

A330-200 CBT NOTES

These notes were made using the A330 VACBI (CBT) course provided to EVA prior to delivery of the EVA A330-200 aircraft. They do not contain a complete copy of the entire text of the CBT information provided but are highlights in the differences between the A330-200 to the B-767 aircraft (a conventional aircraft) and other similar aircraft.

These notes ARE NOT updated on a regular basis and may not contain the latest up-to-date information. The current EVA Airways FCOM is the sourced document and the final authority for the correct operation of the aircraft and the most accurate description of aircraft systems.

A thorough knowledge of the EV A330-200 CBT will provide sufficient knowledge to operate the aircraft safely. However, there is information found in the A330 FCOM and QRH which the pilot is also responsible to know.

If you have any changes to these notes please pass them along to me.

Enjoy the A-330.

Craig Shaver

A330-200 CBT NOTES

INDEX

CBT #1

| | | |
|----|-----------------------|----|
| 20 | Aircraft General..... | 2 |
| 31 | EIS-ECAM..... | 2 |
| 49 | APU..... | 10 |
| 31 | EIS-EFIS..... | 11 |
| 31 | Recorders..... | 17 |
| 22 | Autoflight..... | 17 |
| 36 | Pneumatic..... | 50 |

CBT #2

| | | |
|----|-----------------------|----|
| 21 | Air Conditioning..... | 53 |
| 24 | Electric..... | 58 |
| 29 | Hydraulic..... | 64 |
| 26 | Fire Protection..... | 68 |
| 52 | Doors..... | 71 |
| 34 | Navigation..... | 72 |
| 21 | Pressurization..... | 81 |
| 21 | Ventilation..... | 83 |
| 70 | Power Plant..... | 85 |

CBT #3

| | | |
|----|----------------------|-----|
| 28 | A-330-200 Fuel..... | 93 |
| 32 | Landing Gear..... | 100 |
| 27 | Flight Controls..... | 107 |
| 23 | Communications..... | 124 |

CBT #4

| | | |
|----|-------------------|-----|
| 35 | Oxygen..... | 127 |
| 35 | Cabin..... | 128 |
| 33 | Lights..... | 131 |
| 30 | Ice and Rain..... | 134 |

A330-200 CBT NOTES

CBT # 1

AIRCRAFT GENERAL

At 230,000 kgs MTOW range of 6400 nm

Maximum seats 375

Wingspan 60.3m, height 17.8m, length 58.3m

Minimum pavement width 44m with 72 degrees steering

Dark cockpit philosophy

EIS – ECAM

ECAM composed of E/WD and SD display

Presentation based on a “need-to-know” philosophy.

Presentation based on a “lights-out” philosophy.

LIGHTS

Normal operations = lights out

Abnormal condition = **amber** crew awareness not immediate action

System deactivated = **OFF** white

System activated = **ON** white

Temporarily selected = **blue**

System available and normal = **green**

Immediate Crew Action = **Red**

ADIRS + NAV data = FMGES →

DMC1 Captain -----→ PFD + ND (Display Management Computer)

DMC2 Backup -----→ Backup

DMC3 First Officer --→ PFD + ND

DMC (Display Management Computer) has 2 channels: ECAM, EFIS

ECAM

A/C system sensors → 2 System Data Acquisition Concentrators
(SDAC) - - -→ 3 DMC's

DMC3 -----→ ECAM system

DMC 1 & 2 → backup

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PILOT ASSISTANCE NOTES

2

A330-200 CBT NOTES

2 Flight Warning Computers (FWC). Receive data from A/C system to generate warnings and SDAC generates amber cautions.

FWCs → DMCs for:

- Alert messages
- Attention getters
- Loudspeakers for aural alerts
- Synthetic voice messages

ECAM A

E/WD has 2 parts

- Upper – main engine parameters, FOB and Flap/SLAT position
- Lower – memo messages
If failures occur, Warnings/Cautions displayed in place of memos – Blue checklist, if applicable, appears

SYSTEM DISPLAY (SD) displays particular systems. Synoptic diagrams are shown automatically or manually.

STATUS page shown to check status of aircraft. NORMAL is shown if normal and no inoperative systems.

Can show:

- Limitations
- Approach procedures including actions and corrections
- Information
- Inoperative systems

Bottom of any display shows TAT, SAT, TIME, GW and GWCG

STATUS page shows information on the left side and all INOP SYS on the right side.

ECAM provides pilots with the info they need at the appropriate time – “need to know”.

ECAM divides displays into flight phases.

ECAM ADVISORY will pulse but still be green in color. (e.g. high but normal engine vibration)

When get a caution message, CLEAR keys illuminate to allow clearance of item from ECAM.

A330-200 CBT NOTES

With ECAM message, ask for “ECAM actions”.

When pressing the CLEAR key, the CAUTION message is cleared from the E/WD and moved to the INOP SYST on the STATUS page.

Clearing the STATUS page by pressing one of the CLR or STS keys.

The white STS box at the bottom of the E/WD pages means that there is info on the STATUS page. The ECAM control panel has no lights now.

MASTER CAUTION = 1 chime + lights

Failure message on E/WD

Synoptic display for the system appears

CLR keys on ECAM control panel light up

When action items are taken the appropriate switch lights are off.

A message that is “boxed” indicates a failure that will affect other systems. This is a primary failure.

The systems affected are shown on the right – they are called “secondary failures”

“Primary failures” are shown on the left side.

Clearing these Primary messages causes normal messages to reappear.

The controls that are affected are shown amber in the corresponding synoptic.

Then you can clear the Secondary failure and the INOP SYS section of the STATUS page then shows all relevant failures.

The status page will also show relevant information for continuation of the flight.

Any items on the ECAM will be shown automatically during the approach when slats are extended or the QNH is set. This is for any items that affect the approach and landing.

A330-200 CBT NOTES

ECAM B

MASTER WARNING light, chimes (continuous) and alerting system is reset when the **MASTER WARNING** light is pressed.

LAND ASAP message on E/WD means the ECAM has determined that the fault is serious enough to require a landing as soon as possible.

When a warning has priority over an action, the action will move to the bottom of the ECAM checklist to be done at the appropriate time.

A white line may appear in the checklist to show there is a built-in delay for a particular reason.

When a countdown is complete a blue action line appears to tell you to do the next item.

When an emergency is completed, the red ECAM warning disappears along with local warnings. The **LAND ASAP** changes to **LAND ASAP** which means the fault is less critical but still requires landing ASAP.

If there are more than 7 lines, an OVERFLOW ARROW ↓ shows up at the bottom of the E/WD.

Pressing the CLR key displays the next page.

Pressing the STS key takes you back to the beginning of the STATUS messages.

ECAM priority is:

Low priority faults appear below those more important. Higher priority is placed at a higher level.

* Items on the right side indicate the fault has been seen. The * disappears when the fault is shown on the information side of the E/WD

A330-200 CBT NOTES

ECAM NORMAL OPERATION

Normally, ECAM screens are turned on UPPER first and then LOWER. If reversed, the E/WD will be displayed as it has priority over the SYS display.

DOOR/OXY will automatically display with the doors open on the ground.

Memo area can show that **REFUEL IN PROGRESS**

When a SYNOPTIC is displayed (i.e. APU) that page light on the ECAM control panel is NOT on.

When the APU is started, the DOORS/OXY page is redisplayed.

Press the RCL pushbutton to see what warning/cautions that have been cleared since the last power-up.

When a SYS page is called manually, the light on the ECAM control panel illuminates. Pressing it again, return to the prior display page on the ECAM.

On DOOR/OXY page, green indications mean you are in a “go” state.

ENGINE page displayed when engines are started.

ECAM detects **NW STRG DISC**. After first engine start, changes to **NW STRG DISC** because you are capable of taxiing but the steering is disconnected.

ECAM WHEEL page automatically displayed to monitor brake temps.

When any of FLT CTRLS are moved on the ground, the ECAM F/CTL page is displayed.

2 minutes after the 2nd engine is started, the TAKEOFF memo appears. These actions are required to prepare the aircraft for takeoff.

T.O. CONFIG key is located on the ECAM control panel.

When engines set to TO thrust, the ECAM ENGINES page is displayed.

A330-200 CBT NOTES

T.O. INHIBIT message (magenta) indicates that some warnings and cautions have been inhibited during the takeoff phase.

After 1,500' or 2 minutes after takeoff, the T.O. INHIBIT ceases and memo is removed.

At acceleration altitude the climb phase is activated.

When flaps are fully retracted, the ECAM ENGINES page is replaced by the CRUISE page.

ALL key sequences through the system pages.

As gear is extended, the WHEEL page is displayed.

Passing 1,500' with gear down, a Landing memo appears on the E/WD with actions.

At 800' the **LDG INHIBIT** is active.

At engine shutdown, the DOOR/OXY page is displayed automatically.

A pulsing **STS** message on E/WD means there is a maintenance message on STATUS page to see.

A white message means a system requires service at the next programmed servicing. DOES NOT mean the aircraft is unserviceable.

EIS RECONFIGURATION

EFIS DMC1 normally supplies CAP PFD and ND

EFIS DMC2 normally supplies the FO PFD and ND.

EFIS DMC3 normally is used as a backup.

If one DMC fails, you get a:

MASTER CAUTION

EIS EFIS DMC 1 FAULT

Also get a diagonal white line across the PFD and ND. Indicates the displays are working but not receiving any data.

You select EFIS DMC3 by using the ECAM action.

A330-200 CBT NOTES

ECAM DMC3 supplies both the E/WD and SD using EFIS DMC1 and 2 as backup.

ECAM DMC1 will automatically replace DMC3 to recover the system info as soon as possible.

The ECAM action has you move the ECAM DMC selector to position 1 – this has already occurred automatically though.

If a single SD fails, you can reconfigure the EIS to ensure you have all the info you need.

There is no white diagonal line meaning the CRT has failed. PFD automatically transfers if necessary to the ND screen to maintain data display.

If ND fails, there is no automatic transfer. If required, PFD/ND sw can be used to manually transfer navigation info to the PFD screen.

If the upper E/WD screen fails, the info is displayed on the lower screen. E/WD has priority over the SD.

System pages can be displayed by using the ECAM control panel pb switches.

You push “and hold” to temporarily display the pages. If you hold the pb more than 30 seconds, the system pages is replaced with the E/WD page.

If one display fails, you can transfer SD to one of the ND screens using the ECAM/ND transfer switch on the ECAM control panel. Normal selection of system pages is by the ECAM CP.

If both displays fail, you can transfer E/WD to one of the ND screens using the ECAM/ND transfer switch on the ECAM control panel. Normal selection of system pages is by the ECAM CP for a maximum of 30 seconds.

When limited to a single ECAM screen, handling of malfunctions is slightly different. If an advisory occurs, the relevant system page is not automatically displayed. An advisory (**ADV** – white) message on the E/WD appears and pulses and the light on the ECAM CP system appears.

A330-200 CBT NOTES

If and ECAM warning or caution is triggered, there will be no automatic display of the relevant system page. System pages are called using the manual selection on the ECAM CP.

Actions are then carried out using the E/WD page info.

When actions are carried out and the CLR key is pushed the STATUS page will not be displayed as usual. Pressing the STATUS pb can display the STATUS page for up to 3 minutes before an automatic return to the E/WD.

During the approach phase, there is no automatic display of the STATUS page when Flaps 1 or QNH are set. To remind the pilots to review STATUS, there is a STS boxed and pulsing on the E/WD.

ECAM ABNORMAL OPERATION

The FWCs receive data from aircraft system sensors to generate red warnings and the SDAC1 and SDAC2 to generate amber cautions.

FWC then supply the DMCs for:
display of alert messages
attention getters
aural alerts and synthetic voice messages.

If one FWC fails, you get a **FWS FWC1 FAULT** on the E/WD. This downgrades the aircraft to CAT 3 single.

With a failure of any other system, only ½ of the **MASTER WARNING** or **MASTER CAUTION** will appear. Capt. = lower half, FO = upper half. Reversed for a FWC2 failure.

Loss of both FWC will remove automatic monitoring of the aircraft systems. A message generated by a DMC is displayed on the E/WD. No further ECAM warnings, cautions, aural warnings or MASTER WARNING or MASTER CAUTIONS lights.

NOT AVAIL is:
ECAM WARN
ALTI ALERT
STATUS
A.CALL OUT
MEMO

A330-200 CBT NOTES

You have to check overhead panel for any system warnings

System pages can be checked on the ECAM CP pb. You can use the ALL or individual PB to see this.

The EMER CANC pb is used to cancel an intermittent nuisance message. It can be used to cancel most aural warnings. Get a white CANCELLED CAUTION message. It is then transferred to the STATUS page and can be cleared. If this is done, then notification of a reoccurrence of the same failure will be lost. Pressing the RCL pushbutton for more than 3 seconds cancels the “suppression function” and the system returns to normal.

APU

Aircraft can be started using:

- aircraft batteries
- EPU source
- Normal aircraft AC power

ECAM can monitor:

- EGT
- Compressor speed
- APU generator
- APU bleed valve
- APU inlet flap position

APU provides electrical power and bleed air for engine starting

APU emergency shutdown capability at the nose gear & fueling panel.

APU fire extinguisher overpressure red dot under left horizontal stabilizer

Starting APU you get a “**FLAPS OPEN**” on ECAM APU page.

APU runs 2 minutes to cool – can be interrupted

MASTER switch can be turned back on provided the “**AVAIL**” light is still on the MASTER switch.

A330-200 CBT NOTES

At 95% RPM, **ON/R** extinguishes and **AVAIL** comes on to indicate electric and air are available. ECAM AVAIL on APU page.

APU bleed air to:

- 17,500' for 2 packs
- 22,500' for 1 pack
- 25,000' for battery start
- 37,000' for AC electrical start
- 41,100' for AC start if not used for more than 2 hours
- 41,100' for APU operations and electrical power

APU High EGT on Start

MASTER CAUTION

APU FAULT

AUTO SHUT DOWN

ECAM APU page displays APU master switch **FAULT**.

Autoshutdown for:

- Overspeed
- Slow start
- Low oil pressure
- Etc.

APU Emergency Shutdown

MASTER CAUTION

APU FAULT

EMER SHUT DOWN

APU fire bottle is discharged automatically (does not happen in flight).

APU shutdown also occurs when:

- APU shutoff pb pressed on external power panel
- Shutoff pb is pressed at any of 3 Refuel/Defuel Panels
- APU Fire Panel switch is pushed

APU Emergency shutdown for fire – auto shutdown and bottle discharge on ground

EIS - EFIS

Control panels have 2 sections:

- PFD
- ND

A330-200 CBT NOTES

FCU – Flight Control Unit located in center of the glareshield.
CHRONO pushbuttons control associated chronometer on the ND.

PFD PRESENTATION (A)

Displays altitude, attitude, airspeed, vertical speed and heading and track

Laid out in a “T” configuration

Also provides info on the FMGS on the FMA.

FD pushbutton on EFIS control panel.

Always fly with both FD on or off. NEVER fly with only 1 FD ON.

RA shows below 2,500’.

Roll index triangle shows angle of bank

Sideslip index located below the Roll Index triangle. Replaces the slip ball on most aircraft.

Speed scale moves behind a fixed yellow reference line and triangle.

Speed trend arrow shows the value attained in 10 seconds if acceleration remains constant.

A magenta Target Airspeed triangle appears when FMGS is controlling airspeed. Called Managed Airspeed Target.

A blue triangle ◀ appears when target airspeed is manually selected. Called SELECTED AIRSPEED TARGET.
Achieved by a rotary selector on the FCU.

On PFD,

Magenta = managed

Blue = selected.

Blue decision speed 131 = V1.

Blue circle ○ = VR speed

Magenta speed ◀ = V2. Shown as numbers (141) since beyond the visible scale.

Magenta airspeed target remains at V2. FD target speed is V2+10.

A330-200 CBT NOTES

Minimum flap retraction speed indicated by a green **F**. This is the **F** speed. (VFE)

Flap limit speed shown by a red and black strip at the top of the scale.

At acceleration altitude the target speed jumps to 250 knots. Shown as green number since off-scale.

The **F** speed is replaced with the green **S** indication. This is the minimum slat retraction speed.

VFE increases to reflect the limiting speed for flap 1.

After flaps retracted, the target speed is in line with the speed reference line.

When cleared to accelerate to climb speed, the target speed jumps to approx. 290 kts/

Below approx 30,000', the VMAX is fixed at 330 kts to represent Vmo.
VMAX = Vmo

MACH speed indication appears when speed is above M0.5.

Above 30,000' VMAX = Mmo or M0.86.

A green circle **O** indicates the best lift-drag ration speed for the aircraft in clean configuration.

Called **GREEN DOT** speed.

During a FMGS computed managed descent, magenta triangle indicated target speed. The double magenta bars indicate the speed range. The speed can vary between the two speed range indicators.

VFE NEXT speed (**=**) is shown following initial deceleration to 250 kts, the next flap limiting airspeed.

VFE next indication is visible provided the plane is below 15,000'.

Green dot speed may also be visible.

A deceleration to green dot speed takes the speed below VFE for the first flap selection. Target airspeed at the bottom of the airspeed tape indicates the approach target speed. Shown as a number.

A330-200 CBT NOTES

When Flap 1 is selected, **S**, VFE, and VFE Next appear. The speed decreases to **S** speed.

When Flaps lever in position 2, the **S** speed is removed.

Approach speed target is a .

Once aircraft lands, all additional speed indications are removed except the trend arrow.

PFD PRESENTATION (B)

Altitude indications on right-side of PFD.

Altimeter

Vertical speed

Altimeter

Red ribbon represents field elevation

Blue target altitude is displayed on top to match FCU selected altitude.

Bottom of altimeter shows baro reference.

Baro reference setting achieved by Baro Reference selector and indication on EFIS control panel.

Magenta target altitude indicates a constraint.

As it is approached, a constrain altitude shows as a target box.

Pulling the baro reference knob on EFIS control panel sets transition altitude. Changes targets to FLs (flight levels). **STD** is displayed in baro reference indicator.

Target flight level is magenta when aircraft in a managed descent with a constraint indicated at bottom.

When vertical speed is high, it is displayed in amber (e.g. **68**)

The magenta dot  to the left of the altimeter strip corresponds to the theoretical decent profile computed by the FMGEC. Displayed from TOD to the final interception altitude. Also shown on FMGEC PROG page.

Ground reference ribbon (red) appears with the landing elevation line when on approach.

Compass

Fixed yellow line represents the centerline of the aircraft.

The green diamond  represents the aircraft track. Called "Track Diamond".

A330-200 CBT NOTES

A selected heading may appear as a blue figure (e.g. **080**) on the appropriate side (if the actual heading can't be seen) or as a blue ▼ triangle if it can be seen.

Heading selector and indicator on the FCU.

Small white ticks on the horizon line of the attitude indicator line up with compass headings on the compass. As the heading changes, the ticks move to stay in line.

ILS Indications

ILS pushbutton on EFIS control panel switches on the display.

Shows:

Localizer ◊

Front course (inverted †)

Glideslope ◊

Information (frequency etc.)

ILS front course will be displayed in magenta at the side of the compass scale, if the figure is outside the visible scale.

When ILS front course is within the compass scale, it is shown as a magenta dagger.

Flight Path Vector (FPV)

Shows what the aircraft is doing in relation to the outside world.

An indication of the aircraft flight path. It is not a director.

Green symbol (the "bird") represents the aircraft.

Flight path angle shows the angle at which the aircraft is flying through the air.

With FPV in line with track diamond, shows drift angle.

ND PRESENTATION

5 navigation display modes. The ENG display mode presents engine parameters. It is used in some ECAM failures cases.

3 basic Navigation display modes.

ROSE – 360 degree compass rose.

ARC – a 90 degree segment

PLAN – a map with North at the top

Wind data – shows wind direction (true north) and speed.

Wind arrow shows magnetic wind direction.

Aircraft magnetic heading given by a fixed yellow lubber line at the top.

A330-200 CBT NOTES

Selected heading or track is shown by a blue triangle or numbers (e.g. ▼ or 080), if out of display range. Actual track shown by a green track diamond ◇.

Range marks by white dotted lines with range values in blue.

ROSE ILS is a raw data ILS mode.

ROSE VOR

White bearing pointer for VOR.

Green bearing pointer for ADF

The little white "M" next to the frequency means these are manually tuned.

ROSE NAV displays a map view of the area around the aircraft.

Green line represents the flight plan of the aircraft in the FMGS.

"TO" waypoint is the active waypoint – displayed as blue color.

ARPT contains airports in the airport data base are shown. *

NDB contains NDBs in the airport data base are shown △ + ID

VOR.D contains VORs in the airport data base are shown ▣ TIA

WPT contains waypoints in the airport data base are shown ◇ NAME

CSTR displays only the constraints related to your flight. (speed, altitude, time etc.)

PLAN – the flight plan legs are displayed in relation to true North. The center of the display is a waypoint. The aircraft is displayed in relationship to that waypoint.

EFIS NORMAL OPERATION

When switch on EFIS, turn on PFD then ND. Shows failure flags as there is no data from FMGS or ADIRS are not on line.

QNH defaults to 1013 hPa.

Normally PF has CSTR (constraint) selected on EFIS control panel.

Selection of VOR / ADF selectors depends on the nav aids used for the departure.

A330-200 CBT NOTES

FD are normally switched on when powered up. 1FD2 means Capt. and FO are switched on.

FD crossbars are not displayed because on the ground they are not required. On takeoff they will automatically appear.

If aircraft is shut down, the EFIS displays are turned off using the control knobs.

RECORDERS

DFDR operates for 5 minutes after engine shutdown

ACMS – Aircraft Condition Monitoring System

AUTOFLIGHT

4 main sections

1. Computation & processing (heart of the system)
 - 2 FMGECs (Flight Management Guidance and Envelope Computers) – work together with 2,3,and 4 below
2. Information sources
 - Navigation information
 - Aircraft performance information
 - ADIRS & GPS
 - Clock
 - Radio Navigation information
3. Input devices from pilots
 - FCU (Flight Management Computer) inputs
 - 3 MCDUs (Multi-purpose Control Display Units)
4. Output devices
 - FMGECs provide outputs for:
 - Autopilot system for pitch, roll and yaw
 - Autothrust system – thrust control
 - EFIS and MCDU system for display of information
 - Navigation radios – for automatic tuning of radio aids

FMGECs divided into three main parts: (a 4th part exists called FIDS – for maintenance only)

Flight Management (FM)

A330-200 CBT NOTES

Flight Guidance (FG)

Flight Envelope (FE)

FM part controls:

Navigation – accurate position of the aircraft and the capability to automatically follow the programmed flight plan

Flight Planning – the flight plan computation

Performance Optimization – costs, speed and optimum altitude computation

Predictions – the accurate estimates for waypoints, altitudes, speeds, fuel, destinations and alternates

Display Management – the control of information to the EFIS system to display autoflight modes and navigation information

Navigation Radio Management – the autotuning of the navigation radio

FG part provides:

Autopilot Commands – to automatically control pitch, roll and yaw

Autothrust Commands – to automatically control thrust

Flight Director Commands – to the pilot for control of pitch, roll and yaw

FE part provides:

Flight Envelope and Speed Computations – lowest selectable speed, flaps, placard speeds, etc

GW/CG Computations – backup computations

Windshear and AFT CG Warnings

Monitoring – Flight Management and Flight Guidance parameter monitoring.

The FCCs control many flight envelope functions, such as protections.

As a general rule the 2 FMGECs have access to the same information sources and exchange info.

Each FMGEC is linked to its own MCDU but the information is synchronized with the other FMGEC.

MCDU 3 is used as a backup should MCDU 1 or 2 fail.

MCDU 3 is normally used for other functions such as ACARS, ACMS etc.

A330-200 CBT NOTES

Each FMGEC controls its own AP and FD (normally).

FMGECs send commands to the autothrust system.

Each FMGEC has its own autothrust function but only one is active at a time.

FLIGHT CONTROL UNIT

FCU enables you to control:

- Speed / MACH guidance

- Lateral guidance

- Vertical guidance

- Autopilot and autothrust

Targets are two types:

- Manual – by the crew

- Managed – by the FM

When FM manages the target dashes are displayed in the window – managed light displayed for:

- Speed

- Heading / Track

- Altitude

When manually selected, a target value is displayed

Selector knobs used to:

- Manually select a target by turning it

- Engage the AP/FD mode on the selected target by pulling it

- Engage or arm an FM managed mode by pushing it

Mode pushbuttons used to engage or arm specific modes

- LOC

- ALT

- APPR

SPD/MACH KNOB

Change from SPD / MACH around 30,500'.

Pulling the speed knob sets the speed displayed as the target for the AP and ATHR.

Pushing the selector knob uses the FM managed target speed

A330-200 CBT NOTES

HDG / TRK

Turning it selects a heading or track target.

Pulling it – used as the target for the AP/FD

Pushing it – let FM manages the target HDG/TRK. The managed lateral light illuminates to show arming and white dashed lines after the mode is engaged.

HDG – V/S or TRK FPA toggles between attitude and Flight Path Vector or called BIRD ON and BIRD OFF. Also changes the heading to TRK on the display window.

VERTICAL – 2 areas:

Altitude

Altitude window is never dashed. Only crew has input

Alt select knob can be set for 100 or 1000' increments

PULLING: to use selected target disregarding altitude

constraints

PUSHING: use selected target respecting altitude constraints

(managed mode)

METRIC ALT pb displays the selected and actual altitudes in meters on the PFD.

V/S – FPA selector knob : 3 functions:

TURN: to select the target V/S – FPA

PULL: uses the selected target V/S – FPA

PUSH: commands an immediate level off. (V/S or FPA = 0).

Value 0 is also displayed in the window as well as the FMA.

ALT pushbutton allows you to command an immediate level-off

Green light means that the aircraft is maintaining an altitude.

AP1 And AP2 used to engage them.

RULE: Any FCU change should be shown on the FMA!!!

RULE: Know your FMA at all times!

FLIGHT MODE ANNUNCIATOR

Verify all inputs with an output.

Divided into 5 columns – 3 lines in each column

Thrust

Vertical modes of A/P and FD

A330-200 CBT NOTES

Lateral modes of A/P and FD

Approach capability of Flight Guidance System -- AP, FD, A/THR

Engagement status of Flight Guidance System—AP, FD and A/THR

Certain cases the 2nd and 3rd columns combine to form a Common Mode – on approach & landing.

1st line shows the engaged modes of the flight guidance system. Indicates green.

SPEED – autothrust adjusts thrust to acquire and track target speed

ALT – AP/FD guides a/c to track target altitude

HDG – AP/FD guides a/c to acquire and track the target heading.

2nd line shows armed modes for flight guidance.

Blue color for armed

Magenta color for specific managed mode cases.

3rd line shows reminders or messages

SET MANAGED SPEED reminds you to return from SEL to MGD SPD.

4th Column dedicated to approach capability info and associated minima

First two lines indicate the redundancy level of the FG, available for an ILS approach as well as the resulting capability (CAT2 or CAT3)

Last line displays the approach minimum (MDA or DH in blue) as selected by pilots via the MCDU.

Numerical value is displayed.

5th Column

Line 1 – indicates the engagement status of the FGS (**AP1+2**)

Line 2 – indicates the engagement status of the FDs

e.g. **1FD1** indicates the Capt. FD is on both Capt and FO side

Line 3 – engagement status of A/T

White color – it is on

Blue color – it is armed

Any mode change in the FMA is indicated by a white box around it for a few seconds.

A330-200 CBT NOTES

AUTO PILOTS – FLIGHT DIRECTORS

An A/P can be switched on 5 seconds after takeoff and 100' and left on until after touchdown.

AP1 used when Capt. PF and AP2 when FO flying.

For ILS auto approach 2 AP on at the same time (**DUAL, AP1+2**).

Red A/P pushbutton (or TAKEOVER) is pushed to disengage the A/P.

When 1st AP or FD is turned on, comes up in HDG and V/S basic modes engaged.

On an ILS rollout tracking the localizer is made easier with a YAW BAR where the roll bar used to be.

For ILS equipped aircraft, roll bar is replaced by a yaw bar index (green vertical line below horizon) and tracks localizer on low visibility takeoffs.

With TRK-FPA selected, crossbars are removed and replaced with:

- FP Director

- FP vector which defines the a/c trajectory (track and FPA)

- HDG target changes to track target

- V/S changes to FPA

AUTO THRUST

Works in 2 modes:

- SPEED Mode – thrust adjusted to maintain a target speed/MACH to control a trajectory:

 - e.g. Cruise & Approach

 - ALT, V/S, G/S

- THR mode – when AP/FD vertical mode adjusts the a/c pitch in order to keep a target speed

 - or MACH

 - e.g. MAX CLB. DES, IDLE

A/THR modes linked too AP/FD vertical modes.

A330-200 CBT NOTES

On the A330, the A/THR does not back-drive the thrust levers while it adjusts the thrust.

When A/THR off, crew controls the thrust over a quadrant.

For forward thrust, this quadrant carries 4 physical detents or stops:

IDLE

CL for Max Climb Thrust

FLEX/MCT for FLEX thrust at TO or Max Continuous Thrust in flight

TO GA for Max Takeoff or Go Around Thrust

A/THR can only work when levers are moved forward of the IDLE detent and up to the CLB detent or MCT in case of an engine failure.

NOTE: A FLOOR is an exception.

A/THR doesn't work when thrust levers are in reverse position.

With A/THR on, thrust lever position determines the maximum thrust which can be commanded by the auto thrust, for example, to accelerate in SPEED mode. Thrust gage shows a blue dot  for the thrust lever position.

A/THR has 3 states:

OFF – on the ground. No indication on FMA and ATHR pb green light is out.

ARMED – in blue when thrust levers moved to TOGA for takeoff shows **A/THR** (armed) and **MAN TOGA** in white indicating that A/THR is armed with pb sw green. The pilot manually controls the thrust.

The FCU indicates **A/THR**. It is ready to be turned on by a pilot action on the thrust levers.

Crossing the thrust reduction altitude the pilot must manually set the thrust levers to CL detent.

On FMA, a flashing “**LVR CLB**” prompts the pilot to set the thrust levers to CL detent.

A/THR white – indicates that autothrottles are active.

A330-200 CBT NOTES

THR CLB green on FMA indicates that A/THR is in THR mode. Since the thrust levers are in CL and AP commands a climb, the A.THR commands **THR CLB**.

NOTE: The AP1 vertical mode adjusts pitch to maintain a target speed which is $V2+10$.

Throttles normally left in CL detent through the flare.
If throttles moved forward from CL detent, pilot now manually controls the thrust.

At target altitude, AP/FD switches to **ALT** mode. ATHR switches to **SPEED** so ATHR adjusts thrust to maintain speed.

ATHR also in **SPEED** mode when AP/FD vertical modes are V/S or FPA, G/S and during approach.

Hand-flown flare, throttles brought to IDLE by pilot at 20'. "RETARD" call-out at 20' as a reminder. Setting thrust levers to IDLE turns the A/THR off.

Another way to turn A/THR off is to push one of the two A/THR instinctive pbs on the thrust levers. Pressing at least one of these for more than 15 seconds will inhibit the A/THR for the rest of the flight.

Pushing the A/THR pb on the FCU to disengage A/THR is not a recommended procedure.

FLIGHT MANAGEMENT (A)

RDY light means the MCDU is ready to be switched on – use the brightness (BRT) knob.

RDY light off when MCDU is on.

MCDU1 interfaces with FM1 and MCDU2 interfaces with FM2.

FM uses 2 databases:

Navigation

routes, airports, SIDS, STARs, approaches, airways,
waypoints, VOR/DMEs, NDBs

Databases are updated every 28 days.

A330-200 CBT NOTES

Activation of 2nd database must always be done on the ground, never in flight

Performance

a/c perf model

CHG CODE allows maintenance engineering to change the performance factors.

FM Preflight:

INIT page is the first page called up to insert data.

Amber boxes are fields where data must be inserted.

White dashes are fields which are not available to fill and can't display info since FMGEC doesn't have enough info to calculate the values.

Field on bottom right is the default altitude for the Tropopause. Blue color means it is modifiable. (e.g. **36090**)

Insert DEP / DEST or company route.

LSK 3R is used to align the IRSs.

Call F-PLN page

5 lines of waypoints

Shows ETA, SPD / ALT

6th line shows destination

Shows ETA, DIST and EFOB

Recommended to finalize the flight plan first then insert the weights.
Speeds up calculations.

Magenta stars * at some waypoints indicates that constraints are going to be met.

Amber stars mean that a constraint will be missed.

An asterisk is displayed next to an LSK if pushing that LSK affects the active situation.

→ At upper right corner of F=PLM page indicates that you can access another page using this key →

Allows you to navigate between two pages when they are available.
Called F-PLAN A and F-PLAN B.

A330-200 CBT NOTES

Structure of A & B pages are similar. On B page the TIME is replaced by EFOB and wind predictions. This page is used for fuel management purposes.

Waypoint color coding:

White: the TO waypoint

Green: subsequent waypoints except for destination airport which is white.

There are eight annunciators on the MCDU, five across the top, two on the left side of the keys, and one on the right side of the keys. From left to right they are:

FM1 (top row left) -- This annunciator indicates that the communication with FM1 is lost on the associated side.

IND (top row) -- This annunciator indicates that the FM1 and FM2 are working in independent mode.

RDY (top row) -- This annunciator indicates that the MCDU has passed its operational checks and is ready to be turned on with the brightness knob. (It is only illuminated when the BRT knob is in the OFF position.)

Unused (top row) -- Spare.

FM2 (top row right) -- This annunciator indicates that the communication with FM2 is lost on the associated side.

FAIL (upper left side of keys) -- This annunciator lights when the MCDU is not operating properly. The display is blank except for an FMC FAIL annunciator.

FM (lower left side of keys) -- This annunciator lights when the FMGEC is not linked to the MCDU and the FMGEC requests the display.

MCDU MENU (right side of keys) -- This annunciator lights when a system linked to the MCDU requests the display.

Except for most flight plan-related data, the color of the displayed data indicates what type of data is displayed.

Blue (cyan) means that data can be entered into that field or can be modified. This is helpful in that the pilot does not have to remember every field on every page where data can be entered. The font size of **blue** data differentiates between the pilot--entered data (large font) and FMS-generated data (small font).

Green is used for FMS-generated data that cannot be changed by the pilot (entry is not allowed).

A330-200 CBT NOTES

Magenta identifies limits on altitude, speed, or time that the FMS is predicting will be met.

Yellow always indicates a temporary flight plan display.

Amber means that the displayed data is important and requires immediate action. When an **amber** item is displayed on the MCDU the crew can immediately focus on the important data without having to scan the content of the page.

White is used to display data that clarifies page operation (titles, data field labels, and page selection prompts) and for messages of minor importance.

FMS messages are displayed in **amber** or **white** to indicate the importance of the message. Messages are displayed in the scratchpad when the pilot needs to be notified of a particular condition. Important messages are displayed in **amber**, and other messages are displayed in **white**. For example, if the speed limit for climb or descent is exceeded, the message **SPD LIMIT EXCEEDED** is displayed to communicate the importance of missing an ATC-imposed limit.

White is used for minor messages such as **ENTRY OUT OF RANGE**, which is generated in response to an invalid MCDU entry.

The following data is displayed in **white**:

- Page titles
- Data field labels
- Dashed data fields (no data available)
- Minor scratchpad messages
- Secondary flight plan data (including secondary alternate)
- Active flight plan TO waypoint and predictions
- Active flight plan destination and predictions
- Page selection/reversion prompts
- Flight plan markers.

The following data is displayed in **blue**:

- Modifiable/selectable data
- Large font if pilot--entered
- Small font is FMS--generated
- Entry brackets (no default data exists)
- Missed approach waypoints
- Active alternate flight plan data.

The following data is displayed in **green**:

- Non-modifiable data

A330-200 CBT NOTES

- Active flight plan data (except TO waypoint and destination data).

The following data is displayed in **amber**:

- Mandatory data
- Major scratchpad messages
- Missed altitude/speed/time constraint indicator
- INSERT/ERASE prompts.

The following data is displayed in **magenta**:

- Satisfied altitude/speed/time constraint
- Altitude/speed/time constraint values
- Speed limits for climb and descent.

The temporary flight plan is displayed in **yellow**.

The colors of the matching data on the MCDU and the ND are as follows:

Green for the active flight plan

Yellow for a temporary flight plan

Blue for missed approach and primary alternate flight plan

White for secondary and secondary alternate flight plan.

*NOTE: The **magenta** deceleration point symbol indicates where the aircraft will initiate an automatic deceleration to reach VAPP (when the APPROACH mode starts).*

The altitude constraint symbol is displayed around the constrained waypoint as follows:

Magenta when the constraint is predicted to be met

Amber when the constraint is predicted to be missed

White when the constraint is not being considered and not in managed flight.

EFIS Symbols for Flight Plan

Vertical and Performance Events

Altitude intercept point

→ FCU selected altitude (climb case)

→ Constrained altitude (descent case)

Top-of-descent

→ DESCENT not armed (white)

→ DESCENT armed

Start of climb

→ CLIMB not armed(white)

June 3, 2002

PILOT ASSISTANCE NOTES

28

A330-200 CBT NOTES

→ CLIMB armed

Vertical profile (FMS—computed intercept point)

→ Selected

→ Managed

Speed change

- The aircraft initiates an automatic acceleration or deceleration from current speed to meet a speed limit, speed constraint, or holding speed.

EFIS Flight Plan Event Symbols (Vertical performance)

| | | |
|---------------------------|--|--|
| Deceleration point |  (in circle) | The aircraft initiates an automatic deceleration to reach VAPP (when APPR phase begins) Magenta – NAV engaged White – NAV not engaged |
| Constrained waypoint |  | Constraint is predicted to be met |
| |  | Constraint is predicted to be missed |
| |  | Constraint is not being considered (white) |
| Required distance to land |  | The point where the aircraft is predicted to arrive at the destination airport elevation. |
| Time marker |  HH:MM | Predicted location of aircraft along active flight plan at the entered time. |
| Equi-time point |  (ETP) | Predicted point of equal time between two reference points. |

The EFIS Navigation Symbols

| | |
|---|--|
|  | Active flight plan route -- NAV engaged |
|  | Active flight plan route -- NAV not engaged, or original offset path |
|  | Secondary flight plan route (white) |
|  | Temporary flight plan route |
|  | Alternate flight plan route, abeam/radial vectors, or fix info reference radials |
|  | Missed approach flight plan route |
|  | Engine out flight plan route -- Flight plan not active |

A330-200 CBT NOTES

| | |
|---------------|--|
| | Engine out flight plan route -- Flight plan active |
| | Path vector -- Before NAV engaged |
| * | Airport (option) |
| * | Origination/destination airport(white) |
| == (box) | Runway (160/320 NM EFIS range) (white) |
| == | Runway (10/20/40/80 NM EFIS range) (white) |
| | Co-located VORTAC or VOR/DME navaid (option) |
| | Co-located tuned VORTAC or VOR/DME navaid (option) |
| | VOR navaid (option) |
| | Tuned VOR navaid (option) |
| | DME navaid (i.e., TACAN -- no azimuth) (option) |
| | Tuned DME navaid (no azimuth) (option) |
| | NDB navaid (option) |
| | Tuned NDB navaid (option) |
| | Waypoint (option), ident is magenta |
| | Active waypoint, ident is white |
| | Non--active waypoint, ident is green |
| | Right holding pattern or procedure turn (not active or next leg, or for range scale = 160/320 NM), or for right turn (white) |
| | Left holding pattern or procedure turn (not active or next leg, or for range scale = 160/320 NM), or for left turn (white) |
| | Right holding pattern (active or next leg) |
| | Left holding pattern (active or next leg) |
| OFST X | Offset value where X is L (left) or R (right) and NN is the |
| NN | offset distance |
| †.2R | Cross track error information |

FLIGHT MANAGEMENT (B)

MCDU FROM waypoint is green but white on ND.

Leg is the active leg of the F-PLN. FROM-TO active waypoint is white like on the MCDU.

Waypoint following the TO waypoint is called the NEXT waypoint.

You read a bearing from the a/c position to the TO waypoint and a track between the TO and NEXT line waypoints.

A330-200 CBT NOTES

PLAN page always referenced to North and it is centered on the 2nd line of the F/PLN page (except with a F-PLN DISCONTINUITY where then 3rd waypoint is used).

Allows you to scroll along flight plan and review the waypoints, turn directions and track/distance information.

The symbol of a triangle after the waypoint, means that the aircraft has to overfly the waypoint before turning. (e.g. Δ)

OVFY key can be used to insert an overfly command.

Access APPCH and missed APPCH data using the AIR PORT key. Get the F-PLN A page with the destination landing runway on the 4th line.

If we push the AIR PORT key again, we get the alternate F-PLAN with the alternate airport on the 4th line.

Pressing AIR PORT key again returns you to the departure airport.

To revise or modify a flight plan, use LSK. Lateral revisions on L side and vertical on R side.

LAT REV indicates the waypoint to be modified.

(e.g. DEPARTURES -- In use in green and available changes in blue)

Gives runway ident, length, course, ILS associated with that runway.

Lateral scroll arrow indicates additional pages.

SIDS and TRANS page on DEPARTURES page also shows EOSID (engine-out SID)

EO SID shows as an amber line on the PLAN page whenever the SID departure page is accessed.

NOTE: EO SID is also part of SID list and may be reviewed as a temporary F-FPN.

A330-200 CBT NOTES

In case of a true engine failure, this EO SID would be automatically selected and displayed whatever the map mode.

SID departure page automatically accessed whenever you select a new takeoff RWY.

Vertical arrows indicates other approaches are available.

Lateral scroll arrow indicates that other arrival pages are available.

To access arrival revision page, select LSK 4L and 6L. Best to use LSK 6 all the time as it always displays the destination airport, thus the arrival revision page.

To modify the arrival, select "arrival: page.

When selecting a new arrival get an amber/blue dashed line showing the proposed routing.

1st line shows newly selected approach, associated STARS and TRANS, if any.

2nd line has the link to available VIAS.

Following lines the list of available STARS

Also changes to the 2nd arrival page and proposed new arrival in yellow. Means a temporary F-PLN . On ND shown as an amber dashed line.

F-PLN page used for reviewing the proposed routing before insertion of the changes.

On MCDU, yellow indication **TMPY** at top of temporary flight plan page indicates that not active yet.

Any F-PLN discontinuity cannot be dealt with in a temporary flight plan. Have to INSERT it first and deal with it later.

To clear a F-PLN discontinuity, press CLR key and then hit LSK where discontinuity is.

AIRWAYS on LAT REV page is used to build and modify the airway routing

A330-200 CBT NOTES

HOLD used to insert a holding pattern

Vertical revision page gives EFOB and extra fuel, plus CLB SPD limit/UTC, speed and altitude constraints. Wind can also be inserted to improve fuel predictions.

FLIGHT MANAGEMENT (C)

INIT page has 2nd page – INIT B – scroll arrow

INIT B is devoted to aircraft gross weight and fuel entries

Need to enter ZFW, ZFWCG and BLOCK FUEL to make calculations.

Blue default values can be modified.

TRIP WIND is average wind component.

Inserted as HD or TL followed by velocity.

More accurate to insert individual winds. On INIT A page.

See LSK 5R – WIND page

You access CLIMB WIND page and insert winds at several altitudes.

e.g. 350/56/150

Or access HISTORY WIND page.

Contains all the winds recorded on the descent into the airport on the previous flight.

You can INSERT these for the climb.

To insert winds in cruise, select NEXT PHASE of the flight.

This accesses the CRZ WIND page.

Pressing NEXT PHASE accesses the DESCENT WIND page.

Can also insert an average wind for the ALTERNATE F-PLN.

NOTE: Except for short legs, you will never insert descent winds in preflight! – Airbus philosophy due to type of flight plan they have.

INIT B page now shows TRIP WIND as dashes ----- meaning you have already inserted winds.

A330-200 CBT NOTES

Can insert block fuel from the load sheet or access the INIT FUEL PLANNING function.

Pressing the INIT FUEL PLANNING function on LSK 3R, the FMS computes the minimum legal amount of fuel to fly the sector using:

- F-PLN data
- Wind data
- ALT F-PLN
- Performance data
- ZFW you have entered

FUEL PLANNING goes from amber to green as it computes the fuel required.

Once block fuel computed, you can press the blue **CONFIRM** for fuel planning proposed fuel or overwrite the block fuel by the actual block fuel on the load sheet.

INIT FUEL PLANNING page now becomes INIT FUEL PREDICTION page.

INIT B page is only accessible before engine start. After that, if any changes occur, such as weight modification, the FUEL PRED page is used.

NOTE: On the FUEL PRED page, a weight modification can only be made as an aircraft GW/CG entry.

PERF key page corresponds to the current phase of flight is displayed. TAKE OFF allows you to review and/or insert performance data related to a given phase of flight. e.g. takeoff speeds. PF keeps this page displayed during the takeoff. Also displays these pages during the corresponding phase of flight.

- CLB
- CRZ
- DES
- APPR
- GO AROUND

Can also access through the NEXT PHASE LSK 6R. Once a phase is passed it cannot be accessed.

An MCDU **MENU** annunciator means you must access the MENU page. You identify the system requested by the (REQ) label.

A330-200 CBT NOTES

Annunciator **FM**, when on another system (e.g. ACARS) also means you must access the FM on the MCDU for an important message.

FAIL annunciator is on when there is a problem.

PF keeps TAKE OFF page visible. Has:
THR RED and ACC altitudes
TRANS ALT
ENG OUT ACC
FLAPS and THS

For ETOPS flights, you use another function for EQUI-TIME points. To get ETPs, select DATA function key. Select EQUI TIME POINT. First time you access ETP page, origin and destination airfields are proposed as defaulted locations for which the ETP is computed.

Insert the airport and then the enroute winds over the airport.

ETP shows location +/- from a ETP LOCATION lat/long point. DIST and UTC from ETP is shown. BRG, DIST and UTC from aircraft position to the two airports is shown. BRD, DIST and UTC from ETP to diversion airports is also shown. ETP is shown on the ND as a green circle ● (ETP) but not the MCDU F-PLN page.

When reaching the ETP you must insert the next diversion airport and wind

GUIDANCE MODES (A)

On taxi out the FMA shows **CLB** and **NAV** in cyan meaning they are armed. They engage automatically after takeoff.

Setting throttles to FLEX detent, you have annunciated on the FMA MAN FLX temp. Means you have full manual control of thrust and have set flex takeoff thrust.

On FMA A/THR is armed and ready to be turned on by your action on the thrust levers.

Also FMA annunciates **SRS** (speed reference system) in green above **CLB** as a vertical FD mode. It commands a pitch angle which allows you to fly at a given reference speed, which is a function of V2 and

A330-200 CBT NOTES

depends on conditions such as all engines operative, one engine out...

FD pitch bar (no roll bar) is displayed on takeoff roll.

RWY is annunciated above the NAV as a lateral mode. Commands a yaw angle which allows you to track the takeoff runway localizer during takeoff and initial climb. The FD yaw bar is displayed to help you do this.

If no ILS is available at takeoff, field is blank and no vertical bar is displayed.

For takeoff the PF selects PERF page.
For takeoff the PNF selects F-PLN page

After takeoff managed navigation mode is engages. **NAV** green
CLB mode is cyan and is armed.
Roll bar replaces the yaw bar.

Reaching the thrust reduction altitude, FMA shows a **LVR CLB** white flashing message. Set thrust levers to CL detent. This turns on A/THR automatically. **A/THR** displayed in white.
THR CLB is active; A/THR is in thrust mode and commands max climb thrust (because AP vertical mode is **CLB** and controls speed).

ALT is displayed in cyan indication that altitude capture mode is armed at the FCU altitude.

On ND, any constraint has a magenta circle around it. All reference to this constraint on the PFD and ND are in magenta even though a higher altitude on the FCU is displayed. **ALT** on the PFD is also in magenta.

The MCDU display identifies the parameter with an **amber** asterisk (*). An **amber** circle on the ND next to a point along the route of flight indicates that the system predicts it will miss an altitude constraint (by more than +/- 250 ft). The message SPD ERROR AT XXX is displayed on the MCDU if the system predicts it will miss a projected speed change or limit (by +/- 5 knots).

A330-200 CBT NOTES

Magenta level-off arrow shows where the constraint will be met.

As aircraft approaches the altitude constraint, **ALT CST*** mode automatically appears, indicates that AP/FD vertical mode commands the capture of this altitude.

Once the aircraft overflies the constraint the aircraft will continue the climb since cyan **CLB** is armed. A blue start of climb arrow is shown on the ND.

Summary: **CLB** managed mode is associated with the **THR CLB** mode on the A/THR.

It adjusts aircraft pitch so as to climb towards the target altitude, with the target speed and max climb thrust. The target altitude can be:

- The FCU selected altitude, if there are no restrictive altitude constraints between the aircraft current altitude and the FCU altitude. This target is displayed in blue on the PFD.
- The altitude constraint, if it is restrictive and predicted matched by the FM. This target is displayed in magenta on PFD as intermediate altitude target.

If given an ATC heading, the green solid line is now the track line. The FMGES F-PLN is a green dotted line as you are no longer following it. FMA shows **HDG**.

When engaging HDG mode, CLB mode goes to **OP CLB** mode (Open climb mode). When you fly away from the lateral F-PLN, there is no obligation to respect altitude constraints which are assigned to F-PLN waypoints. **OP CLB** mode allows you to climb directly to the selected FCU target altitude. So HDG mode does not allow **CLB** mode to be engaged.

Pulling the ALT selector adjusts the a/c pitch with max climb thrust to fly direct to the FCU altitude disregarding all altitude constraints. **OP CLB** is associated with **THR CLB** mode on the A/THR. Adjusts the a/c pitch to climb to the altitude maintaining speed with max climb thrust.

When cleared via heading to intercept the FMGES F-PLN, arm the nav mode and see that FMA shows NAV is armed, FCU white dot in heading window that managed **NAV** is armed.

A330-200 CBT NOTES

On ND, the green solid line includes the track line up to the computed INTCPT point and the remainder of the F-PLN.

When aircraft gets close to the intercept point, **NAV** green annunciates on the FMA and automatically engages.

Given a final altitude lower than planned, change the altitude on the PROG page. Modify the altitude. Vertical mode on FMA goes to **ALT CRZ**. ECON CRZ shown on MCDU now.

NOTE: V/S has priority over speed. Means that if too high a V/S is selected, A/P will pitch the a/c down to track the V/S target while A/THR will command idle, thus speed will increase.

Open descents disregard an altitude constraint. **THR IDLE** means idle thrust throughout the descent. AP/FD is in **OP DESC**. Adjusts a/c pitch keeping target airspeed.

At selected altitude, **SPEED** mode engages on A/THR. **ALT*** engages on AP/FD at level off and goes to **ALT**.

If set V/S. A/THR in **SPEED** or **MACH** mode. AP/FD vertical mode is V/S. On the ND, along the F-PLN, a magenta **D** in a circle indicates the position where you start to decelerate towards approach speed (Vapp) and target the a/c configured for landing.

When a/c overflies **D** circle in NAV mode, FM will automatically switch to APPR phase, leading to a decrease of the target speed down to Vapp.

If in **HDG** mode or you wish to decelerate earlier while in NAV mode, you can activate APPR phase manually thru MCDU PERF page LSK 6L – **ACTIVATE APPR PHASE**. This causes the target speed to drop down to Vapp.

*NOTE: When you press APPR pb, you get **LOC – G/S** modes because you inserted an ILS approach in the FM F-PLN which is materialized by “ILS APP” displayed on top of the ND.*

Set AP2 on approach to ensure best possible redundancy. Get **CAT 3 DUAL** on FMA.

A330-200 CBT NOTES

Below 700' RA, neither FM change nor failure will affect the approach. ILS tuning and Vapp target speed are frozen.

At around 400' RA, LAND mode engages and any action by on the FCU is disregarded. Can disengage mode only by engaging GO AROUND mode.

At 50' RA the FLARE mode engages.

At 30' RA the A/THR reduces thrust to idle

At 20' RA a RETARD auto call reminds you to set the thrust levers to idle.

ROLLOUT mode engages at touchdown, yaw bar displayed on PFD.

GUIDANCE MODES (B)

TOD is T/D on MCDU and descent arrow on ND.

If over the T/D, FMA prompts **DECELERATE** – also get **DECELERATE** in the scratch pad on MCDU.

Prompts the pilot to select a lower speed since a/c will be above the descent profile.

A/C vertical position versus the descent path is indicated by the Vertical Deviation (V/DEV) symbol  along the altitude scale. (magenta dot)

To engage managed DES, push the altitude selector to engage descent. Managed DES mode:

A/THR goes to **THR IDLE**

AP vertical mode is **DES**. This mode guides the a/c along decent path so as to fly with V/DEV = 0.

During managed descent, speed scale has a speed range around the ECON descent speed. Indicated by upper and lower . Also AP to vary speed to capture the managed speed profile.

Bent arrow symbol shows where the computed flight path is predicted to be intercepted. When the a/c is above the path, this interception is predicted with ½ speed brakes extended. If bent arrow is running

A330-200 CBT NOTES

away from you then can't intercept the path with current configuration. Get an **EXTEND SPD BRK** message on the FMA when the bent arrow gets close to an altitude constraint.

When on the vertical path again, get a **RETRACT SPD BRK** message on FMA.

NOTE: Don't extend speedbrakes to decelerate if AP/FD in V/S (FPA mode) or if a/c is on or < descent patch. Useless and inefficient.

When a/c reaches the inbound course (e.g. NDB), PF selects track on FCU and A/P guides the track throughout the approach.

If speedbrakes are extended and one engine is above idle for more than 10 seconds, the **SPEEDBRAKE** memo changes to **SPEEDBRAKE** on the E/WD.

ND changes – **HDG** is a green line and F/PLN is a green dashed line.

When pulling the HDG selector, HDG replaces NAV and the DES mode reverts to V/S with the current rate of descent displayed.

BIRD is on for any non-precision approach. Gives **ALT TRACK** on FMA.

FPA angle if engaged shows (e.g.) **FPA – 3.0°** plus angle on the FMA.

To go around, push the thrust levers full forward to the TOGA stop.

When thrust levers reach TOGA stop, the FMA indicates

MAN TOGA: you manually control thrust. You have set TOGA thrust

A/THR: The A/THR is armed

SRs: the AP/FD vertical mode is similar to pitch takeoff mode. Reference speed is the current speed at GA initiation (Vapp mini)

GA TRK: the AP/FD lateral mode guides the aircraft along the track at time of go-around initiation.

This causes the F-PLN to go to the missed approach followed by the previously flown approach. To fly missed approach, engage NAV.

A330-200 CBT NOTES

Always check that the navigation accuracy check is positive for a managed APP NAV/FINAL mode approach.

Even for an NDB approach, when ATC clears you for approach press the APPR pb.

APP NAV mode arms or engages similar to NAV mode. Guides a/c along F-PLN and approach course until the MAP.

When final mode arms after APPR pb pressed, the V/DEV scale is displayed including the brick (magenta) along the altitude scale. (1 dot = 100')

FINAL mode engages when the a/c reaches FAF shown as a blue arrow symbol on the ND provided APP NAV mode is engaged.

When final descent is captured, **FINAL APP** is displayed on two columns (common mode). AP/FD flies the a/c down to MDA.

Altimeter goes amber in color when below MDA.

If you do not set AP to off on approach, it will turn off automatically at MDA-50'.

PROTECTIONS

FMGES gives assistance to remain in the flight envelope:

Engine Failure compensation

Engine failure with AP on, FMGEC ensures auto yaw compensation in all modes. Uses yaw damper at TO and GA and auto rudder trim in all modes.

AP/FD SRS pitch mode automatically adjusts the reference target guidance speed in case of an engine failure at TO or GA.

LOW SPEED protection

- A/THR SPEED mode

If target speed is selected (by pilot on the FCU) and the speed target is below VLS, the A/THR will not allow the speed to decrease below VLS.

- LOW ENERGY warning

A330-200 CBT NOTES

If in turbulence, shear, A/THR OFF, a/c speed drops significantly below VLS, a repetitive “SPEED, SPEED, SPEED” aural warning is triggered by the PRIM.

It drives the pilot’s eyes to the speed scale, so as to readjust thrust. Takes into account the aircraft deceleration rate and current flight path angle which explains the LOW ENERGY wording.

It is available when the aircraft is on departure and arrival between 100’ – 2000’ RA and in configuration 2,3 or FULL

- ALPHA FLOOR protection

If a/c speed continues to drop below LOW ENERGY warning and the angle of attack increases above a given threshold, the “ALPHA FLOOR” function of A/THR is engaged. A/THR commands full thrust: e.g. TOGA. Processed by PRIM as a function of aircraft parameters such as configuration, weight, etc.

If ALPHA FLOOR is triggered:

A/THR is turned on (if it was off), indicated by a white **A/THR** on FMA

A.FLOOR in green with amber box displayed as the A/THR mode

ALPHA FLOOR is available from liftoff down to 100’RA.

NOTE: ALPHA FLOOR is lost in case of an engine failure or A/THR failure.

When exiting ALPHA FLOOR conditions, A/THR reverts to **TOGA LK** mode indicating TOGA thrust is locked regardless of thrust lever position. To regain thrust control, must switch off the A/THR. Now in manual control and can re-engage A/THR when ready.

- **WINDSHEAR** protection – reactive warning provided by FE. Available from liftoff to 1,300’ at takeoff and from 1,300’ down to 50’ on landing with at least CONF 1 selected.

FG provides the following protections against windshear:

At takeoff and go around, with the AP/FD SRS vertical mode, which commands a pitch ensuring a minimum positive rate of climb, despite a potential speed drop.

In approach with the GS mini function: the managed speed target in approach is automatically adjusted with wind variations, to ensure the a/c ground speed does not drop below a minimum value.

NOTE: If the angle of attack gets too high and reaches the fly-by-wire angle of attack protection, the AP disengages.

A330-200 CBT NOTES

AP/FD and A/THR reversions

Automatic mode changes which:

Allow comprehensive autoflight system behavior when pilot modifies targets on the FCU

V/S mode entered from **CLB** or **ALT*** due to (e.g. overshooting an altitude from a late ATC clearance) – up to pilot to decide how to get to altitude.

Happen in case of the loss of NAV mode

OP CLB entered from a **CLB** mode with **HDG** engagement

V/S mode entered from DES mode

Ensure a flight envelope speed protection (manual flight)

FD on, AP off, IDLE. When a/c reaches VLS, A/THR reverts to **SPEED** mode. FDs removed since they were not followed.

When FD orders aren't followed in **THR CLB** or **OP CLB**, pitch a/c over and speed increases. When speed reaches VMAX, A/THR reverts to **SPEED** mode so thrust decreases, FD bars removed since they aren't being followed.

NOTE: depending on a/c configuration, Vmax can be VMO, VLE or VFE

Summary: FE limit speed protection is ensured by AP or A/THR (with FD ON, AP OFF) mode reversion so that:

At minimum speed or maximum speed, the FD bars are removed, therefore, the A/THR reverts to SPEED thrust mode to regain target speed.

DISCONNECTION OPERATION

Press takeover button on the sidestick.

Get 3 cavalry charge for 1 second

MASTER WARNING for 3 seconds

E/WD **AP OFF** red message for 9 seconds

2nd push of takeover pb cancels all these immediately

When both APs and FDs are off, A/THR is in SPEED mode.

When A/THR is disconnected with the instinctive disconnect pb, you get:

Single chime aural warning

MASTER CAUTION for 3 seconds

E/WD **A/THR OFF** amber message for 9 seconds

A330-200 CBT NOTES

2nd push of instinctive pb cancels all these immediately

In this case, you have manual control of thrust. Since levers are in CLB detent, the thrust increases to CLB thrust. A/C accelerates and this is undesirable. Risks destabilizing the approach.

Standard A/THR disconnect technique.

1st retard thrust levers corresponding to the current thrust setting (put blue dot on green line on engine indicator). This illuminates the flashing **LVR CLB** on FMA

2nd press the instinctive disconnect pb on the thrust levers.

You now have manual control of the thrust.

With A/THR ON, if you retard the thrust levers too slowly or inadvertently below the CLB detent, you get the following every 5 seconds:

Single chime

MASTER CAUTION

AUTOFLT A/THR LIMITED on E/WD

Advises you that the thrust lever position limits the maximum thrust for the A/THR.

LVR CLB on FMA and the ECAM caution recommend you bring the thrust levers back to CLB detent.

NOTE: By setting the thrust levers to CLB, all cautions are cancelled.

ABNORMAL OPERATION (A)

FMGECs exchange data through a crosstalk bus and are synchronized. This is called DUAL mode of operation.

The FMGEC driving the synchronization is called the MASTER.

AP 1 ON – FMGEC1 is MASTER

AP 2 ON – FMGEC2 is MASTER

AP 1 and AP 2 ON and/or FD1 + 2 are ON, FMGEC 1 is MASTER

A/THR is driven by master FMGEC.

NOTE: When FD1 + 2 are ON, each FMGEC drives its FD and FMA on its inside PFD.

If crosstalk is lost, each FMGEC then operates independently. Scratchpad message is INDEPENDENT OPERATION.

A330-200 CBT NOTES

The amber **IND** light on the MCDU indicates that the onside FM has detected an independent mode of operation.

In IND mode, each FMGEC drives its own FG (AP/FD), EFIS (PFD/ND) and MCDU.

The crew must make the same entries on each MCDU in order to have the same guidance orders for both AP/FDs and the same info displayed on the EFIS and on MCDU.

When crosstalk is recovered, FMGECs revert automatically to DUAL MODE.

FMGEC failure (e.g. AP1 engaged):

MASTER WARNING

MASTER CAUTION

AUTOFLT AP OFF

AUTOFLT A/THR OFF

AUTOFLT FM1 FAULT

NOTE: when time permits, NAV B/UP function check may be used.

AP1 and A/THR go off.

Amber **FM1** light on MCDU 1 is illuminated – onside FM failed.

Lose ND1 and displays **MAP NOT AVAIL** message

MCDU 1 is blanked.

When select FM BOTH ON 2 (or 1), get a ND message in amber **OFFSIDE FM CONTROL**. Both NDs controlled by remaining FMGEC.

Called SINGLE mode. (e.g. 2FD2 displayed in FMA)

MCDU 1 is now a copy of MCDU 2.

If loss of FM2 (along with FM 1), this leads to NAV BACK UP.

MASTER WARNING

MASTER CAUTION

AUTOFLT AP OFF

AUTOFLT A/THR OFF

AUTOFLT FM1 + 2 FAULT

Get an amber **ENG THRUST LOCKED** flashing on E/WD. Thrust levers have to be manually adjusted.

A330-200 CBT NOTES

Get AP, A/THR OFF triggered on ECAM.

On MCDU, both MCDU MENU pages show LSK 1R NAV B/UP.

MCDU pages titled B/UP F-PLN on the side selected.

BACK UP NAV displayed on ND on that side.

Each MCDU and its ND are driven by its onside IRS. IRS3 is used in case of IRS 1 or 2 failure. This is called NAV B/UP.

B/UP NAV (due to loss of FM 1 + 2) provides:

- Simplified flight planning functions

- Aircraft position computation using the onside IRS

- Flight plan automatic sequencing

- Limited lateral revisions.

In those cases where AP/FD are still available, managed modes cannot be engaged.

The back-up navigation operating mode can be used for lateral navigation if either one or both FMGECs fail. During normal operation, the flight plan is automatically stored and updated in the MCDU memory. Once the back-up navigation mode is engaged, the MCDU uses position information directly from the onside ADIRU or IRS3. In the back--up navigation mode, the MCDU has the following capabilities:

- Flight planning

- Aircraft position using the onside IRS (or IRS3) and GPS (if installed)

- Flight plan display on the ND

- Automatic flight plan sequencing

- Lateral revision (limited).

NOTES:

1. *There is no autopilot or flight director capability in back--up navigation mode.*

2. *MCDU3 does not have back--up navigation capability. It is only available on MCDU1 or MCDU2 through the MCDU MENU page and when the FM source selector for the EFIS display is set to the NORM position.*

Each pilot has to set his own RMP to NAV in order to tune the required nav aids. Autotune and MCDU manual tune functions are lost.

NOTE: DH indication is lost, ILS may only be a CAT I approach.

STATUS page shows **MCDU BACK UP NAV AVAIL** in green.

NOTE: as DH is lost, CAT 1 only approach.

A330-200 CBT NOTES

Advisable to select BIRD ON since NAV is not available.

ABNORMAL OPERATION (B)

FCU has 3 channels – A, B, C

FCU fault means two FCU channels have failed and indicated on ECAM.

1 channel FCU failure has no consequences or operational degradation.

Depending on which channels fail, you may lose AP and A/THR.

2 channel FCU failure (AP 1 ON).

MASTER WARNING

MASTER CAUTION

AUTOFLT AP OFF

AUTOFLT FCU FAULT

AUTOFLT A/THR OFF

NOTE: No consequences on FCU indications since both channels still working.

Get an **ENG THRUST LOCKED** (amber) on E/WD and THR LK on FMA as long as pilot has not moved the thrust levers out of the CLB detent.

Comes on every 5 seconds. Asks for pilot to adjust the thrust levers. Barometer reference must be cross-checked between both PFDs, EFIS CTL panels and STBY altimeter. Baro reference on PFD driven by remaining FCU channel.

Total loss of FCU – 3 channel failure.

MASTER CAUTION

AUTOFLT FCU FAULT

Both APs lost

A/THR lost

All FCU controls and indications are lost along with EFIS control panel.

PFD lose targets: red flags for **SPD SEL** and **ALT SEL** and **HDG** (target not visible)

WX RANGE on ND displayed

ALT ALERT lost

FMA indications lost

BARO reference changes to STD

A330-200 CBT NOTES

FPV displayed
ILS deviation scales displayed
MACH number indication is lost

On ND:

Rose 80 miles range displayed regardless of position of range selected.

WX radar image lost

VOR1 and ADF 2 pointers auto displayed along with DME1 (VOR2 and ADF 1 pointers can be checked on DDRMI, if available)

At transition altitude, you have to apply a correction (STD – QNH) on your PFD altitude reading. (1HPa = 28')

NOTE: In LAND mode below 400' RA, if a total FCU loss happens, there is no operational consequence.

ABNORMAL OPERATION (C)

FMGEC RESET failure. Caused by a software interruption in Managed mode.

MASTER WARNING
AUTOFLT AP OFF

FD reverts to HDG, V/S modes. AP1 not displayed on FMA.
FMGEC 1 is in auto-reset.

During the time of the reset, the FM mode of operation reverts temporarily from DUAL to SINGLE mode of operation.
Since FMGEC 1 is in auto reset, AP2, FD2 and A/THR are fully available.

NOTE: depending on the AP modes initially engaged and the type of reset, AP loss and FD reversion may or may not occur. This can be one of the most serious cases.

During time of reset,

ND 1 displays **MAP NOT AVAIL**

Both MCDUs display A/C STATUS page

Auto tuning of nav aids maybe lost on that side (e.g. side 1)

NOTE: do not use MCDU while PLEASE WAIT message is displayed.

A330-200 CBT NOTES

Reset usually over in a couple of seconds. Then can reselect AP 1 and managed modes and most convenient MCDU page.

If reset not successful, a complete FMGEC reset may be accomplished by pulling the FMGEC and FM circuit breakers on the overhead panel. Follow the QRH for this procedure.

Locked MCDU

In case you can't insert any data in scratchpad or change any MCDU page, the MCDU is "LOCKED". This failure is not automatically detected.

To recover the MCDU, switch off the MCDU and after 5 seconds switch it back on.

MCDU Failure

MCDU **FAIL** (amber) on the left side of the MCDU. Switch off the BRT knob on the MCDU and allow MCDU 3 to replace the failed MCDU.

NOTE: MCDU 3 is not able to achieve the BACK UP NAVIGATION.

A330-200 CBT NOTES

PNEUMATIC

Provides HP air for:

- A/C
- Wing Anti-icing
- Water pressurization
- Hydraulic reservoir pressurization
- Engine starting

3 kinds of sources supply HP air

- Engine bleed system
- APU
- 2 external high pressure GPUs

Controlled and monitored by 2 BMCs (Bleed Monitoring Computer).
One BMC for each engine bleed system.
BMCs are interconnected so if 1 fails, other takes over most of its functions.

Air leakage detection loops in vicinity of hot air ducts in wings, fuselage and pylons.
A leak causes the BMC to automatically isolate the affected areas.

In flight, air is bled from the IP and HP port.
HP valve cuts off bleed air from the HP port

HP only used when IP cannot provide enough pressure, usually at idle.

Air extracted from the compressor (IP) goes to a bleed valve which acts as a shut off and pressure regulating valve.

Since the temperature of the bleed air is high, the air passes through the pre-cooler which uses cool air from the engine fan to regulate the temperature.

Both systems are connected by a crossbleed duct.
A crossfeed valve permits their interconnection and isolation.

APU can be used for bleed air supply, usually on the ground.

APU bleed valve operates as a shutoff valve for APU bleed air.
2 GPUs and APU all connect through the crossbleed duct.

A330-200 CBT NOTES

Displayed on the ECAM BLEED page. Info for the pneumatic system is displayed on the lower portion of the BLEED page.

Cross-bleed valve allows pilot to operate manually or automatically when in AUTO.

NORMAL OPERATION

Engine ID numbers on BLEED page are amber since the engines aren't running.

Engine ID numbers on BLEED page are white when engines are running.

Pressure is in amber since no pressure is supplied.

GND HP connection is always displayed in white on the ground, whether or not GND is connected.

Check x-bleed selector is in AUTO. Displayed x-line green.

NOTE: DO NOT use APU bleed if ground HP air is connected.

Memo APU BLEED is displayed on the E/WD when operating.

Pressure from APU bleed is also shown on the ECAM ENGINE page.

APU bleed valve has priority over engine bleeds during start, therefore, engine bleeds remain closed.

When APU bleed valve is closed, x-bleed valves closes and engine bleed valves open to in-line green.

With APU MASTER SW pb in OFF, the APU bleed valve is no longer shown on ECAM.

On takeoff, HP valves close since IP pressure is sufficient.

On liftoff, the GND HP connection indication disappears. Only displayed on the ground.

On landing, engine HP valve opens since IP pressure is not enough.

A330-200 CBT NOTES

If APU is not used or inoperative, when APU is started the APU bleed valve is displayed.

With GND HP air connected, pressure and temperature are shown on the LEFT BLEED side. The x-feed valve does not open automatically and has to be opened manually to start engine 2 first.

ABNORMAL OPERATION

Bleed Fault means engine bleed has failed due to high temperature.

MASTER CAUTION

AIR ENG 1 BLEED FAULT

AIR ABNORM BLEED CONFIG

Engine 1 BLEED pb sw **FAULT** light on.

BMC detects the overheat and closes ENG 1 BLEED valve. Bleed pressure drops to 0 and the temperature decreases. ENGINE 1 BLEED system is no longer available.

Wing Leak Fault – bleed leakage in the left wing

MASTER CAUTION

AIR L WING LEAK

X-feed valves closes automatically if in AUTO.

When a bleed valve / x-feed valve is in disagreement, it is displayed in amber.

A330-200 CBT NOTES

CBT#2

AIR CONDITIONING

A/C packs.

Has Pack Flow Control Valve to adjust compressor and turbine flow rate through the packs.

Air passes thru a heat exchanger, ACM and another heat exchanger.

Pack Air Inlet Flap allows ambient air in to cool heat exchangers – exits thru Pack Air Outlet Flap.

Air from primary heat exchanger flows around ACM and secondary heat exchanger to modulate pack outlet temperature. Temperature Control Valve does this.

Pack Control Valve and Temperature Control Valve regulated by a pack controller to vary the flow rate and temperature output.

Pack Controller also controls the Pack Air Inlet and Outlet Flaps to vary the amount of air passing through the heat exchangers.

NOTE: inlet and outlet flaps close temporarily on takeoff to prevent FOD ingestion.

Pack air goes to a mixing unit.

In event of both pack failures, emergency air supply provided by ram air valve to ventilate cockpit and the cabin or to remove smoke. (door forward of L pack inlet flap).

ECAM monitors:

Pack flow

Compressor Outlet Temperature

Temperature control Valve position

Pack outlet temperature

3 Cabin Zones + Cockpit

Zone controller monitors and adjusts pack controllers to set the air temperature from the packs.

Zone Controller monitors:

zone duct temperature (temp of air entering a zone)

zone temp itself

all of the system valves (hot air and trim)

Cold Air delivered by the packs. Sent to the 4 zones.

Hot bleed air is delivered by the Trim Air Valves to achieve the demanded temperature.

These valves are controlled by the zone controller.

A330-200 CBT NOTES

Trim air valves are supplied by two Hot Air Valves. Regulate the pressure of the hot air to the trim air system.

A Hot Air Cross Valve connects the supply from Hot 1 & 2 in case of a failure of one hot air valve.

ECAM COND page displays:

- Trim air system
- Hot air system
- Zone duct temperature
- Zone temperature indications

ECAM CRUISE page also displays zone temperature indications + cargo temps)

AIR panel:

PACK pb sw control their associated pack flow control valves.

PACK FLOW selector sets the desired pack flow.

Guarded RAM AIR pb sw controls the emergency RAM AIR inlet valve.

Each HOT AIR pb sw controls its respective Hot Air Valve (on ECAM).

Zone Temperature Selectors used to adjust the required temp for the associated zone (cockpit or cabin).

NOTE: Each cabin zone temp can be modified thru the forward attendant panel.

2 Cabin fans (recirculation fans) are fitted to reduce bleed air requirements from the engine.

NOTE: In normal operations there are no ECAM indications associated with the recirc fans.

CAB FANS pb sw on the VENTILATION panel controls the cabin fans.

NORMAL OPERATION

If packs do not have bleed air but are ON get a **FAULT** amber light for each pack but no ECAM indications. Electrically controlled, pneumatically operated.

PACK FLOW selector to NORM if expecting a standard passenger load. Only affects the flow rate once the engines are running and supplying bleed air to the packs.

When APU is supplying bleed air, ECAM BLEED page shows HI flow automatically regardless of PACK FLOW selector position.

A330-200 CBT NOTES

24 degrees zone temp is demanded when COCKPIT and CABIN zone temp selectors are in 12 o'clock position. (Each increment on selector is 2 degrees. Range of 18 – 30 degrees C)

When engine start sequence begins, pack valves close automatically. When engine start sequence is completed:

Pack valves open

APU bleed supplies the packs (PACK FLOW HI).

NOTE: If either engine start is delayed > 30 seconds, packs come back on automatically.

Engine bleed valves still closed, because APU has priority over engine bleed air.

APU can supply the packs on takeoff which allows no weight penalty due to loss of engine performance on a performance limited runway.

When APU bleed pb sw selected off:

APU bleed and cross bleed valves close

Link lines disappear

Both engine bleed valves open to supply packs with bleed air

With engines supplying air, bleed rate goes from HI to the selected rate since engines supply a higher flow rate than the APU.

When APU shutdown, all APU indications disappear on ECAM BLEED page.

On E/WD a PACK FLOW **LO** shows selected position of LO is displayed in green to inform crew of this. Saves fuel if few passengers.

E/WD shows PACK FLOW **HI** pack flow as above if a full pax load and high temperatures on ground. Uses more fuel.

Once airborne, return flow selector to NORM.

External Conditioning unit is connected directly to the Mixing Unit – no indications in the cockpit.

ABNORMAL OPERATION

Pack fault due to aircraft door being open and engines running.

AIR PACK 1 + 2 FAULT (amber)

PACKS INHIB BY DOORS

At least one a/c door is not closed.

Two pack flow control valves remain closed (cross line amber) to prevent packs from pressurizing a/c with one door open.

*NOTE: On AIR panel the amber **FAULT** lights in the PACK 1 & 2 pb sw are not illuminated.*

A330-200 CBT NOTES

Pack 1 Overheat in flight.

AIR PACK 1 OVHT on E/WD. Overheat detected in pack 1.

ECAM BLEED page displayed automatically.

Observe that:

Pack flow control valve has closed (amber).

Compressor outlet temp is high (amber) because temp limit has been exceeded.

HI flow automatically selected on remaining pack.

PACK **FAULT** light is amber to identify the failed pack.

PACK **OFF** light is on and **FAULT** light remains because overheat is still present after completing ECAM action items.

When **FAULT** light is out and compressor temp is no longer amber, switch pack ON

Air Cycle Machine Failure

AIR PACK __ REGUL FAULT
PACK IN BY PASS MODE

ACM of the __ pack has failed. Air by-pass valve opens automatically allowing the air to by-pass the ACM. Bleed air is now cooled by the heat exchangers only.

On ECAM BLEED page, by-pass valve is indicated by a green arrow → after pack valve.

E/WD amber message indicates that the pack is operating in by-pass mode.

NOTE: On ground with ACM failure, ECAM will advise you to turn off affected pack to avoid overheat.

On ground, both channels of the zone controller have failed.

E/WD **COND ZONE REGUL FAULT**

On ECAM COND page, observe that:

PACK REG appears in green at top of the page meaning that the temperature is regulated by the packs only. The packs deliver a fixed temperature of 5 degrees C. Pack flow and temperature selections are lost.

All temperature indications are also lost – indicated by **XX** amber for each temp.

PACK LOW FLOW at the top of the COND page pulses green when not enough flow from the packs to reach the selected temperature transmitted by the zone controller.

A330-200 CBT NOTES

Cargo isolation valve failure

MASTER CAUTION

COND FWD CRG ISOL FAULT

Ventilation is lost in the forward cargo compartment due to either the inlet or outlet isolation valve is not in the selected position.

CARGO AIR COND panel, FWD ISOL VALVES amber **FAULT** light is on.

CARGO SYSTEM PRESENTATION

FWD – ambient air enters via two inlet isolation valves.

Extracted by an Extract fan and an Outlet isolation valve then goes overboard.

To decrease cargo temperature, cabin ambient air is mixed with cold air from the packs via a cold air valve. Has 3 positions to adjust the quantity of cooled conditioned air.

Cargo Ventilation Controller controls the:

- Inlet isolation valve

- Outlet isolation valve

- Extraction fan

To provide compartment heating, hot bleed air is supplied by a trim air valve.

NOTE: compartment heating is not available when the forward cargo door is open.

AFT cargo compartment same except no heating is available.

Bulk cargo compartment

Only one inlet isolation valve is available for ambient air with an electrical fan heater

NOTE: compartment heating is not available when the bulk cargo door is open.

Cargo heating system displayed on the ECAM COND page. It is an extension of the air conditioning system.

Hot air is routed from the trim air system for the forward cargo compartment and via an independent fan heater for the bulk cargo compartment.

CARGO AIR COND panel on overhead panel contains all the controls for heating and cooling.

A330-200 CBT NOTES

ISOL VALVES pb sw for each compartment. In auto, the cargo ventilation controller automatically controls the isolation valves and extraction fan.

NOTE: No representation of isolation valves and extraction fan on the ECAM page.

FWD cargo compartment has a COOLING selector to add cold air to the ventilation air by controlling the cold air valve.
Final temperature adjustments made by the temp selector that controls the trim air valve.

BULK cargo also has a temp selector.
HOT AIR pb sw is normally left in lights out (on) position. Operates the fan heater for the bulk cargo compartment according to the temp selector position.

AFT cargo does not have a temp selector.

Temp selectors for FWD and BULK cargo compartments set at mid-position (15 degrees C)

ELECTRIC

IDG/GEN → AC1 → TR1 → Feeds DC 1 BUS → DC BAT BUS → 2 batteries

Same for IDG/GEN 2.

DC BAT BUS can charge batteries or receive power from batteries.

2 Essential busses

AC1 → AC ESS → ESS TR → DC ESS

Engine and APU generators are identical and each can supply the entire needs of the aircraft.

On ground a/c can be supplied by 1 or 2 external sources.

EMERGENCY GENERATOR (EMER GEN) powered by green hydraulic system and used as a backup.

Green system can be powered by a RAT located under the right wing.

STATIC INV allows part of the AC electrical system to be supplied from the main batteries (batteries 1 and 2)

A330-200 CBT NOTES

AC2 → APU TR → DC APU which charges the APU BAT
APU BAT dedicated to starting the APU

2 ECAM electrical pages – 1 for AC and 1 for DC
Usually only 1 ECAM ELEC can be shown at a time

For electrical emergencies there is an EMER ELEC PWR panel on the left side of overhead.

BAT voltage can be monitored on the overhead panel using the battery voltage selector on the ELEC DC page.

Each battery controlled by a pushbutton switch

Both main and APU generator controlled by their own pb sw.

EXT PWR sources controlled by their own pb sw.

AC ESS FEED pb sw allows pilots to change the feed for the AC ESS bus from AC 1 → AC 2

BUS TIE pb sw enables pilots to isolate one side of the system from the other.

IDG disconnect pb sw allow you to disconnect

EMER GEN TEST sw is used by maintenance only to test the emergency generator

NORMAL OPERATION (A)

1st check BAT voltage – minimum 25.5 volts.

Batteries have to be turned on to charge

PARAMETERS of electrical sources are shown green on ECAM if in normal range.

If 2 EXT PWR carts connected, EXT A supplies the right side and EXT B the left side electrical power system.

GEN pb sw has FAULT (amber) since engines not running.

Green arrows from DC BAT bus means the batteries are being charged. Same for DC APU and APU BAT.

Average charging cycle is approx 20 minutes.

Batteries disconnected from DC BAT or APU BAT bus when fully charged. Green lines from DC BUS disappear.

Turn off BAT to check voltage.

Place BAT selector in APU position to prevent discharge of BAT 1 or 2. APU when on supplies L electrical system as it has priority over EXT A or B if connected.

WALKAROUND

A330-200 CBT NOTES

Check ground electrical power door is closed if not required.

NORMAL OPERATION (B)

When on batteries, only the upper E/WD screen is active – the SD is off.

With BAT 1 off, the upper screen is off

With BAT 2 off all lights on panels are off.

ABNORMAL OPERATION (A)

IDG Low Oil Pressure Fault

MASTER CAUTION

ELEC IDG __ OIL LO PR (amber)

IDG LO PR (amber) on ECAM ELEC AC page

IDG **FAULT** light on electrical panel

CAUTION: Pres IDG pb sw until GEN FAULT light comes on – not more than 3 seconds to avoid damage to the disengage solenoid.

Amber **DISC** replaces the previous **LO PR**

IDG 1 (white 1) means the engine is still running

GEN in amber means the generator has abnormal parameters

1 (or 2) in white means engine is still running

0% load in green means that load is still in normal range

0 V in amber means that the voltage is outside normal range

0 Hz in amber means that no frequency is sensed

FAULT amber in the GEN pb sw means that the GEN is not supplying the network.

White indication at the bottom of the page (**GALLEY PARTIALLY SHED**) is normal.

CAT 3 SINGLE ONLY

Generator Overload

ELEC GEN __ OVERLOAD (If automatic load shedding did not occur during an electrical overload)

GALLEY FAULT (amber) light

GALLEY pb sw authorizes crew to shed all galleys.

GALLEY SHED (white) message at bottom of ELEC AC page means new status for galleys.

COMMERCIAL pb sw

A330-200 CBT NOTES

Allows crew to shut down the following: (get an white **OFF** light)

Galleys

Passenger entertainment system

Lavatory and cabin lights

COMMERCIAL OFF (white) message appears at bottom of ELEC AC page and has priority over other galley messages.

ABNORMAL OPERATION (B)

AC ESS bus fault (AC ESS bus normally powers pilots screens)

You might be able to manually recover AC ESS by using the AC ESS FEED pb sw.

Capt. PFD, ND and upper ECAM is blank. SOP recommends FO fly and Capt be PNF.

MASTER CAUTION but only ½ (Capt **CAUTION** and F/O

MASTER) of light since FWC 1 is U/S.

E/W/D now displayed on the lower ECAM.

ELEC AC ESS BUS FAULT (amber) leads to **ELEC AC ESS BUS SHED** (amber)

ECAM EL/AC displayed on lower ECAM as long as EL/AC key is pressed down.

Indications are:

AC ESS bus

AC ESS BUS SHED

ESS TR

EL/DC has to be held down to see on lower screen. ESS TR is no longer powered.

DC ESS is powered by automatic reconfiguring and bypassing ESS TR to connect DC1→DC BAT→DC ESS.

Switch the feed from AC 1 to AC 2 (in this case) to restore AC ESS. **ALTN** (white) on.

Automatic Electrical Network reconfiguration

In case of AC bus 1 fault, reconfigures to supply AC ESS bus and ESS TR from AC bus 2.

TR1 is replaced by TR2. It supplies DC2→DC1 via DC BAT bus.

All automatic, no action required.

ABNORMAL OPERATION (C)

A330-200 CBT NOTES

ECMU (2 Electrical Contactor Management Units). Each ECMU controls its own side.

ECMU Failure

MASTER CAUTION

ELEC ECMU 1 FAULT

If the system page is automatically shown, there is no failure shown. Due to ECMU1 associated contactor remaining closed (self held), provided the GEN pb sw is on.

AC part of the system keeps the same configuration.

DC network has reconfigured. DC BAT bus is now powered by DC2.

No corrective action is required.

APU TR C/B tripped

MASTER CAUTION

ELEC C/B TRIPPED

ELEC APU TR FAULT

ECAM C/B page has to be called manually.

Shows APU TR C/B (3PU3) tripped on panel 5000VU

Turn off APU BAT to save power for later APU start.

ABNORMAL OPERATION (D)

Electrical Emergency Configuration (where system is powered by RAT)
(Assume green circuit is already faulty)

NOTE: If the green hydraulic system, which activates the EMER GEN was supplied by an engine driven pump instead of the RAT, more electrical power would have been available. This limited amount of power will lead to the shedding of some equipment or electrical buses.

MASTER WARNING

MASTER CAUTION

Power supply lost to:

Capt ND

Lower ECAM

F/O PFD and ND

On EMER ELEC PWR panel the EMER GEN **FAULT** light is on, meaning that Emergency generator is not yet on line. Turns off when EMER GEN running and supplying power. (Automatic)

NOTE: Capt. ND would have been restored if the green hydraulic system was supplied by an engine driven pump instead of the RAT.

A330-200 CBT NOTES

ELEC EMER CONFIG means that you are in an Electrical Emergency Configuration

LAND ASAP at the nearest suitable airport.

Try and reset all generators.

To access an ECAM page on the upper ECAM by pressing and holding the switch.

EMER GEN shown now and supplies the ESS AC and ESS TR.

*NOTE: **AC ESS SHED** bus is shed due to the limited power of the RAT. **DC ESS SHED** bus is shed due to the limited power of the RAT.*

White **COMMERCIAL SHED** message at bottom of EL/AC page.

BUS TIE OFF separates the two systems and may allow a reset of one of the generators if there was a short circuit.

On approach switching on **LAND RECOVERY** (blue) recovers:

ILS 1

Slats/flaps channel 1

LGCIU1 and BSCU1

LAND RECOVERY (green) AC and DC buses are now connected.

At slats extension, the EMER GEN is inhibited and the supply transferred to the batteries.

ESS TR (amber) is no longer powered.

ESS DC bus is supplied by both batteries as indicated by amber arrows.

Battery discharge currents are high so current indications are displayed in amber.

EL/AC shows **EMER GEN** (amber) and STAT INV parameters shown.

AC ESS bus is supplied from the DC ESS bus via STAT INV.

On ground at low speed, DC BAT bus is automatically connected to the batteries.

If a severe electrical failure and lack of hydraulic power to actuate the EMER GEN, the RAT is normally automatically deployed.

During RAT extension, electrical system supplied by batteries.

Approx flight time on batteries is 30 minutes.

If RAT fails to deploy:

ELEC EMER CONFIG

ELEC EMER PWR.....MAN ON (in blue) appears to tell you to manually deploy the RAT.

EMER GEN **FAULT** (red) light is out as soon as EMER GEN is supplying the system.

A330-200 CBT NOTES

If the EMER Gen does not work after extending the RAT, red **FAULT** light remains. Aircraft only powered by the batteries.

HYDRAULICS

Green

2 edp – 1 & 2

Blue

1 edp – 1

Yellow

1 edp – 2

Pump output is 3000 psi.

Fire shutoff valves located between the reservoir and the edp and are manually closed using FIRE pb sw.

NOTE: Green fire shutoff valves can also close automatically.

Electric pumps also used in abnormal situations to aid in retraction of the hydraulically actuated equipment.

NOTE: Yellow electric pump also used for the cargo doors operation.

In emergency, Green system pressurized by the RAT.

Monitored by the Hydraulic System Monitoring Unit – HSMU

Fully automatic but has a pb sw for abnormal operation.

Each hydraulic edp controlled by a pb sw.

Hydraulic electrical pumps controlled by 2 pb sw each.

NORMAL OPERATION

Hydraulic reservoirs – green rectangles are normal filling range.

Filling level indicators (triangles) > show fluid level.

Amber rectangles are the warning level.

Indications go from green to amber when hit warning level.

Green system goes from 1 white line to 2 amber lines when fluid level reaches an abnormal limit. Insufficient for landing gear extension.

HYD ECAM page, white triangle → pump is off.

Yellow pump runs automatically with cargo door handle ops.

Triangle goes from hollow white to solid green (running) and 3000 psi.

Yellow system is not fully pressurized so **YELLOW**.

Yellow electric pump goes off when door is open.

#1 engine starts, so EDPs change from **LO** amber to in line green.

A330-200 CBT NOTES

Green & blue system IDs go from amber to white – good press.
Engine number ID goes from amber to white – idle achieved.
At gear retraction, the green fluid level increases – normal.

ABNORMAL OPERATION (A)

Green system overheat

MASTER CAUTION

HYD G RSVR OVHT

ECAM page **OVHT** displayed

Green EDP 1 and 2 and electrical pump **FAULT** lights on.

See EDP switched off, edp goes to amber cross line

Get white **OFF** light on pb sw that are turned off.

Since in-flight, pump control on ECAM is now **ELEC**

MASTER CAUTION due to **G SYS LO PR**. This message is boxed due to a primary failure with associated secondary failures.

GREEN → **GREEN** since the system is no longer pressurized.

ECAM WHEEL page displayed automatically. Indicated failures:

Nose wheel steering

Auto brakes

Normal brakes

Spoilers

ECAM F/CTL page then automatically displayed. Shows failed spoilers.

STATUS page displayed showing approach procedures, inop systems and a/c info

STS reminder left on E/WD.

HYD B RSVR LO AIR PR

LO AIR PRESS on SD next to affected reservoir.

Similar problem to system overheat.

ABNORMAL OPERATION (B)

In-flight Yellow Reservoir low-level

MASTER CAUTION

HYD Y RSVR LO LVL

Hyd panel YELLOW ENG 2 and ELEC PUMP **FAULT** are on pb sw.

Reservoir level indicator is amber.

MASTER CAUTION because of **HYD Y SYS LO PR** on E/WD.

Indicates a primary failure with associated secondary failures.

ECAM F/CTL page comes up for review.

STATUS displayed for review.

A330-200 CBT NOTES

GREEN system failure

MASTER CAUTION

HYD G SYS LEAK

MASTER CAUTION again when green low level detected. Both fire shutoff valves close automatically to isolate a possible leak in the engine mast.

NOTE: Closure of green fire shutoff valves is automatic ONLY with the detection of green reservoir LOW LEVEL. Blue and Yellow shutoff valves never close automatically.

Green system is lost but can be restored with the RAT in the event of further blue or yellow low level.

ABNORMAL OPERATION (C)

In-Flight Yellow Pump Low Pressure

MASTER CAUTION

HYD Y ENG 2 PUMP LO PR

Yellow ENG 2 **FAULT** light on.

Yellow EDP pump shows **LO** boxed on ECAM

Yellow ENG 2 **OFF** white is on ENG 2 pb sw.

NOTE: Electric pump cannot replace the edp because of its low flow.

MASTER CAUTION due to yellow system pressure dropping.

HYD Y SYS LO PR is boxed – primary failure with associated secondary failures.

ECAM F/CTL page comes up for review.

STATUS displayed for review.

On ground the RAT should not be deployed.

MASTER CAUTION

HYD RAT FAULT on E/WD

On ECAM page RAT indication with a solid amber arrow indicates this is an abnormal utilization.

NOTE: On the ground you can't be alerted of a problem with the RAT. No procedure required by crew.

In flight RAT extends automatically due to:

Dual engine failure

GREEN + BLUE or GREEN + YELLOW Low Level.

ABNORMAL OPERATION (D)

Double hydraulic failure of Blue and Yellow systems

A330-200 CBT NOTES

Part 1

MASTER CAUTION

HYD B ENG 1 PUMP LO PR

Blue ENG 1 **FAULT** pb sw on.

B SYS LO PR boxed due primary failure with associated secondary failures. Blue hydraulic system displayed in amber.

NOTE: Blue electrical pump not designed to replace Blue Engine pump. So system will not be restored.

Blue EDP pump shows **LO** boxed on ECAM

Blue ENG 1 **OFF** white is on.

PART 2

MASTER WARNING

MASTER CAUTION

AUTOFLT AP OFF

HYD B + Y SYS LO PR due loss of 2 hyd systems

This primary failure has impact on flight controls, thus ***F/CTL**

Last line in red shows that failure is severe. A/P is off and only manual flight available.

LAND ASAP in first line of right memo.

Green overflow arrow pointing down on E/WD means more faults.

Shows Blue ENG 1 pump off (x-lined) because switched off.

Yellow pump **LO** boxed since ECAM actions not completed yet.

Now both engine pumps show amber x-line.

Blue and Yellow pb sw for EDP and electric white **OFF** lights on.

AUTOFLIGHT AP OFF

F/CTL ALTN LAW

(PROT LOST)

NOTE: To recall previous STATUS screen, press the STS key.

*Cannot cancel **LAND ASAP** when displayed.*

Electric Pumps

With all these failures, not one required an electrical pump to be used.

Not designed for continuous use.

Not designed to replace the engine pump.

Each has a temporary and specific function.

All pumps manually controlled and automatic control available for

Green and Yellow pumps.

June 3, 2002

PILOT ASSISTANCE NOTES

67

A330-200 CBT NOTES

Green system electric pump runs for 25 seconds to help gear retraction following an engine failure. Can be manually controlled for retraction of green actuated flight control surfaces in case of loss of both EDPs.

Blue system electric pump is manually controlled for retraction of blue actuated flight control surfaces in case of loss of blue EDP.

Yellow system electric pump automatically starts after an engine 2 failure for assisting with flap retraction (provided Green electric pump not running)

Unlike Green electric pump, the Yellow electric pump must be switched off after the retraction, pressing the ON illuminated pb sw.

FIRE PROTECTION

Each engine and APU have 2 fire detect loops (A & B) and a Fire Detection Unit (FDU).

2 fire bottles for each engine.

1 fire bottle for APU.

Avionics bay has smoke detection (2 detectors in the air extraction duct under fwd cargo floor).

Indications for avionics smoke on the VENTILATION panel.

Lavatory smoke detection – 1 in each.

Smoke Detection Control Unit (SDCU) sends signals → to Flight Warning Computer (FWC) for warnings to the cockpit and also to → Cabin Interphone Data System (CIDS) for warnings to the cabin.

5 sets of 2 detectors are located in the cargo compartment. (each detector linked to one of the 2 loops).

2 sets of detectors in the FWD compartment

2 sets of detectors in the AFT compartment

1 set of detectors in the BULK compartment

SDCU acquires signals from the detectors and send the signal to the FWC for display in the cockpit.

CARGO SMOKE panel on the overhead panel.

2 fire extinguishing bottles are located in the FWD compartment.

A330-200 CBT NOTES

Bottle 2 has a flow metering system to allow a slow discharge for up to 4 hours.

Each bottle has 2 discharge heads. One for the FWD and one for the AFT/BULK zone.

Bottle 1 discharges into the compartment within 60 seconds. Bottle 2 is flow metered and lasts for 4 hours (280 minutes).

Each compartment has 2 nozzles for discharge (Bulk has 1)

Portable extinguishers are in cockpit and cabin.

NORMAL OPERATION (A)

Do APU fire test every day. Make sure that:

APU fire pb sw is in and guarded

AGENT light is extinguished.

Get:

MASTER WARNING

SQUIB (amber) and **DISCH** (white) lights come on.

APU FIRE light

ECAM APU page displayed and ECAM **APU FIRE** message and action item appear.

WALKAROUND

Check APU fire extinguishing overpressure indication (red disc) is in place. An indication that the bottle is low on pressure but has not been discharged.

NOTE: No indication for engine fire bottles.

ENGINE FIRE TEST

Same results

FIRE DRILLS

ENG __ FIRE

MASTER WARNING

Follow ECAM – reduces thrust on bad engine. Nacelle temp pulsing.

Good engine accelerates.

Place good engine in MCT since same as engine failure.

Pushing ENG FIRE switch:

Arms squibs (shown by white **SQUIB** indications)

Closes fuel

A330-200 CBT NOTES

Hydraulic
Bleed and
Pack valves

Get automatic countdown started on ECAM – slows engine down to increase the efficiency of the agent. Get **DISCH** on AGENT pb sw.

Counts down for 30 sec. After discharge of first agent. Message disappears if fire stops.

SMOKE FWD CRG SMOKE

MASTER WARNING

ECAM COND page comes up

CARGO SMOKE panel has red **SMOKE** light

CARGO AIR COND panel, get **FAULT** (amber) light for cargo compartment with smoke. Closes inlet and outlet isolation valves

FWD ISOL VALVES (white) is on – means manually closed forward inlet and outlet isolation valves.

NOTE: Valves not shown on ECAM COND page.

Discharge agent – get a white **SQUIB** light and DISCH indicator has **BTL1** light

White light **BTL2** is discharged automatically. No ability to fight an AFT CARGO SMOKE warning.

Expect smoke light to remain after agent discharge as gases from smoke source are not evacuated and smoke sensors are sensitive to the extinguishing agent.

ABNORMAL OPERATION

Failure of engine fire detection system

ENG __ FIRE LOOP A FAULT (amber) sent by FDU

Still have fire warning.

CLR ENG

Failure of 2nd loop(both loops)

MASTER CAUTION

ENG __ FIRE DET FAULT (amber) Fire detection is not available

FIRE DET 1 or 2 (amber) message on STATUS page

NOTE: If both loops should fail within 5 seconds a fire warning is triggered.

DOORS

6 Cabin Doors with escape slides

A330-200 CBT NOTES

2 Emergency exits – one on each side of the aircraft with an escape slide.

2 Cargo doors on the right side of aircraft.

Bulk cargo door on right rear side aft.

Avionics door forward of nose.

ECAM DOOR/OXY page monitors the doors.

Green – closed and locked.

Amber – if open along with label.

2 sliding windows in cockpit for emergency exit.

NORMAL OPERATION

Escape ropes above and behind each sliding cockpit window.

When a door slide is disarmed there is no label.

Emergency exit doors are normally left with the slides armed SLIDE in white.

SLIDE shows at all doors where doors are armed prior to pushback.

ABNORMAL OPERATION

ECAM DOOR/OXY page automatically shown on ground.

Cargo Door Fault – no depressurization

MASTER CAUTION

DOOR FWD CARGO

Check Cabin V/S on DOOR/OXY page – if normal no depressurization.

Cargo Door Fault – depressurization

MASTER CAUTION

DOOR FWD CARGO

Check Cabin V/S on DOOR/OXY page – if high cabin V/S then:

MASTER WARNING

CAB PR EXCESS CAB ALT

ECAM CAB PRESS page automatically called and emergency descent begun.

Amber **DOOR** on E/WD to show the problem is still present.

NAVIGATION

Divided into 3 main groups:

June 3, 2002

PILOT ASSISTANCE NOTES

71

A330-200 CBT NOTES

ADIRS & STANDBY INSTRUMENTS

ADIRU

GPS

Standby Instruments

RADIO NAVIGATION

Radio Navigation aids

Radio Altimeter

Digital Distance and Radio Magnetic Indicator (DDRMI)

ADDITIONAL NAVIGATION SYSTEMS

GPWS

ATC transponders

Weather Radar

ADIRS – SYSTEM PRESENTATION

Provides air data and inertial info to the EFIS and FMGEC + others

3 ADIRUs – 1, 2, 3

Each ADIRU = Air Data Reference Computer (ADR) and an IRS (IR)

ADR & IR of each ADIRU operate independently.

Failure of 1 doesn't affect the other.

ADR gets info from probes and sensors

Gives air data to FMGEC for: MACH, Airspeed, Temp, overspeed warnings, barometric altitude, Angle of attack.

IR provides to FMGEC: track, heading, acceleration, FPV, position, ground speed, attitude

Controlled thru ADIRS panel.

Initialization done thru 3 MCDUs.

Distribution by two of the switches on the SWITCHING panel.

ADIRU 1 = Capt. EFIS, ADIRU 2 = F/O EFIS.

ADIRU 3 is a standby by use of switching panel.

MSU – Mode Selector Unit panel.

2 Parts and ADIRS selectors control both:

upper is IR

lower is ADR

Arranged 1, 3, 2

Each ADIRU has an IRS rotary selector.

In NAV position gives full inertial data to aircraft systems.

ON BAT light means ADIRU powered by battery only.

Also on for a few seconds at start of alignment – circuit test.

ATT position gives heading and attitude info in case of loss of nav capability.

PPOS is entered on the INIT page of the MCDU.

A330-200 CBT NOTES

RADIO NAVIGATION – SYSTEM PRESENTATION

2 VOR, ILS, ADF, DME

FMGEC 1 auto tunes VOR1, DME1 and ILS1 → same for FMGEC2

ADF can't be autotuned or used by FMGEC for navigation.

Monitored thru MCDU

Can manually tune a specific nav aid along with ADF on RAD NAV page

NOTE: When ILS approach is selected, ILS 1 displayed on PFD1 and ND2. ILS 2 displayed on PFD 2 and ND1.

To see nav aids on ND, have to have ADF or VOR selected ON.

Cannot see NAV data in PLAN mode.

VOR pointers are white, ADF green.

With a double FMGEC failure, backup tuning mode allows radio nav redundancy.

Backup tuning mode accessed on RMP. Press the NAV key. Tuning capability is now lost on both FMGECs. RAD NAV page only shows titles – no boxes. To return to FMGEC, NAV key has to be pressed.

RMP 1 keys associated with VOR1, DME1 and ADF1.

RMP 2 keys associated with VOR2, DME2 and ADF2.

Either RMP 1 or 2 can tune the ILS.

DDRMI displays ADF, VOR and DME raw data. DDRMI compass card displays the bearing scale from ADIRU 1.

EGPWS – SYSTEM PRESENTATION

GPWS warnings are overridden by stall / windshear warnings.

GPWS gets info from:

RA1

ADIRS 1

ILS 1

FMGEC1

LGCIU1

GPWS is not predictive for terrain (forward looking).

- High rate of descent – “SINK RATE”
If excessive get “WHOOOP, WHOOOP, PULL UP”
Red **GPWS** light on.

A330-200 CBT NOTES

- Rising ground:
“TERRAIN, TERRAIN, WHOOP, WHOOP, PULL UP”
Red **GPWS** light on
- Rate of descent on initial climb or go-around:
‘DON’T SINK, DON’T SINK’
Red **GPWS** light on
- Gear and flaps retracted and too low to ground:
“TOO LOW TERRAIN”
Red **GPWS** light on
- At very low levels, if gear is retracted:
“TOO LOW GEAR”
Red **GPWS** light on
- Gear is down but flaps not in landing configuration (at least 2)
“TOO LOW FLAPS”
NOTE: “TOO LOW GEAR” has priority over “TOO LOW FLAPS”
Red **GPWS** light on

<1000’ GPWS “**GLIDESLOPE**” amber if:

Runway is ILS equipped

ILS tuned

ILS signal is valid

a/c is significantly below glideslope

Aural message gets louder if no corrective action.

Some airports have approaches not compatible with GPWS.

These are programmed into the GPWS data base with warning thresholds modified to avoid nuisance warnings.

Flaps 3 is a recognized landing configuration. If option is used or required by ECAM procedure, crew should select LDG CONF 3 on APPR page of MCDU to inhibit warnings that aircraft isn’t in landing configuration.

Can turn off FLAP MODE – White OFF pb sw light.

Green **FLAP MODE OFF** now displayed on E/WD.

EGPWS, forward looking capability for terrain is added.

Based on terrain databases and FMGEC current positions.

Terrain information is displayed on ND except in PLAN mode.

Different image texture, image display sweeps from center outward and **TERR** on lower right corner of ND instead of **TILT** helps to distinguish this from ground radar mode.

A330-200 CBT NOTES

| | |
|----------------|--------------------------------|
| RED | = +2000' above |
| ORANGE | = +1000' above |
| YELLOW | = aircraft elevation |
| GREEN | = -250' → 1000' when gear down |
| | = -500' → 1000' when gear up |
| GREEN | = 1000' → 2000' |
| BLACK | = >2000' below |
| MAGENTA | = unknown areas |

Weather radar info replaced if switched on by EGPWS.

TERR pb sw in OFF turns off only the terrain function, not the GPWS. Failure of enhanced mode causes a **FAULT** light but GPWS still works.

EGPWS uses FMGEC position and terrain data base to look ahead 2 terrain envelopes. Alert triggered when a conflict :

One envelope corresponds to caution level

One envelope corresponds to warning level.

If caution envelope is penetrated, the areas turn solid yellow color.

TERR AHEAD with aural "TERRAIN AHEAD"

GPWS light comes on.

If warning envelope is penetrated, areas which violate will turn solid red color. A **TERR AHEAD** message appears with a repeated "TERRAIN AHEAD, PULL UP", aural alert.

GPWS light comes on.

In case of caution or warning, if TERR ON ND switch is not on, display automatically set on and the **ON** light on the TERR ON ND pb sw comes on.

2nd protective function of EGPWS provides terrain clearance floor envelope for each runway in the database. Warns of a premature descent below the floor regardless of configuration.

CAUTION: The relative height is calculated using the Captain baro setting. Doesn't protect against baro setting errors.

Position is calculated using FM1. Doesn't protect against FM1 position errors.

A330-200 CBT NOTES

When FMGEC position accuracy is degraded (**NAV ACCUR DOWNGRADE**), EGPWS automatically is deselected. **TERR STBY** appears on ECAM memo until a high level of accuracy restored.

RADIO ALTIMETER – SYSTEM PRESENTATION

2 radio altimeters

STANDBY on the ground

Active on lift off

Measures from bottom of wheels to ground

RA data goes to FMGEC and GPWS

Capt – RA1 F/O RA2

ON PFD, RA numbers change in color and size with proximity to ground / DH

Below 500', have a white ground indication line and red ribbon on altimeter scale.

Synthetic voice tied in to RA.

ATC/TCAS – SYSTEM PRESENTATION

2 transponders.

ADR1 → baro info to ATC 1 and ADR2 → baro info to ATC 2

TCAS installed

WEATHER RADAR – SYSTEM PRESENTATION

TILT +4.00 indication on ND.

Gain out of Auto results in a **MAN** below **TILT +4.00 MAN** on ND.

Ground mapping mode shows as:

GREEN = ground

BLACK = water

YELLOW = cities, mountains

With AUTO selected, the Predictive Windshear System generates appropriate visual and aural annunciations. TILT and GAIN automatically controlled for the scanning but **TILT** on the ND indicates the manually selected tilt.

STANDBY INSTRUMENTS – SYSTEM PRESENTATION

Integrated Standby Instrument System installed

NORMAL OPERATION (A)

Walkaround check:

3 AOA probes

A330-200 CBT NOTES

3 + 3 CAPT & F/O static ports

3 Pitot probes

2 TAT probes

IRS to NAV, get **IRS IN ALIGN > 7 MN** initially

After 30 sec attitude info displayed on both PFDs.

INIT page of MCDU, enter PPOS. Can do this by:

Inserting a company route

Enter departure and arrival airfields

Can adjust LAT, LONG by using the UP/DOWN arrows

ALIGN IRS prompt is visible after entering LAT/LONG

If position has not been inserted, IRS countdown stops at 1 minute and get **ENTER PRESENT POSITION** in scratchpad.

At end of flight to check position deviation of the 3 IRSs, select POSITION MONITOR on DATA INDEX page of MCDU.

At end of flight to check residual ground speed, select IRS MONITOR on DATA INDEX page. Select each IRS to check residual speed.

When programming another flight, scratchpad message **RESET IRS TO NAV** means to perform a fast alignment.

Momentarily select 3 IRSs to off, before 5 seconds return to NAV.

Now **ALIGN IRS PROMPT** is seen on INIT page. If correct select and enter into ADIRS.

ADIRS then takes 3 minutes to enter position into MCDU.

NORMAL OPERATION (B)

If VOR associated data and pointers are displayed on ND, then both receivers consider the signal as valid.

Call RAD NAV page to see nav aids auto tuned by FMGEC.

Selecting VOR D pb sw on EFIS panel, displays all VORs in NAV database.

Manually selecting VOR D shows the ident in LARGE case.

There is a "M" on the ND beside the VOR location. An invalid signal is indicated by the associated data and pointer missing. If no DME on VOR, then - - .

ILS pb sw shows the freq, ident and course on the ND

Baro setting to standard shows STD on the altimeter window and the PFD. Changes altitudes to FLs on PFD.

A330-200 CBT NOTES

NAV ACCUR UP GRAD on ND and MCDU scratchpad meaning that the nav accuracy level has switched from LOW to HIGH.

Navigation Accuracy Check

This compares raw data from tuned nav aids with corresponding FM computed data area.

SOP – should do this periodically in cruise, prior to TOD and entering a terminal approach.

*NOTE: If a/c equipped with **GPS PRIMARY**, no accuracy check necessary. Check this on PROG page.*

GPS PRIMARY LOST displayed on scratchpad and ND. Navigation accuracy stays at **HIGH** (shown above scratchpad message). Navigation accuracy must still be verified. Do this on an hourly basis.

Also has to be done when:

IRS only navigation

PROG page displays **LOW** accuracy

NAV ACCUR DOWNGRAD message on MCDU / ND

To do this have to manually tune the selected nav aids. They appear as **CYAN** identifiers on the ND. Untuned are **magenta**.

2 ways to do the check:

1. Compare the To waypoint distance & bearing which is FM computed with corresponding navaid DME and bearing. Insert a VOR/DME ident into the BRG/DIST field on the PROG Page and compare with raw data on the ND (LSK4R).
2. Check that the raw data needle passes thru the blue FMGES generated symbol for the VOR/DME and that position of this symbol corresponds to the DME distance.

Error < 3NM, check is positive and FM position is reliable.

Error > 3NM, FM position is unreliable. Use raw data navigation and monitor.

High latitude or when entering the north magnetic polar region, ADIRUs replace magnetic heading with true heading on EFIS and DDRMI. When approaching the polar region, ADIRU triggers **SELECT TRUE REF** on ND and MCDU scratchpad.

Select NORTH REF pb sw. Get a **TRUE** light on pb sw.

Displays true heading on instruments. **TRUE** label displayed on ND and PFD.

A330-200 CBT NOTES

On ND, grid track is displayed and VOR needles change to magenta. The **CORR** indication, near VOR identifier, indicates that VOR is corrected by FM. Aircraft is true referenced with VOR being magnetically referenced.

On MCDU, bearing or track for waypoints are true with a "T" next to each waypoint.

E/WD displays **TRUE NORTH REF**

ABNORMAL OPERATION (A)

MASTER CAUTION

NAV ATT DISCREPANCY

CHECK ATT displayed on PFD meaning a difference in the aircraft attitude displayed to the pilots.

Check PFDs with STBY horizon.

ATT/HDG sw should be selected to bad side.

ADIRS SWTG memo on E/WD due to switching.

ADR1 FAULT

MASTER CAUTION

NAV ADR _ FAULT

PFD loses:

Speed

Altitude

Mach

Baro indication

Select AIR DATA switch to #3

ADR _ to off. Cancels **FAULT** light and changes to **OFF**.

GPWS to off as there is a **FAULT** on GPWS.

ADIRS SWTG memo on E/WD due to switching.

CAT 3 SINGLE ONLY

RA abnormal

MASTER CAUTION

NAV RA _ FAULT

No procedure

CAT 2 ONLY

RA failed and on approach with other RA failure

MASTER CAUTION

A330-200 CBT NOTES

NAV RA 1 + 2 FAULT

GPWS off since it doesn't receive any RA data from any RA.
Lose both A/Ps for approach, A/CALL OUT and GPWS.

ABNORMAL OPERATION (B)

Dual FMGEC loss – Use of Standby Navigation Keys

Blank FMGECs with **FM1** and **FM2** lit on MCDUs.

MAP NOT AVAIL on the ND

Have to use radio aid raw data.

Use RMPs for standby nav aid tuning.

Press NAV key on RMP 1 or 2.

Green NAV button light indicates RMP 1 in NAV mode.

RMP1 & 2 VOR, DME and ADF keys associated with their respective radios.

RMP1 or 2 can tune both ILSs at same time.

When tune ILS, and freq is tuned and transferred to active, the course is shown C-XXX.

If ADF is selected, pressing the BFO activates the BFO.

NOTE: When an RMP is used to tune an ILS/DME, the PFDs do not display DME distance.

Use RMP for communication by selecting the appropriate VHF or HF key, without deselecting the NAV key.

NAV key must be left on to avoid freq changes of NAV receivers.

ATC Unit Failure

Code display is blank and ATC FAIL light illuminates.

Select other transponder.

Weather Radar Failure

WXR CTL etc. message show:

Amber when degraded

Red when no image is available.

TCAS Failure

Get **TCAS** failure on PFD and ND

NAV TCAS FAULT

DDRMI Flags

HDG flag, VOR/ ADF flag receiver / reception failure

A330-200 CBT NOTES

In case of RMI internal failure all flags are shown.

PRESSURIZATION

2 outflow valves

2 cabin pressure controllers (CPC 1 & 2)

Each CPC has 2 electric motors – 1 for each outflow valve

Only one system (1 controller and 1 motor for each outflow valve) operates at a time.

Other system is used as a backup

3rd motor is installed on each outflow valve which is used for manual control with manual input required.

Safety valves prevent excessive cabin differential pressure

ECAM CAB PRESS page monitors pressurization

Pack is green Δ when ON

System controller in use is shown (SYS 1 or 2)

Single indication for the 2 safety valves

ECAM CRUISE page has indications of:

Cabin differential pressure

Cabin vertical speed

Cabin altitude

ECAM DOOR page

Cabin V/S displayed only when a/c is airborne

CABIN PRESS panel requires no pilot actions during flight (under normal conditions)

Pressurization MODE SEL switch has 2 settings:

Automatic (lights out)

MAN (white light)

LDG ELEV selector normally left in AUTO. Info from FMGS unless abnormal situation.

DITCHING switch

Closes all valves below the waterline so aircraft is sealed.

NORMAL OPERATION

FMGS sets destination airport elevation.

A330-200 CBT NOTES

No amber indications during preflight.

ECAM CABIN PRESS page shows **AUTO** with landing elevation indication.

At liftoff cabin enters climb phase.

ECAM CRUISE page in flight has all major pressurization functions to monitor.

On descent cabin controller works to have cabin reach field elevation just prior to landing.

Cabin rate controller limits rate of descent to approx. 750 fpm.

Once outflow valves are fully open, there is an automatic system changeover to ensure equal use of controllers.

ABNORMAL OPERATION (A)

Cabin Pressure Fault

CAB PR SYS__FAULT

SYS 1 on ECAM CABIN PRESS page

Crew awareness – no MASTER CAUTION – other system now in control and in green – e.g. **SYS 2**.

Dual System Fault

MASTER CAUTION

CAB PR SYS 1+2 FAULT

SYS 1 and **SYS 2** on CABIN PRESS page

CAB PRESS panel has MODE SEL **FAULT** amber light on.

Both outflow valves on ECAM show **MAN** above them.

Use MAN V/S CTL as required.

Landing elevation indication is no longer visible since in MAN V/S.

STATUS page provides target V/S and target cabin altitudes.

On CRUISE page, cabin V/S changed to a gauge format.

ABNORMAL OPERATION (B)

MASTER CAUTION

CAB PR LDG ELEV FAULT FMGS landing elevation data lost

ECAM CAB PRESS page called but no elevation is shown. Still in auto pressurization though.

MAN message appears when LDG ELEV selector is moved out of the AUTO position.

A330-200 CBT NOTES

Selected landing elevation is now shown.

MANual landing elevation shown on the CRUISE page.

CAB PR SAFETY VALVE OPEN (amber) An excessive positive or negative differential pressure, one of the safety valves will automatically operate.

MASTER CAUTION

Safety valve indication is amber on CAB PRESS page.

CAB PR FWD/AFT OFV NOT OPEN (amber) One of the outflow valves is not opening on landing.

MASTER CAUTION

Have to use the MAN guarded selector and select the inoperative outflow valve and then use the V/S CTL to open the outflow valve.

Excessive Cabin Altitude

MASTER WARNING and red indication of cabin altitude.

VENTILATION

2 vent systems

1. Lavatory and galley:

Automatic – no controls or indications

Recirculated cabin air is drawn thru an extraction fan and then vented overboard thru a venturi.

NOTE: extraction fan runs continuously provided electrical power is available.

2. Avionics:

Cooling air for avionics compartment and flight deck instruments and circuit breaker panels.

Air from cabin fans goes to the avionics equipment and then using extract fan to remove warm air. Operates continuously.

On ground with engines not running, air blown thru Avionics Equipment is discharged thru an Overboard valve (ground cooling valve).

Avionics Ground Cooling Unit is installed in case it is very hot outside. Operates independently. Operates on ground when engines are stopped and the air is too hot in the avionics compartment. Air is

A330-200 CBT NOTES

drawn from the compartment fan and removed thru the ground cooling valve.

On ground with engines running, or in flight, Ground Cooling Unit and fan are stopped.

Ground cooling valve is closed. Overboard valve is closed and the air is blown thru the Inboard valve, under the forward cargo compartment, then overboard thru the forward outflow valve.

Avionics Equipment Ventilation Controller (AVEC) controls avionics ventilation systems and sends opening and closing signals to the Overboard, Inboard and Ground Cooling valves.

Ground Cooling and Overboard valves are located below the forward fuselage. Inspected during walk around.

ECAM CAB PRESS displays avionics ventilation system information.

GND COOL (normally white) provides information on the state of the Ground Cooling System

VENT EXTRACT (normally white) on the overboard valve.

Both are open when a/c is on the ground.

In Flight, both are closed.

In some failure cases, Overboard valve is partially open. On ECAM, valve indication changes to an intermediate position (1/2 open).

2 pb on Ventilation Panel – EXTRACT and GND COOL. In AUTO, requires no pilot input.

ABNORMAL OPERATION

VENT EXTRACT FAULT (amber)

MASTER CAUTION

ECAM CABIN PRESS page appears with **VENT EXTRACT** in amber – low extract flow

VENTILATION panel has amber **FAULT** light on EXTRACT pb
Switch to OVRD and get a white **OVRD** light

ECAM CAB PRESS has been reconfigured and shows the extract valve is now partially open to ensure adequate ventilation. Same configuration used for AVIONICS SMOKE procedure.

OVERBOARD VALVE **FAULT** (overboard valve still open after engine start)

MASTER CAUTION

A330-200 CBT NOTES

VENT OVBD VALVE FAULT

Ventilation extract pb sw shows **FAULT**.

Valve has to be controlled manually.

Set EXTRACT pb sw to **OVRD**. If unsuccessful in flight, outflow valves have to be closed manually.

GROUND COOLING FAILURE (similar to OVERBOARD VALVE FAULT).

MASTER CAUTION

VENT GND COOL FAULT

ECAM CAB PRESS page has **GND COOL** and valve partially open.

VENTILATION GND COOL pb sw shows **FAULT**.

On STATUS page get **MAINTENANCE AVNCS VENT** message.

Needs maintenance action.

Due to either a:

Ground Cooling Unit

Ground Cooling Valve

POWER PLANT

GE-CF6-80E1A3 engines

N1 consists of a front fan and LP compressor and LP turbine.

N2 consists of a HP compressor and HP turbine.

2 igniters – A & B

Has a FADEC (Full Authority Digital Engine Control system) – 2 identical independent channels, A & B

ENG MASTER sw and ENGINE START mode selector enable starting or dry cranking.

Mode selector can also provide continuous ignition.

Each engine has FIRE and FAULT light.

Overhead panel has MAN START switches.

E/WD and ENGINE ECAM page display all indications.

Protected by fire protection system.

NORMAL OPERATION (A)

Check ENG master switches are OFF and that ENG START selector is in NORM and ENG MAN START pb are OFF.

At electrical power-up, FADECs are powered and supply info to E/WD.

After 5 minutes, FADECs shutdown automatically and all engine indications change from normal to amber with **XXs**.

A330-200 CBT NOTES

Call ENGINE ECAM page, and then on Maintenance panel on the overhead panel, select ENG FADEC GND PWR sw 1 and 2 to energize FADECs, and check oil quantity is at or above 12 qts.

Walkaround – check that the:

- Thrust reverser cowl door is closed (both sides)

- Engine pressure relief door is closed (both sides)

- Fan cowl doors are closed and latched (both sides)

- Verify condition of drain masts and the absence of leakage

- Check access to the starter valve manual override and reverser latches are closed

- Verify condition of engine inlet and fan blades

- IDG oil fill access door is closed (right side of engine)

- Engine oil fill access door is closed

- Verify turbine exhaust is clear

Cockpit – verify that:

- Thrust levers in idle position

- Reverse levers are stowed

Engine Start:

- During automatic engine start procedure.

- All engine parameters are monitored, controlled and protected by the FADECs.

- ENG START selector set to IGN/START (FADECs powered again)

ECAM ENGINE page is displayed.

NOTE: after 30 seconds without any actions on the master switches, ECAM ENGINE page automatically disappears.

N1:

- Green needle indicates actual N1 – also digital readout.

- Blue circle represents thrust lever position

- Amber mark represents the N1 MAX (N1 limit)

- Red arc is the maximum permissible N1.

Right side of E/W D is the thrust limit mode and N1 rating limit are displayed. e.g. CLB, 93.1%

EGT:

- Green needle is actual EGT and also displayed digitally

- Amber tick indicates the MAX EGT. After stabilization, tick moves automatically to its normal operation position.

A330-200 CBT NOTES

*NOTE: amber tick is not displayed during:
take off
when alpha floor is active
when reversers are selected.*

N2 (HP rotor speed shown digitally)
FF displayed digitally

ECAM ENGINE page:

F USED for each engine. Quantity shown is for previous shutdown fuel used. Resets at next start.

OIL quantity

OIL pressure

OIL temperature

VIB indications displayed (N1 and N2)

Additional indications are displayed only on ground when ENG START selector is in the IGN/START or CRANK position.

They are:

Start valve position indications

Air pressure available for engine start

When engines are started, the valve is replaced by the nacelle temperature.

Start engine 1 first since Blue hydraulic systems engine driven pump is on engine 1 and the Blue system supplies park brake pressure.

Switch on ENG 1:

Start valve opens – shown on ENGINE page

F USED is reset to 0

E/W D – N2 increases – displayed on a gray background

Oil pressure increases

When N2 is > 10%, an igniter is powered (A or B on ECAM ENGINE page – alternate on successive starts)

At or above 15% N2, the fuel flow begins

EGT increases

N2 = 50%, start valve closes.

Thrust limit mode changes from CLB to FLEX (FLX) and N1 rating limit shown.

NOTE: FLEX or TOGA can be the modes used for take off.

At 54% ignition is switched off (indication disappears)

N2 continues to increase.

A330-200 CBT NOTES

At 63% N2 stabilizes and gray background disappears.
AVAIL is shown steady on N1 to indicate engine is at idle.
Disappears after 9 seconds or as soon as thrust is applied.

*NOTE: After a successful engine relight in flight, the **AVAIL** pulses green. Disappears as soon as thrust is applied.*

Set engine start selector to NORM

SUMMARY:

Engine Start:
Start valve open
Fuel used reset
N2 increases
Oil pressure increases
Ignition powered
Fuel flow
EGT increases
N2 >50% start valve closes
N2 54% ignition off
N2 63% engine stabilized with grey background disappears

ECAM ENGINE page is replaced by ECAM WHEEL page.

NOTE: If ENG START selector is not set to NORM, ECAM ENGINE page is automatically replaced by ECAM WHEEL page 15 seconds after 2nd engine start.

Run engines at or near idle for 3 minutes to protect against thermal shock.

NORMAL OPERATION (B)

Thrust levers can be moved manually over the entire throttle quadrant.
Never move automatically.

4 detents:

- IDLE
- CL for Maximum Climb Thrust
- FLEX/MCT – one detent for 2 functions:
FLEX is used for reduced thrust at take off

A330-200 CBT NOTES

- MCT for single engine operations
- TOGA
Maximum Takeoff or
Go Around thrust

Thrust control achieved in 2 ways:

- Manually as in a conventional aircraft
- Automatically when the auto thrust is active.

For Take Off:

On ground, the thrust limit is TOGA or FLEX

FLX is used for reduced thrust take off. The assumed temperature is displayed below the N1 limit.

Move thrust levers to 50% of N1 for spool-up, then move thrust levers to FLEX detent.

Causes the ECAM ENGINE page to replace the WHEELS page.

NOTE: TOGA thrust is always available by moving thrust levers to TOGA detent.

At thrust reduction altitude, move thrust levers to CL detent.

Auto thrust is now engaged and thrust limit mode goes to CLB.

At 1,500' AGL the ECAM ENGINE page is replaced by the CRUISE page.

Green arcs displayed between the current N1 and the new N1 value commanded by FADEC.

Green ▲ triangle indicates the direction of N1 tendency.

NOTE: These indications only displayed with auto thrust engaged. When new N1 value is reached all indications disappear.

In flight, if both throttles are in idle, and **IDLE** indication appears at the top of E/WD.

NOTE: There is a slight difference between ground and flight idle.

Flashes for 10 seconds then goes steady.

In heavy rain or turbulence, advisable to select continuous ignition: IGN/START position on ENG START mode selector.

Both A & B igniters are powered. **IGNITION** message displayed on E/WD memo.

IGNITION automatic when:

A330-200 CBT NOTES

Engine anti-ice is used

For 10 seconds in the event of a flameout

For 10 seconds in event of inadvertent cycling of the master lever with engine running.

Thrust reversers are pneumatically actuated. Require:

One FADEC channel operating

Aircraft on ground

Thrust lever in reverse position

As a/c approaches 70 kts, select idle reverse.

Stow reversers at taxi speed and before leaving runway.

NOTE: If continuous ignition was selected prior to landing, turn off ignition prior to shutting down engines.

MANUAL START

May be required for low pneumatic pressure. Pilot controls time fuel added to engine. FADEC only provides passive monitoring of start.

Found in FCOM 3, Procedures and Techniques.

FADEC controls:

Closure of start valve

Ignition is cutoff on the ground around 50% N2.

If EGT limit is exceeded, FADEC aborts the start.

If FADECs not powered, all engine indications are in amber **XX**.

To start the engines:

ENG START selector to IGN/START -- FADECs energized.

NOTE: After 30 seconds without any action, ECAM ENG page automatically disappears.

To start engine #1, press the MAN START pb sw – this opens the start valve

Blue **ON** light means start valve opened.

When N2 is maximum motoring speed, minimum 15% N1, switch on ENG MASTER sw.

Will see both igniters are on (**A B**)

When N2 reaches 50% the start valve closes.

Switch off ENG 1 MAN START pb

At or above 54% N2 igniters are switched off.

At 63% N2 engine stabilizes and grey background disappears.

ABNORMAL OPERATION (A)

EGT Over limit in Cruise

A330-200 CBT NOTES

EGT above normal range, EGT indication number goes amber

MASTER CAUTION

ENG EGT OVERLIMIT

EGT indication is red

Retard thrust lever

A red strip appears at the max reached value. Disappears after a new start on ground or a maintenance action.

N1 OVERLIMIT

Same type of indications as above.

N2 OVERLIMIT

Similar to above but red indication number > 100%.

Red + appears at the indicated value.

ENG OIL FILTER CLOG

ECAM ENGINE page displayed and the corresponding oil filter is indicated by **CLOG** in amber.

ENG FUEL FILTER CLOG

Same type of indication as above – shows **CLOG** at F USED

CHECK EWD (amber with affected indication having the last number dashed in amber) each time there is a discrepancy between the displayed value and the real value for:

N1

N2 -- last digit is dashed amber

EGT

FF

Start Valves (amber)

Abnormally open or closed

For E/WD and ENGINE pages, when a parameter is invalid, 2 amber crosses replace the associated digital indication.

On E/WD:

For EGT the needle disappears

For N1 the needle and the box around the digital display disappear

On ECAM ENG page the needle is removed for:

Oil quantity

Oil pressure

A330-200 CBT NOTES

NAC temperature

ABNORMAL OPERATION (B)

No ignition on start

MASTER CAUTION

ENG __ START FAULT

ENG panel FAULT light is amber indicating the start is aborted

FADEC shuts off fuel and turns off ignition

After 30 seconds of dry crank a new start is tried. A & B igniters are used now.

2nd start is aborted **NO LIGHT UP** (amber)

ENG __ OIL LO PR

MASTER WARNING

Shutdown engine

ENG __ OIL LO TEMP

MASTER CAUTION

Operating in very cold weather

Oil temp in green

Delay takeoff until engine oil warms up

ENG __ OIL HI TEMP (amber)

MASTER CAUTION

Activated above 185 degrees C.

Low bleed pressure for start

ECAM ENGINE pressure value is amber when N2 > 10%.

Wait for ECAM instructions

A FLOOR

Engine indications are unusual as the achieved N1 is greater than the thrust lever limit N1.

A330-200 CBT NOTES

CBT#3

A330-200 FUEL

Fuel tanks in:

Wings

Wing center box

Trimmable horizontal stabilizer (THS) (The trim tank)

NOTE: Each inner tank is divided into two parts. The division is fitted with a SPLIT valve which is normally open.

Total usable fuel is

| | | | |
|----------------|-------|-------|--------------------|
| Outer | 2895 | x 2 = | 5,790 |
| Inner | 32970 | x 2 = | 65,940 |
| Center | 32625 | x 1 = | 32,625 |
| Trim tank | 4891 | = | 4,891 |
| <u>TOTAL =</u> | | | <u>109,246 kgs</u> |

Each inner tank has a collector cell which contains two engine feed pumps.

The collector cells are always kept full (1000 kg) in order to provide fuel reserve for the pumps, and protection against fuel flow interruption to the engines by negative acceleration.

A standby engine feed pump is fitted to each inner tank outside of the collector cells.

Outer tank transfer (OUTR TK XFR) valves allow fuel to transfer from the outer to the inner tanks.

Engine feed pumps normally feed the respective engine.

Two engine low pressure valves used to cut off fuel to the engines.

Standby engine feed pumps can also feed the engines. System operates automatically if there is a fault in one of the related engine feed pumps.

Crossfeed fitted to connect or isolate the L & R wing tanks.

A330-200 CBT NOTES

Center tank also has 2 fuel pumps to transfer fuel from the center to the inner tanks.

Trim tank isolation valve and trim tank inlet valve allow fuel transfer between the trim tank and the inner or center tanks.

NOTE: only one valve symbol on ECAM FUEL system represents the two valves.

Fuel system also feeds APU with a APU LP valve to cut off fuel to APU.

NOTE: FUEL temperature is not indicated for the right outer tank.

Inner tank split (INR TK SPLIT) valves allow inner tanks to be divided into two parts through an associated split valve.

NOTE: inner tank split valves are not represented on the ECAM FUEL page.

NOTE: WING X FEED valve automatically opens in emergency electrical configuration.

T TANK MODE pb sw and OTR TK XFR pb sw enable fuel transfer.

NORMAL OPERATIONS

Walkaround – check:

Magnetic fuel level indicators are flush with the surface.

Water drain valve – check no water is leaking from the valve

Refuel panel located under the fuselage at the right wing.

A 2nd or 3rd panel is located close to the refuel couplings.

Two refuel couplings located under the wings. Can fuel a/c from both L and R sides.

NOTE: when both side couplings are used, refueling time is 33 minutes for all tanks.

Surge tank is located on wing tips and right side of trim tank.

Protect against overpressure and thermal expansion.

Shroud drain mast. No fuel should be leaking.

Pumps cross-line amber if off.

On preflight, all white lights are off, thus all fuel pumps are on shown in-line green (or standby for standby pumps shown x-line green).

A330-200 CBT NOTES

The Fuel Control and Monitoring System (FCMS) controls the fuel system automatically.

REFUEL IN PROCESS is displayed in green on E/WD indicating the refuel control panel is not set in flight position (door closed).

NOTE: Minimum fuel quantity for takeoff is 5,200 kg.

APU gets fuel from engine 1 collector cell (left hand inner tank).
APU  green triangle means APU LP valve is open and fuel is fed to the APU. (white if closed)

ECAM ENGINE page automatically displayed during engine start.

Before start:

Engines, engine LP valves are x-line amber to indicate closure

Fuel used quantities remain from previous flight (resets to 0 during start)

Engine ID numbers are amber. (white when engine is started)

Engines are started with fuel from the associated collector cells.

Fuel always fed to the engines from the inner tank. Center tank is emptied first by transferring fuel to the inner tanks.

Inner tank inlet valves operate independently and cycle their respective inner tank contents between underfull and high level, underfull being approximately 2000 kg below high level.

Center pumps turn off automatically when center tank is empty, and both inner tank inlet valves close.

Trim tank transfer system controls the CG. In cruise, the FCMC (Fuel Control and Management Computer) calculates CG and compares the result to a target value which depends on the a/c actual weight. Reduces aircraft drag and optimizes CG and reduces fuel consumption.

If the actual CG is forward of the target CG and the aircraft is above FL 255, an aft transfer occurs, indicated by green arrows on the ECAM FUEL page. Fuel for the trim tank transfer can also be provided by the CTR TK unless it is empty.

A330-200 CBT NOTES

The transfer automatically stops when the actual CG reaches the target CG – 0.5%.

NOTE: if during the transfer, the inner tanks are out of balance by more than 500kg, the transfer is stopped on the lightest side until the fuel balance is recovered.

Forward transfer occurs automatically to maintain the actual CG within 0.5% forward of the target CG.

Forward transfer normally directed to the inner tanks, and may be directed to the center tank when not empty.

TRIM TK XFR in green appears on E/WD memo display during trim tank transfer.

When an inner tank content reaches 4000 kg, a forward transfer occurs to transfer the fuel the inner tanks when they are between 4000 – 5000 kg until the trim tank is empty.

NOTE: if during the transfer, the inner tanks are out of balance by more than 500kg, the transfer is stopped on the heaviest side until the fuel balance is recovered

A continuous forward transfer occurs when passing FL 245 or FMGES time to destination < 35 min (<75 min if trim tank forward transfer pump has failed -- gravity transfer).

Forward transfer stops when landing gear or the slats are extended, whatever occurs first.

NOTE: If an inner tank reaches the high level, the transfer stops to prevent tank overflow, and restarts when the quantity reaches 2000 kg below the high level.

When trim tank is empty, the message **T TK XFRD** is shown on the ECAM memo.

When one inner tank quantity drops below 3500 kg, and the trim tank is empty, the outer tank transfer valves open to cycle the inner tank content between 3500 and 4000 kg. Done by gravity.

A330-200 CBT NOTES

The outer to inner tanks transfer is done by gravity feed. Indicated by the triangles between outer and inner tanks. **OUTR TK XFR** displayed in green on ECAM memo page.

Outer tank transfer valves close automatically when outer tanks are empty for 5 minutes.

OUTR TK XFRD displayed on ECAM memo when outer tanks are empty.

At engine shutdown, GW and GWCG values disappear if no calculated data is available.

ABNORMAL OPERATION (A)

Pump Failure:

FUEL LEFT PUMP 2 LO PR

LO box amber means that a pump is failed but ON. STBY pumps start automatically to provide back-up.

FUEL panel **FAULT** on pb sw.

When pump is turned off, the failed pump **LO** is replaced by an amber **XX** meaning the fuel pump has been switched off. Get white **OFF** light on pb sw.

2 Pump Failure: Same as above:

If two pumps on one side fail, no MASTER CAUTION as there is still redundancy for the system.

With any 2 out of 3 pumps are inop, the fuel transfer is inhibited, so get **FUEL AFT XFR** amber memo.

3 Pump Failure: When all three pumps on one side fail, get a:

MASTER CAUTION

FUEL WING PUMPS LO PR (same as above)

Wing **X FEED** valve is white ON when x-feed valve begins to open and green **OPEN** when fully opened.

NOTE: Wing x-feed valve opens automatically in case of emergency configuration.

Now only gravity feed is available for the trapped fuel – follow QRH.

A330-200 CBT NOTES

SUMMARY:

Losing 1 or 2 inner tank pumps is not critical due to redundancy.

Losing 3 inner tank pumps means opening the x-feed and using gravity fuel feeding.

With both CTR tanks inop:

MASTER CAUTION

FUEL L & R CTR PUMPS LO PR

2 CTR-INNER tank transfer valves are shown in amber.

CTR tank fuel is now unusable so fuel quantity indications for FOB and CTR TANK are boxed amber. Fuel transfer from CTR to INNER is stopped.

Engines are fed using fuel from the inner tanks only until either inner tank reaches 17 tons. AFT fuel transfer is inhibited.

When either inner tank quantity is below 17 tons, **MASTER CAUTION** comes on, amber XFER **FAULT** light on.

XFER sw is on. XFR **MAN** and **FAULT** light is out. Now gravity feed is in use but 15 tons of CTR tank fuel is unusable. XFR valves are now displayed green.

Failure of fuel transfer from center tank to inner tanks:

MASTER CAUTION

FUEL CTR TO INNER FAULT

2 amber arrows on ECAM FUEL page along with both CTR TANK XFR pump **FAULT** lights appearing.

Green memo **CTR TO INNER : MAN ONLY** appears on STATUS.

Engines are fed using fuel from the inner tanks only until either inner tank reaches 17 tons.

When below 17 tons inner tank, **MASTER CAUTION** comes on, amber XFER **FAULT** light on

XFER sw is on. XFR **MAN** white and **FAULT** light is out and fuel is now used until empty as fuel transfer from center to inner tanks is possible until CTR tank is empty.

Summary -- CTR to INNER transfer failure:

Automatic fuel transfer is lost

Both center tank pumps have to be set to OFF

Manual transfer is available by selecting the CTR TANK XFR pb sw **MAN** when either inner tanks quantity drops below 17 tons

Both center tank pumps have to be set back to on when the manual transfer is initiated.

A330-200 CBT NOTES

A330-200 does NOT allow a manual forward transfer from the trim to the inner tanks.

ABNORMAL OPERATION (B)

Failure of automatic forward transfer:

MASTER CAUTION

FUEL T TANK XFR FAULT

ECAM L and R forward transfer arrows in amber

FUEL control panel has **FAULT** light amber on T TANK MODE pb sw.

L & R forward transfer arrows replaced with a green forward arrow to the center tank. (Manual forward transfer has been selected.)

E/W/D green **TRIM TK XFR** means a trim tank forward transfer is in progress.

E/W/D green **TRIM TK XFRD** means a trim tank is complete.

When trim tank is empty, the failure is recalled and the T TANK MODE pb sw has to be selected back to AUTO. Trim tank valves automatically close.

In some cases you have to use the T TANK FEED selector either to completely isolate the trim tank, or to manually force the forward transfer.

Failure of fuel transfer from outer to the inner tanks:

MASTER CAUTION

FUEL OUTR TO INNER FAULT

FAULT light on pb sw.

Outer tank transfer changes from a hollow green arrow Δ to a solid amber \blacktriangle arrow.

OUTR TK XFR pb sw **ON** and transfer valves are controlled open (indicated by a solid green arrow \blacktriangle since manually accomplished)

When completed:

MASTER CAUTION

FUEL MAN XFR COMPLETED

OUTR TK XFR pb sw to OFF

Summary Outer to Inner tank transfer failure:

Fuel transfer from outer to inner tanks can be manually selected through the OUTR TK XFR pb sw

When OUTR TK XFR pb sw is selected ON, both transfer valves are controlled open until the OUTR TK XFR pb sw is set to AUTO.

A330-200 CBT NOTES

Jettison System:

NOTE: JETTISON system not installed on EVA A-330-200.

To jettison fuel, have to enter JET GW in FUEL PRED page on the MCDU.

Arm and activate the corresponding pushbuttons.

ECAM FUEL pages shows white **JETTISON** indications with E/WD showing green **JETTISON**.

Also get:

Standby pumps automatically operate

Crossfeed valve automatically opens

Fuel is jettisoned from the center tank with the center tank pumps and the inner tanks using all pumps.

When gross weight reaches predicted value pre-selected on FMGES, jettison pumps normally stop.

Degraded accuracy of FOB indication:

FOB displayed with two amber dashes across the last two digits

The affected tank also shows the two amber dashes.

LANDING GEAR

Main wheels are equipped with:

Carbon brakes

Anti-skid

Autobrakes

Tire pressure indication system (TPIS)

Brake fans

Nose Wheels

TPIS

Steering

ECAM WHEEL page shows indications for:

Nose gear

Main gear

Landing gear doors

Brake temperature

Tire pressure

Top of ECAM WHEEL page the spoiler positions are shown.

A330-200 CBT NOTES

2 Steering handles located on both sides of the cockpit.

2 Braking modes

Normal – Green hydraulic system

Alternate – Blue hydraulic system – includes parking brake.

Brakes gauge measures of alternate brakes and accumulator.

NORMAL OPERATION

Accumulator brake pressure checked before setting the brakes.

If in the green arc, good for 12 hours.

If not in green arc, use blue hydraulic pump to recharge the brake accumulator.

Brake Pressure Indicators

Display only the blue pressure sent to each side either by the parking brake or by the pedals.

In alternate braking without anti skid, the green scale is used by the pilot as a reference to avoid locking the brakes.

Auto brake system is triggered when spoilers deploy.

NOTE: Parking brakes must be set to check brake wear indicators.

E/WD indicates that parking brake handle is in the ON position.

PARK BRK memo.

Pressure to the main brakes is indicated for each main landing gear (brake pressure gauge). This is blue hydraulic pressure as the PARK BRAKE uses blue pressure.

With parking brake to OFF, brake pressure goes to 0.

Walkaround: Check:

Nose Gear:

Gear structure and download springs

Wheel well for general condition

Hydraulic lines

Electrical wires

Chocks, wheels and tires,

Safety pin (bypass)

A330-200 CBT NOTES

Main Gear:

- Gear structure and download springs
- Wheel well for general condition
- Hydraulic lines
- Chocks, wheels and tires
- Safety pin

On pushback, E/WD displays **NW STRG DISC** so nose wheel steering doesn't work because disconnected by ground personnel. Becomes amber if one engine is running.

NOTE: Maximum pushback and towing angle is 60 degrees.

Both engines running and during start with parking brake ON, the aircraft starts to move due to parking brake failure, immediately release PARKING BRKS handle to restore brake pedals.

To verify that green pressure has taken over and blue pressure is at 0, press the top of the rudder pedals and remove the PARKING BRAKE.

Brake pressure goes to 0 on the triple indicator meaning that Normal Braking system is in use.

NOTE: If brake pedals are quickly depressed a brief brake pressure indication appears on the brake pressure triple indicator.

WHEEL page is automatically displayed during taxi.

2 green triangles for each gear. 2 triangles because there are 2 computers for these indications.

Landing Gear Control and Interface Unit (LGCIU 1 and 2).

Green horizontal lines mean the gear doors are closed in the normal position.

Brake temps in green indicate that it is normal.
Tire pressure in green to indicate it is normal.

Autobrake armed to MAX for takeoff during taxi.

A330-200 CBT NOTES

The following show that the AUTO BRK is armed:

ON in the selected pb,

Message on the ECAM WHEEL page

On the **AUTO BRK** line **MAX** changes from blue to green **AUTO BRK MAX** on takeoff configuration page.

Nosewheel steering angle is limited to 65 degrees L or R deflection.

NOTE: Nose wheel steering is self-centered above 100 kts.

To check flight controls, press the rudder pedal disconnect switch. Disconnect the nose wheel steering from the rudder so that you can check full deflection of the rudder pedals versus the indications on the ECAM.

Rudder pedals provide up to 6 degrees L and R deflection at low speeds.

As the speed increases, this deflection angle decreases progressively until 100 kts, when directional control is 0 percent Nosewheel and 100 percent rudder.

AUTO BRK automatically disengaged once gear lever is positioned into the UP position.

ON disappears on the MAX pb

AUTO BRK MAX disappears on the ECAM WHEEL page.

When landing gear lever is positioned UP, the message **L/G CTL** appears. Indicates there is a discrepancy between the landing gear and lever position.

Gear doors deflect downward and are amber since they are open. LDG GEAR indicators go red **UNLK** in the position indicator lights. Landing gear indicators are red on the ECAM wheel page.

When gear lever is down and a/c below 15,000', the ECAM WHEEL page is displayed.

Green doors change from green to amber and move down to show gear is being lowered.

Green dashes (**| | | 3 | | |**) on L and R side of the wheel number indicate that anti-skid is available to that wheel.

*NOTE: The white **R** indication means released and is a label only.*

A330-200 CBT NOTES

Should use autobrakes on:

Short runways

Contaminated runways

When operating in low visibility

Get **AUTO BRK LO** on E/WD (only appears below 800' AGL) and on ECAM WHEEL page. **ON** shows on AUTO BRK pb sw.

Extension of the ground spoilers triggers the autobrake. The **DECEL** light illuminates on the autobrake control panel when the acceleration is at least 80% of the selected rate.

Autobrake action settings are:

LO → braking after approximately 1 second

MED → immediate braking and higher deceleration than in LO

MAX → immediate braking with max deceleration rate. Only used for takeoff.

Green dashes appear on & off during braking to indicate that the anti-skid is active.

Autobrakes can be deselected by:

- Using the corresponding pb on the AUTO BRK panel
- Applying sufficient force to one brake pedal in LO and MED and to both brake pedals in MAX

NOTE: AUTO BRK is automatically disarmed in the case of ground spoiler retraction.

*NOTE: As soon as AUTO BRK pb sw is **ON**, braking using pedals is no longer available.*

A maintenance action is required when:

The difference between two brakes of the same gear is greater than 150 degrees

The temperature of one brake is above 600 degrees or below 60 degrees

Above 100 degrees C, a green arc is displayed over the hottest brake temperature.

Turn ON the BRK FAN if > 100° C.. **ON** light goes white to indicate the fans are running.

A330-200 CBT NOTES

ABNORMAL OPERATION (A)

GEAR NOT DOWNLOCKED

MASTER WARNING

L/G GEAR NOT DOWNLOCKED

WHEEL page, gear not down and locked (**L/G CTL & NW STRG**)

On LDG GEAR panel **UNLK** indication gear is not down and locked

Some ECAM procedures lead you to a non-ECAM action in the QRH

In this case using the L/G GRVTY EXTN selectors isolates the green hydraulic system and the doors and gear are electrically unlocked.

In RESET position, the system is set back to normal extension and retraction mode.

OFF position is for normal operations.

NOTE: After gravity extension nose wheel steering is lost. **NW STRG**

Landing gear doors remain open as indicated by the E/WD message **L/G DOORS NOT CLOSED** and amber gear door open indications on the WHEEL page.

CAT 3 SINGLE ONLY is displayed as there is no nose wheel steering.

Down and locked disagreement (WHEEL page)

If one LGCIU says a gear is not down and locked (red triangle) and the other LGCIU says that it is (green triangle) then the one green down and locked indication is sufficient.

Main Gear – One triangle is missing

One triangle is missing – meaning the gear is detected up and locked by one system.

One triangle is red because the other system detects the gear is in transit.

Both LGCIUs failed, the gear indicators are replaced by amber crosses.

XX XX
XXXX

XX XX **XX XX**
XX XX **XX XX**

A330-200 CBT NOTES

The message **UNLOCK** appears when the landing gear is down and locked with a gear up lock engaged. Get the **MASTER CAUTION**.

NW STRG appears in case of nose wheel steering failure or when the A/SKID & N/W STRG sw is **OFF**. Get **MASTER CAUTION**.

In case of low pressure on a wheel (tire) the corresponding pressure indication is displayed in amber.

The LDG GEAR down selector red down arrow indicates that the gear is not down and locked in approach configuration.

ABNORMAL OPERATION (B)

During braking the brake temp increases:

Above 100 degrees C., a green arc appears on the hottest wheel.

MASTER CAUTION and checklist on E/WD are shown.

BRAKES HOT

Turn BRK FAN ON. BRK FAN sw has **HOT** illuminated amber.

ON indication in white.

On ECAM WHEEL page the temperatures are displayed amber when over 300 degrees C.

Amber arc displayed over the hottest wheel.

BRK FAN memo displayed green when BRK FAN pb is ON.

A/SKID FAULT failure

MASTER CAUTION

BRAKE A/SKID FAULT

ANTI-SKID on E/WD

Caused by either a Blue and Green hydraulic system low pressure or a failure of both Brake and Steering Control Units (BSCUs).

AUTO BRK amber message appears indicating the loss of autobrakes.

Autobrake setting level disappears. (e.g. MED)

Braking will be done using rudder pedals.

Brake pressure monitored on brake pressure indicator and should be limited to 1000psi.

A330-200 CBT NOTES

ABNORMAL OPERATION (C)

MASTER CAUTION

L/G LENGTHENING FAULT

During gear retraction shock absorbers are compressed to reduce their length.

Gear cannot be retracted.

Touchdown should be made as smooth as possible.

Anti-Skid Failure

MASTER CAUTION

BRAKES RELEASED

Brake servo valve jammed closed on the designated wheel or tachometer is failed.

AUTO BRK message in amber, no brake on that wheel shown on WHEEL page.

FLIGHT CONTROLS

Signals from sidesticks go thru FCC to hydraulic actuators (servo controls).

ECAM F/CTL page

Rudder trim indicated by a small blue line on the rudder scale

Rudder and pedal deflections are limited as a function of speed,

Via a rudder travel limiter.

High speed position indicated by small green lines on scale.

Pitch trim shown by THS deflection in degrees UP or DOWN.

Speedbrakes use all the spoilers (6)

Roll controls uses 5 outer spoilers (5)

Ground spoilers use all surfaces. (6)

Spoiler extended position indicated by small arrows .

FCCs = 5 computers manage movement.

3 Primary computers (PRIM)

2 Secondary computers (SEC)

FCDC 1 & 2 acquire data from the PRIM and SEC and send it to the EIS.

Status of PRIM and SEC indicated on the ECAM F/CTL page.

2 Panels control FCC's -- on overhead panel.

A330-200 CBT NOTES

7 Slats on each leading edge.

2 Flaps on each trailing edge.

Slats and flaps are hydraulically actuated and electrically controlled via 2 Slat Flap Control Computers (SFCC)

Each SFCC has 2 channels.

Each channel can drive it's own surfaces.

1 for slats – Flap Channel

1 for flaps – Flap Channel

Slats & Flaps shown on E/WD. Positions indicated by white dots.

No labeling with Flaps 0 setting.

Protection functions for:

Surface asymmetry

Surface attachment failure

Overspeed

Uncommanded movement

SIDE STICK

No feedback from flight controls.

If both sidestick are operated at the same time, their deflections are algebraically added together.

Both sidesticks moved in the same way, total demand never more than full deflection on 1 sidestick.

When either A/P engaged, both sidesticks lock into neutral position. If manually moved, A/P disconnects with aural warning.

MASTER WARNING

AUTOFLT AP OFF

A/P has a red autopilot disconnect and side stick take-over pb.

2 pushes of pb cancels warnings immediately.

Side Stick priority pb.

If press and hold, deactivates other side stick.

Audio and visual indications of which pilot has priority.

Audio warning "PRIORITY LEFT"(Capt. - PF) Opposite side has red arrow to show who has priority. (FO - PNF)

If the deactivated sidestick is moved, a green arrow appears in front of the PF (CAPT). When deactivated sidestick is returned to neutral, the green light extinguishes.

Both pilots press take-over pb, last one gets priority.

If necessary to deactivate opposite side stick permanently, press and hold takeover priority pb for 40+ seconds.

A330-200 CBT NOTES

To reactivate a permanently take-over sidestick, either pilot has to press his take-over pb momentarily. Both side stick priority lights are now extinguished.

Simultaneous inputs aren't recommended.

If PNF must make a control input, must press his take-over pb.

With simultaneous control inputs, both green side-stick priority lights will flash.

NORMAL LAW & PROTECTIONS

Sidestick or A/P → FCC demanding a maneuver

FCC → control surfaces. Pre-set limitations for surface movement is called LAWS.

NORMAL LAW is modified depending on the phase of flight. 3 Modes.

- Ground Mode – Operates on ground when a/c powered electrically and hydraulically – controls are conventional.
- Flight Mode – Operates in the air after a gradual transition just after lift off.
- Flare Mode – Modifies Flight Mode to introduce conventional “feel” to the landing phase.

Control surface deflection is not directly proportional to side stick deflection

Side stick deflection gives a rate demand to the FCC

FCC set control surface deflection to meet rate demand.

Large deflection at low speed but small at high speed.

Side stick input is a:

Rate of roll demand in roll

Load factor (g) demand in pitch

Yaw control is conventional.

Aircraft control surfaces responding to FCCs have a feedback channel to FCCs.

This feedback causes adjustments to control surface deflection to ensure the maneuver rate demand is executed accurately.

Therefore, control surface deflections may be altered with no change in side stick deflection.

Neutral side stick position demand 0 rate of pitch and roll.

A330-200 CBT NOTES

Auto turn-coordination and Dutch-roll damping are provided in Normal Law. Rudder inputs not required.

Normal Law provides airborne pitch protections for:

- Maneuver
- Pitch attitude (UP and DOWN limits)
- High angle of attack
- High speed

Later control – bank angle protection

- Maneuver protection limits control deflections to prevent over-stressing.
 - Clean +2.5 to -1g
 - Flaps extended +2.0 to 0g.
 - Pitch attitude protection limits keeps attitude within a safe range.
 - Shown as two = on the PFD.
 - Pitch up limits vary between 30 and 25 degrees depending on a/c configuration and speed.
 - In Nose-down attitude, limits nose down attitude to 15 degrees.
- High angle of attack prevents a stall and optimum perf in windshear or GPWS. This protection takes priority over all others.
 - Shown on speed scale – red and orange ribbons
 - As speed decreases it reaches V_I (lowest achievable speed with autothrust engaged). Shown as amber single line.
 - With autothrust inop or not engaged, speed can reduce to first level of protection – V_α PROT, shown by top of amber/black band (barber pole)
 - FCCS will maintain speed at V_α PROT. If engaged, A/P will disconnect.
 - If pilots override V_α PROT using the sidestick, aircraft slows to V_α MAX. (solid red ribbon)
 - In Normal law, FCCs maintain V_α MAX even if pilot holds full back stick. Nose up pitch trim inhibited.
 - In this protection range, Normal Law demand is modified and side stick input is an angle of attack demand, instead of a load factor demand.

A330-200 CBT NOTES

If autothrust is serviceable, speed unlikely to reduce to V_{α} MAX before Alpha floor protection is triggered.

Indicated by **A FLOOR** in amber box on FMA and **A FLOOR** on E/WD

If side stick released at V_{α} MAX, speed will return to V_{α} PROT.

- High speed protection
VM0, MM0 shown on PFD at the bottom of red/black barber pole.
= indicate the speed at which protection is activated.
When airspeed > VM0/MM0, ECAM overspeed warning triggered.
If airspeed/Mach increases to the protection speed (=), A/P disengages and FCCs send a pitch up command.
FCC's permit momentary exceedance for maneuvering.
Pilot can't override automatic nose pitch up.
- Bank Angle Protection
Limits to 67 degrees shown as = on either side of PFD.
FD on PFD disappears if bank angle > 45 degrees.
If side stick released when > 33 degrees, a/c returns and maintains 33 degrees.
FD on the PFD returns when bank angle < 40 degrees.
Auto trim is inhibited > 33 degrees.
NOTE: if High Speed or Angle of attack protections are active, bank angle limited to 45 degrees and a/c returns to wings level if side stick released.

RECONFIGURATION LAWS

Single failure cannot result in loss of Normal Law.

Multiple failures of flight control, hydraulic or electrical systems can result in degradation or Reconfiguration of the flight control law.

Level of degradation depends on severity of the failures.

ALTERNATE LAW

Ground and Flare mode are like Normal Law

Flight Mode:

Pitch control: load factor demand as in Normal Law

A330-200 CBT NOTES

Roll Control:

Conventional, surface deflection proportional to side stick deflection

Roll sensitivity proportional to airspeed

Feels more sensitive

Yaw Control:

Damping available with limited authority.

F/CTL ALTN LAW (PROT LOST) shown on ECAM

In Alternate LAW most protections are lost.

Some replaced by stabilities

Pitch attitude protection lost so no limits on pitch.

Indicated on PFD by replacing = with **x** at 30°

Bank Angle Protection is lost.

Indicated on PFD by replacing = with **x**

Maneuver protection similar to Normal Law.

High angle of Attack protection replaced by Low Speed Stability.

V α PROT and V α MAX replaced by stall warning speed (Vsw), indicated by a red and black barber pole.

As speed approaches Vsw, a gentle progressive nose-down pitch input begins. Pitch input can be overridden by input to side stick.

At Vsw, aural "STALL, STALL, STALL" triggered.

A/C will stall if ignored.

Alpha Floor is inop in Alternate Law.

High Speed Protection replaced by High Speed Stability.

= replaced by = on the speed scale

Above VMO/MMO, nose up input given to prevent further increase.

Can be overridden by the pilot.

If VMO/MMO is exceeded, overspeed warning is triggered as in Normal Law

A330-200 CBT NOTES

According to failures, an Alternate Law without reduced protections can exist.

Maneuver protection can exist in this case. High speed and low speed stabilities are also lost.

Stall and overspeed warning are still operative.

DIRECT LAW is the lowest level of computer flight control.

Pilot inputs sent to control surfaces unmodified.

Large number of inputs required to go to Direct Law which is unlikely.

ECAM warning **F/CTL DIRECT LAW (PROT LOST)**

Direct Law gives a direct relationship between side stick movement and deflections of all surfaces.

A/C behaves like a conventional a/c and control sensitivity depends on airspeed.

No protections available.

Stall and overspeed warnings will sound at the appropriate speeds.

Auto trim is not available. **USE MAN PITCH TRIM** on the PFD.

Auto turn coordination and Dutch roll damping is lost.

All yaw control in Direct Law is thru the rudder pedals.

In the worst cases of failure :

Normal → Alternate → Direct → Mechanical Backup mode

Only method of pitch control is the THS provided blue or yellow hydraulics available.

MAN PITCH TRIM ONLY indicated on the PFD.

Lateral control achieved using rudder panels and their mechanical linkage provided at least 1 hydraulic system is available.

In most cases (e.g. resetting FCCs), you will be able to recover from mechanical backup to either Alternate or Direct Law.

SUMMARY:

NORMAL LAW: All protections available

Maneuver

Bank Angle

High Speed

Pitch attitude

High angle of Attack

ALTERNATE LAW – with reduced protections:

Maneuver

Normal

Bank Angle

LOST

June 3, 2002

PILOT ASSISTANCE NOTES

113

A330-200 CBT NOTES

High Speed → High speed stability
Pitch attitude → LOST
High angle of Attack → Low speed stability

ALTERNATE LAW – without reduced protections:

Maneuver → Normal
Bank Angle → LOST
High Speed → High speed stability → LOST
Pitch attitude → LOST
High angle of Attack → Low speed stability → LOST

DIRECT LAW:

All protections lost and a/c handles as a conventional aircraft.

MECHANICAL BACKUP:

No flight envelope protection is left.
Pitch control → pitch trim wheel if B or Y hydraulic available
Lateral control → rudder pedals if hydraulics available

If extreme conditions cause the aircraft to leave the protected envelope (e.g. severe turbulence)... Abnormal attitude laws become effective.

Normal Law → In-Flight abnormal attitude → Abnormal attitude laws

So, if the limits of Normal law are exceeded, Abnormal attitude laws become active. This ensures FCCs never prevent the pilots recovering from abnormal attitudes.

Flight controls operate in Alternate Law without protections in pitch except load factor protection and without auto trim. In roll, Direct Law is provided with yaw in Alternate.

After recovery, controls remain in Alternate Law for pitch and yaw, Direct Law in roll.

NORMAL OPERATION (A)

Before engine start, the bank angle protection indicators are **X**.
Side sticks need hydraulic power to be operative..

After engine start, ground spoilers are armed by pulling the lever out. White band at base of the lever with **GND SPLR ARMED** on E/WD.

A330-200 CBT NOTES

Rudder trim is zeroed by pushing the RESET pb.

Checked on Rudder Trim panel and also on the F/CTL page (**I**)

NOTE: RUD TRIM rotary switch and RESET pb sw are not active during flight with the A/P engaged.

T.O. memo displayed during taxi.

Flaps set at 1+f, 2 or 3)

When flap selection is made:

Blue markers appear to show the selected flap positions.

Blue label shows which flap position has been selected

Current flap / slat position green markers move.

FLAPS T.O. displayed on E/WD

When all flaps and slats have reached their commanded position:

All position indications turn from blue to green

FLAPS T.O. memo on E/WD turns green.

Takeoff trim is set manually using the pitch trim wheels.

Pitch trim position set can be seen on ECAM F/CTL page while taxiing.

(e.g. **PITCH TRIM 4.1° UP**)

When flaps extended, ailerons droop to increase lift.

For Config 1+F, by about 5 degrees

For 2 or 3, by about 10 degrees.

Aileron indexes now point to a small white square representing the new neutral position.

Flight control check made during taxi.

Combined side stick deflection indicator shown by a white cross in the center of the PFD.

Only indicates side stick deflections and not control surface position.

Green bank angle protection indicators appear with hydraulic power indicating Normal Law

Side sticks operable after first engine start with hydraulic power.

On ground, control surfaces directly respond to side stick movement.

This is the ground mode.

F/CTL page automatically called with movement of the side sticks or rudder pedals. Can see deflections of flight controls.

In flight control check for roll, check that the ailerons move opposite (as normal) and that roll spoilers extend on the affected side.

A330-200 CBT NOTES

Before testing rudder pedals, press and hold the rudder PEDAL DISC button.

Both pilots check flight controls through each side stick except for rudder pedals since they are mechanically linked.

After takeoff, the ground mode is slowly blended in to the flight mode.

NORMAL OPERATION (B)

When A/P engaged, side sticks locked into neutral position and rudder pedals remain stationary.

After gear retraction, disarm the ground spoilers.

Example: If takeoff was with CONF 2, when above **F** speed (minimum speed for flap retraction) flaps retract to 1. Flaps and slats are extended to the first position. This is 1+F

When **S** speed is reached (minimum slat retraction speed) retract flaps. If flaps not retracted and as speed approaches VFE flap 1+F, the flaps will automatically retract fully. Slats remain deployed in the first position. This is configuration 1. There is no automatic retraction of the slats.

To use speed brakes, must first press down on the speed brake lever – spring loaded in the RET position.

With the A/P engaged, the maximum speed brake deflection available is approximately ½ even when fully back.

Speed brake retraction rate is reduced when flying at high speed.

WHEEL page gives a **SPEED BRK** memo and F/CTL has **SPD BRK**.

With some power on at least one engine, the **SPEED BRK** message will flash.

If airspeed decreases below maximum speed for VFE, Flap 1. Shown on speed tape by **=**.

Airborne selection of Flap1, extends Slats only. Cannot select flap 1+F from flap 0 in the air.

Flap 2 extends slats to 2 and TE flaps to 2.

Extend gear before flap 3.

See **GND SPLR ARMED** on E/WD

A330-200 CBT NOTES

With gear down and < 2000' AGL, landing memo appears. Below VFE, select Flap 3. Slat to 3 and TE flap to 3.
Flap FULL gives flap to full (TE position 4).
Speed is constant at Vapp.

Passing 100', flight mode changes to Flare Mode.
Flare mode is flown in Direct Law.

On landing, spoilers extend if thrust at idle or reverse.

NOTE: If only 1 main landing gear is compressed, ground spoilers will extend partially, decreasing lift. When both struts compressed, then full spoiler deployment.

If a go around is performed, spoilers retract when power is applied.

ABNORMAL OPERATION (A)

Redundancy of Flight Controls

If a computer failure, the second computer of the same type takes over. Each primary flight control surface is controlled by different hydraulic sources (with an independent actuator for each source):

2 for ailerons, elevator and stabilizer

3 for rudder

Each actuator controlled by a different computer.

One actuator for each surface is always in active mode. Other stays in damping mode and is monitored by its associated computer.

SEC 1 Failure

MASTER CAUTION

F/CTL SEC 1 FAULT

ECAM F/CTL page shows **SEC 1** in amber box. **SEC 2** meaning it has taken over automatically.

Indication for outer aileron actuator is partially boxed in amber.

Means that if the actuator was in active mode it automatically switches to damping mode.

FLT CTL panel has SEC 1 **FAULT** on.

Spoilers affected by SEC 1 are **X**

Recycle SEC 1 computer to try and reset.

If all PRIM computers fail, SEC computers take over and provide complete control using Direct Law.

If a SEC now fails, will be replaced by other SEC computer.

A330-200 CBT NOTES

Elevator fault

Deflection of the remaining one is limited to avoid excessive asymmetrical loads on tail or rear fuselage and to reduce the asymmetry effects.

Remaining surface is sufficient to resume normal flight.

If hydraulics available, mechanical control of THS via pitch trim wheels. Mechanical rudder control is always available in case of complete computer failure.

SUMMARY

General Rules:

- If a computer fails, the second computer of the same type takes over.
Each primary FC surface supplied by at least 2 different hydraulic sources with an independent actuator for each surface.
Each actuator controlled by a different computer. For a surface, one actuator is always in active mode and the other in damping mode.
- Ailerons/Elevators/THS/Rudder:
If all 3 PRIM computer fails, SEC take over. If SEC 2 fails, it will be replaced by SEC 1 or vice-versa.
Mechanical backup always available using rudder pedals and pitch trim wheels, provided appropriate hydraulics available.

ABNORMAL OPERATION (B)

Spoiler Control shared by PRIM and SEC computers.

Spoiler/Speed Brake Fault

MASTER CAUTION **F/CTL SPLR FAULT**

▲ where the spoiler is failed in position on F/CTL page. The SEC which controls this spoiler detects the fault and automatically retracts it and inhibits the opposite symmetrical spoiler (e.g. 3)

Then both spoiler numbers are amber to indicate those spoilers are inhibited.

NOTE: Symmetrical inhibits apply except for spoilers 4 and 6.

A330-200 CBT NOTES

As a general rule, spoilers are automatically retracted when faulty, inhibited or not electrically controlled.

Speedbrake extension can be inhibited under certain circumstances. Spoilers are retracted automatically and stay in this position until inhibition conditions no longer exist and lever is reset.

MASTER CAUTION

F/CTL SPD BRK DISAGREE message or ECAM procedure appears.

Each spoiler is fitted with 1 actuator supplied by a hydraulic system. In case of loss of hydraulic supply, affected spoiler remains in current deflection unless pushed down by aerodynamic forces.

Double FCDC Failure (e.g. dispatch with on FCDC u/s, MEL item)

MASTER CAUTION

F/CTL FCDC 1 + 2 FAULT

On ECAM F/CTL page, data supplied by FCDCs no long available so replaced by amber indications or **XXs**.

F/CTL INDICATIONS LOST on STATUS page.

Turbulence Damping Fault

F/CTL TURB DAMP FAULT

No aural or visual warnings and system page not called.

Turbulence damping function lost.

SUMMARY:

- Spoiler Control shared by PRIM and SEC computers.
- When a spoiler has failed on one wing, the symmetrical one is automatically inhibited except for spoilers 4 & 6.
- Spoilers are automatically retracted when faulty, inhibited or not electrically controlled.
- Each spoiler fitted with a single actuator supplied by one hydraulic system.
- In case of loss of hydraulic supply, affected spoiler remains in current deflection unless pushed down by aerodynamic forces.

ABNORMAL OPERATION (C)

SFCC 1 Flap Channel Fault

F/CTL FLAP SYS 1 FAULT

A330-200 CBT NOTES

No aural or visual warnings

Flaps info displayed on E/WD so no system page is called.

FLAPS SLOW due to moving at ½ speed.

If 2 channels of one SFCC fail, both slats and flaps operate at ½ speed.

Flap Fault

MASTER CAUTION

F/CTL FLAPS LOCKED

E/WD flap indicator shows **F LOCKED** and flap triangle is amber meaning a flap fault.

White **S** and green triangle **△** mean the slats have reached the selected position.

Flaps are locked in position by the Wing Tip Brakes (WTB) – hydraulic. Lock the affected surface movement on both wings in case of:

Asymmetry

Overspeed

Symmetrical runaway or uncommanded movement

NOTE: Cannot be released in flight.

Slat operation is still possible and vice versa if WTB is activated.

Speed is restricted for the flaps setting.

Vapp and landing distance will be increased to compensate for the locked flaps. Use QRH to determine the new Vapp and landing distance.

Slat Fault

MASTER CAUTION

F/CTL SLATS FAULT

E/WD the **S** and amber slat triangle confirm a slat fault.

Restricted to VFE for the flaps extended.

F/CTL ALTN LAW (PROT LOST) confirmed on PFD by **XX** at the roll limits and pitch limits when visible.

Vapp and landing distance will be increased to compensate for the locked flaps. Use QRH to determine the new Vapp and landing distance

T.O. Position Disagree with MCDU Flap Value on PERF TO page

MASTER CAUTION

F/CTL FLAP MCDU DISAGREE

A330-200 CBT NOTES

Triggered in case of discrepancy between real takeoff flaps position and value entered on MCDU PREF TO page.

Slats Alpha/Speed Lock Function

Inhibits slat retraction at high angle of attack and/or low speed.

A LOCK pulsing green on E/D

A330-200 CBT NOTES

NORMAL FLIGHT CONTROL LAWS

| NORMAL LAW | | | Degradation into Alternate Law can return to Normal Law when Fault is cleared | | |
|---|--|---|---|--|---|
| | | | Reversion into Abnormal attitude Law cannot return to Normal Law | | |
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| 33° – Auto Trim Inop 45° – AP disengages FD bias out (Return at 40°) Low Speed Prot High Speed Prot 67° – Max Bank Roll rate is proportional to sidestick deflection Max 15°/second | Turn Coordination and Yaw Damping | Flaps 0-3 Nose UP 30°→25° Full 25°→20° <u>Nose Down</u> -15° FD <u>Lost Regained</u> +25° (+22°) -13° (-10°) Pitch control is a load factor proportional to stick deflection | High AOA Protection α Prot Low Energy Warning α Floor α Max AOA +15° α -0° α | <u>Protection Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g <u>Auto Trim Inhibited</u> >+1.25g < +0.5 g | <u>High Speed Protection</u> 330/.86 – Vmo / Mmo <u>Vmo / Mmo</u> +0.6/.01 AP disconnects Non-overridable pitch-up command Max bank 45° Rolls wings level with neutral sidestick +16/.04 Max stabilized speed with full forward stick +30/0.7 Max momentary speed with full forward stick |

DEGRADED FLIGHT CONTROL LAWS

| ALTERNATE LAW WITH STABILITY | | | Often said to be caused by: "A multiple failure of redundant systems" | | |
|---|----------------|--|---|---|---|
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| Roll Direct (Direct stick-to-surface relationship) No protections | Yaw Damping | Load factor proportional to stick deflection Flare mode available for landing | <u>Low Speed Stability</u> Over-ridable nose down command to prevent a stall 5-10 kts above Vsw | <u>Protection Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g | <u>High Speed Stability</u> Overridable nose-up command to prevent overspeed at Vmo/Mmo <u>Vmo/Mmo = 330/.86</u> .82 if Dual Hyd Press Low |

| ALTERNATE LAW WITHOUT STABILITY | | | Caused by the loss of: 2 IRUs 2 or 3 ADRs 1 Elevator | | |
|---|---|--|--|---|---|
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| Roll Direct (Direct stick-to-surface relationship) No protections | Yaw Damping (Unless loss of 3 ADRs, where it would be Mechanical) | Load factor proportional to stick deflection Flare mode available for landing | Vsw only (Stall warning) | <u>Protection Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g | <u>Vmo/Mmo = 330/.86</u> .82 if Dual Hyd Press Low |

A330-200 CBT NOTES

| | | | | | |
|---|--|--|---|---|---|
| DIRECT LAW | | | Indicated by amber: USE MAN PITCH TRIM on FMA Caused by putting the gear down in Alternate Law (with the AP off) or a loss of 3 IRUs. | | |
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| Roll Direct (Direct stick-to-surface relationship) No protections | Mechanica I (Cables to hydraulic actuators) | Pitch Direct (Direct stick-to-surface relationship) No Protections | Aural Stall Warning only | <u>Limit Only</u> <u>Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g | <u>Aural Overspeed Only</u> <u>Vmo/Mmo = 330/.82</u> |

| | | | | | |
|---|--|---|--|---|---|
| MECHANICAL BACK-UP | | | Indicated by red " USE MAN PITCH TRIM " on FMA Requires hydraulic pressure. The rudder must be hydraulically operated. | | |
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| Rudder Rolls Only No protections | Mechanica I (Cables to hydraulic actuators) | Manual Pitch Trim and Thrust Only No Protections | Aural Stall Warning only | <u>Limit Only</u> <u>Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g | <u>Aural Overspeed Only</u> <u>Vmo/Mmo = 330/.82</u> |

ABNORMAL ATTITUDE FLIGHT CONTROL LAWS

| | | | | | |
|-------------------------------------|------------|----------------|--|-------------|------------------------------|
| ABNORMAL ATTITUDE PARAMETERS | | | Approximately 2 times the available amount in Normal Law | | |
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| >125° | N/A | >+50° >-30° | < 60 kts/.1Min > +30° α > -10° α | N/A | > 440/.91 |

| | | | | | |
|---|---|--|--|---|------------------------------|
| ABNORMAL ATTITUDE LAW EXCEEDING THE PARAMETERS | | | Compare to Alternate Law <i>without</i> Stability. The difference is you don't have Yaw Damping | | |
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| Roll Direct (Direct stick-to-surface _{relationship}) No protections | Mechanica I (Cables to hydraulic actuators) <u>NO</u> Yaw Damping | Load factor proportional to stick deflection | Vsw only (Stall warning) | <u>Protection</u> <u>Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g | <u>Vmo/Mmo = 330/.86</u> |

A330-200 CBT NOTES

| ABNORMAL ATTITUDE LAW BACK IN NORMAL LIMITS | | | Compare to Alternate Law <i>with</i> Stability The difference is that you have Flare Mode for landing. | | |
|---|-------------|--|---|---|---|
| ROLL | YAW | PITCH | AOA (LOW SPEED) | LOAD | SPEED (HIGH SPEED) |
| Roll Direct (Direct stick-to-surface relationship) No protections | Yaw Damping | Load factor proportional to stick deflection Flare mode <i>is</i> available for landing | <u>Low Speed Stability</u> Overridable nose down command to prevent a stall 5-10 kts above Vsw | <u>Protection Clean / Slats</u> +2.5 g -1.0 g <u>Slats</u> +2.0 g -0.0 g | <u>High Speed Stability</u> Overridable nose-up command to prevent overspeed at Vmo/Mmo <u>Vmo/Mmo = 330/86</u> |

COMMUNICATION

RMP (3 Radio Management Panels) and ACP (3 Audio Control Panels) control all communication.

2 RNP on center pedestal and one on right overhead panel.

STBY NAV keys provide backup navigation tuning in the event of dual FMGS failure.

SEL light turns white when a pilot selects a radio on a RMP which is not dedicated to that RMP.

RMP 1 dedicated for VHF 1.

RMP 2 dedicated for VHF 2.

RMP 3 dedicated for VHF 3 or HF 1 or 2.

ACP

CALL light flashes amber with a buzzer when a SELCAL is received on the applicable radio.

MECH light flashes amber with a buzzer when a call is initiated by the mechanic.

ATT light flashes amber with a buzzer when a call is initiated to the flight deck from any attendant station through the interphone system.

RESET key silences any buzzer and extinguishes the flashing amber light associated with any of the calls above.

The INTERphone/RADIO (INT RAD) switch is a 3 position switch. Two of the positions are latched, one is spring-loaded. INT and neutral are latched. RAD is spring-loaded.

In the INT position, the switch operates as a hot mike on either the boomsets or the oxygen masks.

A330-200 CBT NOTES

NOTE: It is useless to select the INT transmission key.

When held in RAD position it works as a PTT sw. Side stick PTT switch has the same function.

VOICE key suppresses the navaid ident signal to enable clearer reception of the voice message. (e.g. ATIS transmission on VOR freq).

PA key allows use of boomset, oxygen mask or hand mike. Can also use cockpit handset.

When EMER pb is selected to ON, the

ON light flashes white

CALL light flashes amber

Pink light flashes on all Area Call Panels

CALL PRIO CAPT message appears on all Attendant Indication Panels, a red light flashes and three high/low chimes sound through all loudspeakers.

If an emergency call is initiated from the cabin, the:

ON light flashes white

CALL light flashes amber

Three long buzzers sound in the cockpit.

CVR controlled through the RCDR panel and the CVR Control Unit.

Can be switched ON, on the ground by using the GND CTL pb switch.

ERASE pb allows complete erasure of the memory.

NORMAL OPERATION

CVR runs for 5 minutes on first power-up and then shuts down until first engine start.

CVR test is part of pre-flight check.

RCDR GND CTL to **ON**

PARK BRK ON

CVR TEST sw pushed.

Should see 1 green LED. Can also hear a low frequency signal.

First engine is running so blue **ON** light on CVR is off and CVR operates automatically.

Operates for remainder of flight plus 5 minutes after last engine is shutdown.

A330-200 CBT NOTES

If FO selects RMP 2 for VHF 1 and changes active frequency, active freq is displayed in both RMP 1 & 2 and previous active freq is set in RMP 2 standby window. Allows either pilot to change the active frequency on any radio and not change the standby frequency of the other pilot.

When using ACP, can use the following to transmit on the radio:
INT/RAD sw held in the RAD position
Side-stick PTT switch
Hand mike PTT.

Mechanic light is automatically cancelled after 60 seconds or the RESET pb is pressed on the ACP.

To talk to ground mechanic, you can:
Select INT on the INT/RAD switch
Press INT transmission key, then talk using a PTT switch

ABNORMAL OPERATION

Continuous VHF transmission (stuck PTT switch)

MASTER CAUTION
COM VHF - EMITTING

RMP is blank with ON/OFF switch ON

No ECAM caution.
Indicates an RMP failure. Turn off the affected RMP.
Radio tuning must be done with the remaining RMPs.

No reply from ATC transmission when using side-stick PTT.

See all lights on ACP are extinguished. Unable to select any radio for transmission.

ACP is inop.

Can use AUDIO selector on the center pedestal to select CAPT ON 3 or F/O ON 3. De-energizes ACP 1 or 2.

All functions (handset, boom mike etc.) are transferred to ACP 3.
Get **AUDIO 3 XFRD** message on E/WD memo.

A330-200 CBT NOTES

CBT#4

OXYGEN

3 Oxygen systems

Fixed cockpit oxygen system with all controls in the cockpit

4 Full-face quick donning masks

Pressing the RESET control after the O2 mask has been used cuts off the O2 mask microphone.

Fixed cabin chemical system

2-4 masks / generator located above the seats, the lavatories, each galley and each CA station

Portable O2 system in the cockpit and cabin

1 smoke hood + several other cabin hoods

PBE provides 20 minutes of O2

DOOR/OXY ECAM page monitors the O2 system

NORMAL OPERATION

Check stowed in cockpit properly along with portable O2 stowed properly

DOOR/OXY ECAM message **CKPT OXY** (amber) means the CREW SUPPLY pb on the oxygen panel is in the OFF position. Turning white means the pressure is available. The pressure should be in green meaning sufficient pressure.

An amber half-frame surrounding the pressure means the pressure is below 1500 psi and the MIN FLT CREW OXY CHART should be checked to be sure of sufficient O2 for the flight.

The O2 high pressure indication (pressure number) becomes amber when the pressure is below 400 psi.

If **REGUL LO PR** message is displayed, the O2 pressure from the regulator is lower than 50 psi – call maintenance.

O2 Check

Loudspeakers set to ON

ACP the INT reception knob is selected and INT/RAD switch to RAD position

A330-200 CBT NOTES

Test the flow by pressing the TEST AND RESET control

To Test emergency O2 pressure, hold TEST AND RESET down and press the Emergency pressure selector simultaneously.

Check that the PRESS AND RESET button returns to UP position and the supply selector is on the 100% oxygen position (down).

If mask used, the OXY ON flag appears (white flag).

Pressing the PRESS AND RESET button:

- resets the OXY ON flag

- de-energizes the microphone

- stops the flow of O2.

When the MASK MAN ON guarded pb located on the OXYGEN panel is in the AUTO position, the pax masks auto deploy if the cabin altitude exceeds 14,000'. This can also be used to manually deploy the masks.

The Passenger **SYS ON** white light illuminates on the OXYGEN panel meaning that the masks are deployed.

15-22 minutes of O2 available depending on the generator size.

Starts when masks are pulled down.

CABIN

Type "A" doors at exits 1,2, 4 (swing out)

Type "1" doors at exits 3

This requires 8 Cabin Attendants

If Type "A" doors at exits 3, then requires 9 Cabin Attendants

Maximum 375 pax with 8 CAs.

CIDS Cabin Intercommunication Data System

- 2 Directors – 1 primary and 1 hot standby

- Linked to FAP (Forward Attendant Panel)

- Communicates with (DEU) Decoder Encoder Units with

- Cabin, Pax and Crew

- FAP has:

- PIM – Programming Indication Panel

- LAMM – Light Audio & Misc. Module

A330-200 CBT NOTES

Attendant Indicator Panel (AIP) located at each Cabin Crew Station.

Area Call Panel (ACP) in ceiling at each exit indicates:

- Crew communication
- Pax calls
- Lavatory calls
- Lavatory smoke system

DOOR OPERATION

All doors can be opened from the outside. Automatically disarms the door when the outside handle moves.

2 mechanical indicators indicate door unlocked/locked status.

Opening the cabin door, while lifting the control handle, a white light illuminating means the slide is still armed.

Door emergency open cylinder located here.

2 lights in observation window at door:

White -- when door slide is armed and door handle is moved up.

Red -- flashes in case of cabin pressurization when both engines are off and door is disarmed.

Makes sure that the red pressure indicator is not flashing.

A330 Double Lanes Escape Slide – Type A (passenger) doors – inflates in 4 seconds

Slide Rafts for Door 3 if Type A doors – has slide raft lights supplied from cabin emergency evacuation unit.

Exits behind wing (Type 1 emergency exit door) have a single land escape slide. – 6 seconds to inflate.

O2 masks in cabin have a door stop for the test procedure to prevent masks from dropping.

PRIO CAPT key on handset pushed in cabin to call the cockpit (for emergency).

To call Cockpit, CA presses CAPT on handset. In cockpit, get an ACP **ATT** and a single buzzer.

A330-200 CBT NOTES

Select RESET key to reset the **ATT** light.

To answer the call press the CAB pb sw. Then use normal procedures. When call finished, press RESET key or replace handset.

To make an emergency call from the cabin to the cockpit, press the PRIO CAPT key on the handset.

Get **CALL** light on the CALL panel and the **ATT** light on the ACP with three long buzzers.

Answer the call by pushing the transmission and reception keys on the ACP.

When answering, the lights are extinguished. When call finished the system resets when the reset key on the handset is pushed or hanging up the handset.

Pressing the EVAC COMMAND pb sw, turns on a red EVAC/RESET light at each FAP and ACP along with a specific horn.

In cockpit, get **EVAC** and **ON** lights on EVAC COMMAND pb sw and a specific horn is triggered.

The EVAC HORN OFF pb sw and reset pb sw on the forward and additional attendant panels shut off the horn in the corresponding area.

If EVAC CMD switch on Fwd CA panel is activated and EVAC switch in cockpit is in CAPT, the evac horn sounds for 3 seconds and **EVAC** indicator flashes.

If selector in cockpit is in CAPT & PURS position, the purser can now initiate the evacuation in the entire aircraft by pressing the **EVAC CMD**.

In cockpit, EVAC horn sounds and **EVAC** indicator flashes.

In cabin, horn sounds and EVAC indicators flash on all attendant panels.

LIGHTS

Includes cockpit, exterior lights, cabin signs, emergency lighting.

A330-200 CBT NOTES

Cockpit divided into:

- Panel & instrument lighting

 - On 3 different panels

 - Underneath the glareshield

- General cockpit illumination

 - 2 dome lights

- Ambient illumination

 - 2 Pilot reading lights – overhead panel

 - 2 other reading lights on each side of upper overhead panel

 - Side console lights allow pilots to:

 - Side consoles

 - Briefcase area

 - Floor around the pilot seats

 - 2 map holder lights – one on each side of the cockpit.

 - 2 lighting strip lights are fitted on each side of the overhead panel

Exterior lights

- Navigation

- Landing

- Runway turnoff and takeoff and taxi

- Logo

- Anti-collision

Cabin Signs

- Emergency lighting

- NO SMOKING

- FASTEN SEAT BELTS

NORMAL OPERATION (A)

Dome lighting switch located on left rear panel of cockpit

STBY COMPASS switch controls standby compass and seat alignment indicator lighting

Dome CTL switch switches the dome lights ON or OFF when the selector switch is in either DIM or BRT.

A330-200 CBT NOTES

NOTE: Depending on the dome lighting switch position on the rear panel, the DOME lights can be lighted even with the CTL switch in the down position.

NOTE: On ground during an accelerate-stop, the right-hand dome light automatically illuminates whatever the position of the switches.

STORM position causes both dome lights and main instrument panel floodlights to illuminate at high intensity.

In TEST position, the annunciator lights come on high intensity and all LCDs indicate “8”s.

INTEG (Integral) LT knob sets the brightness for the main instrument panel, the pedestal panel and the overhead panel.

FCU lighting controlled by 2 rotating knobs.

L one controls the integral lighting and LED lighting on the FCU.

R one controls the integral lighting of the FCU windows display.

All exterior lights are in a fixed position.

Nose: (facing forward)

1 taxi (R) & takeoff light (L)

2 runway turnoff lights

2 white nav lights and 1 strobe light below the APU exhaust.

NORMAL OPERATION (B)

Cockpit preparation:

Strobes to AUTO (come on automatically on liftoff and off at touchdown)

FASTEN SEATBELT selector to AUTO:

On when slats extended or main gear extended.

On landing, remain on even if slats are retracted.

NO SMOKING selector AUTO

On when gear is extended and off when gear is retracted.

A330-200 CBT NOTES

If cabin altitude exceeds 14,000', the NO SMOKING/FASTEN SEAT BELT, RETURN TO SEAT and EXIT signs come on automatically regardless of position.

Memo message appears on E/WD when signs are ON or in AUTO

Emergency lighting

Escape slide integral lighting

Exit signs

Overhead emergency lights in cabin

Floor emergency escape path lighting

EMER EXIT LT selector

OFF Get amber **OFF**

ARM Emergency escape path, exit signs, overhead lighting come on if normal electrical power fails.

ON Turns on above

2 wing lights on each side illuminate the wing leading edge and engine air intakes for iced detection.

NOTE: NAV & LOGO switch in 1 or 2, logo lights only on when flaps are extended or when main gear is compressed.

TAXI light switch:

TAXI taxi lights illuminated

TAKEOFF taxi + takeoff lights illuminated

STROBE LT OFF memo message appears in E/WD when strobes are selected off in flight.

ICE AND RAIN

Wing anti-ice uses hot air for the 4 outboard leading-edge slats on each wing.

A330-200 CBT NOTES

Engine anti-ice heats each cowl by HP bleed air from the high stage compressor.

NOTE: In the event of an electrical power supply failure the valve is automatically opened.

Electrical heating provided for:
Windshield anti-icing
Cockpit side windows demisting

Visual ice indicator with an integrated light is installed between the two windshields.

Ice detection system (optional) with 2 ice detectors located on lower forward fuselage.

Speed limit with wipers operating is 230 kts.

E/WD memo indicates use of anti-ice.

NORMAL OPERATION

Preflight – Wipers off and PROBE/WINDOW HEAT switch in AUTO.

NOTE: In AUTO, probes & windows are automatically heated after first engine start.

OAT < 10C with visible moisture in air.

TATs not heated until airborne. GND has pitots at low heat.

You can clear windows manually prior to engine start by pushing the PROBE/WINDOW HEAT pb switch to ON

N1 idle is increased on each engine to give better protection against flameout. (approx 1% N1)

With 1 ANTI_ICE switch on, the ignition is turned on with **IGNITION** memo messages on E/WD.

A330-200 CBT NOTES

Use of APU bleed is not authorized for wing anti-icing.

Idle N1 is increased with wing-anti-ice on. In addition to engine > idle. (approx 7.1% N1) get **ENG A.ICE** memo and **ON** light on pb sw.

ECAM BLEED page shows that the wing ANTI_ICE pb is ON with white **ANTI-ICE** displayed and two green triangles **△△** on each side that the valves are open.

On ground, 30 seconds after WING anti-ice pb switch is set to on, the wing anti-ice valve indications disappear. This is a ground test function. Open again after liftoff.

If ice detection system is installed and clear of icing conditions for at least 3 minutes, the **ICE NOT DET** memo on the E/WD is displayed.

SAT < -40C does not require any anti-ice systems on. (Climb and cruise)

If icing conditions expected during descent, turn on prior to descent.

Don't retract flaps & slats if approach made in icing conditions until a visual inspection.

During extended ground idle operations, periodic engine run-up to 50% N1 may be performed to remove any ice from the spinner and fan blades.

ABNORMAL OPERATION (A)

Several A.ICE non-normals can indicate **AVOID ICING CONDITIONS** on STATUS page.

If pitot failure, switch ADRs by ECAM action from 1 or 2 to 3 (back-up)

A.ICE ICE DETECTED memo if ice detected. A.ICE pb sw to **ON**.

E/WD shows **SWTCHG PNL** if any instrument switching has been done.

A330-200 CBT NOTES

SEVERE ICE DETECTED ECAM message – turn on WING anti-ice

If wing anti-ice valve not open:

MASTER CAUTION

A.ICE WING VALVE NOT OPEN

Get an **APPR PROC** on STATUS page.

ABNORMAL OPERATION (B)

Wing valves that are not in the commanded position are indicated with a **△**.

Wing anti-ice valve failure

MASTER CAUTION

A.ICE L INR WING OPEN

FAULT on pb sw.

WAI AVAIL IN FLT on STATUS page.

With the WING anti-ice valve(s) stuck open, you will get a automatic recall of the problem on landing to remind you to switch off the engine bleeds to avoid any damage to the wing. With a engine or wing valve failure, the APU bleed should not be used.