST switch on the face of the EGPWC.

ACTION	RESULT
1. In the flight compartment, on the panel 3VU :	In the flight compartment :
- Press and hold CAPT PULL UP/GPWS indicator light (3WZ) for less than 2 seconds.	- The FAULT legend of the GPWS annunciator (24WZ) comes on. - The FAULT legend of the TERR MODE pushbutton switch (31WZ) comes on. - The GPWS legends of the PULL UP/GPWS indicator lights (3WZ and 4WZ) come on. The aural "GLIDE SLOPE" warning is enunciated. - The aural "GLIDE SLOPE" warning stops. - The GPWS legends of the PULL UP/GPWS indicator lights (3WZ and 4WZ) go off. - The PULL UP legends of the PULL UP/GPWS indicator lights (3WZ and 4WZ) come on. - The aural "PULL UP" warning is enunciated. - The aural "PULL UP" warning stops. - The aural "TERRAIN AHEAD PULL UP or TERRAIN TERRAIN PULL UP (On FAA Audio menu Configuration)" warning is enunciated. - The ON ND legends of the TERR pushbutton switches (30WZ1 and 30WZ2) come on. - On the NDs, the terrain display self test pattern is shown after several sweeps of the terrain display. Refer to figure 15. - Make sure that square related to peaks configuration is displayed in cyan. - The PULL UP legends of the PULL UP/GPWS indicator lights (3WZ and 4WZ) go off.

ACTION	RESULT
	- The ON ND legends of the TERR pushbutton switches (30WZ1 and 30WZ2) go off. - On the NDs, the terrain display self test pattern goes off. NOTE : The terrain display can remain on for approximately 10 seconds after the legends of the TERR pushbutton switches (30WZ1 and 30WZ2) go off. - The FAULT legend of the GPWS annunciator (24WZ) goes off. - The FAULT legend of the TERR MODE pushbutton switch (31WZ) goes off.
2. On the panel 5VU, press F/O PULL UP/GPWS indicator light (4WZ) for more than 5 seconds.	The following warnings are enunciated: - GLIDE SLOPE - PULL UP - TERRAIN AHEAD PULL UP - SINK RATE - PULL UP - TERRAIN - PULL UP - DON’T SINK DON’T SINK - TOO LOW TERRAIN - TOO LOW GEAR - TOO LOW FLAPS - TOO LOW TERRAIN - GLIDE SLOPE - BANK ANGLE (if pin prog activated) - BANK ANGLE (if pin prog activated) - TOO LOW TERRAIN - TERRAIN AHEAD or CAUTION TERRAIN (On FAA Audio menu Configuration) - TERRAIN AHEAD or CAUTION TERRAIN (On FAA Audio menu Configuration)

ACTION	RESULT
	- TERRAIN AHEAD PULL UP or TERRAIN TERRAIN PULL UP (On FAA Audio menu Configuration)
	- OBSTACLE AHEAD or CAUTION OBSTACLE (on FAA Audio menu Configuration)
	- OBSTACLE AHEAD or CAUTION OBSTACLE (on FAA Audio menu Configuration)
	- OBSTACLE AHEAD PULL UP or OBSTACLE OBSTACLE PULL UP (on FAA Audio menu Configuration)

c Close-up :

- On the panel 417VU, close the safety cover of the WARNING SYS/EMER CANCEL switch and install the copper safety wire (Dia. 0.5 mm).
- Set the LDG GEAR/POSITION DET/SYS1/SYS2 switch (10GA) to the SYS1 position.
- De-energize the RA1 (Refer to AMM 34-42-00, Page block 501).
- De-energize the ILS1 and the ILS2 (Refer to AMM 34-36-00, Page block 501).
- De-energize the ADC (Refer to AMM 34-10-00, Page block 501).
- Make sure that the NORM/FLAP OVRD/OFF switch (12WZ) is in the NORM position and guarded.
- De-energize the FMS 1 and 2 (Refer to AMM 34-60-00, Page block 501).
- De-energize the aircraft electrical network and disconnect the electrical ground power unit (Refer to AMM 24-41-00, Page block 301).
- Make sure that the work areas are clean and clear of tools and other items of equipment.

D. <u>CLOSE UP</u>

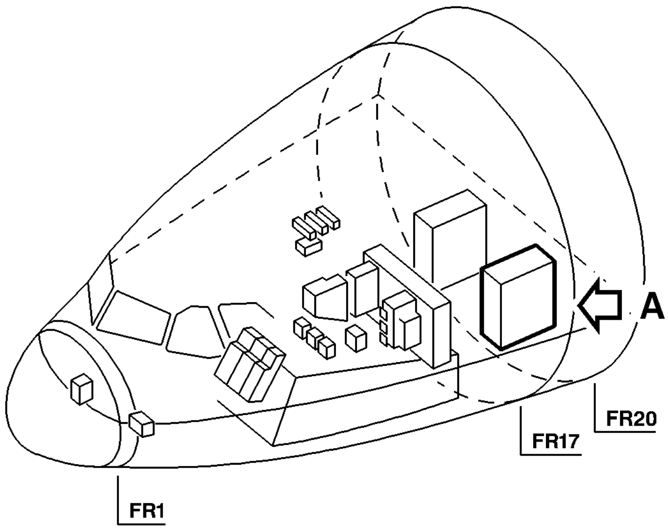
(1) Config. 01 and Config. 02

(a) Do the close-up procedure as specified in the removal/installation of the GPWC (FIN 1WZ) (Refer to AMM 34-48-11, Page block 401).

(b) Restore the systems and the aircraft to normal operating condition.

E. <u>DOCUMENTATION</u>

Write in the applicable aircraft records that you have done all the work given in the Service Bulletin.



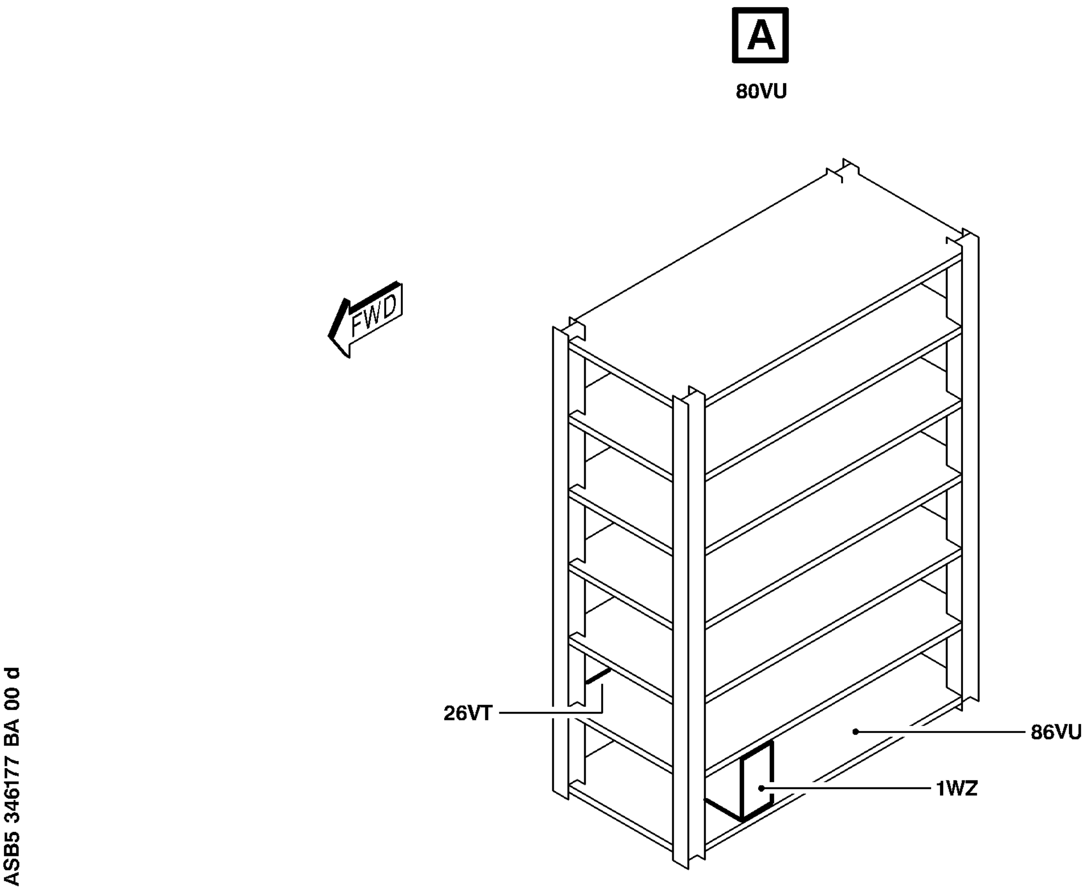
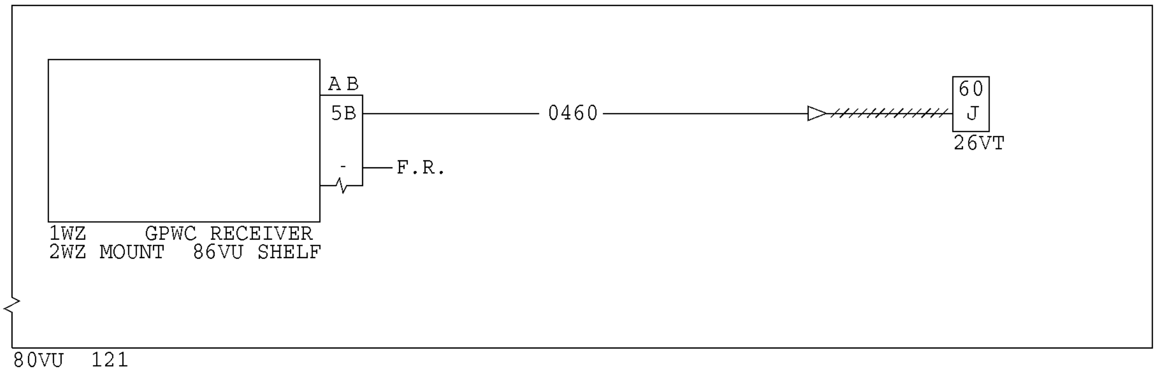
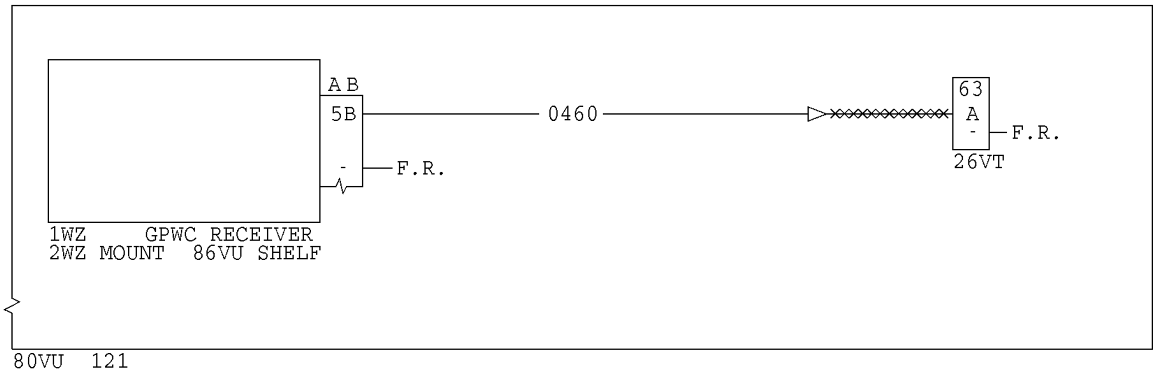


Figure 1, Sheet 1
Config. 01 and Config. 02 : Location of the Equipment

BEFORE



AFTER



OLD HOOK-UP
NEW HOOK-UP
F.R. FOR REFERENCE

NOTE : UNLESS OTHERWISE SPECIFIED PREFIX ALL WIRE IDENTIFICATION WITH ATA3448
UNLESS OTHERWISE SPECIFIED ALL WIRES ARE CF24 GAUGE
UNLESS OTHERWISE SPECIFIED ALL ROUTES ARE W1M

DB5346177AAAAA

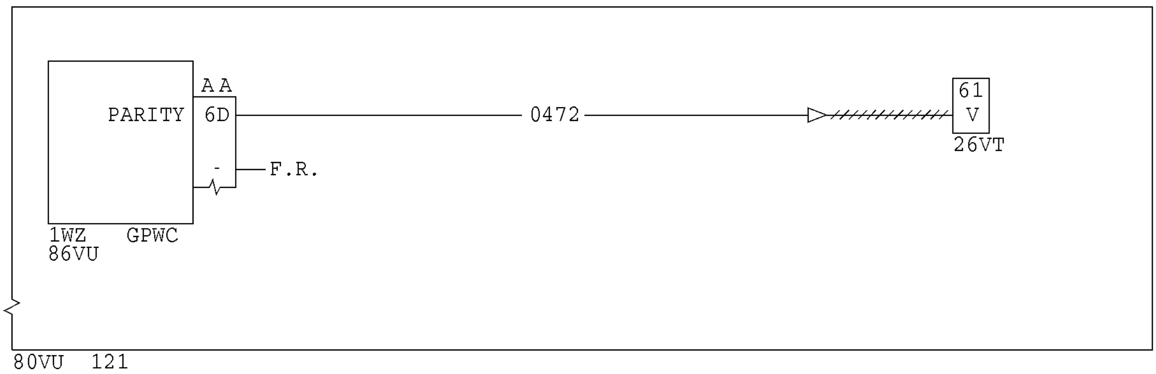
Figure 2, Sheet 1
Config. 01 : Modification of the Pin Programming Wiring

Line	END 1				LEAD						END 2				Instructions
	Zone or Panel	Elec.Ident.	Term	Terminal P/N	Wire Ident.	Co	Rte	Gauge	Length mm	Length Inch	Zone or Panel	Elec.Ident.	Term	Terminal P/N	
1	80VU	26VT	60J		3448-0460		W1M	CF24			86VU	1WZ-AB	5B		M1O
2	80VU	26VT	63A	EN3155-016M2222	3448-0460		W1M	CF24			86VU	1WZ-AB	5B		M1N
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

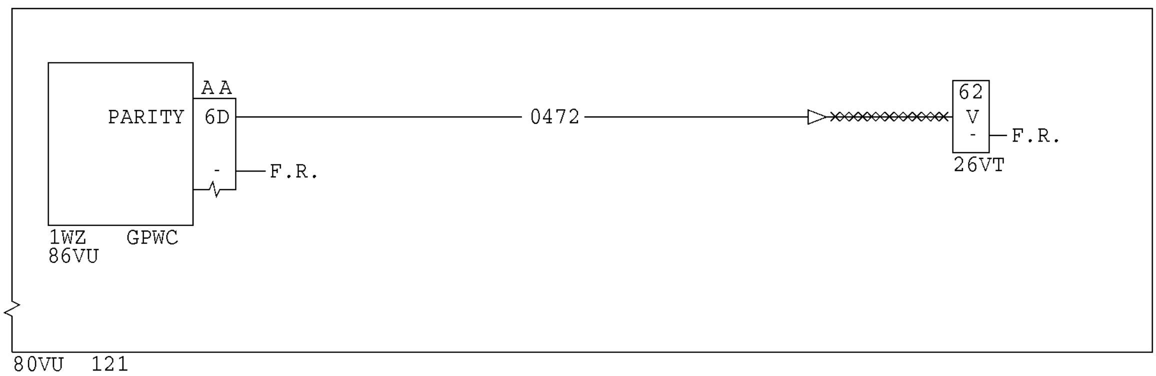
M1O = OLD HOOK-UP ON END 1
M1N = NEW HOOK-UP ON END 1

Figure 3, Sheet 1
Config. 01 : Hook-up Chart

BEFORE



AFTER



OLD HOOK-UP

NEW HOOK-UP

F.R. FOR REFERENCE

NOTE : UNLESS OTHERWISE SPECIFIED PREFIX ALL WIRE IDENTIFICATION WITH ATA3448
UNLESS OTHERWISE SPECIFIED ALL WIRES ARE CF24 GAUGE
UNLESS OTHERWISE SPECIFIED ALL ROUTES ARE W1M

DB5346177ABAAA

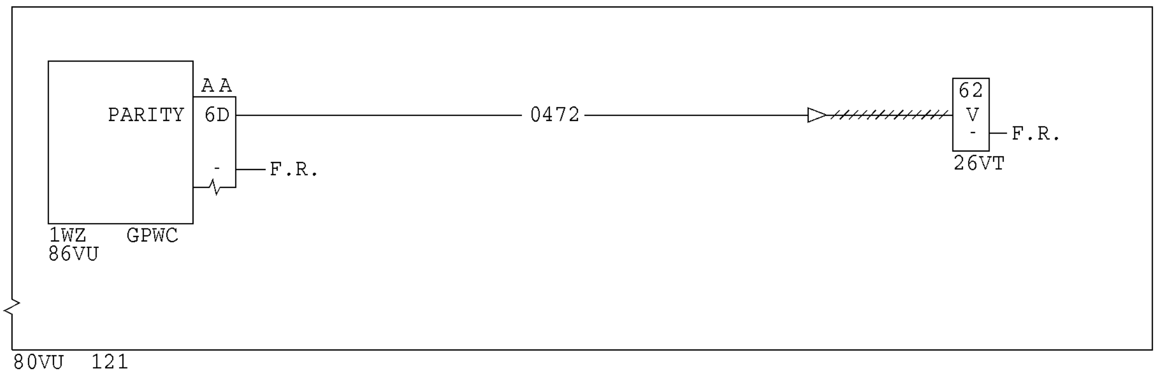
Figure 4, Sheet 1
Config. 01 : Modification of the Parity Wiring

Line	END 1				LEAD						END 2				Instructions
	Zone or Panel	Elec.Ident.	Term	Terminal P/N	Wire Ident.	Co	Rte	Gauge	Length mm	Length Inch	Zone or Panel	Elec.Ident.	Term	Terminal P/N	
1	80VU	26VT	61V		3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1O (1)
2	80VU	26VT	62V	EN3155-016M2222	3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1N
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

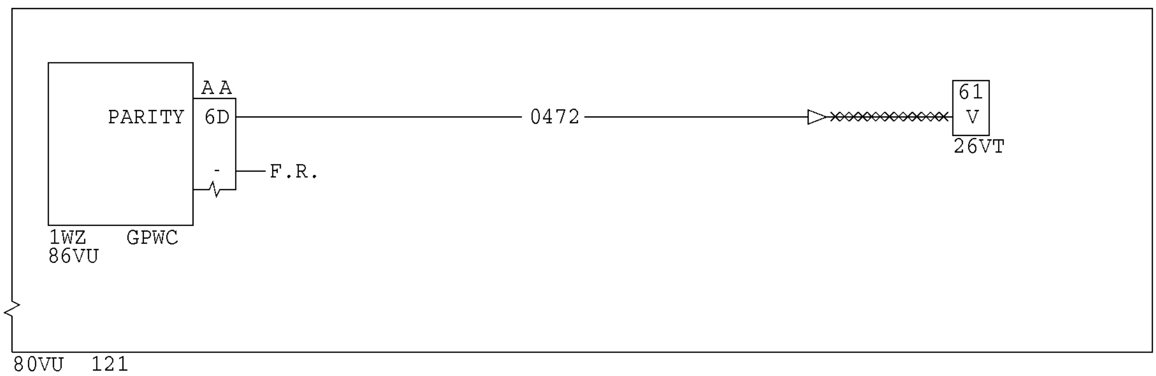
M1O = OLD HOOK-UP ON END 1
M1N = NEW HOOK-UP ON END 1
(1) = Refer to paragraph preparation for the parity

Figure 5, Sheet 1
Config. 01: Hook-up Chart

BEFORE



AFTER



OLD HOOK-UP

NEW HOOK-UP

F.R. FOR REFERENCE

NOTE : UNLESS OTHERWISE SPECIFIED PREFIX ALL WIRE IDENTIFICATION WITH ATA 3448
UNLESS OTHERWISE SPECIFIED ALL WIRES ARE CF24 GAUGE
UNLESS OTHERWISE SPECIFIED ALL ROUTES ARE W1M

DB5346177ACAAA

Figure 6, Sheet 1
Config. 01 : Modification of the Parity Wiring

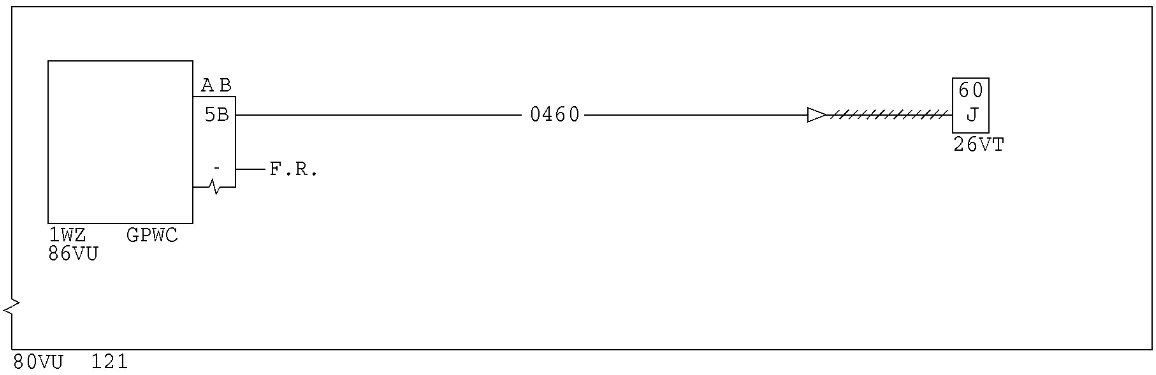
Line	END 1				LEAD						END 2				Instructions
	Zone or Panel	Elec.Ident.	Term	Terminal P/N	Wire Ident.	Co	Rte	Gauge	Length mm	Length Inch	Zone or Panel	Elec.Ident.	Term	Terminal P/N	
1	80VU	26VT	62V		3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1O (1)
2	80VU	26VT	61V	EN3155-016M2222	3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1N
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

M1O = OLD HOOK-UP ON END 1
M1N = NEW HOOK-UP ON END 1

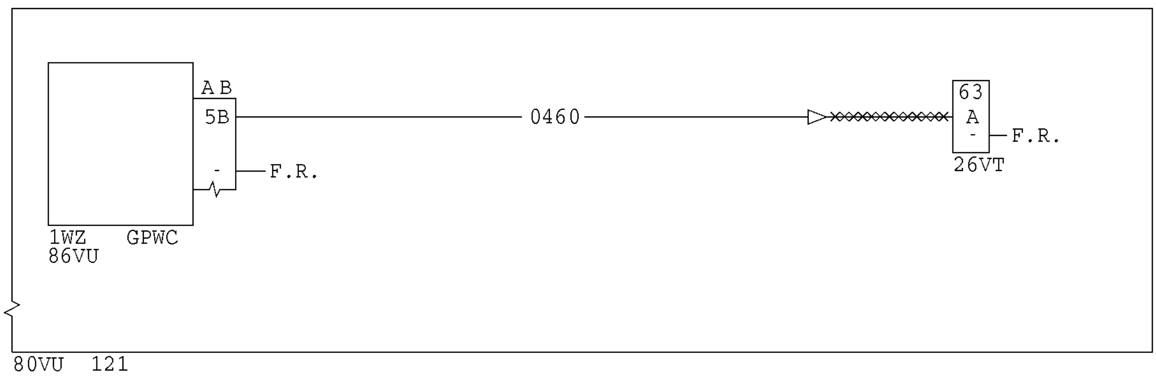
(1) = Refer to paragraph preparation for the parity

Figure 7, Sheet 1
Config. 01 : Hook-up Chart

BEFORE



AFTER



OLD HOOK-UP

NEW HOOK-UP

F.R. FOR REFERENCE

NOTE : UNLESS OTHERWISE SPECIFIED PREFIX ALL WIRE IDENTIFICATION WITH ATA3448
UNLESS OTHERWISE SPECIFIED ALL WIRES ARE CF24 GAUGE
UNLESS OTHERWISE SPECIFIED ALL ROUTES ARE W1M

DB5346177ADAAA

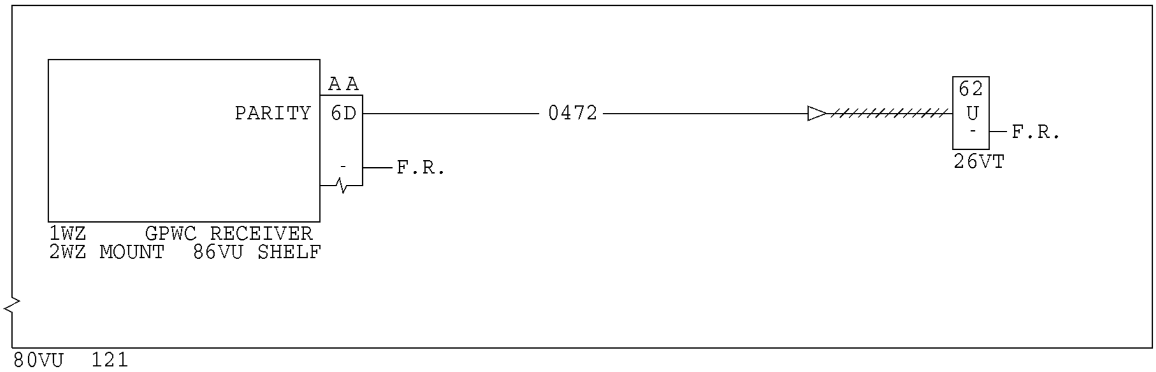
Figure 8, Sheet 1
Config. 02 : Modification of the Pin Programming Wiring

Line	END 1 Zone or Panel	END 1 Elec.Ident.	END 1 Term	END 1 Terminal P/N	LEAD Wire Ident.	LEAD Co	LEAD Rte	LEAD Gauge	LEAD Length mm	LEAD Length Inch	END 2 Zone or Panel	END 2 Elec.Ident.	END 2 Term	END 2 Terminal P/N	Instructions
1	80VU	26VT	60J		3448-0460		W1M	CF24			86VU	1WZ-AB	5B		M1O
2	80VU	26VT	63A	EN3155-016M2222	3448-0460		W1M	CF24			86VU	1WZ-AB	5B		M1N
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

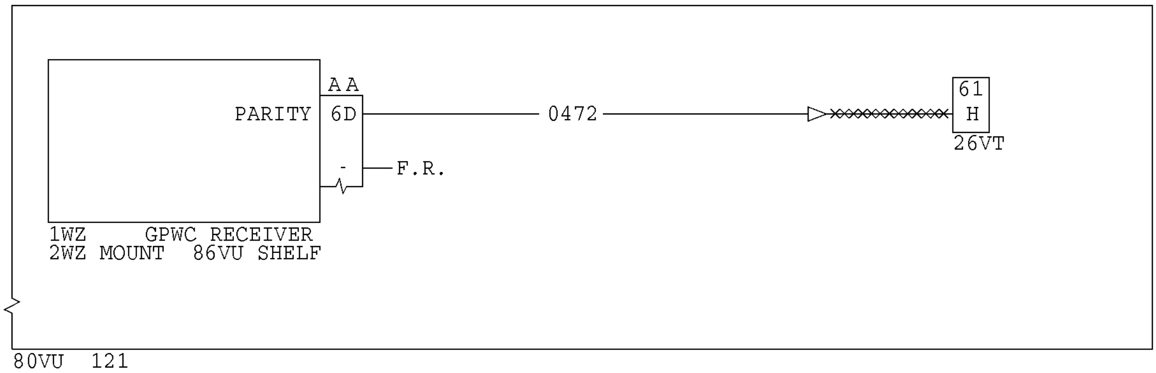
M1O = OLD HOOK-UP ON END 1
M1N = NEW HOOK-UP ON END 1

Figure 9, Sheet 1
Config. 02 : Hook-up Chart

BEFORE



AFTER



OLD HOOK-UP
NEW HOOK-UP
F.R. FOR REFERENCE

NOTE : UNLESS OTHERWISE SPECIFIED PREFIX ALL WIRE IDENTIFICATION WITH ATA3448
UNLESS OTHERWISE SPECIFIED ALL WIRES ARE CF24 GAUGE
UNLESS OTHERWISE SPECIFIED ALL ROUTES ARE W1M

DB5346177AEAAA

Figure 10, Sheet 1
Config. 02 : Modification of the Parity Wiring

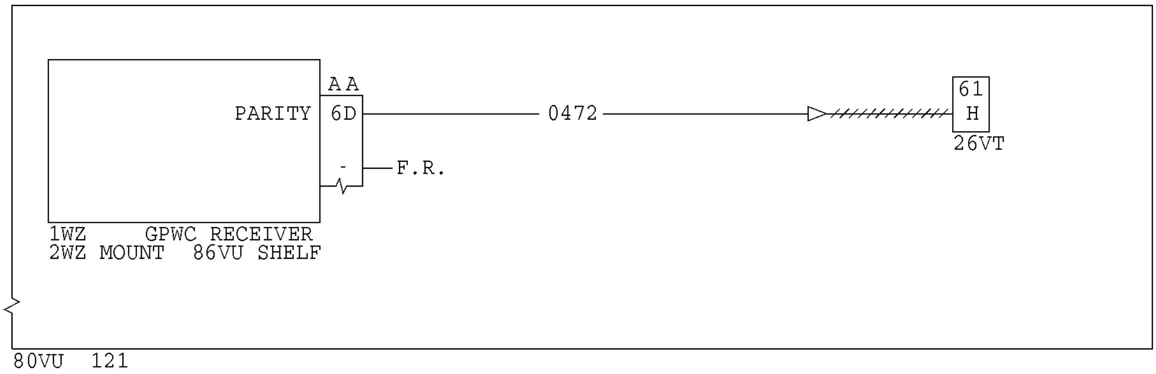
Line	END 1				LEAD						END 2				Instructions
	Zone or Panel	Elec.Ident.	Term	Terminal P/N	Wire Ident.	Co	Rte	Gauge	Length mm	Length Inch	Zone or Panel	Elec.Ident.	Term	Terminal P/N	
1	80VU	26VT	62U		3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1O (1)
2	80VU	26VT	61H	EN3155-016M2222	3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1N
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

M1O = OLD HOOK-UP ON END 1
M1N = NEW HOOK-UP ON END 1

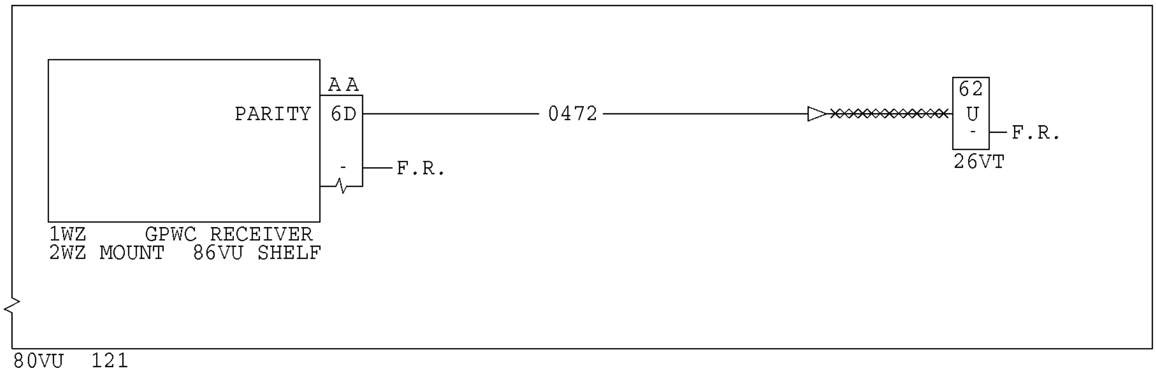
(1) = Refer to paragraph preparation for the parity

Figure 11, Sheet 1
Config. 02 : Hook-up Chart

BEFORE



AFTER



OLD HOOK-UP

NEW HOOK-UP

F.R. FOR REFERENCE

NOTE : UNLESS OTHERWISE SPECIFIED PREFIX ALL WIRE IDENTIFICATION WITH ATA3448
UNLESS OTHERWISE SPECIFIED ALL WIRES ARE CF24 GAUGE
UNLESS OTHERWISE SPECIFIED ALL ROUTES ARE W1M

DB5346177AFAAA

Figure 12, Sheet 1
Config. 02 : Modification of the Parity Wiring

Line	END 1				LEAD						END 2				Instructions
	Zone or Panel	Elec.Ident.	Term	Terminal P/N	Wire Ident.	Co	Rte	Gauge	Length mm	Length Inch	Zone or Panel	Elec.Ident.	Term	Terminal P/N	
1	80VU	26VT	61H		3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1O (1)
2	80VU	26VT	62U	EN3155-016M2222	3448-0472		W1M	CF24			86VU	1WZ-AA	6D		M1N
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

M1O = OLD HOOK-UP ON END 1
M1N = NEW HOOK-UP ON END 1

(1) = Refer to paragraph preparation for the parity

Figure 13, Sheet 1
Config. 02 : Hook-up Chart

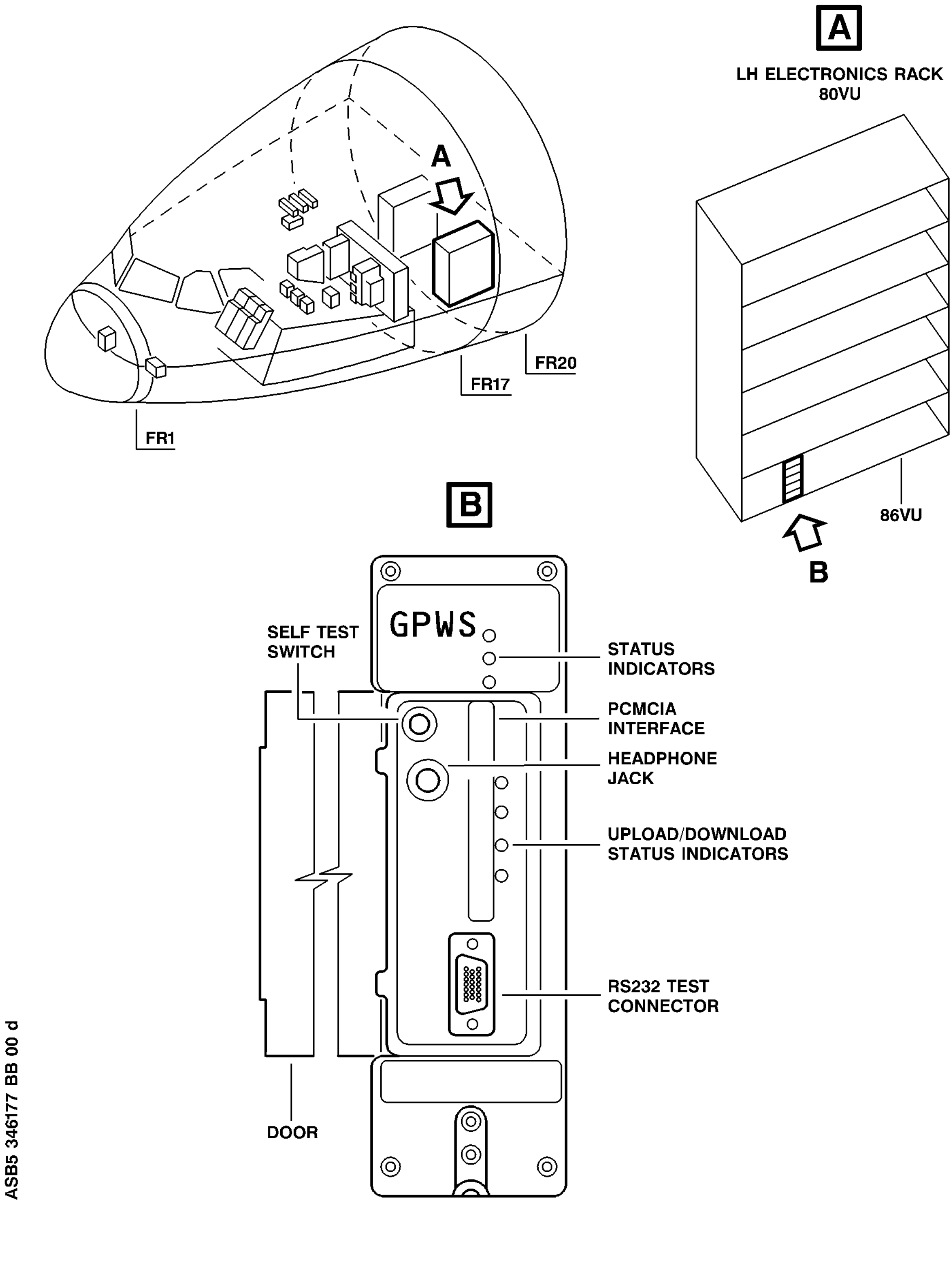
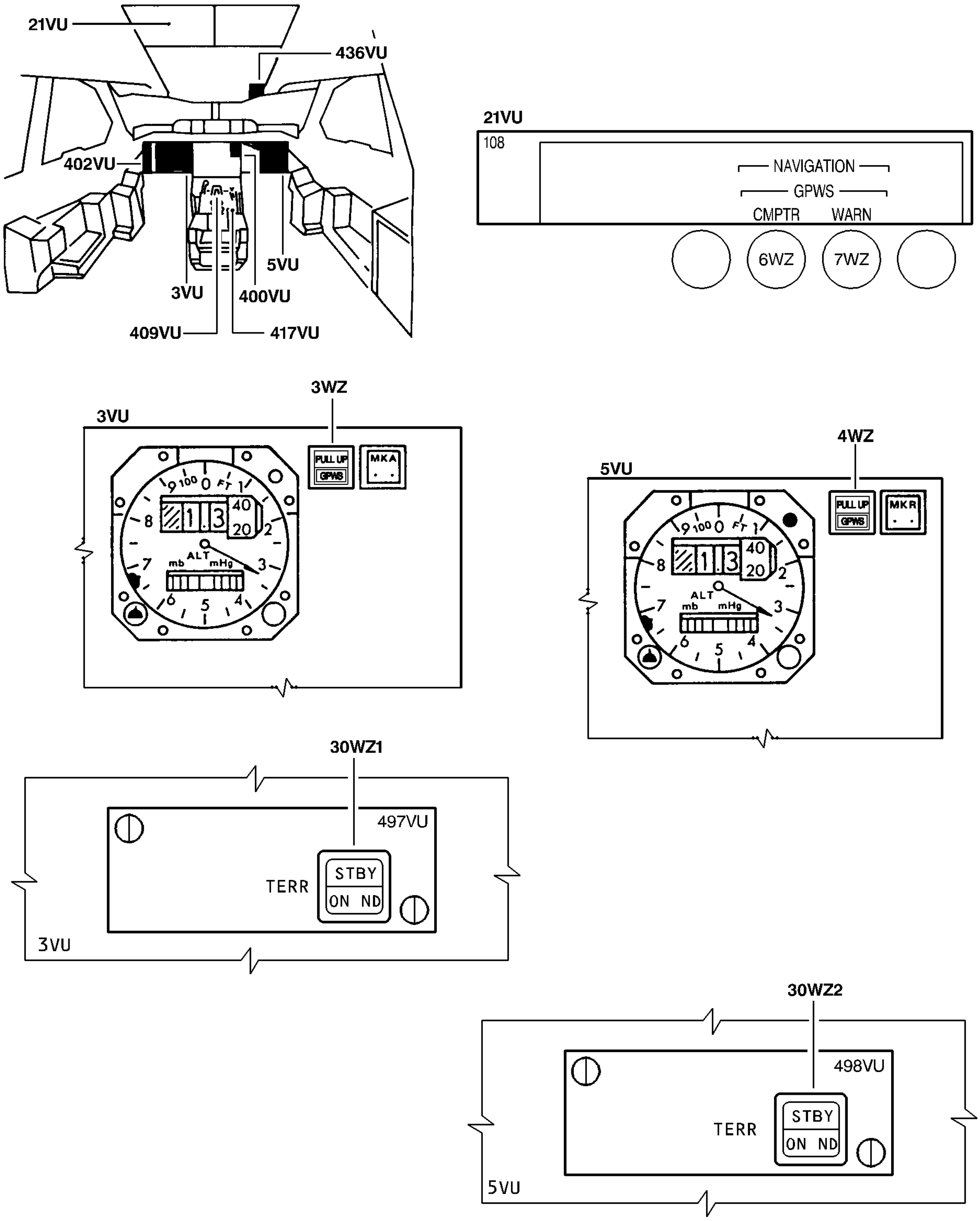
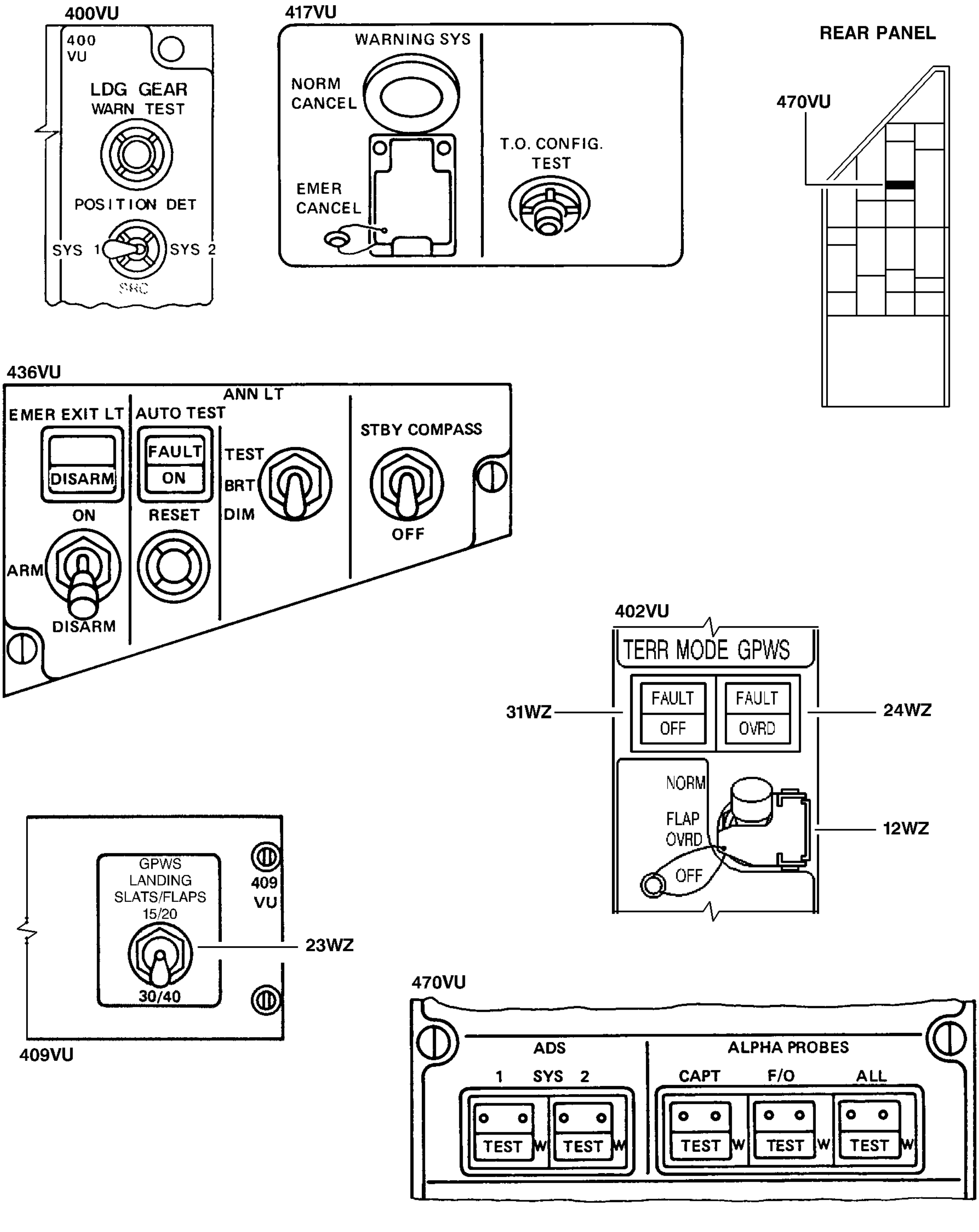


Figure 14, Sheet 1
Config. 01 and Config. 02 : EGPWS - Adjustment/Test



ASB5 346177 BC 00 d

Figure 14, Sheet 2
Config. 01 and Config. 02 : EGPWS - Adjustment/Test



ASB5 346177 BD 00 d

Figure 14, Sheet 3
Config. 01 and Config. 02 : EGPWS - Adjustment/Test

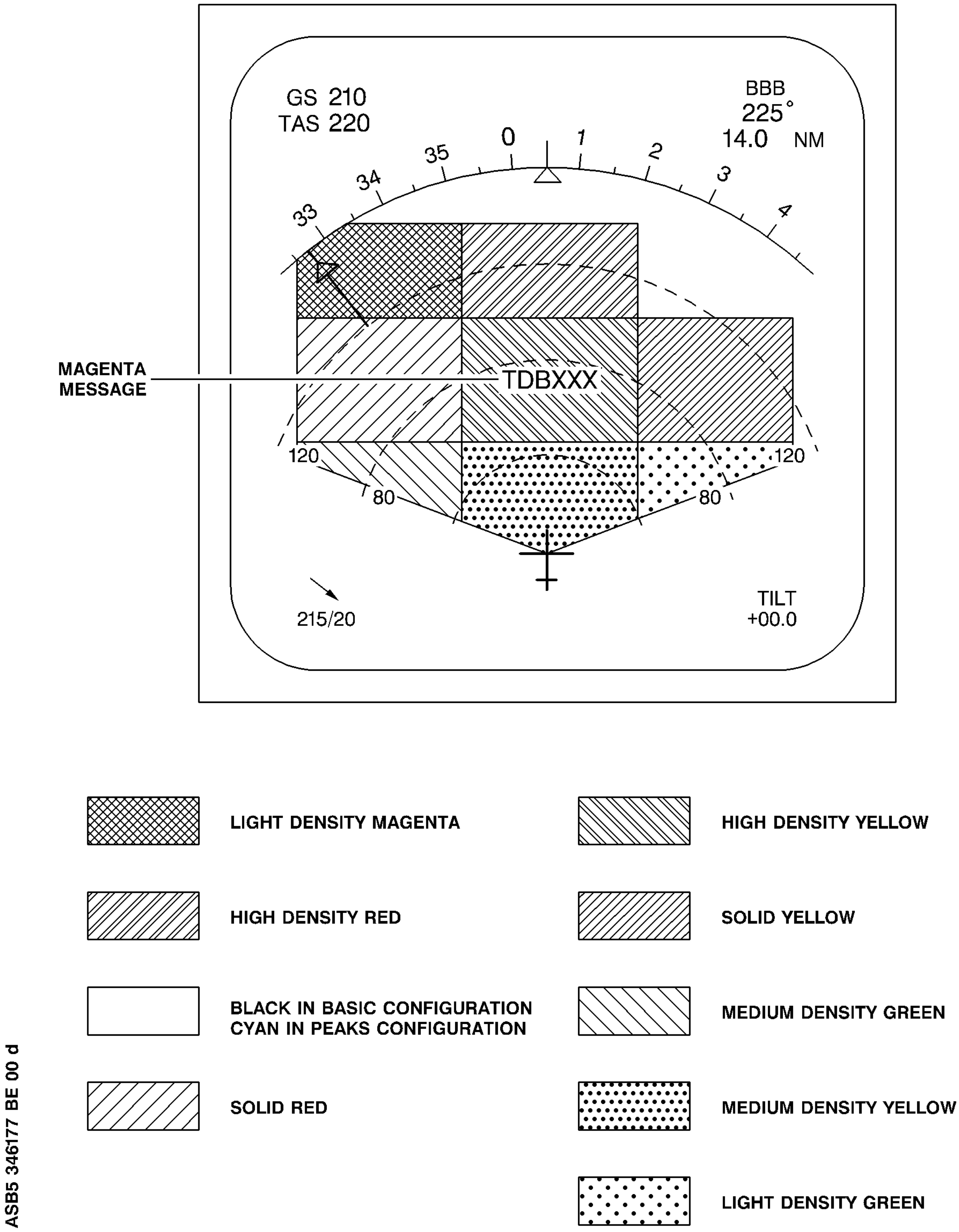


Figure 15, Sheet 1
Config. 01 and Config. 02 : EGPWS - Adjustment/Test

This Page Intentionally Left Blank

SERVICE BULLETIN
REPORTING SHEET

TITLE : NAVIGATION - EGPWS - INSTALL ENHANCED GPWS HONEYWELL PN 965-1676-002 AND ACTIVATE PEAKS / OBSTACLE FUNCTIONS OF EGPWS.

MODIFICATION No. : 13095S22586, 13174S22617, 13175S22618

Please complete the appropriate item (A or B):

A - SB WILL BE embodied .... YES/NO (if NO please comment)
If YES, aircraft concerned (as per SB effectivity by default) and planned dates (month/year) of embodiement:
....
....

B - SB HAS BEEN embodied on aircraft: ....
....
....

Operator comments: ....
....
....

From Airline: ....
Name/Title: ....
Signature:..................... Date: ....

If operational documentation is affected (see Paragraph 1.K of this SB): If information is needed prior to next normal revision or prior to SB embodiment, please indicate required service(s):
Either : Advance data... YES/NO
Or : Intermediate/Temporary revision .... YES/NO

Important Information: This SB will only be incorporated in your maintenance and operational documentation if this sheet is returned to Airbus and signed by a duly authorised representative. With the next feasible revision, this will result in

- updating of maintenance documentation to show pre and post SB data.
- updating of maintenance and operational documentation to show post SB data after embodiment.

If this SB requires previous or simultaneous accomplishment of other SBs, Airbus shall automatically include them in the manual revisions. Refer to SIL 00-037 for detailed information.

Please return this completed sheet to:

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE

Attn: SEDCC1 Technical Data and Documentation Services
FAX: (+33) 5 61 93 28 06
e-mail: sb.reporting@airbus.com
Or via your Resident Customer Support Office.

Alternatively, SB lists via letters or fax are also accepted.

SERVICE BULLETIN
REPORTING QUALITY

TITLE : NAVIGATION - EGPWS - INSTALL ENHANCED GPWS HONEYWELL PN 965-1676-002 AND ACTIVATE PEAKS / OBSTACLE FUNCTIONS OF EGPWS.

MODIFICATION No. : 13095S22586, 13174S22617, 13175S22618

Use this form to tell us what is your perception of the quality of this Service Bulletin.The reported data that you provide us will be used to analyse areas of difficulties and to take corrective action to futher improve the quality of our Service Bulletins.
We thank you for the time you have taken in completing this form.

(Please rate on a scale of 1 to 4, with 4 being the highest score)

-Quality rating of this SB	4 3 2 1
-Quality rating of the Accomplishment Instructions	4 3 2 1
-Quality rating of the Illustrations	4 3 2 1
-Is this SB easy to understand ?	Y / N

If you have had difficulties in the accomplishment of this SB please quote below the area(s) and give a short description of the issue.

Planning	Material	Instructions
X Effectivity	X Kit Content	X Preparation
X Reason	X List of Materials	X Mod/Inspection
X Manpower	Operator Supplied	X Test
X References	X Re-identification	X Close-up
X Publication	X Tooling	X Illustrations

Comments :

Operator : Date:

Name/Title :

Please return this form to:

AIRBUS
CUSTOMER SERVICES DIRECTORATE
1 Rond Point Maurice Bellonte
31707 BLAGNAC CEDEX FRANCE

Attn: SEMB Service Bulletins Management
FAX: (+33) 5 61 93 42 51
Or via your Resident Customer Support Office.

APPENDIX 21

OPERATORS INFORMATION TELEX - OPERATORS INFORMATION TELEX

TO: ALL AIRBUS OPERATORS

SUBJECT: ATA 34 - FUTURE REQUIREMENTS ON TERRAIN AWARENESS AND WARNING SYSTEM (TAWS).

OUR REF.: SE 999.0013/04/VHR DATED 05 FEB 2004

OIT CLASSIFICATION: AIRWORTHINESS, RECOMMENDATION

1. PURPOSE

THE PURPOSE OF THIS TELEX IS TO INFORM / REMIND ALL AIRBUS OPERATORS OF THE FORTHCOMING CHANGE OF REGULATIONS REGARDING THE REQUIREMENTS FOR TERRAIN AVOIDANCE WARNING SYSTEMS.

2.DESCRIPTION OF REQUIRED FUNCTIONS

THE TAWS (TERRAIN AWARENESS AND WARNING SYSTEM) IS AN IMPROVED SYSTEM OVER THE EXISTING GPWS (GROUND PROXIMITY WARNING SYSTEM). IT IS ALSO KNOWN AS THE "ENHANCED GROUND PROXIMITY WARNING SYSTEM" (EGPWS) OR "TRAFFIC AND TERRAIN COLLISION AVOIDANCE SYSTEM" (T2CAS).

TAWS IMPROVES ON EXISTING SYSTEMS BY PROVIDING THE FLIGHT CREW AUTOMATIC ADVANCED AURAL AND VISUAL DISPLAY OF IMPENDING TERRAIN, MUCH EARLIER WARNING, FORWARD LOOKING CAPABILITY, AND OPERABILITY IN LANDING CONFIGURATION. THESE IMPROVEMENTS PROVIDE MORE TIME FOR THE FLIGHT CREW TO MAKE SMOOTHER AND GRADUAL CORRECTIVE ACTION.

3. NEW REGULATIONS REQUIREMENTS

THE GPWS (TSO-C92) HAS BEEN REQUIRED BY OPERATIONAL REGULATIONS IN NEARLY ALL COUNTRIES. ALTHOUGH THIS SYSTEM HELPED TO REDUCE THE NUMBER OF "CONTROLLED FLIGHT INTO TERRAIN" ACCIDENTS, IT STILL HAS SOME LIMITATIONS. THE FAA AND JAA DETERMINED THAT EVEN MORE ACCIDENTS COULD BE AVOIDED IF THE TAWS WAS INSTALLED.

THEREFORE THE FAA AND JAA MANDATED THE TAWS (TSO-C151A) WITH THE FOLLOWING CONSEQUENCE FOR THE AIRBUS AIRCRAFT:

FAA: (REFER TO FAR 121.354) ON EVERY US REGISTERED AIRCRAFT (OR USED BY AN US OPERATOR) WITH SIX-PASSENGER SEAT (OR MORE) ARRANGEMENT.
- TAWS MANDATORY FOR THE AIRCRAFT MANUFACTURED AFTER MARCH 29, 2002
- TAWS MANDATORY AFTER MARCH 29, 2005 FOR THE AIRCRAFT MANUFACTURED ON OR BEFORE MARCH 29, 2002.

JAA: (REFER TO JAR-OPS 1.665, NPA-OPS 23)
- TAWS MANDATORY FROM 1 OCTOBER 2001 FOR A/C WITH A

CERTIFICATE OF AIRWORTHINESS ISSUED ON OR AFTER 1 OCTOBER 2001.
- TAWS MANDATORY FROM 1 JANUARY 2005 FOR AIRCRAFT WITH A CERTIFICATE OF AIRWORTHINESS ISSUED BEFORE 1 OCTOBER 2001.

4. RECOMMENDATIONS:

AS THE TAWS RETROFIT MUST BE DONE WITHIN ONE YEAR, AIRBUS HIGHLY RECOMMENDS THAT OPERATORS NEEDING TO RETROFIT THE TAWS CONTACT IMMEDIATELY AIRBUS UPGRADE SERVICES FOR A RETROFIT OFFER (VIA RFC/RMO CHANNEL). THIS WILL HELP PRODUCE THE NECESSARY KITS IN DUE TIME.

PLEASE REFER TO SIL 34-080 FOR MORE DETAILS ON THE AVAILABLE EQUIPMENTS AND ASSOCIATED AIRBUS SERVICE BULLETINS.

REMINDER: TAWS OPERATIONS ARE BASED ON THE USE OF A TERRAIN DATABASE. THIS DATABASE MUST BE KEPT UPDATED REGULARLY TO THE LATEST VERSION, TO OBTAIN THE FULL BENEFITS OF TAWS OPERATIONS. PLEASE REFER TO SIL 34-080 FOR MORE INFORMATION ON THE TERRAIN DATABASE AND ITS ASSOCIATED DOWNLOADING PROCEDURE.

5. FOLLOW-UP PLAN

NO SPECIFIC FOLLOW-UP OF THIS OIT IS PLANNED.

QUESTIONS ABOUT THE TECHNICAL CONTENT OF THIS OIT ARE TO BE ADDRESSED TO:
MR CARSTENSEN DIMITRI, SEE44 DEPT
PHONE 33 562118612
FAX 33 561934425

BEST REGARDS

P. GLAPA
VICE PRESIDENT, SYSTEMS AND POWERPLANT
ENGINEERING SERVICES
CUSTOMER SERVICES DIRECTORATE

APPENDIX 22

OIT - FOT 999.0015/04-00

OPERATORS INFORMATION TELEX - OPERATORS INFORMATION TELEX
AND
FLIGHT OPERATIONS TELEX - FLIGHT OPERATIONS TELEX

TO : ALL AIRBUS OPERATORS

SUBJECT: ATA 34 - AIRBUS POLICY CONCERNING THE USE OF GPS POSITION FOR TERRAIN AWARENESS AND WARNING SYSTEM (TAWS) OPERATIONS

OUR REF.: SE 999.0015/04/VHR DATED 05 FEB 2004

OIT CLASSIFICATION: AIRWORTHINESS, RECOMMENDATION

1. PURPOSE

THE PURPOSE OF THIS TELEX IS TO INFORM ALL AIRBUS OPERATORS OF THE NEW AIRBUS POLICY CONCERNING THE USE OF GPS POSITION FOR TAWS OPERATIONS. PLEASE NOTE THAT TAWS IS ALSO KNOWN AS EGPWS (ENHANCED GROUND PROXIMITY WARNING SYSTEM) OR T2CAS (TRAFFIC AND TERRAIN COLLISION AVOIDANCE SYSTEM).

2. DESCRIPTION OF THE USE OF GPS POSITION FOR TAWS OPERATIONS.

REMINDER:
TAWS WILL BE RENDERED MANDATORY BY JAA AND FAA EARLY 2005. FOR MORE INFORMATION ON THESE MANDATORY REQUIREMENTS AND ASSOCIATED DATES, PLEASE CONSULT OIT REF. SE 999.0013/04/VHR DATED 05 FEB 2004.

THE TAWS IS AN IMPROVED SYSTEM OVER THE EXISTING GPWS (GROUND PROXIMITY WARNING SYSTEM). TAWS IMPROVES ON EXISTING SYSTEMS BY PROVIDING THE FLIGHT CREW AUTOMATIC ADVANCED AURAL AND VISUAL DISPLAY OF IMPENDING TERRAIN, MUCH EARLIER WARNING, FORWARD LOOKING CAPABILITY, AND OPERABILITY IN LANDING CONFIGURATION. THESE IMPROVEMENTS PROVIDE MORE TIME FOR THE FLIGHT CREW TO MAKE SMOOTHER AND GRADUAL CORRECTIVE ACTION.

TO ACHIEVE THE NEW TERRAIN FUNCTIONS, THE TAWS COMPUTER USES THE AIRCRAFT POSITION TO LOCATE THE AIRCRAFT ON ITS INTERNALLY LOADED TERRAIN DATABASE. THIS AIRCRAFT POSITION IS CURRENTLY PROVIDED BY THE FLIGHT MANAGEMENT SYSTEM (FMS) THAT COMPUTES IT:

1) FROM THE ADIRUS AND GPS POSITION SOURCE FOR AIRCRAFT EQUIPPED WITH GPS SENSOR UNIT (GPSSU) OR MULTIMODE RECEIVER (MMR), WHEN GPS PRIMARY IS AVAILABLE, OR

2) FROM THE ADIRUS AND RADIO POSITION UPDATE, FOR AIRCRAFT NOT EQUIPPED WITH GPS, WHEN GROUND RADIO NAVAIDS ARE AVAILABLE, OR

3) FROM THE ADIRUS ONLY, FOR AIRCRAFT NOT EQUIPPED WITH GPS RECEIVER WHEN RADIO POSITION UPDATE IS NOT AVAILABLE

3. NEW AIRBUS POLICY

IN THE FRAME OF THE AIRBUS POLICY FOR IMPROVEMENT OF TAWS OPERATIONS, AIRBUS WOULD STRONGLY ENCOURAGE THE USE OF A GPS SOURCE IN THE GLOBAL ARCHITECTURE OF THE TAWS SYSTEM.

AS A CONSEQUENCE, AIRBUS HIGHLY RECOMMENDS TO ASSOCIATE TAWS OPERATIONS WITH THE USE OF GPS RECEIVERS, THROUGH THE INSTALLATION OF MULTIMODE RECEIVERS.

IN ADDITION, AIRBUS WILL NOT CERTIFY ANY OF THE SOLUTIONS THAT ARE USING A GPS CARD INTERNALLY INSTALLED IN THE TAWS COMPUTER.

4. RECOMMENDATIONS

4.1. TECHNICAL PROPOSAL:

IN ORDER TO HELP THE OPERATORS IN THIS APPROACH FOR TAWS OPERATIONS, AIRBUS HAS DECIDED TO PROMOTE THE INSTALLATION OF GPS RECEIVER VIA THE INSTALLATION OF MULTIMODE RECEIVERS (MMR). THIS PROMOTION IS DONE THROUGH AN ATTRACTIVE OFFER

THAT INCLUDES, IN A SAME PACKAGE:

- THE AIRBUS SERVICE BULLETINS DEDICATED TO THE COMPLETE MMR INSTALLATION
- THE SB KIT'S
- THE 2 MMRS TO BE INSTALLED (SFE)
- THE 2 GPS ANTENNAS (SFE)

AIRBUS PROPOSES THIS PACKAGE AT A COMPETITIVE PRICE, TO BE COMPARED WITH THE PRICES OF THE SIMILAR SUPPLEMENTARY TYPE CERTIFICATES (STC) AVAILABLE ON THE MARKET (E.G. THE STCS FOR INSTALLATION OF A GPS INTERNAL CARD INTO THE TAWS COMPUTER).

THE PACKAGE AND ASSOCIATED SERVICE BULLETINS HAVE TO BE REQUESTED TO AIRBUS UPGRADE SERVICES VIA RFC/RMO CHANNEL.

NOTE: FOR SOME AIRCRAFT CONFIGURATIONS, THE IMPLEMENTATION OF MMR RECEIVERS MAY NEED THE UPGRADE OF OTHER AIRCRAFT EQUIPMENT, TO TAKE FULL BENEFIT OF THE GPS AS PRIMARY MEANS OF NAVIGATION.

THE POTENTIALLY IMPACTED EQUIPMENT ARE:

- ADIRU HONEYWELL AND LITTON FOR SINGLE AISLE AND HONEYWELL FOR LONG RANGE
- CFDIU FOR SA
- CMC FOR LR
- DMC FOR SA
- SGU/ECAM AND SGU/EFIS FOR WB.

MOST OF THESE UPGRADES ARE COMMON TO THE IMPLEMENTATION OF TAWS SYSTEM OR ALREADY ADDRESSED BY WORLDWIDE FLEET RETROFIT CAMPAIGNS. ADIRUS COULD HAVE ALREADY BEEN UPGRADED FOR UPDATING MAGNETIC VARIATION DATABASE.

THE STUDIES OF THE EQUIPMENT TO BE UPGRADED WILL BE PERFORMED ACCORDING TO THE AIRCRAFT CONFIGURATION, BY AIRBUS UPGRADE SERVICES, DURING THE RFC/RMO PROCESS.

REMINDER: TAWS OPERATIONS ARE BASED ON THE USE OF A TERRAIN DATABASE. THIS DATABASE MUST BE KEPT UPDATED REGULARLY TO THE LASTEST VERSION, TO OBTAIN THE FULL BENEFITS OF TAWS OPERATIONS. PLEASE REFER TO SIL 34-080 FOR MORE INFORMATION ON THE TERRAIN DATABASE AND ITS ASSOCIATED DOWNLOADING PROCEDURE.

4.2. TECHNICAL AND OPERATIONAL BENEFITS:

THE MAIN ADVANTAGES OF THE MMR SOLUTION ARE:

- BOTH NAVIGATION AND SURVEILLANCE FUNCTIONS ARE IMPROVED, AND USE THE SAME AIRCRAFT POSITION PROVIDING HIGH NAVIGATION ACCURACY.
- A DUAL MMR ARCHITECTURE ENSURES HIGH NAVIGATION FUNCTION AVAILABILITY.
- THE MIXING BETWEEN GPS AND IRS ENSURES HIGH NAVIGATION INTEGRITY.
- MONITORING OF THE POSITION DATA COMPUTED BY GPS/IRS/FMS TO PROVIDE WARNING OF ANY DISCREPANCY.
- AIRCRAFT COMPLIANT WITH CURRENT NAVIGATION REGULATIONS WITHOUT TIME LIMITATION (RNP10, BRNAV, PRNAV).
- ANTICIPATE FUTURE REGULATIONS / POSSIBILITIES.
- MATURE SOLUTION, SEVERAL YEARS EXPERIENCE.

5. FOLLOW-UP PLAN

NO SPECIFIC FOLLOW-UP OF THIS OIT IS PLANNED.

QUESTIONS ABOUT THE TECHNICAL CONTENT OF THIS OIT ARE TO BE ADDRESSED TO:
MR CARSTENSEN DIMITRI, SEE44 DEPT
PHONE 33 562118612
FAX 33 561934425

BEST REGARDS

P. GLAPA	C. MONTEIL
VICE PRESIDENT, SYSTEMS & POWERPLANT	VICE PRESIDENT
ENGINEERING SERVICES	FLIGHT OPERATIONS
CUSTOMER SERVICES DIRECTORATE	SUPPORT AND LINE
	ASSISTANCE

APPENDIX 23

OIT - FOT 999.0050/06-00

OPERATORS INFORMATION TELEX - OPERATORS INFORMATION TELEX
AND
FLIGHT OPERATIONS TELEX - FLIGHT OPERATIONS TELEX

TO: All Airbus Operators

SUBJECT: ATA 34 AIRBUS OFFER FOR STANDARD SERVICE BULLETINS INSTALLING EGPWS PN 965-1676-002 ENABLING DIRECT USE OF GPS DATA AND ADDITIONAL NEW FUNCTIONS

OUR REF: SE 999.0050/06/VHR dated 18 April 2006

OIT/FOT CLASSIFICATION: Flight Operations / Engineering Advice

REFERENCED DOCUMENTATIONS:

- Ref.A: Airbus OIT SE 999.0015/04/VHR dated 05 February 2004
- Ref.B: Airbus Service Information Letter (SIL) 34-080

1. PURPOSE

The purpose of this telex is to inform all Airbus operators of the availability of Standard Service Bulletins installing the EGPWS (ENHANCED GROUND PROXIMITY WARNING SYSTEM) PN 965-1676-002 in place of PN 965-0976-003-206-206 or PN 965-1676-001, with the activation of EGPWS functions improving aircraft operations.
The new EGPWS PN 965-1676-002 is part of the technical answer developed in the frame of the Airbus policy concerning the use of GPS position for TAWS operations. For additional details on subject policy please refer to Ref.A OIT: "AIRBUS POLICY CONCERNING THE USE OF GPS POSITION FOR TERRAIN AWARENESS AND WARNING SYSTEM (TAWS) OPERATIONS".

2. DESCRIPTION OF THE ADVANTAGES PROVIDED BY EGPWS PN 965-1676-002 AND ASSOCIATED NEW FUNCTIONS.

For the benefit of Airbus operators, Airbus and Honeywell agreed on very attractive conditions for the conversion to EGPWS PN 965-1676-002 and the activation of the associated new functions.

The EGPWS PN 965-1676-002 can be installed in place of previous EGPWS versions, on every Airbus Aircraft Families, and provides with the following benefits:

2.1. The use of GPS data for Lateral Position instead of FMS data on aircraft equipped with a GPS sensor in the conditions described in Ref.A OIT.

Technical improvements and associated Operational benefits:
- The EGPWS can directly use the GPS data for positioning the aircraft for each Terrain function of the TAWS, i.e. Terrain Awareness and Display (TAD) and Terrain Clearance Floor (TCF), avoiding potential spurious Terrain warnings due to FMS Map-shifts or FMS positioning errors due to inaccurate Navaids (VOR/DME/ILS).
- The 5 Basic Modes of the EGPWS, also known as the GPWS part, are also improved. The modulation of the envelope protections of Modes 2 and 4 are improved thanks to the better accuracy of the GPS position.

2.2. The use of GPS data for Geometric Altitude on aircraft equipped with a GPS sensor in the conditions described in Ref.A OIT. The Geometric Altitude is a computed aircraft altitude designed to ensure optimal operations of the EGPWS Terrain functions through all phases of flight and atmospheric conditions.

Technical improvements and associated Operational benefits:
Geometric Altitude uses the GPS altitude, plus an improved pressure altitude calculation, plus Radio altitude and Terrain and Runway Elevation data to reduce or eliminate errors potentially induced in corrected barometric altitude by extreme temperatures, non-standard altitude conditions and altimeter miss sets.

2.3 The availability of Peaks and Obstacles functions for all Airbus Aircraft, equipped whether with EIS1 (CRT) or EIS2 (LCD) display systems, whereas this was limited to EIS2 equipped aircraft with the previous EGPWS standards.

Technical improvements and associated Operational benefits:
Improvement of the EGPWS situational awareness through the display of PEAKS (terrain information always displayed whatever the altitude) and OBSTACLES (man made obstacles database) on the EGPWS Terrain display,

with an associated OBSTACLE new audio warning.

This new EGPWS will also enable a fleet wide Part Number commonality whatever the aircraft various configurations, resulting in a noticeable benefit for the spares and interchangeability management.

3. AIRBUS STANDARD SERVICE BULLETINS

Airbus has developed a set of Standard Service Bulletins for every Airbus Aircraft Family, which will be sent to every operator having aircraft already equipped with EGPWS PN 965-0976-003-206-206 and PN 965-1676-001.

3.1. For the A300/A310 Family

EGPWS Computer Upgrade and activation of Peaks and Obstacles:
- SB A300-34-6175 to upgrade EGPWS 206-206 into 001
- SB A300-34-6177 to upgrade EGPWS 001 into 002 and activation of Peaks and Obstacles
- SB A310-34-2188 to upgrade EGPWS 206-206 into 001
- SB A310-34-2206 to upgrade EGPWS 001 into 002 and activation of Peaks and Obstacles

Subject Service Bulletins will be available in May 2006.

Use of GPS data for Lateral Position:
- SB A310-34-2207
- SB A300-34-6178

Subject Service Bulletins will be available in June 2006.

Geometric Altitude activation:
- SB A310-34-2205
- SB A300-34-6176

Subject Service Bulletins will be available in June 2006.

3.2. for the A320 Family

EGPWS Computer Upgrade:
- SB A320-34-1278 to upgrade EGPWS 206-206 into 001 (*)
- SB A320-34-1345 to upgrade EGPWS 001 into 002

Use of GPS data for Lateral Position:
- SB A320-34-1352

Geometric Altitude activation:
- SB A320-34-1351

Peaks and Obstacles activation:
- SB A320-34-1345

Subject Service Bulletins package will be available in May 2006, except (*) already available.

3.3. For the A330/A340 Family

EGPWS Computer Upgrade:
- SB A330-34-3184 to upgrade EGPWS 206-206 or 001 into 002
- SB A340-34-4171 to upgrade EGPWS 206-206 or 001 into 002
- SB A340-34-5041 to upgrade EGPWS 206-206 or 001 into 002

Use of GPS data for Lateral Position:
- SB A330-34-3188
- SB A340-34-4176
- SB A340-34-5044

Geometric Altitude activation:
- SB A330-34-3187
- SB A340-34-4175
- SB A340-34-5043

Peaks and Obstacles activation:
- SB A330-34-3186
- SB A340-34-4174
- SB A340-34-5042

Subject Service Bulletins package will be available in May 2006.

REMINDER: TAWS operations are based on the use of a terrain database. This database must be kept updated regularly to the latest version, to obtain the full benefits of TAWS operations. Please refer to Ref.B SIL for more information on the Terrain Database and its associated downloading procedure.

5. FOLLOW-UP PLAN

No specific follow-up of this OIT/FOT is planned.

Questions about the technical content of this OIT/FOT are to be addressed to:

Mr. Dimitri CARSTENSEN, SEE44 dept
Phone+33/(0)5 62 11 86 12
Fax +33/(0)5 61 93 44 25
E-mail: dimitri.carstensen@airbus.com

Questions about the operational content of this OIT/FOT are to be addressed to:

Mrs. Sourya KAHLOUL, STLS dept
Phone+33/(0)5 62 11 83 45
Fax +33/(0)5 61 93 29 68
E-mail: sourya.kahloul@airbus.com

Best regards,

P. GLAPAC. MONTEIL
VICE PRESIDENT, VICE PRESIDENT FLIGHT OPERATIONS
ENGINEERING SUPPORT SUPPORT & LINE ASSISTANCE
CUSTOMER SERVICES

APPENDIX 24

A300/A310 Family Operational Liaison Meeting 2006

Presented by

Marlène VUILLEMIN

A300 Flight Operations Standards
Group Manager

New TAWS features

AIRBUS

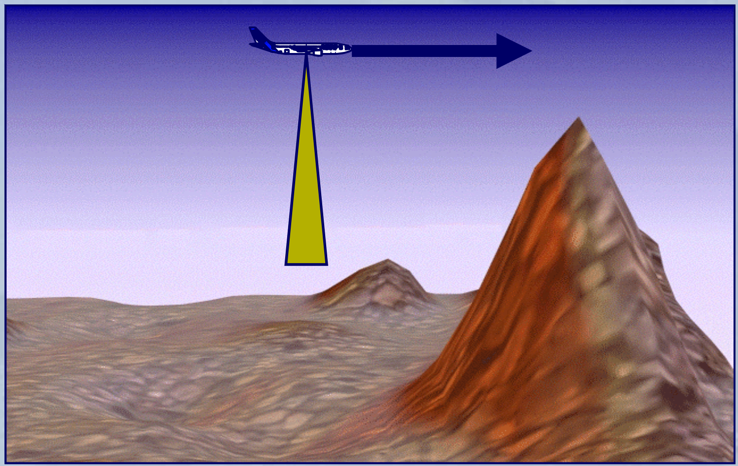
Contents

Contents

AIRBUS

What is the geometric altitude?

- A new computation for altitude
- Based on the GPS altitude
- An answer to the current limits :
  - Low/high temperatures,
  - Non-standard atmosphere,
  - Incorrect altimeter settings



The geometric altitude

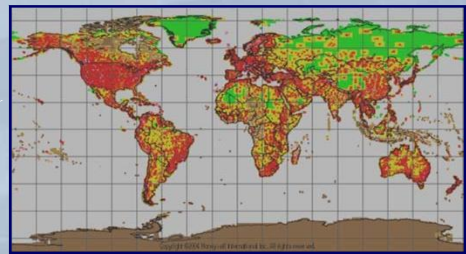
T2CAS EGPWS

The geometric altitude uses:

GPS altitude (not used before by the EGPWS)

Radio altitude

TAWS terrain, runway database



Pressure altitude

Static Air Temperature

AIRBUS

Final Blended Solution

The **final Geometric Altitude**, a blend of:

- Radio altitude Calibrated Altitude (approach)
- Runway-Calibrated altitude (takeoff, climb)
- GPS-Calibrated altitude (all phases of flight)
- Barometric-Corrected altitude (below 18000ft)

The geometric altitude

T2CAS EGPWS

Advantages

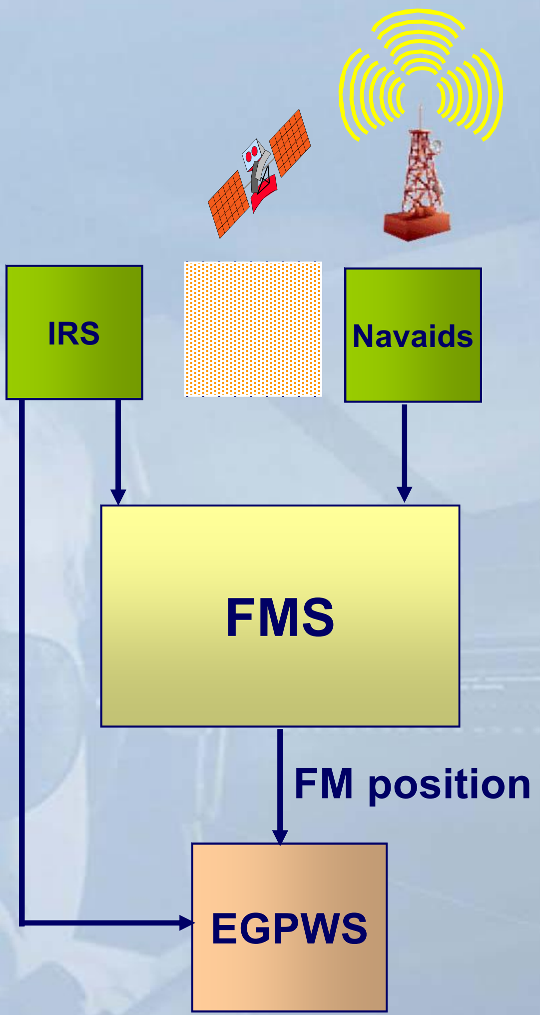
- Not sensitive to temperatures and non-standard atmosphere
- Independent from incorrect altimeter settings
- GPS altitude provided at any altitude
- Continued operation with one or more failed altitude component
- If GPS altitude fails, reverts to corrected Barometric altitude
- Suppression of nuisance EGPWS warnings due to false RA (overflight, heavy precipitation)

Contents

Use of GPS Primary

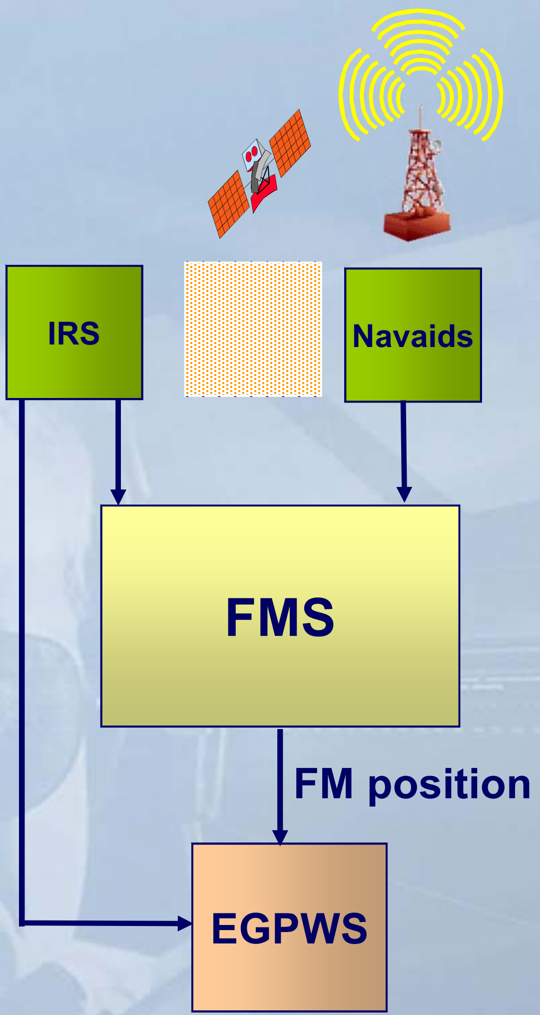
T2CAS EGPWS

Current design



- Currently, aircraft position from FMS
- Based on IRS, radio navaids and GPS Primary data (if available)
- A map shift may occur

Current design



Improved design

Use of GPS Primary

Advantages

- Direct GPS lateral position
- FMS position as a back-up
- Independence between navigation and surveillance systems
- Avoid some EGPWS false or late alerts
- Dual GPS Primary architecture (MMR)

Contents

Peaks function

- Altitude of highest geographic terrain elevations
- Display of terrain data, whatever the aircraft altitude
- Display of the sea in blue (MSL = 0 ft)

Navigation Display

Obstacles Function

- Man-made constructions within an obstacle database
- Same color code as the terrain on the ND
- Audio alerts

Obstacles

- Audio annunciation

OBSTACLE AHEAD (JAA) or
CAUTION OBSTACLE (FAA)

OBSTACLE AHEAD PULL UP (JAA), or **OBSTACLE OBSTACLE PULL UP** (FAA)

On the ND

- Caution: OBST
- Warning: **OBST**

Peaks and Obstacles function

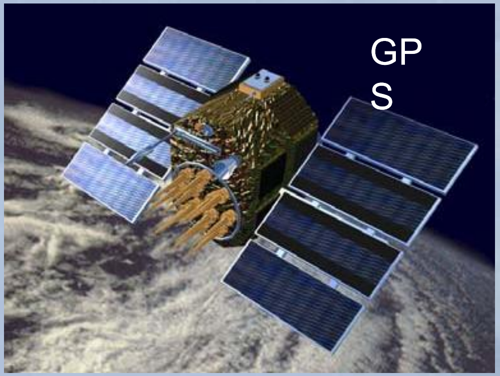
- Optional - Activated by pin programming
- Requires EGPWC P/N 965-1676-002

Contents

AIRBUS

Conclusion

T2CAS EGPWS



- Highly recommended to use GPS source with TAWS
  - See OIT/FOT 999.0015/04
- Use Geometric Altitude, Peaks, Obstacle options
  - Certified in 2006 – SB available mid 2006
- New EGPWC P/N 956-1676-002
  - Certified in 2006 – SB available mid 2006
- T2CAS already includes part of these functions

AIRBUS

AIRBUS S.A.S.
31707 BLAGNAC CEDEX, FRANCE
CONCEPT DESIGN GDCOS
REF. GDCOS-A 038
MARCH 2005
PRINTED IN FRANCE

AN EADS JOINT COMPANY
WITH BAE SYSTEMS

APPENDIX 25

Presented by

Panxika CHARALAMBIDES
Flight Safety Manager

Near CFIT event

Synopsis

- The following was reported:
  - A single aisle aircraft was performing a VOR/DME approach in VMC conditions.
  - Due to low visibility (banks of fog), go around performed
  - Diversion to the alternate airport
  - During this manoeuvre the aircraft hit some domestic electrical supply wires
  - Landing at alternate Airport
  - No injuries

Content

- Damages
- Factual information
- DFDR analysis
- Reminder
- Conclusion

Damages

- Electrical power lines (25ft high) found sheared on site, at about 1100m before RWY threshold

- Aircraft damaged due to impact with the electrical lines:
  - Nose Landing gear
  - Fuselage and Wings

Damages

- Aircraft damaged due to impact with the electrical lines:
  - Nose Landing gear

Investigation

- Airbus was provided with a copy of the DFDR
- An official investigation has been launched by the local Authorities of investigation

Content

- Damages
- Factual information
- DFDR analysis
- Reminder
- Conclusion

Factual information

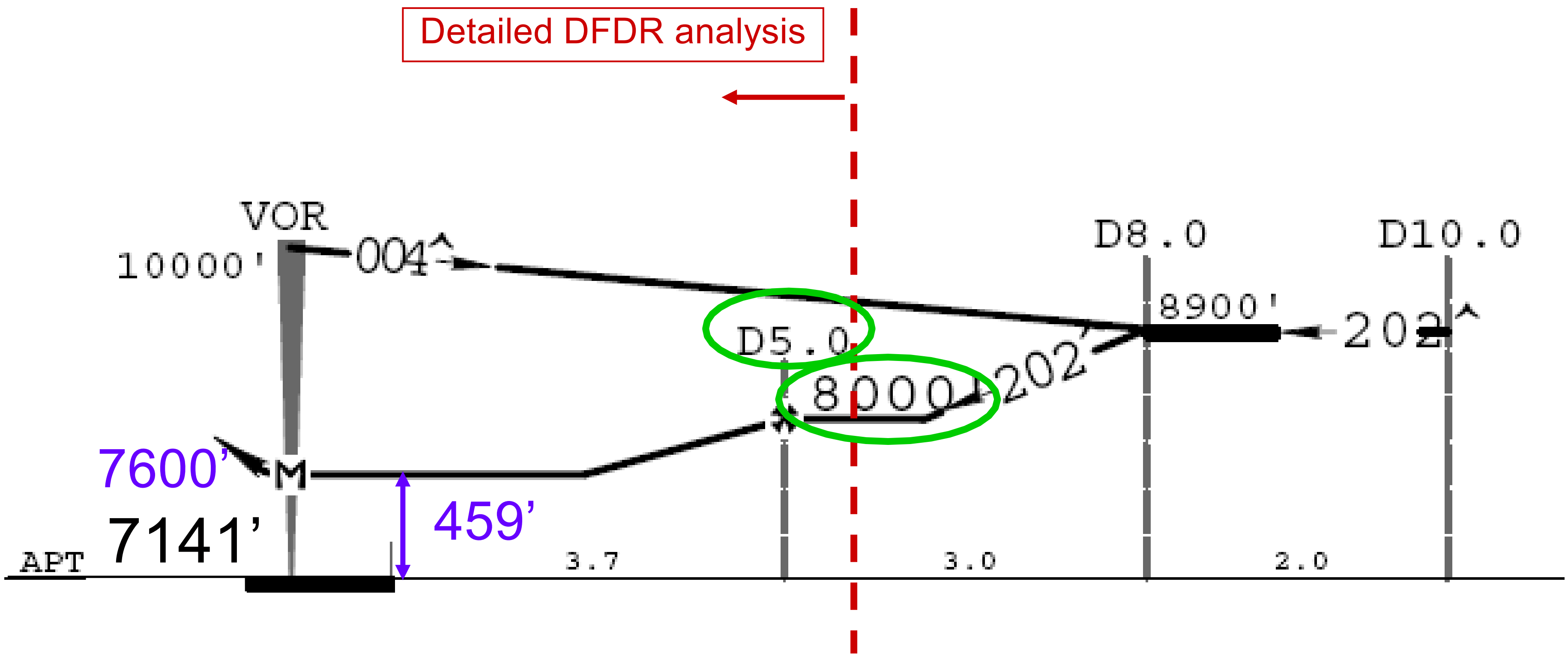
- Destination airport information:
  - Runway equipped with PAPI 3°
  - 10kts headwind
  - Weather report: partly cloudy sky with 10 miles of visibility
  - During the descent ATC informed the crew about variable banks of fog closing and opening the station
  - Early morning/ daylight

Content

- Damages
- Factual information
- DFDR analysis
- Reminder
- Conclusion

DFDR Analysis

- Step-down VOR/DME Approach



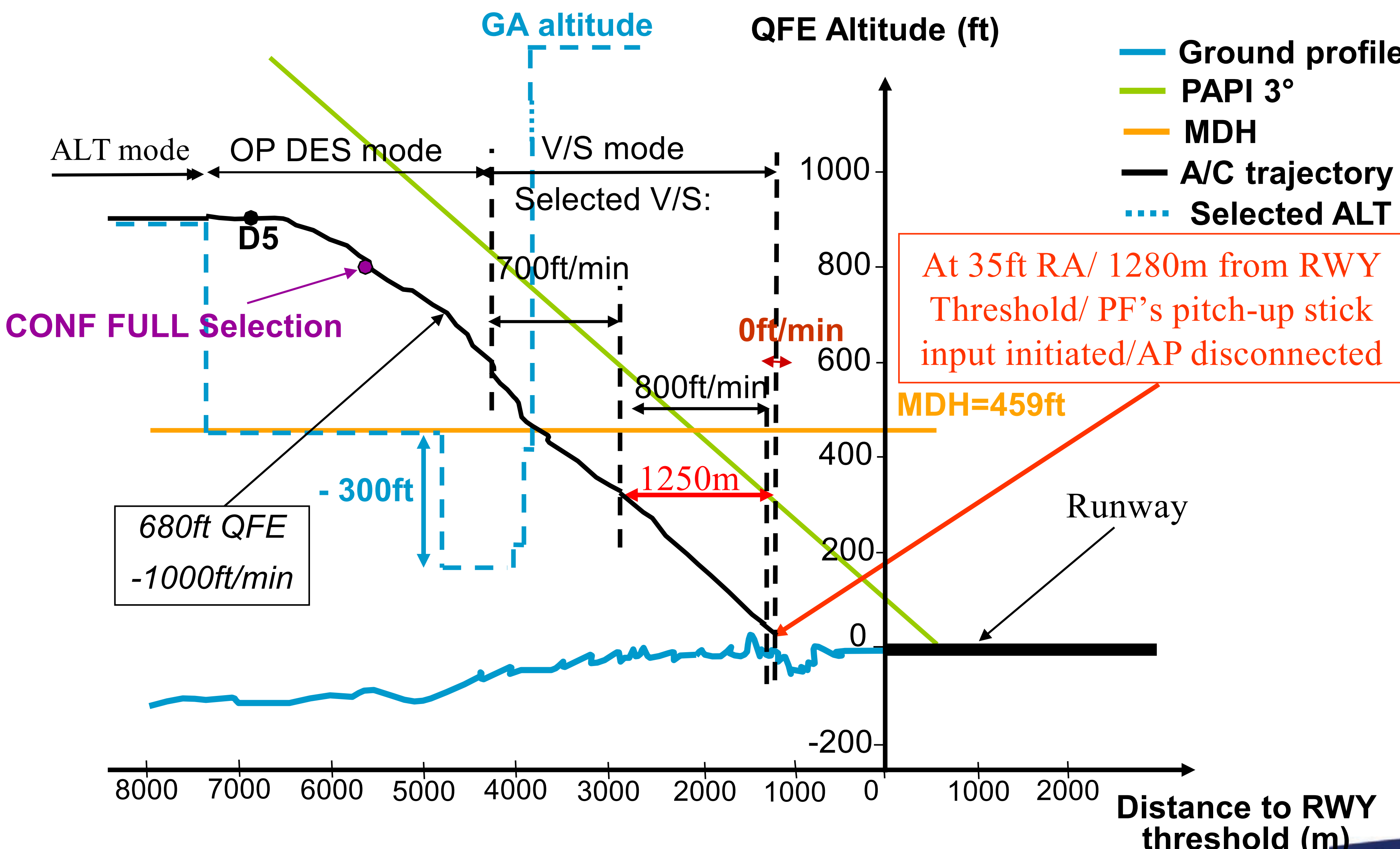
MDA (H) 7600' (459')

DFDR Analysis

Terrain elevation: 7141ft
MDA (H): 7600ft (459ft)

- Approach conditions at 8000ft QNH/860ft QFE (Level-off):
  - Gross weight: 53T
  - Configuration 3 (Slats 22°/ Flaps 20°)
  - Gear down
  - Both FD engaged
  - A/P N°2 engaged in ALT mode/ NAV mode
  - A/THR engaged and active in Speed managed mode (Vapp=VLS+5kts=123kts)

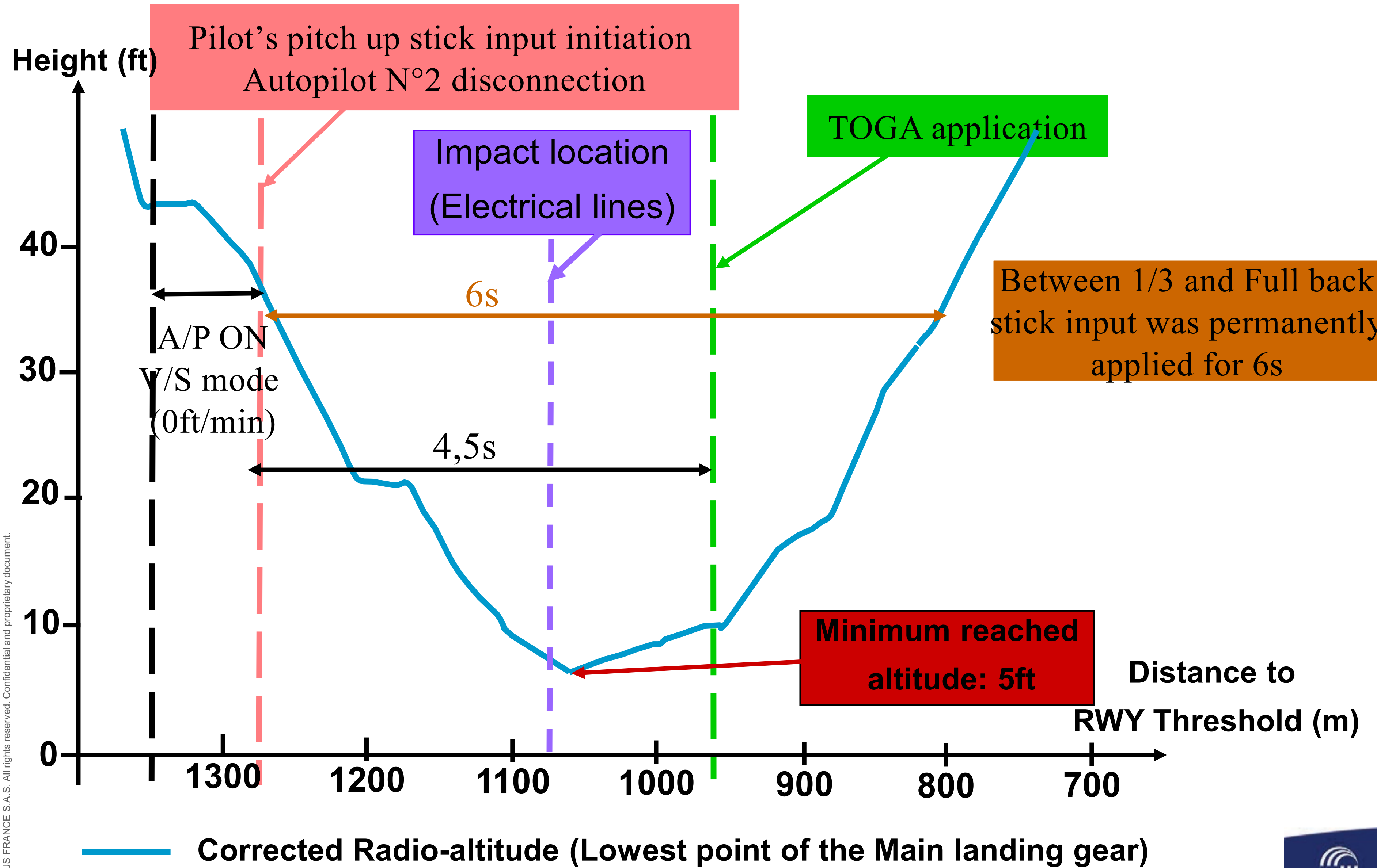
DFDR Analysis



DFDR Analysis

- At 47ft RA Vertical speed selected to 0ft/min
- At 35ft RA about 1280m before runway threshold, the PF applied 2/3 of Full back stick input.
- As a consequence, the A/P immediately disconnected.
- This pilot's take-over occurred 36s after A/C descending below MDA.

DFDR Analysis / Zoom on Go around phase

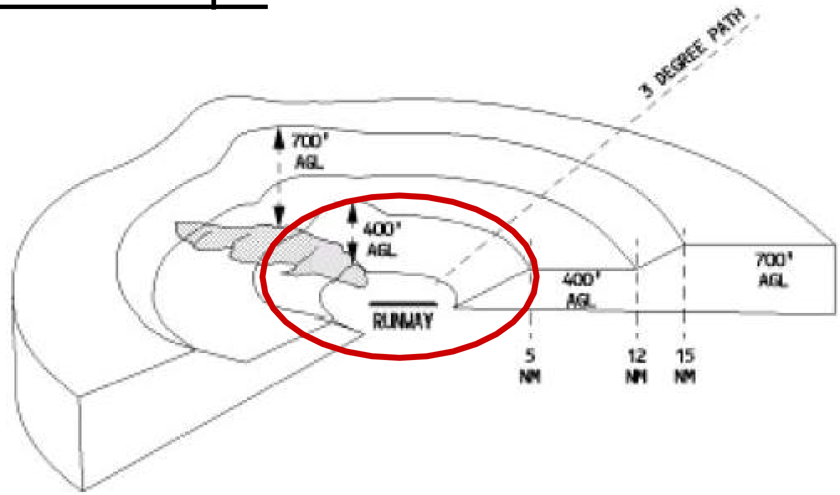


DFDR Analysis/ Zoom on Go around phase

- 4.5s after initial pitch-up input,TOGA thrust applied
- 43s after TOGA application Landing Gears were selected up
- 2 minutes after TOGA application CONF 3 selected
- No EGPWS warning triggered when the aircraft was very close to the ground

DFDR Analysis/ EGPWS alert

- DFDR analysis points out the non triggering of EGPWS Terrain Clearance Floor (TCF) alert:
  - The TCF function:
    - uses a TCF envelope stored in the EGPWS database



    - Warns ("TOO LOW TERRAIN" aural warning) in case of premature descent below this floor
    - BUT a desensitization zone exists close to the Runway

DFDR Analysis / EGPWS alert

- No EGPWS Terrain Clearance Floor (TCF) alert (cont'd):
  - With EGPWS software version fitted on aircraft the Terrain Clearance Floor function had a higher desensitization zone than current EGPWS. No alert was given.
  - With latest EGPWS software version (and GPS) alert would have been triggered for about 20s (from about 200ft QFE)

Content

- Damages
- Factual information
- DFDR analysis
- Reminder
- Conclusion

Reminder

- When conducting a non precision approach, descent below MDA requests adequate visual references.
- Airbus does not recommend MDA (and altitude lower than MDA) selection on FCU.
- For Non Precision Approaches Airbus recommends implementing the Constant Angle Non Precision Approach (CANPA).
- Airbus encourages the operators to upgrade EGPWS software (and a fortiori to install GPS that improves its efficiency) available for every Airbus aircraft family since May 2006 (and Free of charge)

Content

- Damages
- Factual information
- DFDR analysis
- Reminder
- **Conclusion**

Conclusion

- Following this event the operator launched corrective actions:
  - EGPWS update (Whole fleet retrofitted)
  - NPA training reinforcement.
  - Discussions with authorities to change step down approach to constant approach path.

Near CFIT Event

Discussion

- ***DLH: Should Autopilot disconnection have occurred at MDA?***
- ***AIB: Not in V/S mode. In managed guidance only (FINAL APP mode engaged) when the aircraft reaches MDA (MDH) –50ft or 400ft (if no MDA/MDH entered) the autopilot automatically disengages.***
- ***MEA: We prefers to not perform a level off at MDA***
- ***AIB: Airbus agrees. Airbus does not recommend performing a level off at MDA but this is not inhibited and some operators still want to do it.***
- ***EAT: With regard to the desensitization area of the Terrain Clearance Floor alert, how much is the reduction with the last EGPWS standard?***
- ***AIB: The desensitization area depends on FMS estimated position accuracy and runway estimated position accuracy. In particular this software release allowed for GPS position data to be used directly resulting in much smaller estimated error values that allow for smaller desensitization areas.***

Furthermore, this last software version was revised to reduce the minimum desensitization area to a circle with a radius of 0.25NM whereas such radius was 1NM for the software version installed on the aircraft at the time of the event.

Near CFIT Event

Discussion

Lastly, the inner part of the envelope was revised to give additional protection in close to the runway.

Airbus would like to encourage all operators to upgrade the EGPWS software with the last version (free of charge on any Airbus aircraft type) and a fortiori to install the GPS that is not requested for the installation of this last EGPWS software standard but that improves its efficiency. GPS can be retrofitted through Service Bulletins.

- ***GWI: SB N° please for the EGPWS latest standard***
- ***AIB: Please refer to OIT ref: SE 999.0050/06/VHR dated 18/04/2006 and to latest SIL ref:34-080***
- ***CLA: with regard to terrain elevation, above 5000ft we perform a special briefing***
- ***CPA: Why was this approach not fully managed?***
- ***AIB: We don't know but this requires validated databases. If authorised by the database provider a fully managed approach would avoid this kind of event.***

Near CFIT Event

Discussion

- *TACA: What about Human Factors? What was PNF doing? What about PNF call-outs?*
- *AIB: such information was not available to Airbus. An incident investigation is still on going and if more information is available in the final report then an update will be done at the next FSC*
- *LTU: Were Autocallouts triggered?*
- *AIB: Yes between 200ft RA and 10ft RA several autocallouts were triggered.*
- *VLG: What was the vertical profile on the chart after D5?*
- *AIB: The chart provider is not known. This is why Airbus recommends operators to work with their authorities to have constant angle approaches (CANPA) instead of the step approach*

END

AIRBUS

AN EADS COMPANY

APPENDIX 26

Presented by

Gilbert GORETTA

New navigation regulations

New navigation regulations

- Part 1. P-RNAV (Precision Area Navigation)
- Part 2. EGPWS (Enhanced Ground Proximity Warning system)
- Part 3. Elementary/Enhanced Surveillance
- Conclusion

New navigation regulations

- Part 1. P-RNAV (Precision Area Navigation)
- Part 2. EGPWS (Enhanced Ground Proximity Warning system)
- Part 3. Elementary/Enhanced Surveillance
- Conclusion

Contents

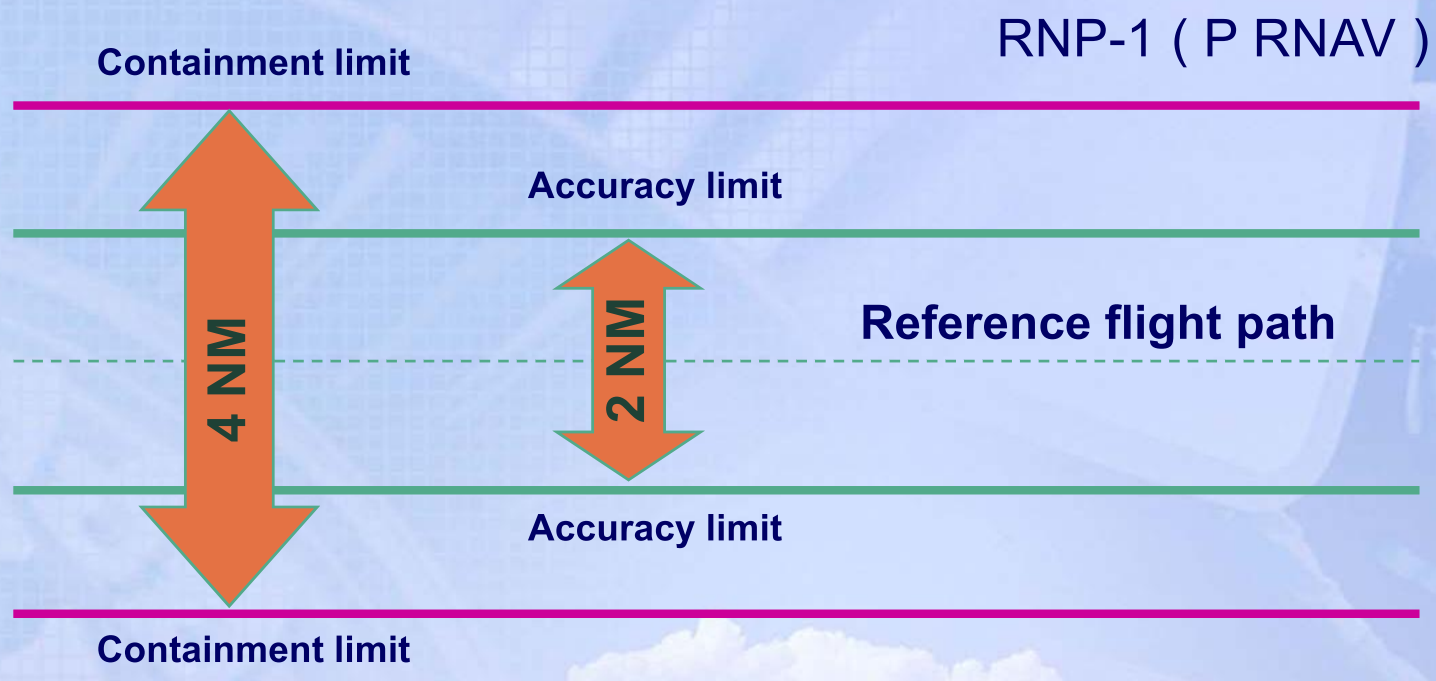
Introduction

- Due to traffic growth in Europe
  - The airspace is getting more and more saturated
    - B-RNAV in place since 1998 (lateral enroute separation)
    - RVSM in place since 2001 (1000ft Vertical separation)

    => NOT ENOUGH
  - P-RNAV :
    - Even smaller lateral separation for terminal airspace
    - Enables more closely spaced routes in congested areas

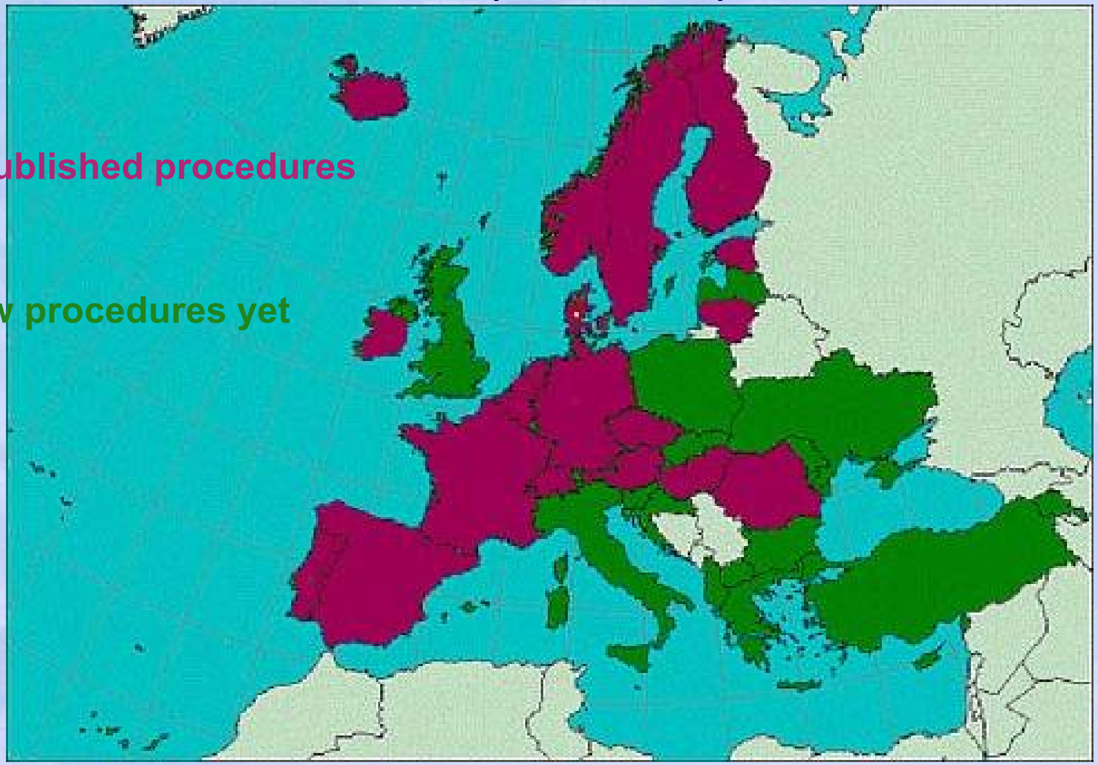
Airworthiness requirements - P-RNAV requirement

- Track-keeping accuracy of +/- 1 NM (RNP 1) 95 % of the time



Airworthiness requirements - P-RNAV applicability

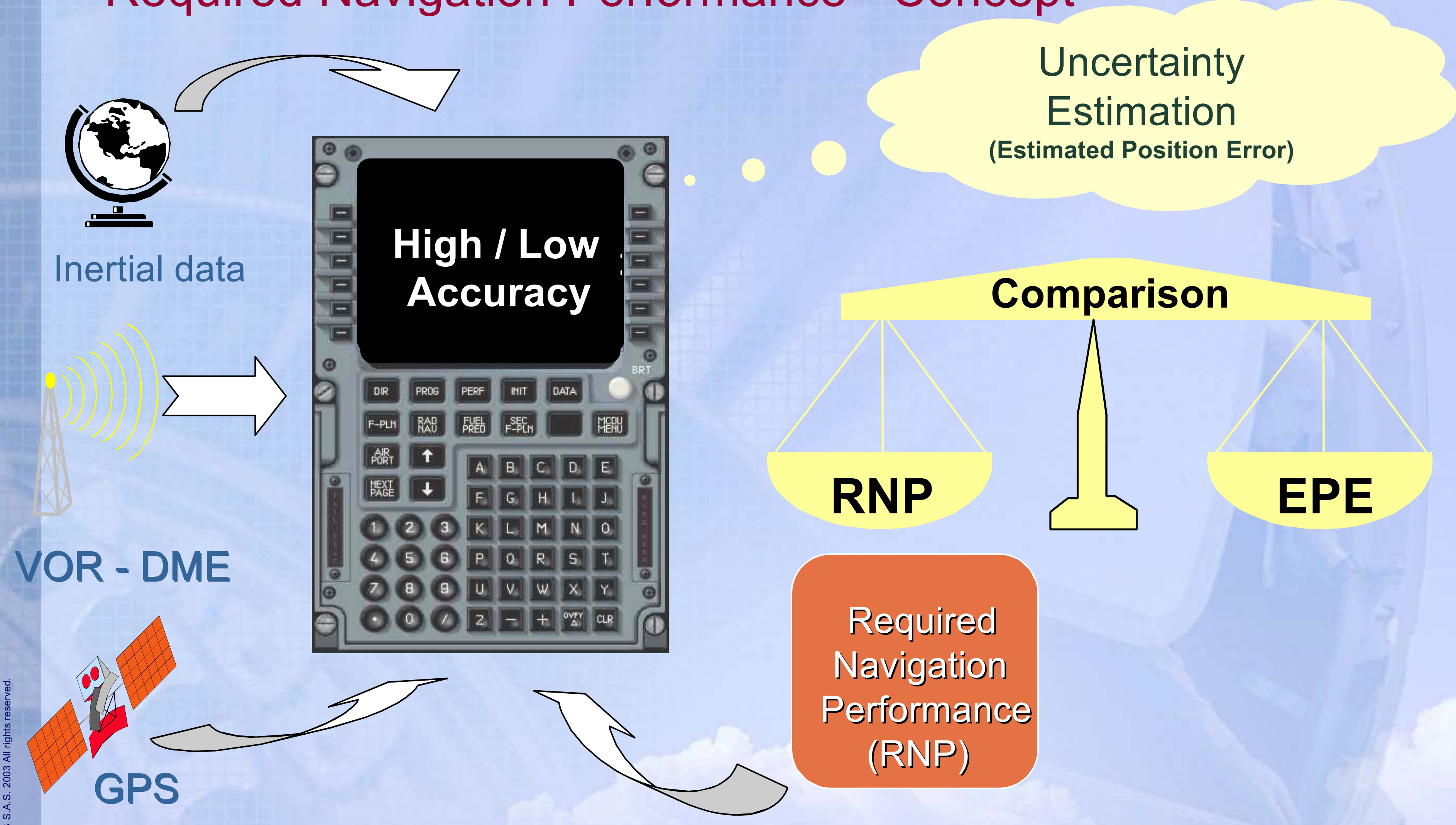
- Progressive introduction from March 2003 (new Terminal Area procedures)
- Operational Approval according to JAA Temporary Guidance Leaflet 10 (TGL 10)



New published procedures

No new procedures yet

Required Navigation Performance - Concept



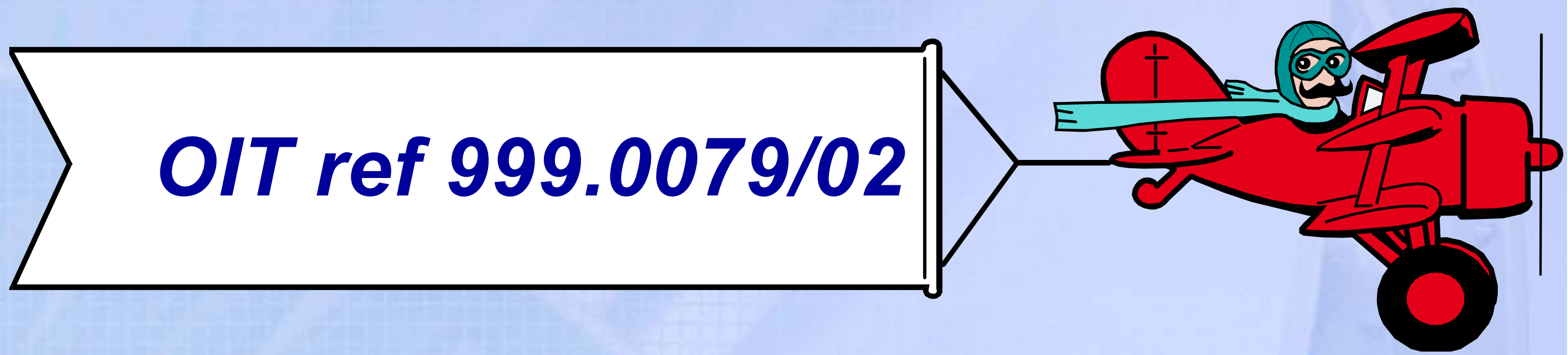
Airbus technical compliance

- Aircraft fitted with FMS2
  - Comply with the JAA TGL 10
  - Aircraft Flight Manual reflects P-RNAV compliance

- Aircraft fitted with FMS1 (Legacy)
  - P-RNAV operational approval completed for all Airbus certified configurations:
    - Flight Manual updated 1st QTR 2003
    - No actions for the operators

Part 1. P-RNAV (Precision Area Navigation)

Airbus technical compliance



Summary

- Implementation of P-RNAV on Airbus aircraft does not require modifications

- B-RNAV + P-RNAV will allow to cope with growing traffic in Europe.

New navigation regulations

- Part 1. P-RNAV (Precision Area Navigation)
- Part 2. EGPWS (Enhanced Ground Proximity Warning system)
- Part 3. Elementary/Enhanced Surveillance
- Conclusion

Part 2. EGPWS (Enhanced Ground Proximity Warning)

Contents

- Authorities Requirement
- Airbus solution
  - Visual alert requirement
  - 500ft call out requirement

Authorities Requirement

- Install Terrain Awareness & Warning System TAWS (also called EGPWS)

  - Some countries follow ICAO recommendation (ex: Japan)
    - All aircraft to be equipped after 1st January 2003
  - JAA :
    - All aircraft manufactured after 1st October 2001
    - All other aircraft after 1st January 2005
  - FAA :
    - All aircraft manufactured after 29 March 2002
    - All other aircraft after 29 March 2005

Part 2. EGPWS (Enhanced Ground Proximity Warning)

Authorities Requirement

AIRBUS

Airbus Solution

- Airbus standard solution is compatible with JAA and FAA requirement
- Particular requirement:
  - JAA to impose a single **visual indication** format starting with the new EGPWS PN 965-1676-001
  - FAA requires a **500ft altitude call out** (or equivalent)

Part 2. EGPWS (Enhanced Ground Proximity Warning)

Visual indication

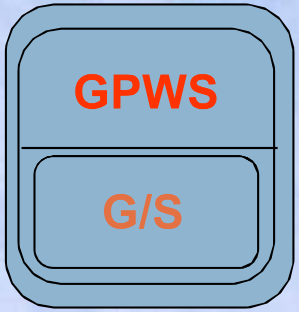
- JAA:
  - Starting with the new EGPWS PN, visual indication (cockpit P/B) must now be consistent with general policy:
    - Visual Warning in RED
    - Visual Caution in AMBER

Visual indication

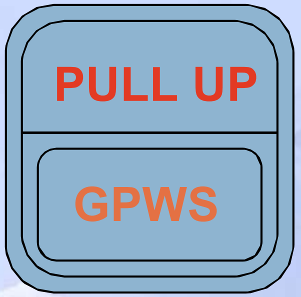
- The alternate Airbus visual indication format was :
  - PULL UP in red for warnings (with Pull-Up voice)
  - GPWS in Amber for cautions

It was proposed as optional modifications (mod 21391 + 26935). It becomes standard with new EGPWS PN.

- Effect in cockpit: P/B switch 4WZ and 5WZ modification



Previous standard configuration



New standard configuration

Visual indication

- Consequences:
  - JAA linked this requirement to the new EGPWS standard PN 965-1676-001 (mod 31374) only
    - Basic in June 2003
    - All aircraft equipped with it must have the new visual indication
    - Retrofit to PN 976-1676-001 requires modification of the cockpit push-buttons.
    - Aircraft with previous EGPWS (PN 965-0976-003-x) do not need to be modified

500ft call out requirement

- FAA:
  - The equipment specification requires that the EGPWS provides a “500ft” call-out
  - Airbus solution is with the FWC programmed altitude call-out
  - FAA accepted that Airbus operators could use any FWC altitude call-out combination in place of the 500ft call-out

Part 2. EGPWS (Enhanced Ground Proximity Warning)

Part 2. EGPWS (Enhanced Ground Proximity Warning)

Summary

- EGPWS available since 1997 on A320 family
- Current standard version compliant with JAA &FAA regulations
- Additional modification for new EGPWS retrofit only

New navigation regulations

- Part 1. P-RNAV (Precision Area Navigation)
- Part 2. EGPWS (Enhanced Ground Proximity Warning system)
- Part 3. Elementary/Enhanced Surveillance
- Conclusion

Part 3. Elementary/Enhanced Surveillance

Contents

- Authorities Requirement
- Transition Period
- Airbus solutions

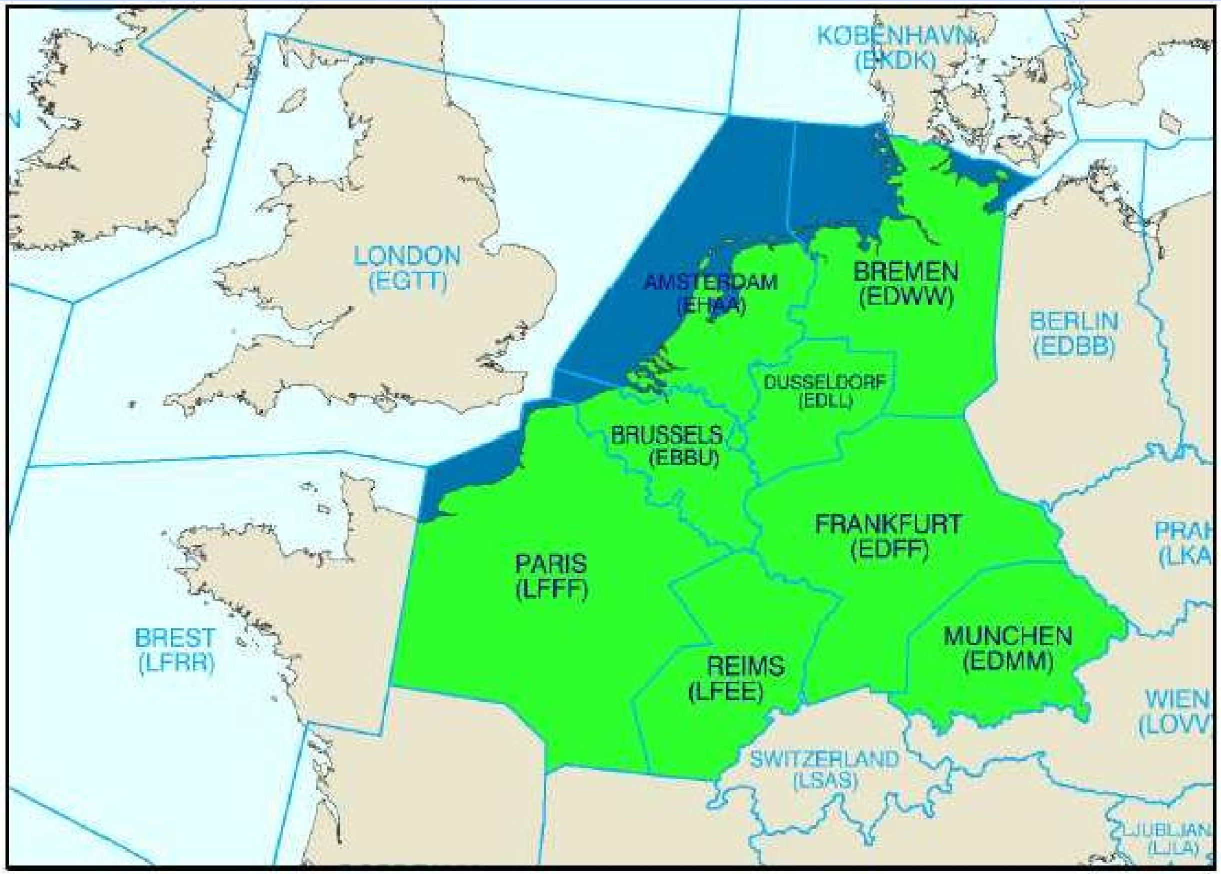
Part 3. Elementary/Enhanced Surveillance

Authorities Requirement

- Elementary surveillance
  - New parameters transmitted by Mode S transponder
    - Aircraft Identification
      - Allows correlation with flight plan in the Air Traffic Management (ATM) centers
    - Selective interrogation code
      - Reduces the radio frequency interference
  - National authorities issued their own Air Information Circular (AIC)

Authorities Requirement

- Elementary surveillance
  - Geographical Deployment

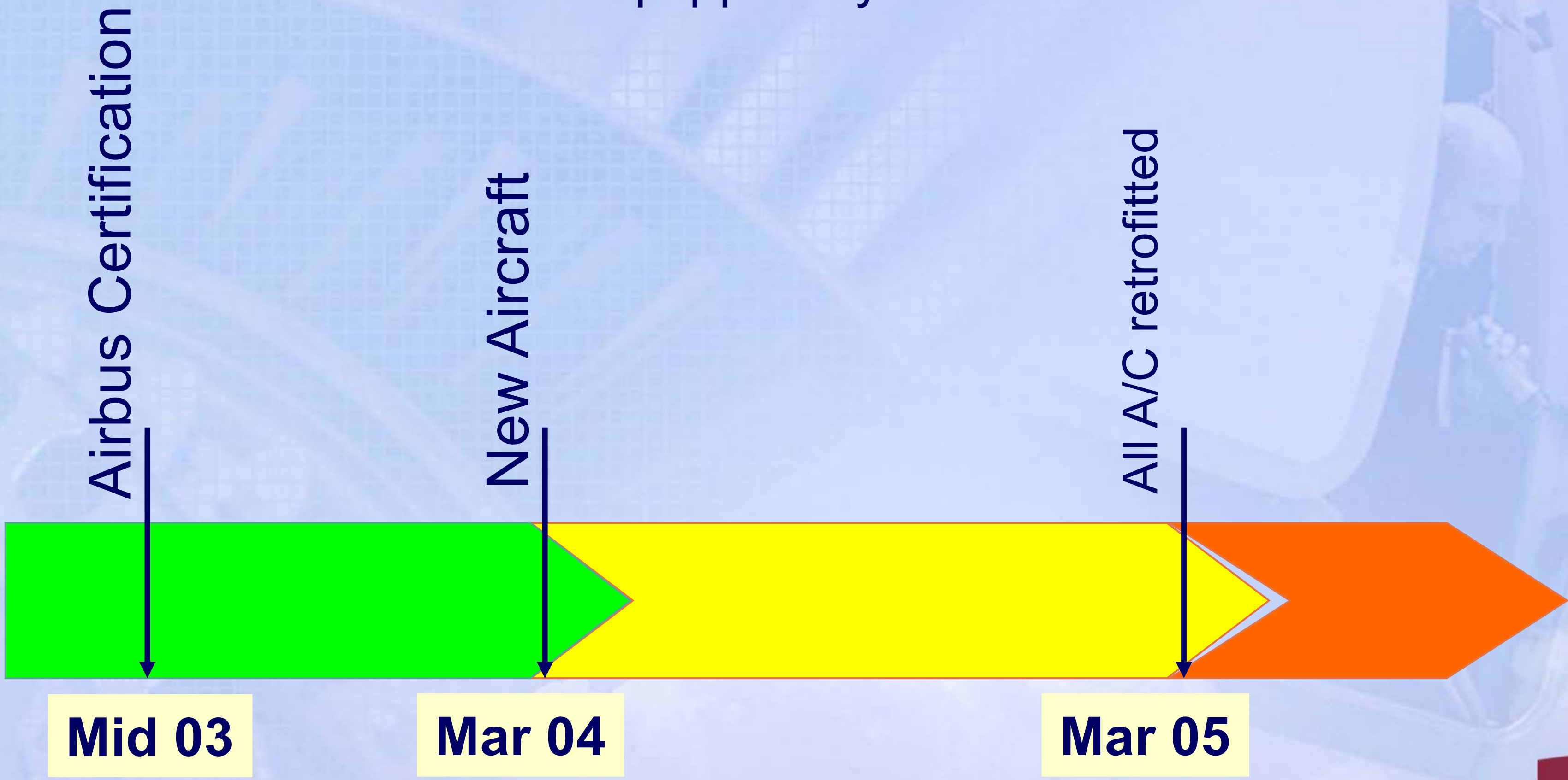


Forthcoming Requirement

- Enhanced Surveillance
  - Additional downlink parameters to improve flight path prediction by ATM
    - Example: Magnetic heading, Speed, Roll angle, selected altitude, etc
  - Required in Germany, France and UK after March 2005

Transition Period to Elementary Surveillance

- Aircraft flying in core Europe should comply as follows:
  - New aircraft delivered after 31 March 2004
  - All aircraft to be equipped by 31 March 2005



AIRBUS solutions (Elementary Surveillance “ELS”)

- Certification of Elementary surveillance
  - ACSS (ex L3COM):
    - XS-950 (PN 7517800-10005) => 2nd Qtr 2003
  - Honeywell
    - TRA-67A (PN 066-01127-1402) => 2nd Qtr 2003
  - Rockwell Collins
    - TPR-901 (PN 822-1338-021) => 2nd Qtr 2003
  - Common Wiring modification
    - MOD 32927 => 2nd Qtr 2003
- Airlines involved are requested to issue a RFC/RMO

AIRBUS solutions (Enhanced Surveillance “EHS”)

- Certification of new Mode S transponders (compliant to ELS and Enhanced surveillance)
  - Same PN as for ELS only
  - Minor wiring change may be needed
  - Officially certified for EHS when ground stations are ready.
  - Will Require MMEL and FCOM update

- Involved airlines are requested to issue a RFC/RMO

Security Modification

- Airbus secured Hijack mode is independent of Mode S transponder evolution
  - Remote control box (RATC) independent of transponder version
  - Compatible with both Elementary and Enhanced surveillance (and future evolutions)
  - Fully compliant with FAA NPRM No. 03-02 “Transponder Continuous Operation”
- Airbus modifications:
  - SB 34-1258 (Wiring provision), SB 34-1269 (Install two push-buttons in the cockpit), SB 34-1268 (install the RATC box) available through RFC/RMO.

Summary

- Progressive implementation of the Elementary & Enhanced Surveillance
- Three Mode S transponder models proposed by Airbus
- Early certification enables smooth retrofit for operators
- RATC compliant with FAA requirement

New navigation regulations

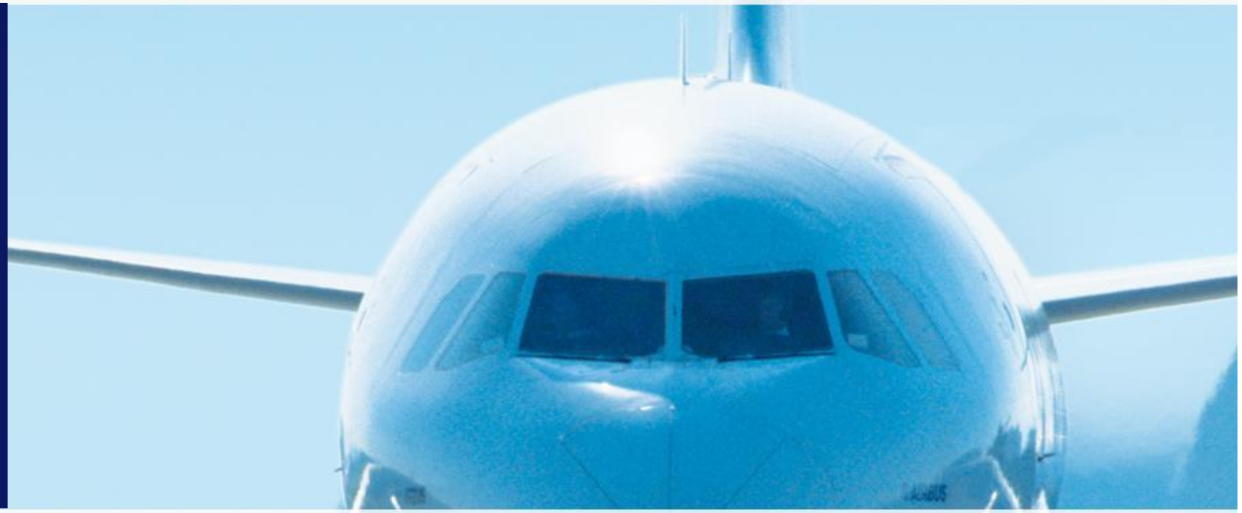
- Part 1. P-RNAV (Precision Area Navigation)
- Part 2. EGPWS (Enhanced Ground Proximity Warning system)
- Part 3. Elementary/Enhanced Surveillance
- Conclusion

Conclusion

- Airbus is in position to propose timely upgrades to comply with current and future navigation regulation requirements

Presented by:

Xavier BARRIOLA
Navigation & Flight
Guidance/Management Systems



Navigation Systems
Summary

AIRBUS

Thales/Smiths FMS2 status

Thales/Smiths FMS2 issues now clearly identified and will be fully addressed in REV2 (REV2+) standard.

REV. 1			REV. 1+		REV. 2 (In-Service Evaluation only)	REV. 2+
S1C8 S1I8	S1C10	S1C10	S2C10 S2I9	S2C11	S3C11 S3I9	S4C1X Std S4IXX
08/2002	07/2003 (A318)	12/2003 (A319/A320/A321)	03/2004	12/2004	2Q/2005	1Q2006
OEB: 154 (FG), 158 (FM), 163 (FM), 164 (FM), 165 (FM), 166 (FM)		***OEB:*** 156 (FM), 157 (FG), 158 (FM), 161 (FG), 163 (FM), 164 (FM), 165 (FM), 166 (FM)	***OEB:*** 157 (FG), 161 (FG), 163 (FM), 164 (FM), 165 (FM), 166 (FM)	***OEB:*** 163 (FM), 164 (FM), 165 (FM), 166 (FM)		Clean-up standard

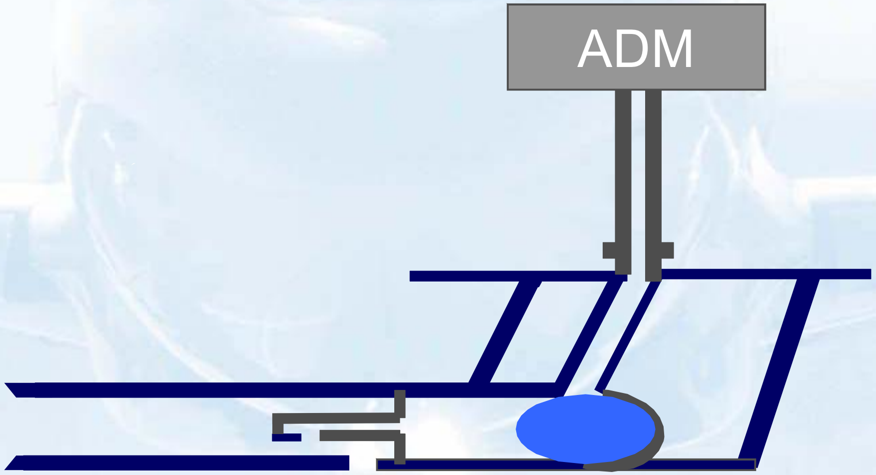
Air data system

Background

- Numerous cases of airspeed discrepancy/fluctuation reported with Thales pitot probe:
- This can lead to:
  - Aborted takeoff
  - Auto pilot disconnection
  - Reversion into alternate law
  - Unnecessary ADIRU removal

Current situation

- Investigations have highlighted incorrect pressure measurement is caused by trapped water.



Airbus action

- New Thales pitot design under study. Certification scheduled for first quarter 2006

Map shifts and associated EGPWS false warnings

Background

- Several reports from field of “Map Shift” event (different flight phases, sometimes associated with false EGPWS warning).

Current Situation

- Map Shift can be defined as:
  - Noticeable and unexpected change in FMS position,
  - Aircraft symbol offset from track on ND.
- Map shift causes:
  - Several reasons but wrong data from FM Navigation Data Base is at the origin of the majority of reports.

Map shifts and associated EGPWS false warnings (cont.)

Airbus action

The following enhancements are proposed:

- Navigation:
  - Use of GPS for navigation (GPIRS position),
  - Modify current FM logic with the suppression of “LOC and Takeoff updates”.
- EGPWS:
  - Installation of GPS (MMR solution),
  - Use of pure GPS signal as aircraft position source for the EGPWS instead of FM position (FM stays back-up),
  - New EGPWS PN 965-1676-002 required.

“MMR solution” strongly recommended


A310
A310-300
AIRBUS
A300
A300-600
AIRBUS

A300/A310 Family Technical Symposium

A310/A300-600

Presented by:

Dimitri CARSTENSEN

Surveillance Systems Engineer
Radio Nav/Com, Datalink & Surveillance Systems Customer Services

A310/A300-600 Surveillance TAWS Operations with GPS

AIRBUS

TAWS operations with GPS

1. Background

2. Spurious terrain alert

3. New design: TAWS + GPS

Conclusion

TAWS operations with GPS

1. **Background**

2. Spurious terrain alert

3. New design: TAWS + GPS

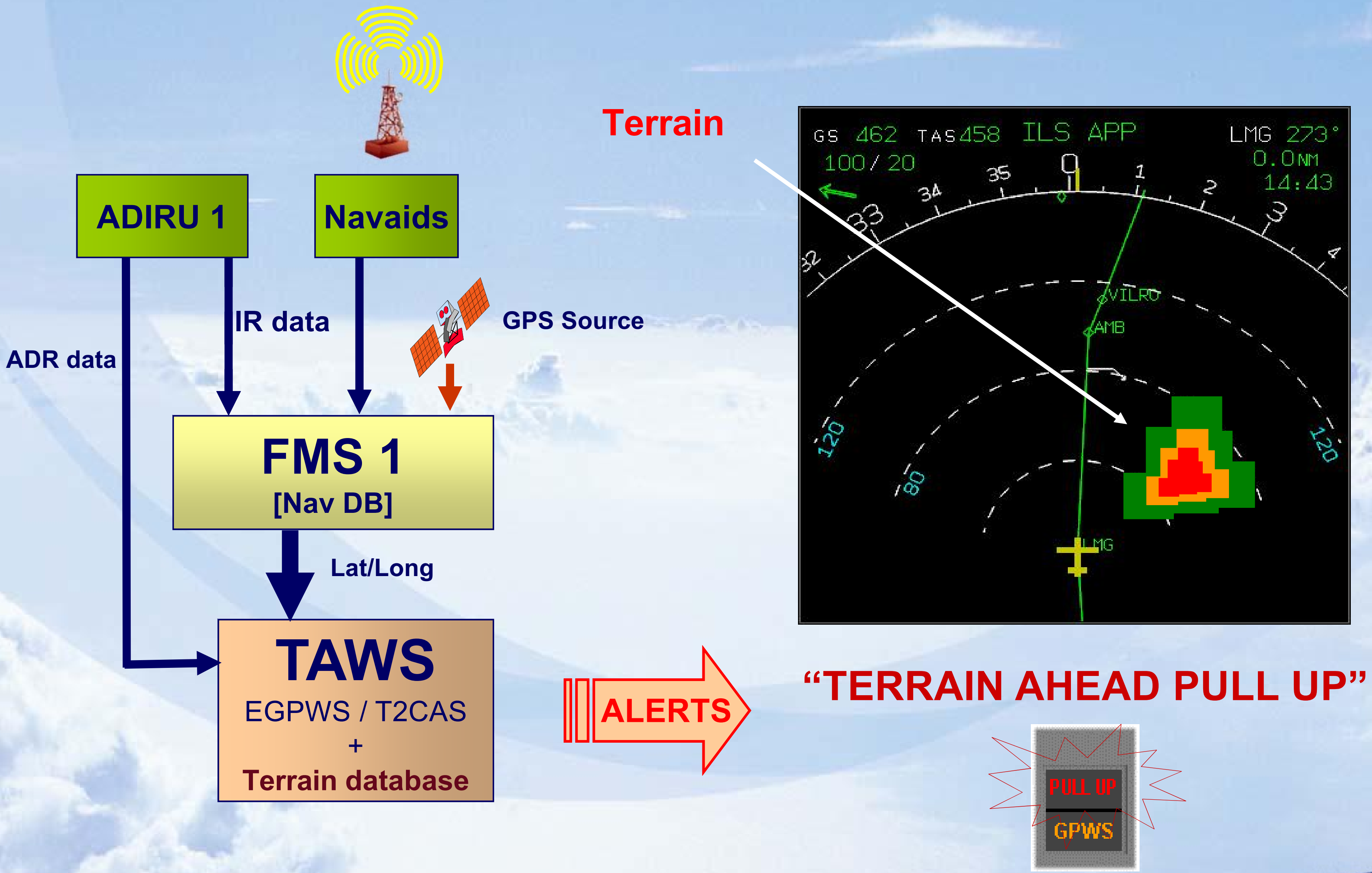
Conclusion

Background

Terrain Awareness and Warning System (TAWS)

- Ground Proximity Warning System (GPWS) with Enhanced Terrain functions
  - Also known as:
    - ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS by Honeywell)
      - **installed as Airbus standard configuration from mid 1999**
    - TRAFFIC AND TERRAIN COLLISION AVOIDANCE SYSTEM (T^2CAS by ACSS).
      - **proposed since May 2005 under RFC process**
- FAA and EASA have mandated TAWS (TSO-C151a):
  - **FAA:** (Refer to FAR 121.354)
    - **mandatory from March 29, 2005**
  - **EASA:** (Refer to JAR-OPS 1.665, NPA-OPS 23)
    - **mandatory from January 1, 2005**

Background



ADIRU 1
Navaids
ADR data
IR data
GPS Source
FMS 1
[Nav DB]
Lat/Long
TAWS
EGPWS / T2CAS
+
Terrain database
ALERTS
Terrain
GS 462 TAS 458 ILS APP
100 / 20
LMG 273°
0.0NM
14:43
VILRU
AMB
LMG
"TERRAIN AHEAD PULL UP"
PULL UP
GPWS

Spurious terrain alert

1. Background

2. **Spurious terrain alert**

3. New design: TAWS + GPS

Conclusion

Spurious Terrain Alert Scenario

Drift

ADIRU 1 OR Navaids Position error

ADR data

IR data

OR

FMS 1
[Nav DB]

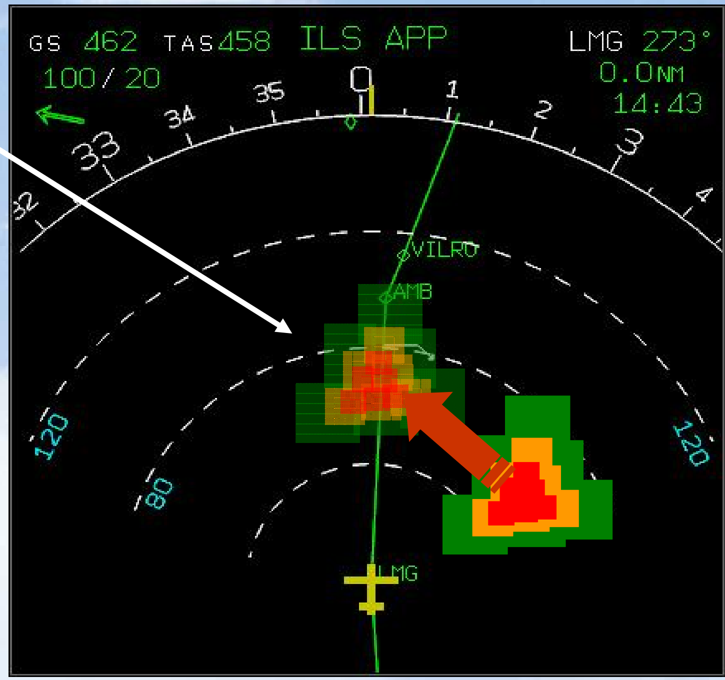
Nav DB coding error

FM position SHIFT

TAWS

ALERTS

Terrain “seen” by TAWS



Spurious
“TERRAIN AHEAD PULL UP”
+
Potential Go-Around

TAWS operations with GPS

1. Background

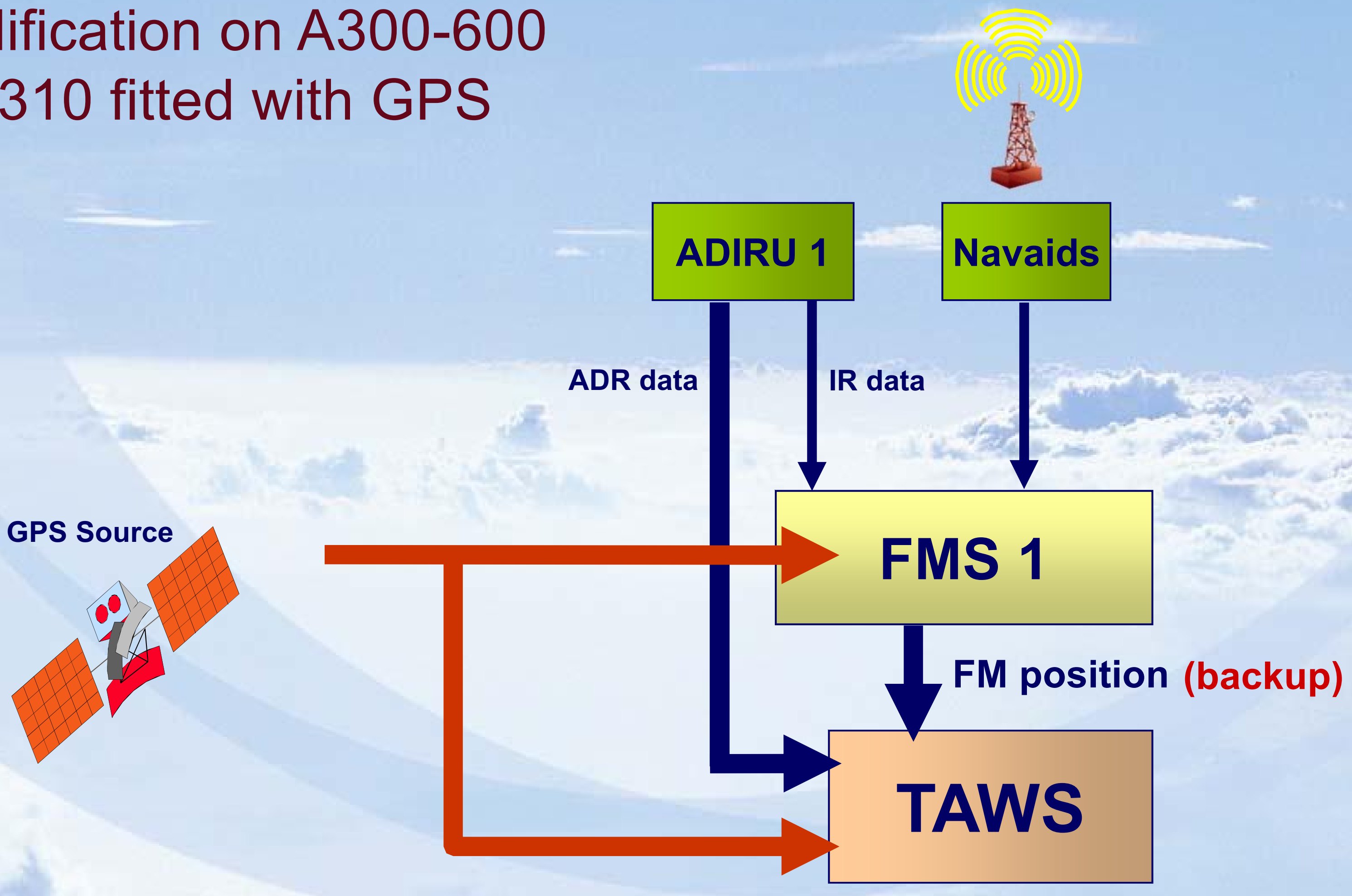
2. Spurious terrain alert

3. **New design: TAWS + GPS**

Conclusion

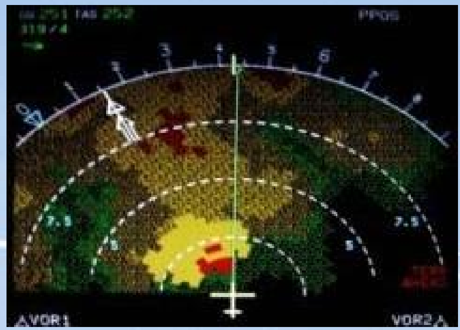
New design: TAWS + GPS

Modification on A300-600 or A310 fitted with GPS



TAWS now uses GPS as primary source

New design: TAWS + GPS



	Potential Spurious Alert	
	Classic FMS Architecture	New GPS Architecture
Altitude error	YES	NO
Navaids position error	YES	NO
ADIRU drift	YES	NO
FM Database error	YES	NO

Spurious Terrain Alerts and Go-Arounds avoided

TAWS + GPS – Key figures

Honeywell EGPWS solution:

- Pre-requisite:
  - EGPWS PN 965-1676-002
  - MMR or GPS-SU
- New TAWS + GPS architecture:
  - Standard SBs available

ACSS T²CAS solution:

- Pre-requisite:
  - T²CAS PN 900000-10110 or 900000-11111
  - MMR
- New TAWS + GPS architecture:
  - SB availability pending RFC

Modification is only a wiring change

TAWS operations with GPS

1. Background

2. Spurious terrain alert

3. New design: TAWS + GPS

Conclusion

Conclusion

- ✓ TAWS is subject to spurious alert in case of FM shift
- ✓ With GPS priority in TAWS: spurious alerts are avoided
  - ▶ **Fewer Go-Arounds**
  - ▶ **Less missed approaches**
  - ▶ **Reduction of delays**
  - ▶ **Some fuel savings**
  - ▶ **Flight crew confidence**

OPERATIONAL CONFIDENCE ↑

OPERATING COST ↓

Enhanced Surveillance systems

Guidelines

TAWS + GPS Architecture Guidelines

- Avionics Magazine - February 2004

Title: Perils of a lone positioning source – by David Evans

- OIT SE 999.0015/04/VHR Dated 05 February 2004

Title: ATA 34 - AIRBUS POLICY CONCERNING THE USE OF GPS POSITION FOR TERRAIN AWARENESS AND WARNING SYSTEM (TAWS) OPERATIONS

- Airbus Safety First – January 2005

Title: Go-Arounds at Addis Ababa due VOR Reception Problems – by Jean Daney, Director of Flight Safety

- OIT SE 999.0050/06/VHR dated 18 April 2006

Title: ATA 34 - AIRBUS OFFER FOR STANDARD SERVICE BULLETINS INSTALLING EGPWS PN 965-1676-002
ENABLING DIRECT USE OF GPS DATA AND ADDITIONAL NEW FUNCTIONS

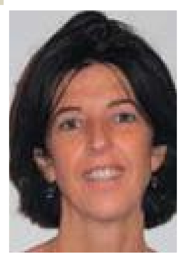
- SIL 34-080 rev.6 – March 2007

Title: TERRAIN AWARENESS AND WARNING SYSTEM" (TAWS) ON AIRBUS AIRCRAFT

AIRBUS

APPENDIX 27

Near CFIT event during Non Precision Approach



By: Panxika Charalambides
Flight Safety Manager

1 | Introduction

Today most of major incidents and accidents belong to one of the following categories:

- Controlled Flight Into Terrain (CFIT)
- Loss of control in flight
- Landing short
- Runway excursion

In particular CFIT events make up 45% of approach-and-landing accidents, that represent 55% of global accidents.
This article details a near CFIT event encountered on a single aisle aircraft as well as the associated lessons learned.
This event presents numerous classical components conducive to a CFIT and approach accident.

2 | Reported event

The following was reported to Airbus:
*"This flight was uneventful until the approach phase that was a non precision approach performed in VMC conditions. Weather report indicated a partly cloudy sky with 10 miles visibility at destination, but, during the descent, ATC informed the crew about variable weather conditions due to banks of fog closing and opening the station.
On final approach, due to low visibility, the crew initiated a go-around and hit electrical lines. The crew then diverted to the scheduled alternate airport."*

The investigation performed on site revealed that 25ft high electrical lines, located perpendicularly to the runway axis, at about 1100m from the runway threshold, were found sheared.
The aircraft was damaged subsequently to the impact with the electrical power lines. Damage was present all across the aircraft (fuselage, engine, wings) indicating that the aircraft impacted the lines head-on. Furthermore, some pieces of electrical lines were found in the area of the nose landing gear and it was concluded that the initial impact occurred at nose landing gear level.

The aircraft diverted and landed at the scheduled alternate airport. There were no passenger or crew injuries during this incident.

This article is mainly based on the analysis of the DFDR, which was provided to Airbus. Human factors aspects, in particular, will not be covered, due to lack of information.

3 | DFDR analysis

Note: for de-identification reasons altitudes are given in heights with reference to QFE.

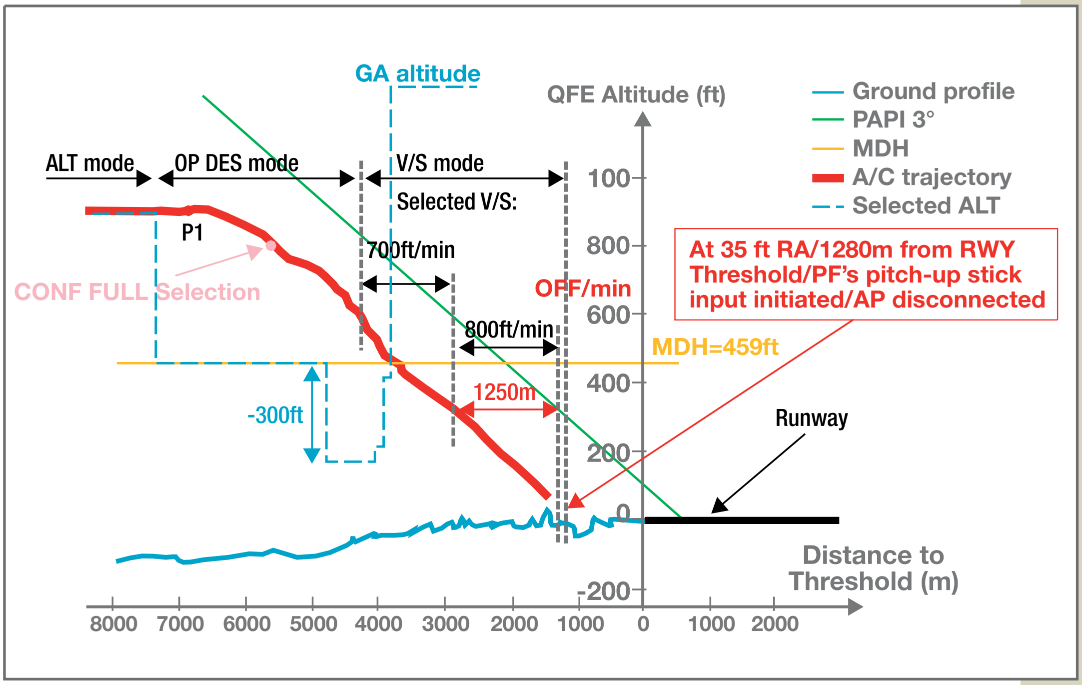
This was a step-down VOR-DME approach conducted in daylight, early in the morning, autopilot engaged.

As a consequence, the approach was a succession of descent and level flight phases so that autopilot longitudinal modes were alternatively OP DES mode and ALT*/ALT modes, while the auto-thrust modes were respectively idle mode and speed mode (with speed managed by the FMS). The successive constraint altitudes were fully respected.
Shortly before over-flying the last altitude constraint "P1" (859ft QFE situated at 3.7NM from the runway threshold) the aircraft was in level flight at 860ft QFE.
The minimum descent height was 459ft.

The figure here below presents the descent profile from "P1"

This sequence can be detailed as follows:

- Shortly before over-flying "P1", MDA altitude was selected on the FCU, and the OP DES longitudinal autopilot mode was selected so that a thrust reduction was progressively commanded to target idle thrust, while the autopilot pitch mode maintained the speed target.
- At that stage the aircraft was in slats/flaps configuration 3, gear down, both flight directors engaged, autopilot N°2 engaged.
- For the whole approach the autopilot lateral mode remained in NAV mode.
- **At 800ft QFE, 3NM from runway threshold**, shortly after over-flying the last altitude constraint "P1" full slats/flaps configuration was selected.
- **At 680ft QFE, 2.6NM from runway threshold**, whereas the rate of descent was 1000ft/min, an altitude 300ft below MDA was selected on the FCU.
- **At 600ft QFE, 2.3NM from runway threshold**, while the current rate of descent was -1400ft/min, the crew selected the autopilot V/S mode with initially a selected V/S of -700ft/min. From that time auto-thrust was therefore engaged in speed mode. Target speed was Vapp (VLS +5kts).
- While descending **below MDA about 2.1 NM from runway threshold**, go-around altitude was selected on the FCU.
- **At 325ft QFE/ 1.54NM from runway threshold**, the crew selected a vertical speed of - 800ft/min.
- **At 47ft RA at about 0.72NM from runway threshold** the crew selected a vertical speed of 0ft/min.
- **At 35ft RA, at 0.70 NM from runway threshold**, the Pilot Flying applied 2/3 of full back stick input that disconnected immediately the autopilot.



Descent profile

Notes:

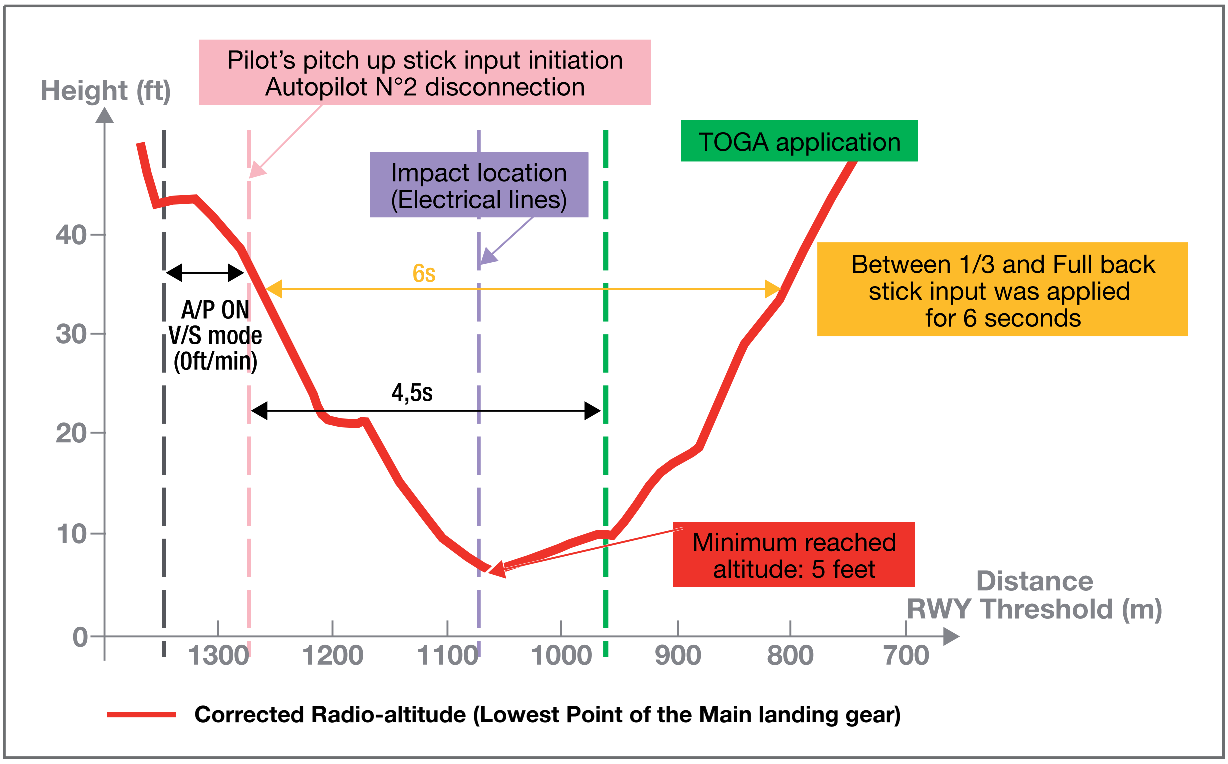
1/ As this approach was performed in GPS primary (In this case only GPS and IRS data are used for the aircraft position computation) the accuracy of the recorded aircraft position is very good.

2/ In managed guidance only (FINAL APP mode engaged) when the aircraft reaches MDA (MDH) –50ft or 400ft (if no MDA/MDH entered) the autopilot automatically disengages.

3/ As noticeable on the figure here above, from MDA altitude this final descent was performed on a 3° slope.

The figure here below presents a zoom on the pilot's take-over phase:

- The radio-altimeter parameters recorded in the DFDR (here plotted in red) indicate the distance between the lowest point of the main landing gear and the ground.
- The initial PF's pitch-up stick input was followed by permanent pitch-up stick input (between 1/3 and full back stick input) applied for 6 seconds, so that the aircraft stopped descending and started to climb.
- Minimum recorded altitude was 5ft RA reached at about 1100m from the runway threshold.
- The estimation of the impact location indicates that, at that moment, the aircraft impacted the electrical lines.
- At 10ft RA, 4.5 seconds after the initial PF's pitch-up stick input, thrust levers were moved forward to TOGA detent.
- 43 seconds after TOGA application, landing gears were selected up.
- 2 minutes after TOGA application, Slats/Flaps configuration 3 was selected.
- The aircraft diverted to the scheduled alternate airport.



Zoom on pilot's take-over phase

4 | Lessons learned

Following are the lessons to be learned from this near CFIT event:

4.1 Descent below MDA requests adequate visual references:

When conducting a non precision approach, it is recommended to apply the "Non Precision Approach" Standard Operating Procedures.
In particular, when the aircraft is properly established at MDA, the runway in sight must be confirmed by both PF/PNF, before disconnecting the autopilot and descending for a visual approach.

Furthermore, **if the required visual references are met at MDA but are lost at any time below MDA, a go-around procedure must be immediately applied.**

This is also highlighted in Chapter 7.3 (Acquisition of visual references) of the "Getting to Grips with..." ALAR brochure (Approach And Landing Accident Reduction).
This brochure can be downloaded from the Flight Operations Community at https://w3.airbus.com/.

4.2 Parameters monitoring

When conducting this particular approach, successive radio-altimeter callouts triggered below 200ft RA, while the aircraft was getting closer and closer to the ground, should have alerted the crew.

It is recommended as soon as the radio-altimeter is activated (at 2,500 feet AGL) to call out "radio altimeter alive". The radio altimeter reading should then be included in the instrument scanning for the remainder of the approach. See Flight Operations Briefing Note " Altimeter Setting – Use of Radio Altimeter."
This FOBN can be downloaded from the Flight Operations Community at https://w3.airbus.com/.

4.3 Step-down Non Precision Approach:

For non precision approaches, Airbus recommends implementing the Constant Angle Non Precision Approach (CANPA) rather than the classical step-down non precision approach. Flying a constant-angle approach profile will reduce the risk of CFIT. Indeed it will provide a more stabilized flight path, will reduce the workload during this critical flight phase and will minimize the risk of error in step-down distances/altitudes and the need for a level off at the MDA (MDH). This technique is detailed in the chapter 7.2 (Flying Constant-Angle Non Precision Approaches) of the "Getting to Grips with..." ALAR brochure (Approach And Landing Accident Reduction).

4.4 No EGPWS alert was triggered during the flight phase where the aircraft was getting very close to the ground:

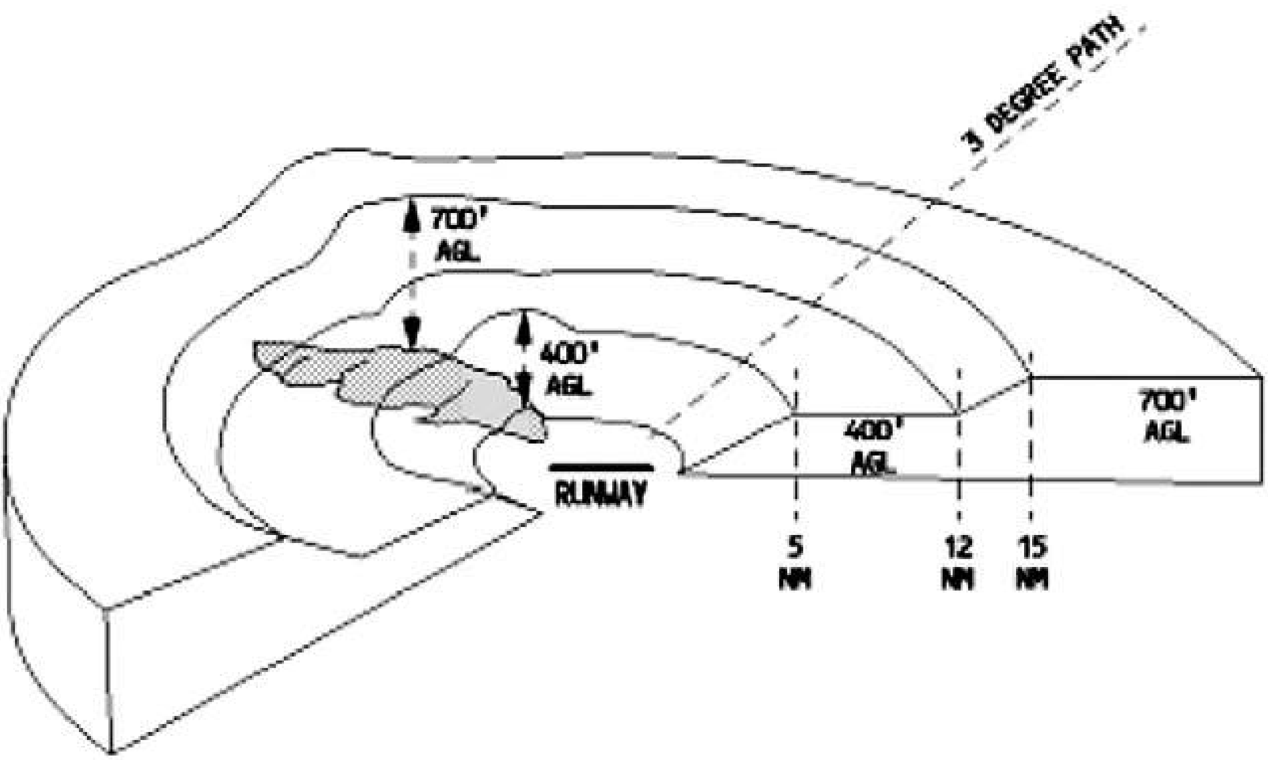
As the aircraft was in landing configuration (full slats/flaps, gear down…) no GPWS (Ground Proximity Warning System) basic modes could have been triggered, but as the aircraft was fitted with an E(enhanced)GPWS, the EGPWS mode "Terrain Clearance Floor (TCF) " could have been triggered. Indeed, the TCF function uses a Terrain Clearance Floor envelope (see drawing here below) stored in the EGPWS database for each runway for which terrain data exists, and warns in case of premature descent below this floor, regardless of the aircraft configuration.
If the aircraft descends below this floor a "TOO LOW TERRAIN" aural warning sounds. In case of such alert, it is recommended by the Standard Operating Procedures (SOPs) either to adjust the flight path (In daylight with terrain and obstacles clearly in sight) or to initiate an immediate go-around (during night or IMC conditions).

But as shown on the sketch here below there is a progressive desensitization of this function when the aircraft approaches the runway. In particular, in a circle centered on the runway, a full desensitization exists i.e. no warning when the aircraft is very close to the runway.
With the EGPWS software version fitted on this particular aircraft, the Terrain Clearance Floor function had a higher desensitization zone than current EGPWS, so that no alert was given when the aircraft descended very close to the ground.
With the latest EGPWS software version (the aircraft was equipped with a GPS), an alert would have been triggered about 20s before impacting the electrical lines (at about 200ft QFE).

Upgrade to last EGPWS software standard (P/N 965-1676-002) for any Airbus aircraft type: Please refer to OIT ref. SE 999.0050/06/VHR dated 18 April 2006. Please refer to last ref. SIL 34-080 revision

Note: The desensitization area depends on the FMS estimated position accuracy.
In particular this software release allows for the GPS position data to be used directly, resulting in much smaller estimated error values that allow for smaller desensitization areas.
This latest software version was revised to optimize the envelope profile and to reduce the minimum desensitization area to a circle with a radius of 0.25NM, whereas such radius was 1NM for the software version installed on the aircraft at the time of the event.
This results in significantly improved protection for "landing short" accidents.

This last, free of charge, EGPWS software version is available for any Airbus aircraft type since May 2006.



4.5 MDA and then an altitude lower than MDA were successively selected on the FCU during the final approach:

When performing non precision approaches, Airbus does not recommend MDA selection and even less so an altitude below MDA. Indeed, this may cause unwanted ALT* mode engagement and consequently approach destabilization at a critical stage of the approach. Therefore FCU altitude should be set at go-around altitude after over-flying the final approach fix (FAF).

5 | Conclusion

Five main recommendations should be particularly highlighted:

- **To be go-around prepared and go-around minded**
  When performing an approach, even and because the go-around is not a frequent occurrence, it is of prime importance to always be go-around-prepared and go-around-minded. This will help in performing the go-around appropriately, in the optimal conditions and as per procedures.
  In particular the flight crew should have a clear view of excessive deviation and should be ready to interrupt the approach if:
  - Ceiling and visibility are below the required weather minimums
  - Criterias for stabilized approach are not achieved
  - Doubt exists about the aircraft position
  - There is confusion about the use of automation
  - The aircraft is destabilized below MDA
  - The visibility is lost below MDA
- **To adhere strictly to SOPs for Non Precision Approaches**
  In particular altitude/distance checks and respect of MDA are crucial when performing Non Precision Approaches.
- **To retrofit a GPS on aircraft not already equipped with this system**
  The installation of a GPS improves the efficiency of the EGPWS by providing a more accurate aircraft position to the system.
- **To upgrade the EGPWS software standard**
  The EGPWS software should be upgraded with the last version (free of charge for any Airbus aircraft type), which reduces the desensitization area.
- **Constant Angle Non Precision Approach**
  Airbus encourage the operators to work with their Authorities in order to translate step down Non Precision Approaches into Constant Angle Non precision Approaches.

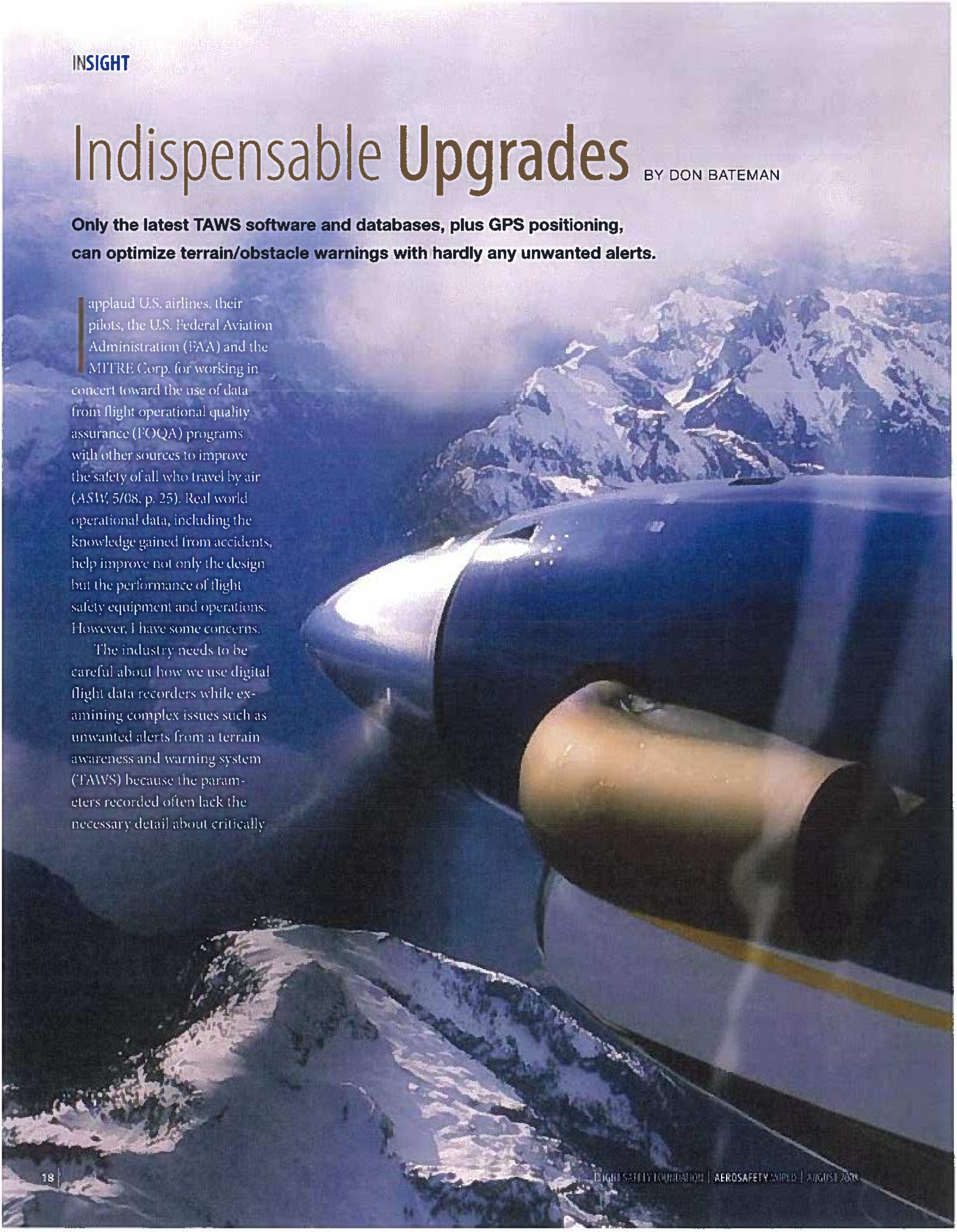
AIRBUS

APPENDIX 28

Indisponsable Upgrades

BY DON BATEMAN

Only the latest TAWS software and databases, plus GPS positioning, can optimize terrain/obstacle warnings with hardly any unwanted alerts.



I applaud U.S. airlines, their pilots, the U.S. Federal Aviation Administration (FAA) and the MITRE Corp. for working in concert toward the use of data from flight operational quality assurance (FOQA) programs with other sources to improve the safety of all who travel by air (*ASW*, 5/08, p. 25). Real world operational data, including the knowledge gained from accidents, help improve not only the design but the performance of flight safety equipment and operations. However, I have some concerns.

The industry needs to be careful about how we use digital flight data recorders while examining complex issues such as unwanted alerts from a terrain awareness and warning system (TAWS) because the parameters recorded often lack the necessary detail about critically important factors. This can end up distorting and hurting a well-intentioned study. Further, we need to wisely invest precious public funds by using the work that others in the industry already have accomplished.

As described in the May 2008 *AeroSafety World*, the limited method used in the FAA-industry study of unwanted TAWS alerts was not a wise choice. A key variable, the technical characteristics of each TAWS unit, was mentioned but apparently not considered. As a result, the flight data from FOQA programs provided no information about a TAWS unit's manufacturer, model, software version, database version or whether the aircraft position data sent to the unit was from a flight management system (FMS) or a global positioning system (GPS) receiver/sensor.

This omission is significant. Ongoing research on the Honeywell enhanced ground-proximity warning system (EGPWS) shows that a large number of unwanted alerts are caused by the failure of many operators to periodically update the software. The updates improve the alerting algorithms and expand the database of terrain, obstacles and airports. Many airlines have never updated their EGPWS database since they installed or received the equipment.

Similarly, unwanted alerts also can be traced to a failure to use GPS to provide a direct source of aircraft three-dimensional (3D) position to the EGPWS — latitude, longitude and geometric altitude. In aircraft equipped as recommended, however, unwanted alerts from the EGPWS unit have been reduced to less than one per 20,000 flights (*ASW*, 6/08, p. 21). The remaining unwanted alerts have been caused mostly by some characteristics of unstabilized approaches that should not cause a TAWS alert.

Despite the widely hailed adoption of this technology, an aircraft equipped with EGPWS or other TAWS equipment still could experience a controlled flight into terrain (CFIT) accident because of the factors involved in unwanted TAWS alerts. In such a CFIT scenario, the impaired TAWS equipment would not provide a timely warning to the flight crew (Figure 1, p. 20). In one serious incident in 2006, the EGPWS-equipped aircraft struck power lines some 1,200 m (3,937 ft) short of the runway. There was *no* EGPWS warning because the unit's software had not been updated and there was no GPS data direct to the EGPWS. With the latest software and GPS data direct to EGPWS, that flight crew would have had more than 30 seconds of warning prior to colliding with the power lines.

Such scenarios underscore the importance of updating the database at least once a year to help provide timely alerts and reduce the probability of an unwanted warning. Keeping the system fully operational requires sound avionics maintenance practices. It is also important for operators to provide a standard operating procedure in which one terrain display is enabled on every departure or arrival to enhance pilot situational awareness of terrain and obstacles.

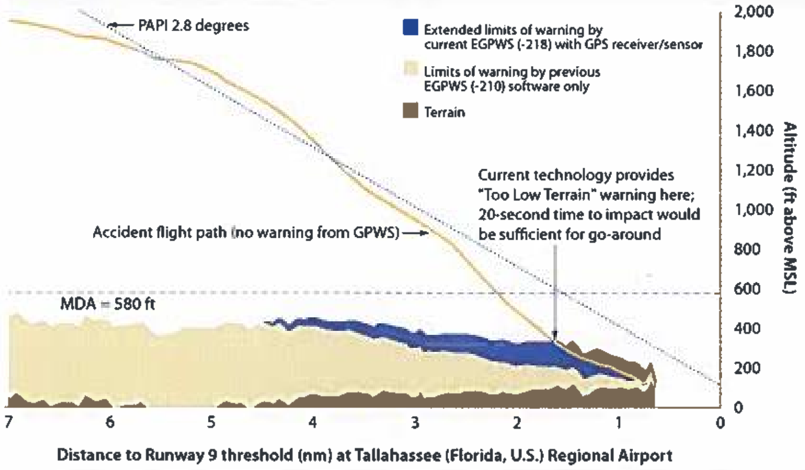
An EGPWS unit that uses only the FMS and barometric altimeter as its data sources for aircraft position can have limitations such as map shift, faulty updating of aircraft position while navigating to ground coordinates; a mismatch between the geographic coordinates issued in a nation's aeronautical information publication and the World Geodetic System 1984 reference frame (WGS-84) coordinates used by TAWS for terrain, obstacles and runway-end positions; and altimetry errors.

When an EGPWS-equipped aircraft has the latest software and terrain-obstacle-airport database installed — and also uses GPS as an aircraft position source — current research shows that it will have virtually no unwanted TAWS alerts in the United States and will be compatible with most air traffic control (ATC) vectoring.

A GPS receiver/sensor, with geometric altitude enabled in the EGPWS example, is especially important because it provides earlier terrain/obstacle warnings when needed near the runway, creates less risk of unwanted alerts, provides compatibility with QFE operations[1] and provides independence from barometric altimeter-setting errors and altimeter errors. Unfortunately, more than half of the 18,000 large commercial jet aircraft currently equipped with EGPWS operate without the benefits of aircraft 3D position from GPS direct to EGPWS.

When updated as recommended, EGPWS and other TAWS units also may add proprietary functions that help reduce the risk of loss of control, a premature descent or a collision with an obstacle during a go-around. The "peaks" function of EGPWS, for example, helps the pilot to detect a possible premature ATC descent clearance over mountainous terrain and provides a descent aid during an off-course weather deviation or a descent required by engine shutdown or an explosive decompression of the cabin. This can be enabled on any EGPWS unit by changing a jumper wire on the unit to enable display of the highest terrain value ahead of the aircraft, display obstacles and provide aural and visual warnings for a possible flight path into a tower or obstacle higher than 30 m (98 ft) above terrain. An estimated 60 percent of airliners equipped with EGPWS do not have these functions enabled.

Go-Around Opportunity With Current TAWS Technology



EGPWS = Honeywell enhanced ground-proximity warning system; GPS = global positioning system; GPWS = ground-proximity warning system; MDA = minimum descent altitude (unused nonprecision radar approach); MSL = mean sea level; PAPI = precision approach path indicator; TAWS = terrain awareness and warning system

Note: Federal Express Flight 1478, a Boeing 727, struck trees on short final approach and crashed short of Runway 9 on July 26, 2002. During this night visual approach to landing, the crew did not respond to the too-low indication of the PAPI. The onboard GPWS, which met existing requirements, was not designed to provide terrain alerts in this landing scenario. EGPWS also does not provide terrain alerts in this scenario unless the software and terrain-obstacles-airport database are current and the unit receives aircraft latitude, longitude and geometric altitude from a GPS receiver or internal GPS sensor.

Source: Don Bateman and U.S. National Transportation Safety Board

Figure 1

Various methods of identifying sources of unwanted TAWS alerts have evolved. As an analytical tool, a nonvolatile flash-memory device was designed into EGPWS units in 1995 to automatically store flight path data whenever a terrain caution or warning alert occurs. Conditions such as wind shear and excessive bank angle also activate recording. The memory retains a flight history from 20 seconds prior to each alert to 10 seconds after the alert. An airline can download this deidentified data with a memory card for its own analysis and/or contribute the data to the Honeywell research database.

The flight history comprises the aircraft groundspeed, ground track, airspeed, heading, altitude, vertical speed, geographic position during the event, runway track and location, flap/gear configuration, EGPWS software version, EGPWS terrain/runway database version and the aircraft type. In accordance with agreements reached in 1995 with the initial airlines that installed EGPWS and their pilot associations, the flight history has no time/date stamp or aircraft registration number.

To date, more than 11 million departures — counting flight legs/sectors — have been audited from a total of some 300 million departures of Western-built large commercial jets around the world without compromising the privacy of the pilots or the airlines. Contributions of downloaded flight histories to this research database during the last 10 years have led to EGPWS software upgrades and the improvement and validation of databases. Specifically, the audits have helped validate that runway locations match their WGS-84 coordinates. They also have helped to improve algorithms in the software to increase the predictive terrain warning time in case of an inadvertent flight path into the ground or into water short of the runway.

Today, an industry goal should be to systematically prioritize all types of unwanted warnings in the cockpit, isolate the systemic causes and reduce those warnings through improvements in the total system architecture. In my opinion, the minimum operational standards for the traffic-alert and collision avoidance system (TCAS) and ATC practices need to be revisited (*ASW*, 6/08, p. 17). For example, the smart use of automatic dependent surveillance–broadcast (ADS-B), including flight path intent information from the FMS of the other aircraft to improve the integrity of TCAS could help greatly to reduce unwanted resolution advisories and help both the pilot and the air traffic controller.

Thus, if U.S. airlines, the FAA and industry partners combine forces to collect actual warning data that give sufficient detail on the equipment in use, analyzing these data will allow us all to make improvements to complete aircraft systems and the traffic environment.

Don Bateman, corporate fellow-chief engineer, flight safety technologies, at Honeywell Aerospace, received awards for research and development of EGPWS in the 1990s and GPWS in the 1970s.

Note

1. In the QFE method, the pilot adjusts the altimeter with a setting provided by the airport so that it will read zero at touchdown on the runway.