AIRBUS

A380

AIRBUS

FLIGHT CREW TRAINING MANUAL

AIRBUS S.A.S
CUSTOMER SERVICES DIRECTORATE
31707 BLAGNAC CEDEX
FRANCE

REFERENCE: KAL A380 FLEET FCTM

ISSUE DATE: 16 AUG 11

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TRANSMITTAL LETTER

Issue date: 16 AUG 11

This is the FLIGHT CREW TRAINING MANUAL at issue date 16 AUG 11 for the A380 and replacing last issue dated 08 JAN 11

No comment

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FILING INSTRUCTIONS

Please incorporate the revision as follow:

Localization Subsection Title	Remove	Insert Rev. Date

No filing instructions

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PRELIMINARY PAGES

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M[1]	Localization	Subsection Title	Rev. Date
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(1) Evolution code : N=New, R=Revised, E=Effectivity, M=Moved

M[(1)]	Localization	DU Title	DU identification	DU date
	AO-10	**Quick Reference Handbook**	00023135.0001001	01 MAR 10
	Criteria: T78678 **Applicable to: ALL** *Impacted DU: 00011429 Quick Reference Handbook*			

(1) Evolution code : N=New, R=Revised, E=Effectivity

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This table gives, for each delivered aircraft, the cross reference between:

- The Manufacturing Serial Number (MSN).
- The Fleet Serial Number (FSN) of the aircraft as known by AIRBUS S.A.S.
- The registration number of the aircraft as known by AIRBUS S.A.S.
- The aircraft model.

M(1)	MSN	FSN	Registration Number	Model
	0035		HL7611	380-861
	0039		HL7612	380-861
	0059			380-861
	0068			380-861
	0075			380-861

(1) Evolution code : N=New, R=Revised

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M(1)	MODIFICATION	Linked SB	Incorp. Date	Title
	T62521		03 AUG 10	INDICATING/RECORDING-HUD- INSTALL A SINGLE LH HUD
	Applicable to: ALL			
	T76484		03 AUG 10	INDICATING/RECORDING SYSTEMS GENERAL-FLIGHT WARNING SYSTEM (FWS)- Define and Install FWS Software : Standard L41
	Applicable to: ALL			
	T76701		03 AUG 10	FLIGHT CONTROLS - ELECTRICAL BACKUP - Swap BCM wiring from inboard elevators to outboard elevators.
	Applicable to: ALL			
	T76662		03 AUG 10	HYDRAULIC POWER - GENERAL - INSTALL HSMU STD 5 WITH MODIFIED PUSH-BACK AND SIMULATED FLIGHT FUNCTIONS
	Applicable to: ALL			
	T71614		03 AUG 10	INFORMATION SYSTEMS - FLIGHT CREW APPLICATION - INSTALL ELECTRONIC FLIGHT FOLDER AND FLIGHT FOLLOW-UP (EFF/FFU) SOFTWARE V2.2 IN THE 3 LAPTOPS
	Applicable to: ALL			
	T73386		03 AUG 10	AUTO FLIGHT-AUTOPILOT/FLIGHT DIRECTOR (AP/FD)-CERTIFY AUTO PILOT TCAS MODE
	Applicable to: ALL			
	T73377		03 AUG 10	ELECTRICAL POWER - DCGS - INTRODUCE NEW DCGS ARCHITECTURE.
	Applicable to: ALL			
	T76645		03 AUG 10	INFORMATION SYSTEMS-PORTABLE ONBOARD INFORMATION TERMINAL-INSTALL CONFIG DATA (LAOD INTEGRATOR) IN THE 3 LAPTOPS FOR ILG 3.4 AND QFA01
	Applicable to: ALL			
	T77518		03 AUG 10	INDICATING/RECORDING SYSTEMS GENERAL-FLIGHT WARNING SYSTEM (FWS)- Define and Install FWS Software : Standard L50
	Applicable to: ALL			
	T78678		03 AUG 10	INDICATING/RECORDING SYSTEMS - FLIGHT WARNING SYSTEM (FWS)-DEFINE AND INSTALL NEW ATQC V5 L50.
	Applicable to: ALL			

(1) Evolution code : N=New, R=Revised, E=Effectivity

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GENERAL INFORMATION

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MAIN FCTM CHANGES

Applicable to: ALL

INTRODUCTION

PURPOSE

The purpose of the Main FCTM Changes is to provide general information about this FCTM revision and to highlight the main changes.

Note: *In addition, each Documentary Unit (DU) provides highlights with the reason(s) for change and uses revision bars to indicate the revised sections.*

TIMEFRAME

The Main FCTM Changes are defined on a monthly basis, regardless of the revision cycle that is applicable to each Operator.
The subjects in the Main FCTM Changes are categorized by month, but include revision information from the preceding 6 months only.

SEPTEMBER 2010

MODIFICATION OF THE OPERATIONAL RECOMMENDATIONS IN THE CASE OF TRAFFIC ADVISORY (TA) ALERT

In 2004, the visual acquisition of the intruder was removed from the Resolution Advisory alert procedure, for all Airbus aircraft. This is in accordance with a set of recommendations on the use of TCAS II, issued by the aviation industry following in-service events.

In particular, Eurocontrol issued the following limitations relative to visual acquisition of the traffic:
- The visual assessment of the traffic can be misleading. At high altitude, it is difficult to assess the range and heading of traffic as well as its relative height. At low altitude, the heavy aircraft attitude at low speed makes it difficult to assess whether it is climbing or descending
- Visual acquisition does not provide any information about the intent of other traffic
- The traffic in visual contact may not be the threat that triggers the Resolution Advisory. A visual maneuver relative to the wrong visual traffic may degrade the situation against the real threat.

Airbus considers that the above limitations apply as well in the case of a Traffic Advisory alert, as in the case of a Resolution Advisory alert.
As a consequence, the Supplementary Information / TCAS / Operational Recommendations section is amended, in order to remove the recommendation to try to see the reported traffic, in the case a Traffic Advisory is generated.

NORMAL OPERATIONS FLOW PATTERNS

Flow patterns are moved from the FCTM to the FCOM/SOPs, at the end of each associated chapter.

AUGUST 2010

No FCTM revision in August.

JUNE 2010

The stall recovery procedure in the FCOM is updated, as explained in Flight Operations Telex 999.0044/10 issued May 12, 2010.
A new FCTM chapter in FCTM/Abnormal Operations/Operating Techniques provides the flight crew with more information and background on the new stall recovery procedure.

FCTM PURPOSE

Applicable to: ALL

The Flight Crew Training Manual (FCTM) complements the Flight Crew Operating Manual (FCOM).
The FCTM is designed to provide the flight crews with information on how to operate the aircraft. The flight crew should read the FCTM in conjunction with the FCOM.
If the data contained in the FCTM differs from the data in the FCOM, the FCOM remains the reference.
The Airline Training Policy may be different. In this case, the Airline Training Policy remains the reference.
Airbus encourages all manual holders and users to submit any FCTM question and suggestion to:
E.MAIL: fltops.A380std@airbus.com
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ABBREVIATIONS

Applicable to: ALL

A

Abbreviation	Term
A	Ampere
A.FLOOR	Alpha Floor

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Abbreviation	Term
A/C	Aircraft
A/THR	Autothrust
A623	ARINC 623 format for FANS A+
ABB	Abbreviation
ABSELV	Alternate Brake Selector Valve
ABV	Above
ABN	Abnormal
ABN PROC	Abnormal Procedure
AC	Alternating Current
ACARS	Aircraft Communication Addressing and Reporting System
ACC	Active Clearance Control, Acceleration
ACCEL	Acceleration, Accelerate
ACCELMTR	Accelerometer
ACCU	Accumulator
ACD	Additional Control Device
ACCUR	Accuracy
ACFT	Aircraft
ACM	Air Cooling Machine, Aircraft Configuration Matrix, Abbreviated Component Maintenance Manual, Aircraft Conversion Manual, Air Cycle Machine
ACMF	Aircraft Condition Monitoring Function
ACMS	Aircraft Condition Monitoring System
ACP	Audio Control Panel
ACQ	Acquisition
ACR	Avionics Communication Router
ACUTE	AIRBUS Cockpit Universal Thrust Emulator
ADCU	Automatic Deployment Control Unit
ADF	Automatic Direction Finder
ADIRS	Air Data/Inertial Reference System
ADIRU	Air Data/Inertial Reference Unit
ADK	Activate/Dialing Key
ADR	Air Data Reference
ADS	Air Data System Automatic Dependent Surveillance
ADV	Advisory
AEO	All Engine Operative
AES	Automatic Extension System
AESS	Aircraft Environment Surveillance System
AESU	Aircraft Environment Surveillance Unit
AFM	Aircraft Flight Manual
AFN	ATS Facilities Notification

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Abbreviation	Term
AFS	Automatic Flight System
AGL	Above Ground Level
AGP	Alternate Gauging Processor
AGT	Auto Ground Transfer
A-ICE	Anti-Ice
AICU	Anti-Ice Control Unit
AIP	Attendant Indication Panel
AIR COND	Air Conditioning
ALL ENG FF	All Engine Fuel Flow
AIV	ACM Isolating Valve
ALD	Actual Landing Distance
ALT	Altitude
ALT CRZ	Altitude Hold of the Cruise Flight Level
ALT CRZ*	Altitude Capture of the Cruise Flight Level
ALT CST	Altitude Constraint Hold Mode
ALT CST*	Altitude Constraint Capture Mode
ALT RPTG	Altitude Reporting
ALT*	Altitude capture Mode
ALTN	Alternate, Alternative
AM	Amplitude Modulation
AMU	Audio Management Unit
AMI	Airline Modifiable Information
ANS	Airport Navigation System
ANSA	At Nearest Suitable Airport
ANSU	Aircraft Network Server Unit
AOA	Angle-Of-Attack
AOC	Airline Operational Control
AP	Autopilot
APP	Approach
APPR	Approach
APPU	Asymmetry Position Pick Off Unit
APT	Alternate Pressure Transmitter
APU	Auxiliary Power Unit
ARM	Airworthiness Review Meeting
ARPT	Airport
ARS	Auto Retraction System
ARU	Aircraft Router Unit
ARV	Alternate Refill Valves
ASD	Accelerate Stop Distance
ASDA	Accelerate Stop Distance Available

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Abbreviation	Term
ASELV	Alternate Selector Valve
A-SKID	Antiskid
ASPSU	Autonomous Standby Power Supply Unit
ASV	Alternate Servo Valve
ATA	Air Transport Association
ATC	Air Traffic Control
ATIS	Airbus Technical Information System
ATIS	Automatic Terminal Information Services
ATM	Air Traffic Management
ATS	Air Traffic Services
ATT	Attitude
AUTO	Automatic
AUTO BRK	Autobrake
AVAIL	Available, Availability
AV	Altitude Valve
AVNCS	Avionics
AZIM	Azimuth

B

Abbreviation	Term
B/C	Back Course
BARO	Barometric
BAT	Battery (Electrical)
BCM	Backup Control Module
BCS	Brake Control System
BEA	Bureau d'Enquêtes et d'Analyses
BFO	Beat Frequency Oscillator
BITE	Built-in Test Equipment
BKUP	Backup
BLG	Body Landing Gear
BLW	Below
BPS	Backup Power Supply
BRG	Bearing
BRK	Brake
BRT	Bright, Brightness
BSCS	Brake and steering Control System
BSU	Beam Steering Unit
BTAC	Belly Taxi Aid Camera
BTC	Bus Tie Contactor
BTL	Bottle

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Abbreviation	Term
BTMS	Brake Temperature Monitoring System
BTV	Brake To Vacate
BUSS	Back Up Speed Scale
BWS	Body Wheel Steering

C

Abbreviation	Term
C/B	Circuit Breaker
C/L	Check List
CAB	Cabin
CAN	Controller Area Network
CAPT	Captain
CAS	Calibrated Air Speed
CAT	Category, Clear Air Turbulence
CAUT	Caution
CCD	Cursor Control Device
CCOM	Cabin Crew Operating Manual
CCRC	Cabin Crew Rest Compartment
CDAM	Centralized Data Acquisition Module
CDL	Configuration Deviation List
CDLCU	Cockpit Door Lock Control Unit
CDLS	Cockpit Door Locking System
CDS	Control and Display System
CDSS	Cockpit Door Surveillance System
CF	Cost of Fuel
CFIT	Controlled Flight Into Terrain
CFP	Computerized Flight Plan
CG	Center of Gravity
CHR	Chronometer
CHRO	Chronometer
CI	Cost Index
CIDS	Cabin Intercommunication Data System
CKPT	Cockpit
CL	Coefficient of Lift, Climb Detent on Thrust Levers
CLB	Climb
CLR	Clear
CLS	Cargo Loading System
CM1	Crewmember (Left Seat)
CM2	Crewmember (Right Seat)
CMS	Constant Mach Segment, Cabin Management System, Central Maintenance System

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Abbreviation	Term
CMV	Concentrator and Multiplexer for Video
CNS	Communication, Navigation and Surveillance
CO RTE	Company Route
COM	Communication
COND	Condition, Conditioned, Conditioning
CONF	Configuration
CONFIG	Configuration
CP	Control Panel
CPA	Closest Point of Approach
CPC	Cabin Pressure Controller
CPCS	Cabin Pressure Control System
CPDLC	Controller/Pilot Datalink Communication
CPIOM	Core Processing Input/Output Module
CPNY	Company
CRC	Continuous Repetitive Chime
CRG	Cargo
CRS	Course
CRZ	Cruise
CST	Cabin Service Trainer
CSTR	Constraint
CT	Cost of Time
CVMS	Cabin Video Monitoring System
CVR	Cockpit Voice Recorder

D

Abbreviation	Term
DA	Decision Altitude
DC	Direct Current
DDD	Decompression Deceleration Device
DDRMI	Digital Distance and Radio Magnetic Indication
DECEL	Decelerate, Deceleration Point
DEP	Departure
DEPS	Door Emergency Power Supply
DES	Descend, Descent
DEST	Destination
DET	Detection, Detector
DEV	Deviation
DFDR	Digital Flight Data Recorder
DH	Decision Height
DIR	Direction, Direct, Director

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Abbreviation	Term
DIRTO	Direction To
DISA	Deviation from ISA law
DISC	Disconnection, Disconnect, Disconnected
DIST	Distance
DLCS	Data Loading Configuration System
DME	Distance Measuring Equipment
DOC	Direct Operating Cost
DSMCU	Door and Slides Control Unit
DSMS	Doors and Slides Management System
DTO	Derated Take-off Thrust
DU	Display Unit
DY	Day

E

Abbreviation	Term
EASA	European Aviation Safety Agency
EBCU	Emergency Brake Control Unit
EBHA	Electrical Backup Hydraulic Actuator
EBPTU	Emergency Brake Pedal Transmitter Unit
EC	Engine Control
ECAM	Electronic Centralized Aircraft Monitoring
ECAS	Emergency Crew Alerting System
ECB	Electronic Control Box
ECON	Economy, Economic
ECP	ECAM Control Panel
ECU	Electronic Control Unit
EDP	Engine Driven Pump
EEC	Engine Electronic Controller
EFB	Electronic Flight Bag
EFF	Electronic Flight Folder
EFIS	Electronic Flight Instrument System
EFOB	Estimated Fuel on Board
EGT	Exhaust Gas Temperature
EHA	Electro-Hydrostatic Actuator
EIPM	Engine Interface Power Management
ELEC	Electric, Electrical, Electricity
ELEV	Elevation, Elevator
ELEVN	Elevation
ELMU	Electrical Load Management Unit
ELT	Emergency Locator Transmitter

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Abbreviation	Term
EMER	Emergency
EMP	Electric Motor Pump
EMU	Engine Monitoring Unit
ENG	Engine
ENMU	Electrical Network Management Units
ENT	Entry
EO	Engine Out
EOSID	Engine Out Standard Instrument Departure
EP	End Point
EPSU	Emergency Power Supply Unit
EPU	Emergency Power Unit, Estimated Position Uncertainty
ESC	Escape
ESS	Essential
ET	Elapsed Time
ETA	Estimated Time of Arrival
ETACS	External and Taxiing Aid Camera System
ETD	Estimated Time of Departure
ETP	Equal Time Point
ETT	Estimated Takeoff Time
ETRAC	Electrical Thrust Reverser Activation Controller
ETRAS	Electrical Thrust Reverser Activation System
EVAC	Evacuate, Evacuation
EWD	Engine and Warning Display
EXT	External Generator, External

F

Abbreviation	Term
F	Minimum Flap Retract Speed
F/C	Flight Crew
F/CTL	Flight Control
F/O	First Officer
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FANS	Future Air Navigation System
FAP	Final Approach Point, Flight Attendant Panel, Forward Attendant Panel
FAR	Federal Aviation Regulations
FCDC	Flight Control Data Concentrator
FCGU	Flight Control and Guidance Unit
FCOM	Flight Crew Operating Manual

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Abbreviation	Term
FCTM	Flight Crew Training Manual
FCU	Flight Control Unit, Fuel Control Unit
FD	Flight Director
FDIU	Flight Data Interface Unit
FDRS	Flight Data Recording System
FDU	Fire Detection Unit
FE	Flight Envelope
FFCM	Free Fall Control Module
FG	Flight Guidance
F-G/S	FLS Guide Slope, FLS Guide Slope Track Mode
F-G/S*	FLS Guide Slope Capture Mode
FIN	Functional Identification Number
FL	Flight Level
FLEX	Flexible
F-LOC	FLS Localizer, FLS Localizer Track Mode
F-LOC*	FLS Localizer Capture Mode
FLRS	Flap Load Relief System
FLS	FMS Landing System
FLT	Flight
FLX	Flexible
FM	Flight Management, Frequency Modulation
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMS	Flight Management System
FMV	Fuel Metering Valve
FO	Fully Open
FOB	Fuel On Board
FOCT	Flight Operation Consultation Tool
FOD	Foreign Object Damage
FOHE	Fuel Oil Heat Exchanger
FPA	Flight Path Angle
F-PLN	Flight Plan
FPPU	Feedback Position Pick-off Unit
FPV	Flight Path Vector
FQDC	Fuel Quantity Data Concentrator
FQI	Fuel Quantity Indicating
FQMS	Fuel Quantity and Management System
FTAC	Fin Taxi Aid Camera
FTO	Flexible Take-off Thrust
FU	Fuel Used

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Abbreviation	Term
FWC	Flight Warning Computer
FWD	Forward
FWF	Flight Warning Function
FWS	Flight Warning System
FSM	Flight System Message

G

Abbreviation	Term
G/S	Glide Slope
G/S*	Glide Slope Capture Mode
GA	Go-Around
GA TRK	Go-Around Track Mode
GCU	Ground Control Unit
GD	Green Dot
GDOT	Green Dot
GEN	Generator
GES	Ground Earth Station
GGPCU	Generator and Ground Power Control Unit
GLS	GNSS Landing System
GND	Ground
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPIRS	GPS IRS
GPWS	Ground Proximity Warning System
GRVTY	Gravity
GS	Ground Speed
GSE	Ground Support Equipment
GW	Gross Weight
GWCG	Gross Weight Center of Gravity

H

Abbreviation	Term
HA	Holding Pattern to an Altitude Termination
HCF	Heading Control Function
HCU	Head-Up Combiner Unit
HDG	Heading
HF	High Frequency
HH	Hour (entry format)
HI	High
HM	Holding Pattern with a Manual Termination

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Abbreviation	Term
HMI	Human Machine Interface
HMU	Hydromechanical Metering Unit, Hydromechanical Unit
HP	High Pressure
HPA	High Power Amplifier
HPU	Head-Up Projection Unit
HR	Hour
HSMU	Hydraulic System Monitoring Unit
HUD	Head-Up Display
HUDC	Head-Up Display Computer
HYD	Hydraulic

I

Abbreviation	Term
IAS	Indicated Airspeed
IATA	International Air Transport Association
IBLC	Inter-Bus Line Contactor
ICAO	International Civil Aviation Organization
IDENT	Identification, Identifier, Identify
IFE	In-Flight Entertainment
IFPA	In-Flight Performance Application
IFR	Instrument Flight Rules
IGN	Ignition
IGV	Inlet Guide Vane
ILS	Instrument landing System (LOC and G/S)
IMA	Integrated Modular Avionics
IMC	Instrument Meteorological Conditions
IN-BND	In-Bound
INFO	Information
INIT	Initial(ization)
INOP	Inoperative
INR	Inner
INT	Interphone
IOM	Input/Output Module
IP	Intermediate Pressure
IPCU	Ice Protection Control Unit
IR	Inertial Reference
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISIS	Integrated Standby Instrument System

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Abbreviation	Term
ISPSS	In-Seat Power Supply System
IVS	Inertial Vertical Speed

K

Abbreviation	Term
KBD	Keyboard
KCCU	Keyboard and Cursor Control Unit
KOZ	Keep Out Zone

L

Abbreviation	Term
L	Left
L/G	Landing Gear
LAF	Load Alleviation Function
LAND	Landing
LAT	Latitude, Lateral
LCD	Liquid Crystal Display
LDA	LOC type Directional Aid
LDC	Local Door Controller
LDG	Landing
LDPA	Landing Performance Application
LED	Light Emitting Diode
LEHGS	Local Electro-Hydraulic Generation System
LGCIS	Landing Gear Control Indication System
LGERS	Landing Gear Extension and Retraction System
LH	Left Hand
LIM	Limit, Limitation, Limiting, Limiter
LL	Latitude/Longitude
LL XING	Latitude/Longitude Crossing
LO	Low
LOC	Localizer, Localizer Track Mode
LOC B/C	Localizer Back Course Track Mode
LOC B/C*	Localizer Back Course Capture Mode
LOC*	Localizer Capture Mode
LONG	Longitude
LP	Low Pressure
LRC	Long Range Cruise
LS	Landing System, Low Speed, Loudspeaker
LSELV	Locking Selector Valve
LSK	Line Selection Key

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Abbreviation	Term
LT	Light
LVR	Lever
LW	Landing Weight

M

Abbreviation	Term
MABH	Minimum Approach Breakoff Height
MAG	Magnetic
MAN	Manual
MAP	Missed Approach Point
MAX	Maximum
MC	Master Caution
MCD	Magnetic Chip Detector
MCDU	Multipurpose Control & Display Unit
MCL	Maximum Climb Thrust
MCPU	Motor Control and Protection Unit
MCR	Maximum Cruise Thrust
MCT	Maximum Continuous Thrust
MDA	Minimum Decision Altitude
MDH	Minimum Descent Height
MECH	Mechanic, Mechanical, Mechanism
MEL	Minimum Equipment List
MET	Meteorological
METAR	Meteorological Airport Report
METOTS	Modified Engine Takeoff Thrust Setting
MFD	Multi Function Display
MFP	MultiFunction Probe
MGA	Maximum Go-around Thrust
MHA	Minimum Holding Altitude
MIN	Minimum
MIP	Maintenance Information Printer
MIXIRS	Mixed IRS
MKR	Marker (radio) Beacon
MLG	Main Landing Gear
MLS	Microwave Landing System
MLW	Maximum Landing Weight
MM	Middle Marker, Minutes (entry format)
MMEL	Master Minimum Equipment List
MMO	Maximum Operating Mach
MMR	Multi-Mode Receiver

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Abbreviation	Term
MORA	Minimum Off Route Altitude
MRP	Map Reference Point
MSA	Minimum Safe Altitude
MSG	Message
MSL	Mean Sea Level
MSN	Manufacturer Serial Number
MTO	Maximum Takeoff Thrust
MTOW	Maximum Takeoff Weight
MW	Master Warning
MZFW	Maximum Zero Fuel Weight

N

Abbreviation	Term
N1	Engine Fan Speed, Low Pressure Rotor Speed
N2	Engine Intermediate Pressure Rotor Speed
N3	Engine High Pressure Rotor Speed
NADP	Noise Abatement Departure Procedure
NAV	Navigation
NAVAID	Navigation Aid
NAVAIDS	Navigation Aids
NBPT	No Break Power Transfer
NBPTU	Normal Brake Pedal Transmitter Unit
NBSELV	Normal Brake Selector Valve
NCD	Non Computed Data
ND	Navigation Display
NDB	Non-Directional Beacon
NLG	Nose Landing Gear
NORM	Normal
NPA	Non-Precision Approach
NPT	Normal Pressure Transmitter
NSELV	Normal Selector Valve
NSS	Network Server System
NSV	Normal Servo Valve
NTSB	National Transportation Safety Board
NW	Nose Wheel
NWS	Nose Wheel Steering

O

Abbreviation	Term
OANS	Onboard Airport Navigation System
OAT	Outside Air Temperature
OEB	Operations Engineering Bulletins
OEI	One Engine Inoperative
OEW	Operational Empty Weight
OIS	Onboard Information System
OIT	Onboard Information Terminal
OMS	Onboard Maintenance System
OMT	Onboard Maintenance Terminal
OOOI	Out-Off-On-In
OP	Open
OPC	Operational Program Configuration
OP CLB	Open Climb
OP DES	Open Descent
OPMS	Oleo Pressure Monitoring System
OPS	Operations
OPT	Optimum, Optional
OPV	Overpressure Valve
OSCU	Oxygen System Control Unit
OUT-BND	Out-Bound
OUTR	Outer
OVHT	Overheat
OVRD	Override
OXY	Oxygen

P

Abbreviation	Term
P.POS	Present Position
P/N	Part Number
PA	Passenger Address
PAPI	Precision Approach Path Indicator
PARK	Parking
PAX	Passenger
PB	Place/Bearing, Pushbutton
PB-SW	Pushbutton-Switch
PBD	Place/Bearing/Distance
PBE	Protective Breathing Equipment
PBSELV	Parking Brake Selector Valve
PD	Place/Distance

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Abbreviation	Term
PDLCU	Privacy Door Lock Control Unit
PDLS	Privacy Door Lock System
PDU	Power Drive Unit
PERF	Performance
PF	Pilot Flying
PFD	Primary Flight Display
PFQ	Preselected Fuel Quantity
PFTU	Pedal Feel and Trim Unit
PIN PROG	Pin Programming
PLS	Primary Locking System
PMA	Permanent Magnetic Alternator
PMAT	Portable Multipurpose Access Terminal
PNF	Pilot Non Flying
POB	Power-Off Brake
PPOS	Present Position
PR	Pressure
PRED	Prediction
PRED W/S	Predictive Windshear
PRESS	Pressure, Pressurization, Pressurize
PREV	Previous
PRIM	Primary Flight Control and Guidance Computer
PRM	Precision Runway Monitor
PROC	Procedure
PROG	Program, Programming
PSI	Pound per Square Inch
PTT	Push-to-Talk
PURS	Purser
PWR	Power
PWS	Predictive Windshear

Q

Abbreviation	Term
QAR	Quick Access Recorder
QFE	Field Elevation Atmospheric Pressure
QFU	Runway Heading
QNH	Sea Level Atmospheric Pressure
QRH	Quick Reference Handbook

R

Abbreviation	Term
R	Right
RA	Radio Altimeter, Radio Altitude, Resolution Advisory
RAD	Radio
RAM	Random Access Memory
RAT	Ram Air Turbine
RCDR	Recorder
RCL	Recall
RED	Reduction
REF	Reference
REGUL	Regulation
REC	Recommended
REV	Revise, Revision, Reverse
RFCF	Runway Field Clearance Floor
RH	Right Hand
RLD	Required Landing Distance
RMP	Radio Management Panel
RNAV	Area Navigation
RNP	Required Navigation Performance
ROC	Rate of Climb
ROD	Rate of Descent
ROP	Runway Overrun Protection
ROW	Runway Overrun Warning
RPTG	Reporting
RQRD	Required
RST	Reset
RTA	Required Time of Arrival
RTD	Required Time to Destination
RTE	Route
RTO	Rejected Takeoff
RTOW	Runway Takeoff Weight
RTU	Radar Transceiver Unit
RUD	Rudder
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
RWY	Runway, Runway Mode
RWY TRK	Runway Track Mode

S

Abbreviation	Term
S	Minimum Slat Retract Speed, South
S/C	Step Climb
S/D	Step Descent
SAT	Static Air Temperature
SATCOM	Satellite Communication
SC	Single Chime
SCI	Secure Communication Interface
SCS	Steering Control System
SD	System Display
SDF	Smoke Detection Function, Simplified Directional Facility
SDU	Satellite Data Unit
SEC	Secondary Flight Control Computer, Secondary Flight Plan
SEL	Select, Selected, Selector, Selection
SELCAL	Selective Calling
SFC	Specific Fuel Consumption
SFCC	Slat Flap Control Computer
SFD	Standby Flight Display
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
SIRU	Secure Interface Router Unit
SND	Standby Navigation Display
SOP	Standard Operating Procedure
SP	Space, Sampling
SPD	Speed
SPD LIM	Speed Limit
SPDB	Secondary Power Distribution Box
SPEC	Specification
SPECIF	Specification
SPLR	Spoiler
SQWK	Squawk
SR	Specific Range
SRS	Speed Reference System
SS	Sky/Shading
SSA	Side Slip Angle
SSB	Single Side Band
STAR	Standard Terminal Arrival Route
STBY	Standby
STD	Standard
STL	System Torque Limiter

Continued on the following page

Continued from the previous page

Abbreviation	Term
STRG	Steering
STS	Status
SURV	Surveillance, Surveillance System
SW	Switch
SYS	System

T

Abbreviation	Term
T-P	Turning Point
T.O	Takeoff
T/C	Top of Climb
T/D	Top of Descent, Touchdown
TA	Traffic Advisory
TAC	Taxiing Aid Camera
TACS	Taxiing Aid Camera System
TACAN	Ultra-high Frequency Tactical Air Navigation Aid
TAD	Terrain Awareness and Display
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed
TASOV	Trim Air Shut-Off Valves
TAT	Total Air Temperature
TAU	Estimated Time to Intercept
TAV	Trim Air Valve
TAWS	Terrain Awareness and Warning System
TBC	To Be Confirmed
TBD	To Be Defined
TBV	Transient Bleed Valve, Turbine Bypass Valve
TCAS	Traffic Alert and Collision Avoidance System
TCC	Turbine Case Cooling
TCF	Terrain Clearance Floor
TCM	Thrust Control Malfunction
TCV	Temperature Control Valve
TDU	Temporary Documentary Unit
TEI	Two Engines Inoperative
TEL	Telephone
TEMP	Temperature
TERR	Terrain
TFLEX	Flex Temperature
THR	Thrust
THS	Trimmable Horizontal Stabilizer

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Continued from the previous page

Abbreviation	Term
TK	Tank
TLS	Tertiary Locking System
TMPY	Temporary
TO	Takeoff
TOCG	TakeOff Center of Gravity
TOD	Takeoff Distance
TODA	Takeoff Distance Available
TOGA	Takeoff/Go-Around
TOPA	TakeOff Performance Application
TOR	Takeoff Run
TORA	Takeoff Run Available
TOW	Takeoff Weight
T-P	Turn Point
TPIS	Tire Pressure Indicating System
TPR	Turbofan Power Ratio
TR	Transformer Rectifier
TRAF	Traffic
TRANS	Transition
TREF	Reference Temperature, Flat-Rating Temperature
TRK	Track (angle)
TROPO	Tropopause
TRPU	Trust Reverser Power Unit
TURB	Turbulence, Turbulent
TWLU	Terminal Wireless LAN Unit

U

Abbreviation	Term
USB	Universal Serial Bus
UTC	Universal Time Coordinated

V

Abbreviation	Term
V/S	Vertical Speed
V1	Decision Speed, Critical Engine Failure Speed
V2	Takeoff Safety Speed
VAPP	Approach Speed
VASI	Visual Approach Slope Indicator
VD	Vertical Display
VDAR	Virtual Digital ACMS Recorder
VDEV	Vertical Deviation

Continued on the following page

Continued from the previous page

Abbreviation	Term
VENT	Ventilation
VERT	Vertical
VERT DEV	Vertical Deviation
VERT REV	Vertical Revisor
VFE	Maximum Flap Extended Speed
VFG	Variable Frequency Generator
VHF	Very High Frequency
VIGV	Variable Inlet Guide Valve
VLE	Maximum Landing Gear Extended Speed
VLO	Maximum Landing Gear Operating Speed
VLOF	Lift-off Speed
VLR	Very Long Range
VLS	Lowest Selectable Speed
VMAX	Maximum Allowable Speed
VMAXOP	Maximum Operating Speed
VMC	Visual Meteorological Conditions
VMCA	Minimum Control Airspeed in Flight
VMCG	Minimum Control Airspeed on Ground
VMCL	Minimum Control Airspeed for Landing
VMCL-2	Minimum Control Airspeed for Landing with two engines inoperative
VMO	Maximum Operating Speed
VMU	Minimum Unstick Speed
VOR	VHF Omnidirectional Range
VORTAC	Collocated VOR and TACAN beacon
VR	Rotation Speed
VREF	Landing Reference Speed
VS1g	Stall Speed with a Load Factor of 1g
VSI	Vertical Speed Indicator
VIVG	Variable Stator Vanes
VV	Velocity Vector
VQAR	Virtual Quick Access Recorder

W

Abbreviation	Term
W/S	Windshear
WADU	Weather Antenna Drive Unit
WARN	Warning
WBA	Weight and Balance Application
WBBC	Weight and Balance Backup Computer
WD	Warning Display

Continued on the following page

Continued from the previous page

Abbreviation	Term
WLG	Wing Landing Gear
WPT	Waypoint
WR	Weighing Report, Weather Radar
WTB	Wing tip brake
WX	Weather Mode
WXR	Weather Radar

X

Abbreviation	Term
XING	Crossing
XPDR	Transponder
XTK	Cross Track

Y

Abbreviation	Term
Y	Year

Z

Abbreviation	Term
ZFCG	Zero Fuel Center of Gravity
ZFW	Zero Fuel Weight
ZFWCG	Zero Fuel Weight Center of Gravity

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OPERATIONAL PHILOSOPHY

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OP-PLP PRELIMINARY PAGES

OP-10 General

OP-20 Flight Controls

OP-20-20-1 Laws

OP-20-20-2 Protections

OP-20-20-3 System Characteristics

OP-30 Flight Guidance

OP-30-30-1 AP/FD

INTRODUCTION

Applicable to: ALL

The Airbus cockpit is designed to achieve pilot operational needs throughout the aircraft operating environment, while ensuring maximum commonality within the Fly by Wire family. The cockpit design objectives are driven by three criteria:

- Reinforce the safety of flight
- Improve efficiency of flight
- Answer pilot requirements in a continuously changing environment
  Airbus operational rules result from the design concept, more particularly from the following systems:
  - The Fly by wire system with its control laws and protections, commanded through the side stick,
  - An integrated Auto Flight System comprising:

- The FMS interfaced through the MFD
- The AP/FD interfaced through the FCU
- The ATHR interfaced through the non back driven thrust levers
- The FMA, providing Guidance targets and Information, to monitor the AFS

- A set of Display units (DU) providing information and parameters required by the crew

- To operate and to navigate the aircraft (the EFIS)
- To communicate (the ATC mail box area on lower ECAM)
- To manage the aircraft systems (the ECAM)
- FMA interface to provide Guidance targets and information to monitor the AFS/FD

- A Forward Facing Cockpit Layout with “Lights out” or “Dark Cockpit” concept assisting the crew to properly control the various aircraft systems.

The operational rules applicable to these specific features are given in the other sections of this chapter.

OPERATIONAL GOLDEN RULES

Applicable to: ALL

1. The aircraft can be flown like any other aircraft
2. Fly, navigate, communicate - in that order
3. One head up at all times
4. Cross check the accuracy of the FMS
5. Know your FMA at all times
6. When things don’t go as expected - take over
7. Use the proper level of automation for the task

8. Practice task sharing and back-up each other

INTRODUCTION

Applicable to: ALL

The relationship between the Pilot Flying's (PF's) input on the sidestick and the aircraft's response is referred to as control law. This relationship determines the handling characteristics of the aircraft. There are three sets of control laws and they are provided according to the status of the computers, peripherals and hydraulic generation.

The three sets of control laws are:
- Normal law,
- Alternate law,
- Direct law.

OBJECTIVES OF THE NORMAL LAW

Applicable to: ALL

The aim of normal law is to provide the following handling characteristics within the normal flight envelope (regardless of aircraft speed, altitude, gross weight and CG):
- Aircraft must be stable and maneuverable,
- The same response must be consistently obtained from the aircraft,
- The actions on the sidestick must be balanced in pitch and in roll.

The normal law handling characteristics at the flight envelope limit are:
- The PF has full authority to achieve Maximum Aircraft Performance,
- The PF can have instinctive/immediate reaction in the event of an emergency,
- There is a reduced possibility of overcontrolling or overstressing the aircraft.

Normal Law is the law that is most commonly available and it handles single failures.

CHARACTERISTICS IN PITCH OF THE NORMAL LAW

Applicable to: ALL

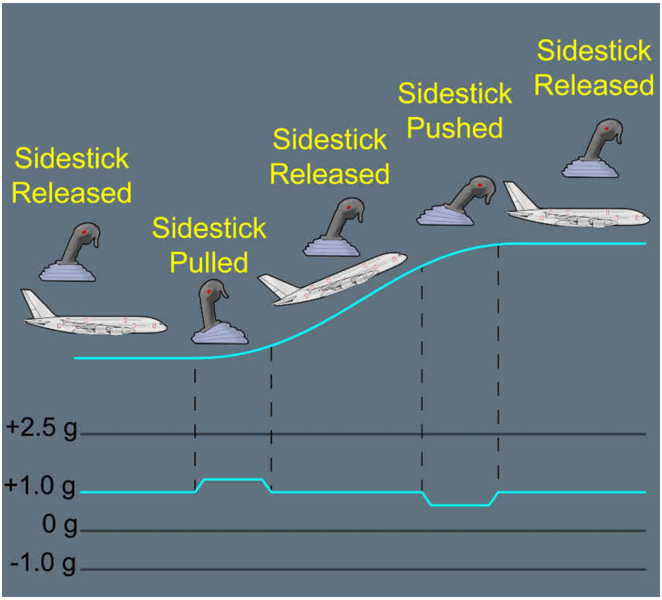
IN FLIGHT

When the PF performs sidestick inputs, a constant G-LOAD maneuver is ordered and the aircraft responds with a G-LOAD / Pitch Rate. Therefore the PF's order is consistent with the response that is "naturally" expected from the aircraft: Pitch Rate at low speed, Flight Path Rate or G at high speed.

So if there is no input on the stick:

- The aircraft maintains the flight path even in case of speed changes
- In case of configuration changes or thrust variations, the aircraft compensates for the pitching moment effects
- In turbulence, small deviations occur on the flight path. However the aircraft tends to regain a steady condition.

Airbus Pitch Characteristic



Operational Recommendation

Since the aircraft is stable and auto-trimmed, the PF needs to perform minor corrections on the sidestick if the aircraft deviates from its intended flight path.

The PF should not fight the sidestick or overcontrol it. If the PF senses an overcontrol, the sidestick should be released.

AT TAKEOFF AND LANDING

The above-mentioned pitch law is not the most appropriate for takeoff and flare because the stable flight path is not what the PF naturally expects. Therefore the computers automatically adapt the control laws to the flight phases:
- GROUND LAW: the control law is direct law,
- FLARE LAW: the control law is a smoother direct law.

Operational Recommendation

Takeoff and landing maneuvers are naturally achieved. For example, a flare requires the PF to apply permanent aft pressure on the sidestick in order to achieve a progressive flare. Whereas, derotation consists of smoothly flying the nosegear down by applying slight aft pressure on the sidestick.

LATERAL CHARACTERISTICS OF THE NORMAL LAW

Applicable to: ALL

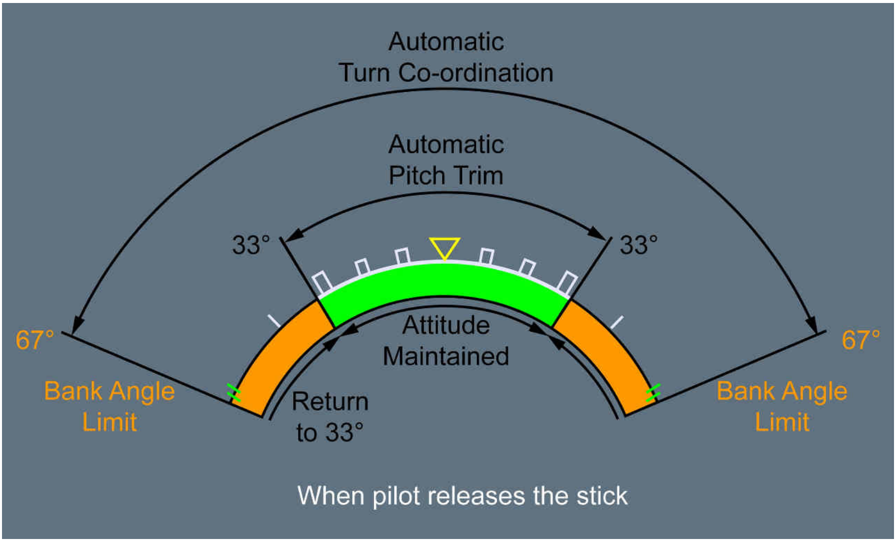
NORMAL CONDITIONS

When the PF performs a lateral input on the sidestick, a roll rate is ordered and naturally obtained. Therefore at a bank angle of less than 33 ° with no input on the sidestick, a zero roll rate is ordered and the current bank angle is maintained. Consequently the aircraft is laterally stable and no aileron trim is required.

However lateral law is a mixture of roll and yaw demand with:
- Automatic turn coordination,
- Automatic yaw damping,
- Initial yaw damper response to a major aircraft assymetry.

In addition, if the bank angle is less than 33 °, pitch compensation is provided.
If the bank angle is greater than 33 °, spiral stability is reintroduced and pitch compensation is no longer available. This is because, in normal situations, there is no operational reason to fly with such high bank angles for a long period of time.

Airbus Lateral Characteristic



Operational Recommendation

During a normal turn (bank angle less than 33 °), in level flight:
- The PF moves the sidestick laterally (the more the sidestick is moved laterally, the greater the resulting roll rate - e.g. 15 ° per second at max deflection),
- Not necessary to make a pitch correction,
- Not necessary to use the rudder.

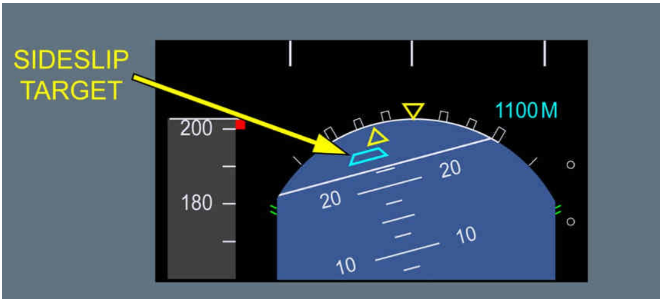
In the case of steep turns (bank angle greater than 33 degrees), the PF must apply:
- Lateral pressure on the sidestick to maintain bank,
- Aft pressure on the sidestick to maintain level flight.

ENGINE FAILURE

In flight, if an engine failure occurs and no input is applied on the sidestick, lateral normal law controls the natural tendency of the aircraft to roll and yaw.
The lateral behavior of aircraft is safe.
However, the PF is best suited to adapt the lateral trimming technique when necessary. From a performance standpoint, the most effective flying technique, in the event of an engine failure at takeoff, is to fly a constant heading with roll surfaces retracted. This technique dictates the amount of rudder that is required and the resulting residual sideslip.

As a result, to indicate the amount of rudder that is required to correctly fly with an engine-out at takeoff, the measured sideslip index is shifted on the PFD by the computed residual-sideslip value. This index appears in blue instead of in yellow and is referred to as the beta target. If the rudder pedal is pressed to center the beta target index, the PF will fly with the residual slip as required by the engine-out condition. Therefore, the aircraft will fly at a constant heading with ailerons and spoilers close to neutral position.

Beta Target on PFD



Operational Recommendation

In the case of an engine failure at takeoff, the PF must:

- Smoothly adjust pitch to maintain a safe speed (as per SRS guidance)
- Center the Beta target (there is no hurry, because the aircraft is laterally safe).
- When appropriate, trim the aircraft laterally using the rudder trim
- Apply small lateral sidestick inputs, so that the aircraft flies the appropriate heading.

PROTECTIONS AVAILABLE IN NORMAL LAW

Applicable to: ALL

Normal Law provides five different protections (Refer to the Protections paragraph):

- High angle-of-attack protection,
- Load factor protection,
- High pitch attitude protection,
- Bank angle protection,
- High speed protection.

ALTERNATE LAW

Applicable to: ALL

GENERAL

In some double failure cases, the integrity and redundancy of the computers and of the peripherals are not sufficient to achieve normal law and associated protections. System degradation is progressive and will evolve according to the availability of remaining peripherals or computers.
In addition, depending on the type of failure, the control law may either be Alternate 1 or Alternate 2.

ALTERNATE LAW CHARACTERISTICS

In pitch:
- Same as in normal law.

In lateral:
- Same as in normal law (ALTN 1) or lateral direct law with yaw damper and turn coordination (ALTN 2).

Protections:
- In all cases, they are indicated lost on the PFD,
- In few cases of alternate 1, all protections remain available,
- However, in most cases:
  - Most protections are lost, except:
    - Load factor protection,
    - Bank angle protection, if normal roll is still available (ALTN 1 only).
  - At the flight envelope limit, the aircraft is not protected:
    - In high speed, natural aircraft static stability is restored with an overspeed warning,
    - In low speed (at a speed threshold below VLS), the automatic pitch trim stops, and natural longitudinal static stability is restored (stall warning available),
    - In certain failure cases, such as the loss of three ADRs, the longitudinal static stability cannot be restored at low and high speed.
  - ALPHA FLOOR is inhibited.

OPERATIONAL RECOMMENDATION

The handling characteristics within the normal flight envelope are identical in pitch with normal law. Outside the normal flight envelope, the PF must take appropriate preventive actions to avoid losing control and/or avoid high speed excursions. These actions are the same as those that would be applied in any case where non protected aircraft (e.g. in case of stall warning: add thrust, reduce pitch, check speedbrakes retracted).

DIRECT LAW

Applicable to: ALL

GENERAL

In most triple failure cases, direct law triggers. When this occurs:

- Elevator deflection is proportional to stick deflection.
  Maximum deflection depends on the configuration and on the CG.
- Aileron and spoiler deflections are proportional to stick deflection but vary with the aircraft configuration,
- Pitch trim is commanded manually,
- Yaw damper and minimum turn coordination are provided.

Handling characteristics are natural, of high-quality aircraft, almost independent of the configuration and of the CG. Therefore the aircraft obviously has no protections, no automatic pitch trim but overspeed or stall warnings.
In direct law, VMO/MMO settings are reduced to 310/.86 and ALPHA FLOOR is also inhibited.

OPERATIONAL RECOMMENDATION

The PF must avoid performing large thrust changes or sudden speedbrake movements, particularly if the center of gravity is aft. If the speedbrakes are out and the aircraft has been re-trimmed, the PF must gently retract the speedbrakes to give the aircraft time to retrim and thereby avoid a large nose-down trim change.

INDICATIONS

Applicable to: ALL

GENERAL

The ECAM and PFD indicate any control law degradation.

ON THE ECAM

In Alternate Law:

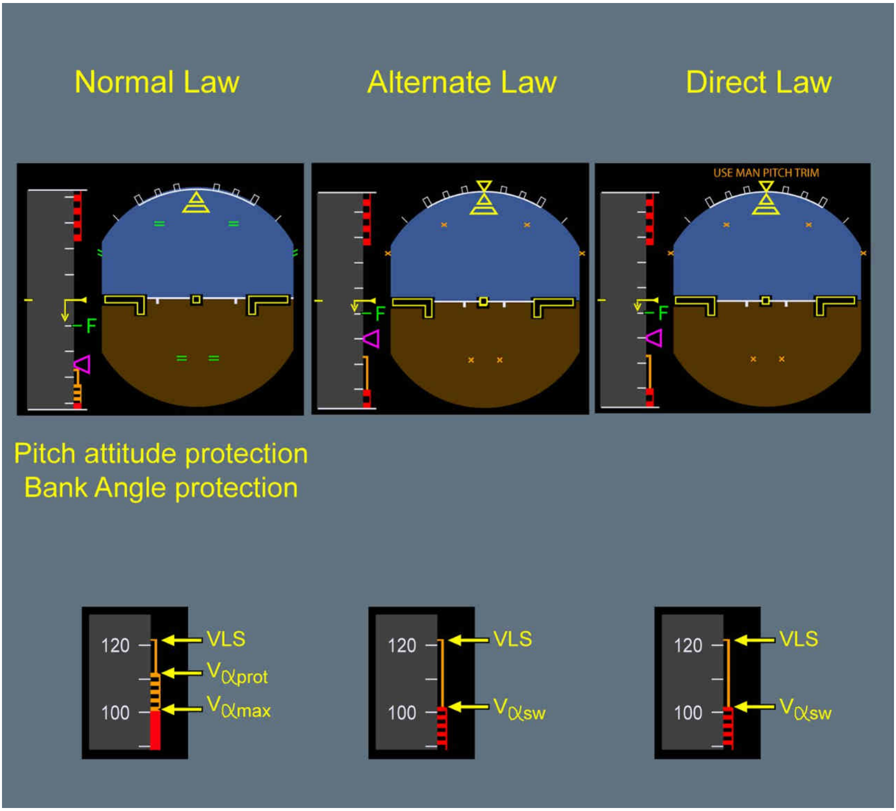
F/CLT ALTN LAW (PROT LOST)
MAX SPEED : 310 KT

In Direct Law:

F/CLT DIRECT LAW (PROT LOST)
MAX SPEED : 310/.86
MANEUVER WITH CARE

ON THE PFD

The PFD enhances the PF's awarness of the status of flight controls.
Specific symbols (= in green) and specific formatting of low speed information on the speed scale in normal law indicate which protections are available.
When protections are lost, amber crosses (X) appear instead of the green protection symbols (=).
When automatic pitch trim is no longer available, the PFD indicates this with an amber "USE MAN PITCH TRIM" message below the FMA.



Therefore by simply looking at this main instrument (PFD), the flight crew is immediately aware of the status of flight controls and the operational consequences.

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OBJECTIVES OF THE PROTECTIONS

Applicable to: ALL

One of the PF's primary tasks is to maintain the aircraft within the limits of the normal flight envelope. However some circumstances, due to extreme situations or aircraft mishandling, may provoke the violation of these limits.
Despite system protections, the PF must not deliberatly exceed the normal flight envelope. In addition, these protections are not designed to be structural limit protections (e.g. opposite rudder pedal inputs). Rather, they are designed to assist the PF in emergency and stressful situations, where only instinctive and rapid reactions will be effective.

Protections are intended to:
- Provide full authority to the PF to consistently achieve the best possible aircraft performance in extreme conditions,
- Reduce the risks of overcontrolling or overstressing the aircraft,
- Provide PF with an instinctive and immediate procedure to ensure that the PF achieves the best possible result.

BANK ANGLE PROTECTION

Applicable to: ALL

Bank angle protection prevents that any major upset or PF mishandling causes the aircraft to be in a high-bank situation (wherein aircraft recovery is complex, due to the difficulty to properly assess such a situation and readily react). Bank angle protection provides the PF with full authority to efficiently achieve any required roll maneuver.

The maximum achievable bank angle is plus or minus:
- 67 °, within the Normal Flight envelope, in clean configuration (2.5 g level flight), 60 ° with slats out,
- 45 ° in nose down high pitch protection,
- 45 ° in high Speed protection (to prevent spiral dive).

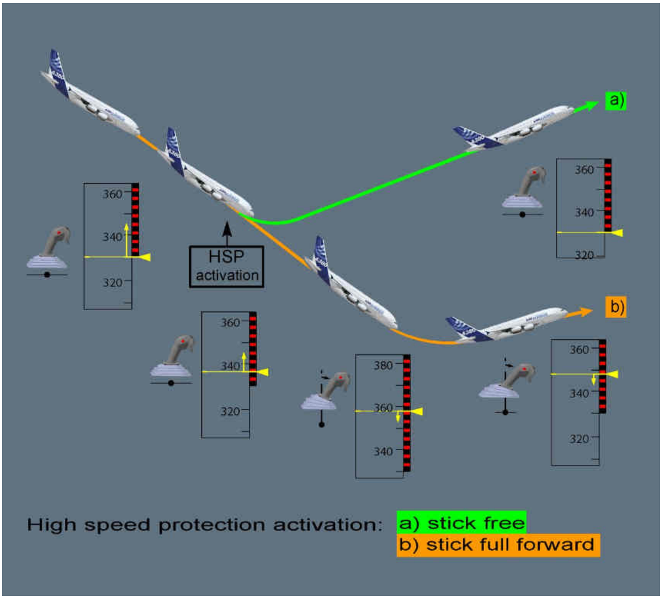
HIGH SPEED PROTECTION

Applicable to: ALL

When flying beyond maximum design speeds VD/MD (which are greater that VMO/MMO), there is an increased potential for aircraft control difficulties and structural concerns, due to high air loads. Therefore, the margin between VMO/MMO and VD/MD must be such that any possible overshoot of the normal flight envelope should not cause any major difficulty.
High speed protection adds a positive nose-up G demand to a sidestick order, in order to protect the aircraft, in the event of a dive or vertical upset. As a result, this enables a reduction in the margin between VMO/MMO and VD/MD.

Therefore in a dive situation:

- If there is no sidestick input on the sidestick, the aircraft will slightly overshoot VMO/MMO and fly back towards the envelope,
- If the sidestick is maintained full forward, the aircraft will significantly overshoot VMO/MMO without reaching VD/MD. At a speed between VMO/MMO and VD/MD, the pitch nose-down authority smoothly reduces to zero (which does not mean that the aircraft stabilizes at that speed).



The PF, therefore, has full authority to perform a high speed/steep dive escape maneuver when required, via a reflex action on the sidestick. In addition, the bank angle limit is reduced from 67 ° to 45 °, which minimizes the risk of a spiral dive.

Note: *An OVERSPEED warning is provided.*

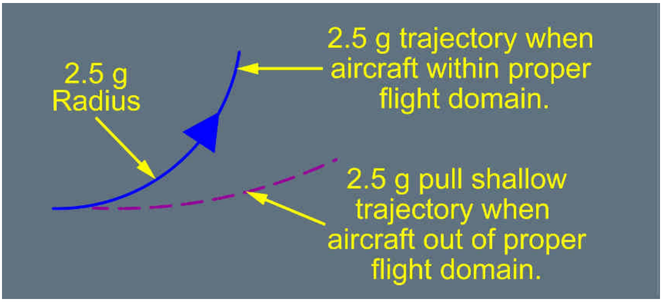
LOAD FACTOR PROTECTION

Applicable to: ALL

On commercial aircraft, high load factors can be encountered during evasive maneuvers due to potential collisions or CFIT…
Pulling "g" is efficient, if the resulting maneuver is really flown with this "g" number. If the aircraft is not able to fly this trajectory or to perform this maneuver, pulling "g" will be detrimental.

On commercial aircraft, the maximum load that is structurally allowed is:
- 2.5 g in clean configuration and
- 2.0 g with the flaps extended.

Airbus Load Factor Protection and Safety



On most commercial aircraft, the potential for an efficient 2.5g maneuver is very remote.
Furthermore, as G-LOAD information is not continuously provided in the cockpit, airline PFs are not used to controlling this parameter. This is further evidenced by inflight experience, which reveals that:
In emergency situations, initial PF reaction on a yoke or sidestick is hesitant, then aggressive.
With load factor protection, the PF may immediately and instinctively pull the sidestick full aft: the aircraft will initially fly a 2.5 g maneuver without losing time. Then, if the PF still needs to maintain the sidestick full aft stick because the danger still exists, the high AOA protection will take over. Load factor protection enhances this high AOA protection.
Load factor protection enables immediate PF reaction without any risk of overstressing the aircraft.
Flight experience has also revealed that an immediate 2.5 g reaction provides larger obstacle clearance, than a hesitant and delayed high G Load maneuver (two-second delay).

HIGH PITCH ATTITUDE PROTECTION

Applicable to: ALL

Excessive pitch attitudes, caused by upsets or inappropriate maneuvers, lead to hazardous situations:
- Too high a nose-up => Very rapid energy loss,
- Too low a nose-down => Very rapid energy gain.

Furthermore, there is no emergency situation that requires flying at excessive attitudes. For these reasons, pitch attitude protection limits pitch attitude to plus 30 ° / minus 15 °.
Pitch attitude protection enhances high speed protection, high load factor protection and high AOA protection.

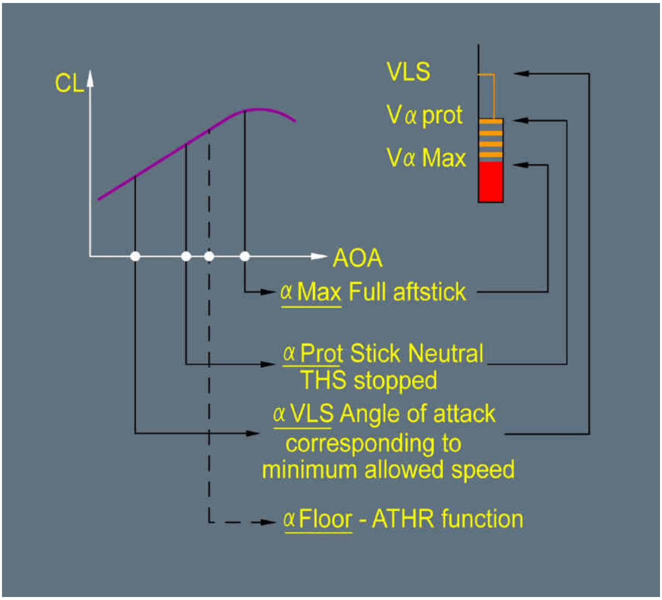
HIGH ANGLE-OF-ATTACK (AOA) PROTECTION

Applicable to: ALL

High AOA protection enables the PF to pull the sidestick full aft in dangerous situations and thus consistently achieve the best possible aircraft lift. This action on the sidestick is instinctive and the high AOA protection minimizes the risk of stalls or control loss.

High AOA protection is an aerodynamic protection:
- The PF will notice if the normal flight envelope is exceeded for any reason, because the auto pitch trim will stop, the aircraft will sink to maintain its current AOA (αPROT, strong static stability) and a significant change in aircraft behavior will occur.
- If the PF then pulls the sidestick full aft, a maximum AOA (approximately corresponding to CL Max) is commanded. In addition, the speedbrakes will automatically retract if extended.

Airbus AOA Protection



In addition to this aerodynamic protection, there are three more energy features:

- If A/THR is in SPEED mode, the speed cannot drop below VLS, even if the target speed is below VLS.
- A “LOW ENERGY” aural alert triggers when the aircraft energy level drops below a specific threshold function of, for example, IAS, ACCEL/DECEL or FPA.
  This “SPEED, SPEED, SPEED” alert draws the PF’s attention to the SPEED scale and indicates the need to adjust thrust.
  It comes immediately before the ALPHA FLOOR and is available when the aircraft is below 2 500 ft RA and is in CONF≥2.
- If the angle-of-attack still increases and reaches ALPHA FLOOR threshold, the A/THR triggers TOGA thrust and engages (in engine out, TOGA thrust would be applied on the symmetrical running engines only).

EMERGENCY SITUATION

In case of an emergency situation, such as Windshear or CFIT, the PF is assisted in order to optimize aircraft performance via the:

- A/THR: adds thrust to maintain the speed above VLS,
- Low Energy Speed – Speed warning: enhances PF awareness,
- ALPHA FLOOR: Provides TOGA thrust,
- HIGH AOA protection: provides maximum aerodynamic lift,
- Automatic speedbrake retraction: minimizes drag.

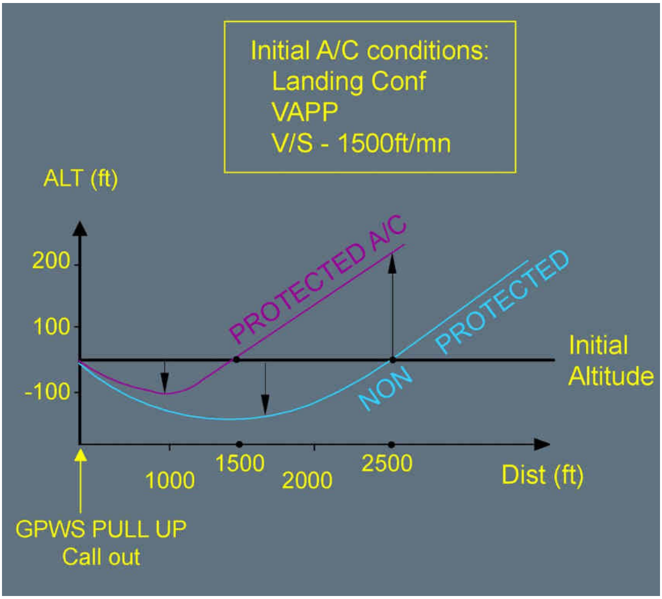
OPERATIONAL RECOMMENDATIONS

When flying at αmax, the PF can make gentle turns, if necessary.
The PF must not deliberately fly the aircraft in alpha protection except for brief periods when maximum maneuvering speed is required.
If alpha protection is inadvertently entered, the PF must exit it as quickly as possible by easing the sidestick forward to reduce the angle-of-attack while simultaneously adding power (if alpha floor has not yet been activated or has been cancelled). If ALPHA FLOORS has been triggered, it must be cancelled with the DISC pb (on either thrust lever), as soon as a safe speed is resumed.

In case of GPWS / SHEAR:

- Set the thrust levers to TOGA,
- Pull the sidestick to full aft (for shear, fly the SRS, until full aft sidestick),
- Initially maintain the wings level.

This immediately provides maximum lift/maximum thrust/minimum drag. Therefore, CFIT escape maneuvers will be much more efficient.



The above-illustrated are typical trajectories flown by all protected or not protected aircraft when the PF applies the escape procedure after an aural GPWS PULL UP alert.
The graph demonstrates the efficiency of the protection, to ensure a duck-under that is 50 % lower, a bucket-distance that is 50 % shorter, a safety margin that more than doubles (due to a quicker reaction time) and a significant altitude gain (~250 ft). These characteristics are common to all protected aircraft because the escape procedure is easy to achieve and enables the PF to fly the aircraft at a constant AOA, close to the max AOA. It is much more difficult to fly the stick shaker AOA on an aircraft that is not protected.

ABNORMAL ATTITUDES

Applicable to: ALL

If the aircraft is, for any reason, far outside the normal flight envelope and reaches an abnormal attitude, the normal controls are modified and provide the PF with maximum efficiency in regaining normal attitudes (an example of a typical reason for being far outside the normal flight envelope would be a mid-air collision).

The so-called “abnormal attitude” law is:
- Pitch direct,
- Roll direct law with yaw alternate.

These laws trigger, when extreme values are reached:
- Pitch (50 ° up, 30 ° down),
- Bank (120 °),
- AOA (30 °, -10 °),
- Speed (420 kt, 70 kt),
- Mach (M 0.96, M 0.1).

It is very unlikely that the aircraft will reach these attitudes because fly-by-wire provides protection to ensure rapid reaction far in advance. This will minimize the effect and potential for such aerodynamic upsets.
The effectiveness of fly-by-wire architecture and the existence of control laws, eliminate the need for upset recovery maneuvers to be trained on protected Airbus aircraft.

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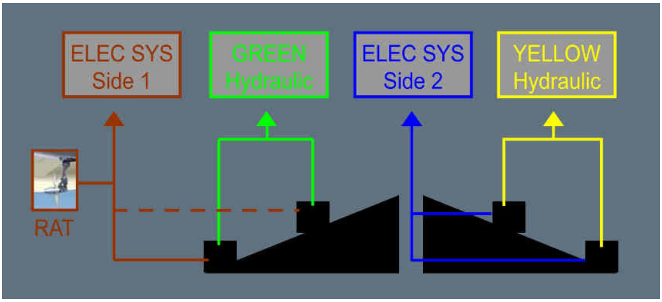
ARCHITECTURE REDUNDANCY

Applicable to: ALL

POWER REDUNDANCY

The A380 flight controls are powered by conventional hydraulic actuators and EHA/EBHA.
There are 2 hydraulic systems, supplying the hydraulic actuators and 2 sides of the electrical system, supplying the EHA.
Such an integrated electrical/hydraulic architecture enhances the redundancy of the flight control system.

Electrical/Hydraulic Architecture Redundancy



BACKUP CONTROL

The backup control is active in the case of the loss of all flight control computers (PRIMs and SECs), which is very unlikely. The backup control enables the PF to safely stabilize the aircraft while reconfiguring the systems.
The objective is not to fly the aircraft accurately, but to maintain the aircraft attitude safe and stabilized, in order to allow the recovery of lost systems.

For this purpose, the Backup Control Module (BCM), supplied by its two own electrical generators (each of them powered by one hydraulic circuit), enables to control:
- Both inner ailerons
- Both rudders
- Both outer elevators
- The THS.

SIDESTICK AND TAKEOVER P/B

Applicable to: ALL

When the Pilot Flying (PF) makes an input on the sidestick, an order (an electrical signal) is sent to the fly-by-wire computers. If the Pilot Monitoring (PM) also acts on the stick then both signals/orders are added.
Therefore, as on any other aircraft type, PF and PM must not act on their sidesticks at the same time. If the PM (or Training Captain) needs to take over, the PM must press the sidestick takeover pushbutton and announce: "I have control".
If a flight crewmember falls on a sidestick or a mechanical failure leads to a jammed stick (there is no associated ECAM caution), the "failed" sidestick order is added to the "non failed" sidestick order.
In this case, the other not affected flight crewmember must press the sidestick takeover pushbutton for at least 30 s in order to deactivate the "failed" sidestick.
A pilot can at any time reactivate a deactivated stick by momentarily pressing the takeover pushbutton on either sidestick.
In the case of a “SIDE STICK FAULT” ECAM alert, the affected sidestick order (sent to the computer) is forced to zero. This automatically deactivates the affected sidestick. This explains why there is no procedure associated with this warning.

OBJECTIVE

Applicable to: ALL

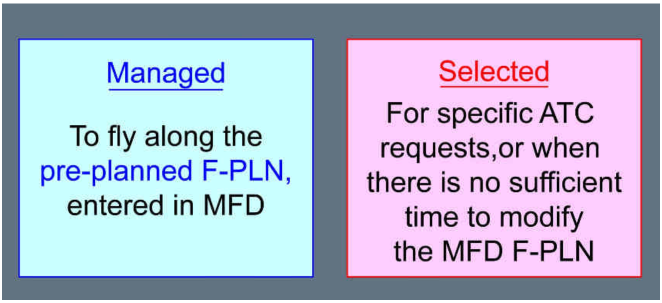
The Auto Pilot (AP) and Flight Director (FD) assist the flight crew to fly the aircraft within the normal flight envelope in order to:
- Optimize performance in the takeoff, go-around, climb or descent phases,
- Follow ATC clearances (lateral or vertical),
- Repeatedly fly and land the aircraft with very high accuracy in CAT 2 and CAT 3 conditions.

To achieve these objectives:
- The AP takes over routine tasks. This gives the Pilot Flying (PF) the necessary time and resources to assess the overall operational situation,
- The FD provides adequate attitude or flight path orders and enables the PF to accurately fly the aircraft manually.

MANAGED AND SELECTED MODES

Applicable to: ALL

The choice of mode is a strategic decision that is taken by the PF.

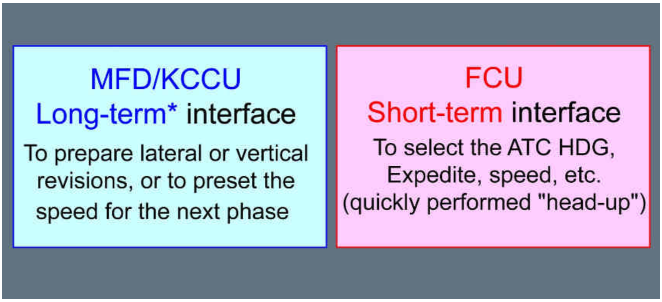


Managed modes require:
- Good FMS navigation accuracy (or GPS PRIMARY),
- An appropriate ACTIVE F-PLN (i.e. the intended lateral and vertical trajectory is entered and the sequencing of the F-PLN is monitored).

If these two conditions are not fulfilled, revert to selected mode.

MAIN INTERFACES WITH THE AP/FD

Applicable to: ALL



*The DIR TO function is an exception to this rule.

Operational Recommendation

With the FMS, anticipate flight plan updates by:

- Preparing EN ROUTE DIVERSIONS, DIVERSION TO ALTN, CIRCLING, LATE CHANGE OF RWY in the SEC.

This enables the MFD/KCCU to be used for short-term actions.

TASKSHARING AND COMMUNICATIONS

Applicable to: ALL

The FCU and MFD/KCCU must be used, in accordance with the rules outlined below, in order to ensure:

- Safe operation (correct entries made),
- Effective inter-pilot communication (knowing each other's intentions),
- Comfortable operations (use "available hands", as appropriate).

Tasksharing_N_comm

MFD/KCCU entries are performed by the **PM**.	FCU entries are performed by: -The PF, with the AP on - the PM (upon PF request), with the AP off
A crosscheck must be performed.	FCU entries must be Announced.
Time consuming entries should be avoided below 10000 ft. Entries should be restricted to those that have an operational benefit.	Upon FCU entries:
(PERF APPR, DIR TO, DIR TO INTERCEPT, RADNAV, LATE CHANGE OF RUNWAY, ACTIVE SEC F-PLN, ENABLE ALTN)	The **PF** must check and Announce the corresponding PFD/FMA target and mode. The **PM** must crosscheck And announce "CHECKED".

AP/FD MONITORING

Applicable to: ALL

The FMA indicates the status of the AP, FD and A/THR and their corresponding operating modes. The PF must monitor the FMA and announce any FMA changes. The flight crew uses the FCU or MFD/ KCCU to give orders to the AP/FD. The aircraft is expected to fly in accordance with these orders.

The main concern for the flight crew should be:
- **WHAT IS THE AIRCRAFT EXPECTED TO FLY NOW ?**
- **WHAT IS THE AIRCRAFT EXPECTED TO FLY NEXT ?**

If the aircraft does not fly as expected:

- and, if in managed mode: Select the desired target
- or, disengage the autopilot, and fly the aircraft manually.

AUTOPILOT (AP) OPERATION

Applicable to: ALL

The flight crew can engage the Autopilot (AP) within the normal flight envelope, atleast5 s after liftoff, and at a minimum height of 100 ft. The AP automatically disengages when the aircraft flies significantly outside the normal flight envelope limits.
The flight crew cannot engage the AP when the aircraft is outside the flight envelope. Flight control laws are designed to assist the flight crew to return within the flight envelope in accordance with the selected strategy.

The flight crew can use the AP:
- For precision approaches with automatic landing, and until the end of the roll out, in accordance with the limitations indicated in the FCOM
- For other approaches, at the following minimum height:
  - 200 ft for straight-in non-precision approach
  - 200 ft for circling approach
  - 160 ft for ILS approach with CAT 1 displayed on FMA
- For all other phases, at a minimum height of 500 ft.

The flight crew can also use the AP in the case of:
- Engine failure: Without any restriction, within the demonstrated limits, including for automatic landing
- Abnormal configuration (e.g. slats/flaps failure): Down to 500 ft AGL. These configurations require extra vigilance. The flight crew must be ready to take over if the aircraft deviates from its intended safe flight path.

The flight crew should use the sidestick pushbutton to disengage the AP. Instinctive override action (i.e. movement on the sidestick beyond a given threshold) also disengages the AP.
The flight crew should use the AP1(2) pb on the AFS CP to switch from AP1(2) to AP2(1).

Note: *If the FCU backup is activated, the flight crew should use the AP1(2) pb on the AFS CP page to switch from AP1(2) to AP2(1).*

RECOMMENDED PRACTICE FOR AUTOPILOT (AP) ENGAGEMENT

Before engaging the AP, the flight crew should:
- Fly the aircraft on the intended path
- Check on the FMA that the Flight Director (FD) is engaged with the appropriate guidance modes for the intended flight path
  If not, set the FD on, and the appropriate guidance mode(s) as required.
- Center the FD bars with the aircraft symbol on the PFD.

Note: *Engaging the AP while large orders are required to achieve the intended flight path may result in an AP overshoot of the intended vertical and/or lateral target. This situation can surprise the flight crew, due to the resulting large pitch/roll changes and thrust variations.*

USE OF THE FD WITHOUT THE AP

Applicable to: ALL

When manually flying the aircraft with the FDs on, the FD bars provide lateral and vertical orders in accordance with the active modes that the flight crew selects.

Therefore:
- Fly with a centered FD,
- If not using FD orders, turn off the FD.

It is strongly recommended to turn off the FDs to ensure that the A/THR is in SPEED mode if the A/THR is active.

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OBJECTIVE

Applicable to: ALL

The A/THR computer (within the FG) interfaces directly with the engine computer, referred to as the FADEC.

The A/THR sends to the FADEC the thrust targets that are needed to:
- Obtain and maintain a target speed when in SPEED mode,
- Obtain a specific thrust setting (e.g. CLB, IDLE) when in THRUST mode.

INTERFACE

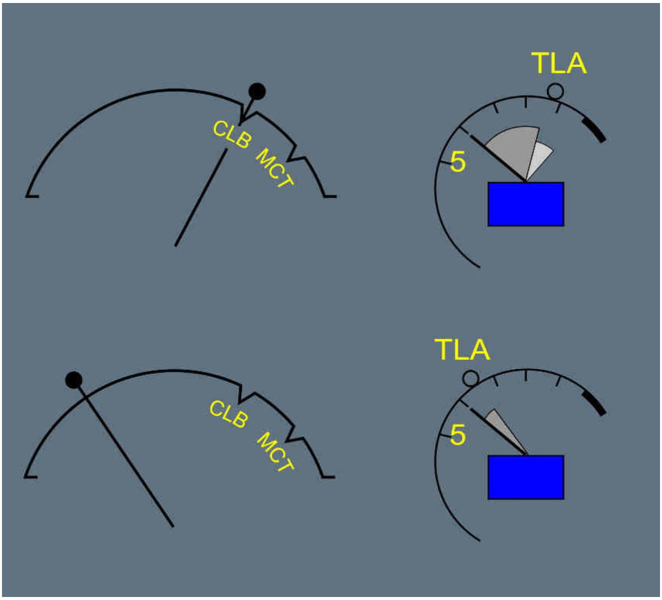
Applicable to: ALL

When the A/THR is active, the thrust lever position determines the maximum thrust that the A/THR can command in SPEED or THRUST mode. Therefore, with A/THR active, thrust levers act as a thrust limiter or a thrust-rating panel.

The A/THR computer does not drive back the thrust levers. The PF sets them to a specific detent on the thrust lever range. The A/THR system provides cues that indicate the energy of the aircraft:
- Speed, acceleration or deceleration, obtained by the speed trend vector,
- THR and THR command on the THR gauge.

All these cues are in the flight crew's direct line of vision.
In other words, the Thrust Lever Angle (TLA) should not be used to monitor correct A/THR operation. Neither should the thrust lever position of a conventional autothrottle, be considered a cue because, in many hazardous situations, the thrust lever position can be misleading (e.g. engine failure, thrust lever jammed).

The TLA Determines Max Thrust For The A/THR



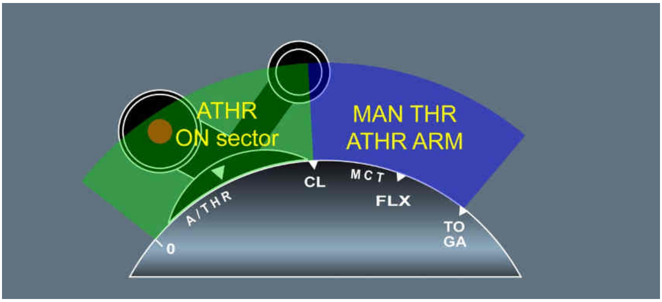
NORMAL OPERATIONS

Applicable to: ALL

NORMAL OPERATIONS

The A/THR can only be active when the thrust levers are between IDLE and the CLB detent. When the thrust levers are beyond the CLB detent, thrust is controlled manually to the thrust lever position and the A/THR is armed (A/THR appears in blue on the FMA). This means that the A/THR is ready to be re-activated when the flight crew sets the thrust levers back to the CLB detent (or below).

A/THR Operating Sectors With All Engines Operating



AT TAKEOFF

The thrust levers are set either full forward to TOGA or to the FLX detent. Thrust is manually controlled to the TLA and A/THR is armed. The FMA indicates this in blue.

AFTER TAKEOFF

When the aircraft reaches THR RED ALT, the flight crew sets the thrust levers back to the CLB detent. This activates A/THR. MAX CLB will, therefore, be the maximum normal thrust setting that will be commanded by the A/THR in CLB, CRZ, DES or APPR as required.

THRUST LEVER(S) BELOW THE CLB DETENT

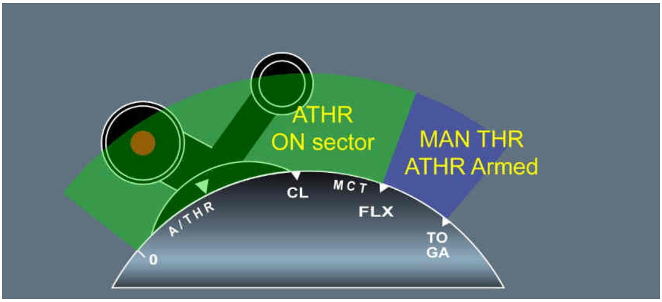
If one thrust lever is set to below the CLB detent, the FMA triggers a LVR ASYM message as a reminder to the flight crew (e.g. this configuration might be required due to an engine's high vibration level). However, if all thrust levers are set to below the CLB detent, with the A/THR active, then the ECAM repeatedly triggers the AUTO FLT A/THR LIMITED caution. This is because there is no operational reason to be in such a situation and to permanently limit A/THR authority on all engines. In this case all thrust levers should either be brought back to the CLB detent or the A/THR should be set to OFF.

OPERATIONS WITH ONE ENGINE INOPERATIVE

Applicable to: ALL

The above-noted principles also apply to an one-engine inoperative situation, except that A/THR can only be active when the thrust levers are set between IDLE and MCT.

A/THR Operating Sectors With One Engine Inoperative

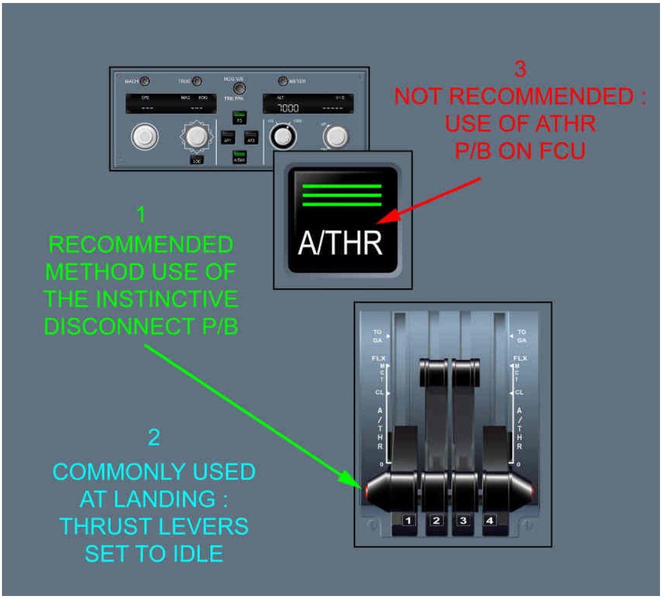


In case of engine failure the thrust levers will be in MCT detent for remainder of the flight. This is because MCT is the maximum thrust that can usually be commanded by the A/THR for climb or acceleration in all flight phases (e.g. CLB, CRZ, DES or APPR).

TO SET AUTOTHRUST TO OFF

Applicable to: ALL

How to Set A/THR to Off



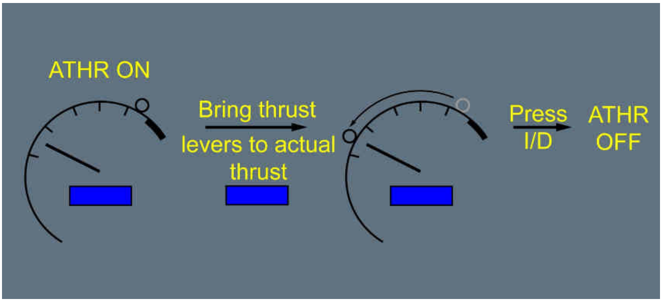
1) USE OF INSTINCTIVE DISCONNECT (I/D) PUSHBUTTON

If the I/D pb is pressed when the thrust levers are in CLB detent, thrust will increase to MAX CLB. This may cause a not desired thrust change and perturb the approach.

Therefore the recommended technique for setting A/THR to off is:
- Return the thrust levers to approximately the current thrust setting by observing the TLP symbol on the thrust gauge,
- Press the I/D pb.

This technique minimizes thrust discontinuity when setting A/THR to off.

Recommended Technique to Set A/THR Off



2) THRUST LEVERS SET TO IDLE

If thrust levers are set to IDLE, A/THR is set to off. This technique is usually used in descent when the A/THR is in THR IDLE or at landing. During flare, with the A/THR active, the thrust levers are set to the CLB detent. Then, when thrust reduction is required for landing, the thrust levers should be moved smoothly and set to the IDLE stop. This will retard thrust and set A/THR to off. As a reminder, the “RETARD” aural alert will sound. In flare, this aural alert will occur at 20 ft, except in the case of autoland where it occurs at 10 ft.
It should be noted that when the thrust levers are set back to IDLE and A/THR set to off: The A/THR can be reactivated by pressing the pushbutton on the FCU and returning the thrust levers to the applicable detent. The thrust levers should be immediately returned to the applicable detent in order to avoid an ECAM “A/THR LIMITED” message.

3) USE OF THE FCU pb

Use of the FCU pb is considered to be an involuntary A/THR off command (e.g. in the case of a failure). When pressed, thrust is frozen and remains locked at the value it had when the flight crew pressed the A/THR pb, as long as the thrust levers remain in the CLB or MCT detent.
If thrust levers are out of detent, thrust is manually controlled and, therefore, unlocked.
An ECAM caution and an FMA message trigger during thrust lock:

- THR LK appears in amber on the FMA
- The ECAM caution is:

AUTO FLT : ATHR OFF
ENG……THR LOCKED
Thrust levers…move
In this case when the flight crew moves the thrust levers out of detent, full manual control is recovered and the THR LK message disappears from the FMA.
This feature should not be used, unless the instinctive disconnect pushbuttons are inoperative.

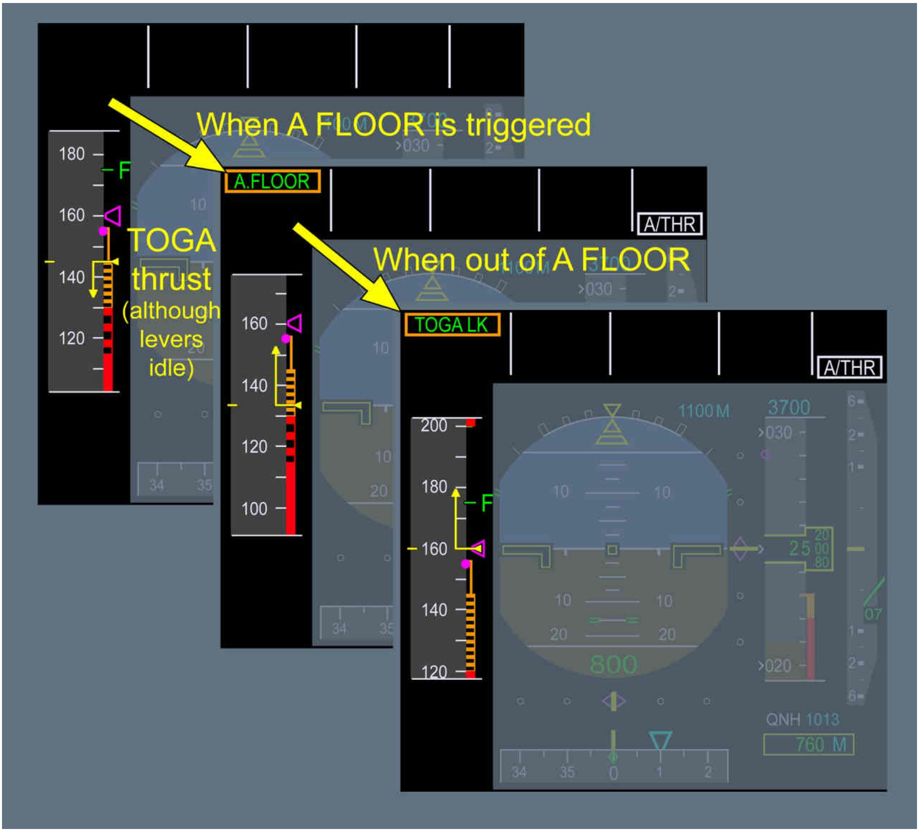
ALPHA FLOOR

Applicable to: ALL

When the angle-of-attack of the aircraft goes beyond the ALPHA FLOOR threshold, this means that the aircraft has decelerated significantly (below ALPHA PROT speed): A/THR activates automatically and orders TOGA thrust, regardless of the thrust lever position.
The example below illustrates that:

- The aircraft is in descent with the thrust levers manually set to IDLE,
- The aircraft decelerates, during manual flight with the FD off, as indicated on the FMA.

Speed Scale and FMA indications in a Typical Alpha Floor Case



When the speed decreases, so that the angle-of-attack reaches the ALPHA FLOOR threshold, A/THR activates and orders TOGA thrust, despite the fact that the thrust levers are at IDLE.
When the aircraft accelerates again, the angle-of-attack drops below the ALPHA FLOOR threshold. TOGA thrust is maintained or locked. This enables the flight crew to reduce thrust, as necessary. TOGA LK appears on the FMA to indicate that TOGA thrust is locked. The desired thrust can only be recovered by setting A/THR to off with the instinctive disconnect pushbutton.
ALPHA floor is available when the flight controls are in NORMAL LAW from liftoff to 100 ft R/A at landing. In case of one engine out operation, the TOGA thrust would be applied on the symmetrical running engines only.

A/THR USE - SUMMARY

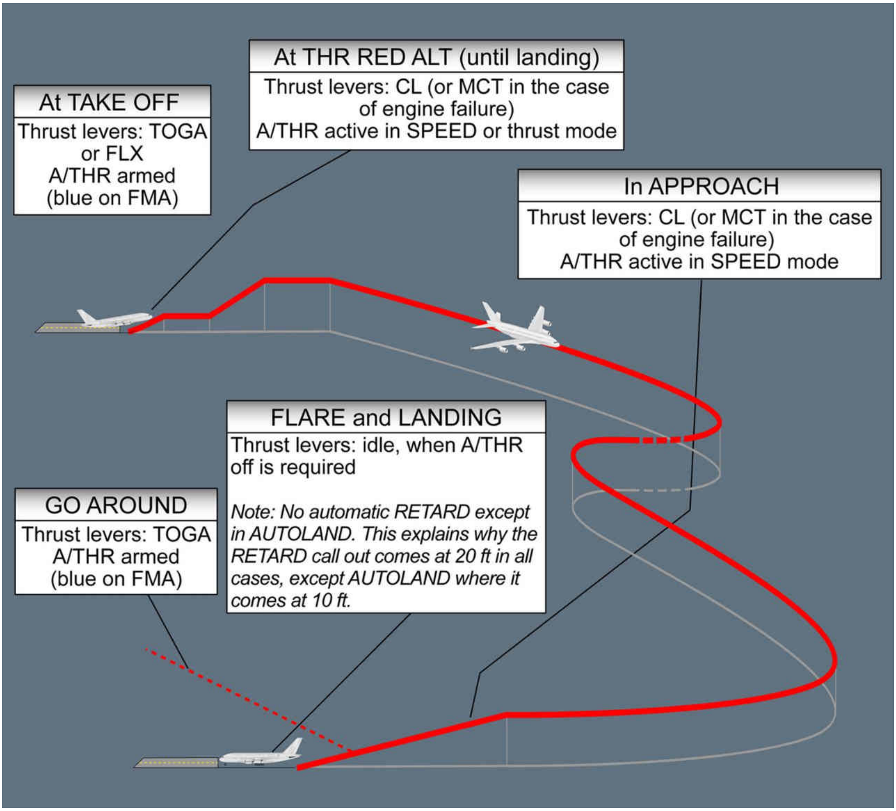
Applicable to: ALL

A/THR USE - SUMMARY

Use of A/THR is recommended during the entire flight. It may be used in most failures cases, including:

- Engine failure, even during autoland,
- Abnormal configurations.

A/THR Use - Summary



A/THR should be monitored via the:

- FMA-SPEED/SPEED TREND on the PFD
- THR/THR command on the ECAM E/WD.

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INTRODUCTION

Applicable to: ALL

The flight crew manually engages the modes. However, they may change automatically, depending on the:

- AP, FD, and A/THR system integration
- Logical sequence of modes
- So-called "mode reversions".

AP, FD, A/THR SYSTEM INTEGRATION

Applicable to: ALL

There is a direct relationship between aircraft pitch control, and engine thrust control. This relationship is designed to manage the aircraft's energy.

- If the AP/FD pitch mode controls a vertical trajectory (e.g. ALT, V/S, FPA, G/S):
  → A/THR controls speed
- If the AP/FD pitch mode controls a speed (e.g. OP CLB, OP DES):
  → A/THR controls thrust (THR CLB, THR IDLE)
- If no AP/FD pitch mode is engaged (i.e. AP is off and FD is off):
  → A/THR controls speed

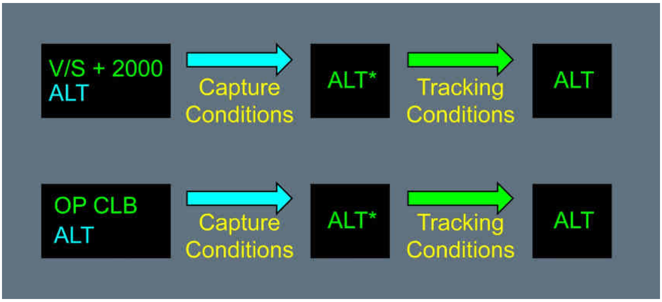
Therefore, any change in the AP/FD pitch mode is associated with a change in the A/THR mode.

Note: *For this reason, the FMA displays the A/THR mode and the AP/FD vertical mode columns next to each other.*

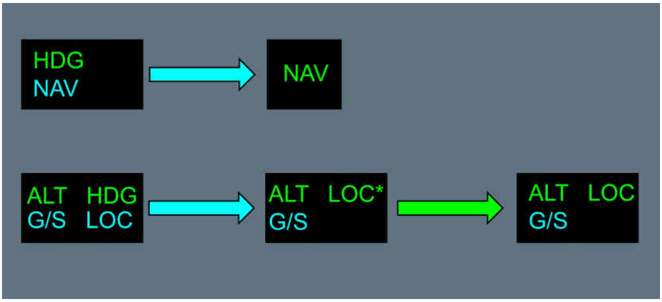
THE LOGICAL SEQUENCE OF MODES

Applicable to: ALL

In climb, when the flight crew selects a climb mode, they usually define an altitude target, and expect the aircraft to capture and track this altitude. Therefore, when the flight crew selects a climb mode, the next logical mode is automatically armed.
For example:



The flight crew may also manually arm a mode in advance, so that the AP/FD intercepts a defined trajectory.
Typically, the flight crew may arm NAV, LOC-G/S, and APPNAV-FINAL.
When the capture or tracking conditions occur, the mode will change sequentially.
For example:



These logical mode changes occur, when the modes are armed. They appear in blue on the FMA.

MODE REVERSIONS

Applicable to: ALL

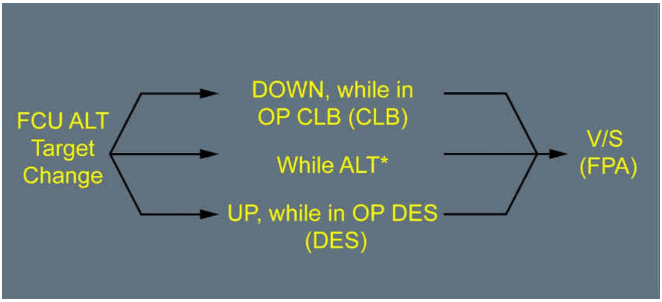
GENERAL

Mode reversions are automatic mode changes that unexpectedly occur, but are designed to ensure coherent AP, FD, and ATHR operations, in conjunction with flight crew input (or when entering a F-PLN discontinuity).
For example, a reversion will occur, when the flight crew:

- Changes the FCU ALT target in specific conditions
- Engages a mode on one axis, that will automatically disengage the associated mode on the other axis
- Manually flies the aircraft with the FD on, but does not follow the FD orders, which leads to the aircraft to the limits of the flight envelope.

Due to the unexpected nature of their occurrence, the FMA should be closely-monitored for mode reversions.

FLIGHT CREW CHANGE OF FCU ALT TARGET → ACTIVE VERTICAL MODE NOT POSSIBLE



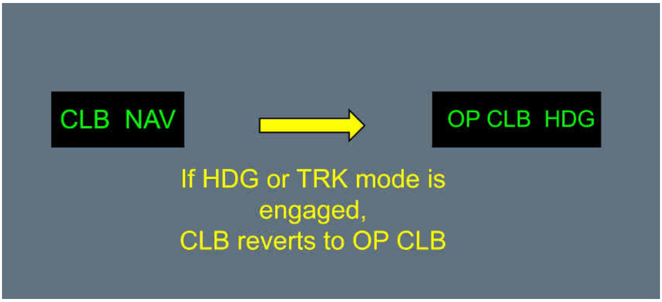
This reversion to the V/S (FPA) mode on the current V/S target does not modify the pitch behaviour of the aircraft.
It is the flight crew's responsibility to change it as required.

FLIGHT CREW HDG OR TRK MODE ENGAGEMENT→ DISENGAGEMENT OF ASSOCIATED MODE ON THE VERTICAL AXIS

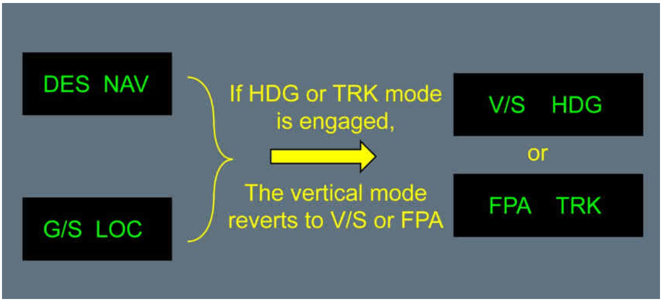
This reversion is due to the integration of the AP, FD, and ATHR with the FMS.
When the flight crew defines a F-PLN, the FMS considers this F-PLN as a whole (lateral + vertical). Therefore, the AP will guide the aircraft along the entire F-PLN:

- Along the LAT F-PLN (NAV – LOC – F-LOC modes)
- Along the VERT F-PLN (CLB – DES – G/S - F-G/S modes).

Vertical managed modes can only be used, if the lateral managed NAV mode is used. If the flight crew decides to divert from the lateral F-PLN, the autopilot will no longer guide the aircraft along the vertical F-PLN.
Therefore, in climb:



In descent:



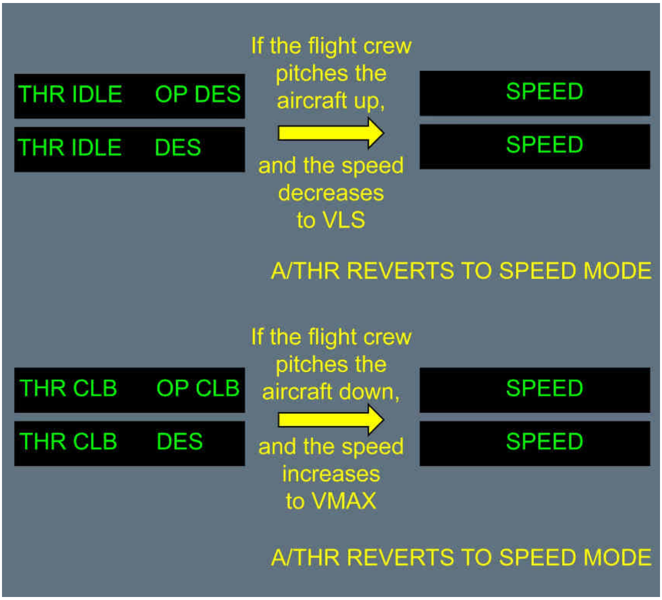
This reversion to V/S (FPA) mode on the current V/S target does not modify the pitch behavior of the aircraft. It is the flight crew's responsibility to adapt pitch, if necessary.

THE AIRCRAFT ENTERS A F-PLN DISCONTINUITY

NAV mode is lost, when entering a F-PLN discontinuity. On the lateral axis, the aircraft reverts to HDG (or TRK) mode. On the vertical axis, the same reversion (as the one indicated above) occurs.

THE PF MANUALLY FLIES THE AIRCRAFT WITH THE FD ON, AND DOES NOT FOLLOW THE FD PITCH ORDERS

If the flight crew does not follow the FD pitch orders, an A/THR mode reversion occurs. This reversion is effective, when the A/THR is in THRUST MODE (THR IDLE, THR CLB), and the aircraft reaches the limits of the speed envelope (VLS, VMAX):



A/THR in SPEED mode automatically readjusts thrust to regain the target speed. The FD bars will disappear, because they are not being followed by the PF.

TRIPLE CLICK

Applicable to: ALL

The "triple click" is an aural alert. It is an attention-getter, designed to draw the flight crew's attention to the FMA.
The PFD FMA highlights a mode change or reversion with a white box around the new mode, and the pulsing of its associated FD bar.
The reversions, described in the previous paragraph, are also emphasized via the triple click aural alert.

Note: *The triple click also appears in the following, less usual, cases:*

- *SRS → CLB (OPCLB) reversion: If, the flight crew selects a speed on the FCU*
- *The V/S selection is «refused» during ALT *: The flight crew pulls the V/S knob, while in ALT**
- *The V/S target is not followed, because the selected target is too high, and leads to VMIN/VMAX.*

PURPOSE OF THE ECAM

Applicable to: ALL

The Electronic Centralized Aircraft Monitoring (ECAM) system is a main component of Airbus' two-crewmember cockpit, which also takes the "dark cockpit" and "forward-facing crew" philosophies into account.

The purpose of the ECAM is to
- Display aircraft system information
- Monitor aircraft systems
- Indicate required flight crew actions, in most normal, abnormal and emergency situations.

The ECAM fully supports the no-paper cockpit concept, and enables to reduce the number of memory items.

MAIN PRINCIPLES

Applicable to: ALL

INFORMATION PROVIDED WHEN NEEDED

One of the main advantages of the ECAM is that it displays applicable information to the flight crew, on an "as needed" basis. The following outlines the ECAM's operating modes.

- **Normal Mode**
  Automatically displays systems and memos, in accordance with the flight phase.
  Automatically selects the applicable normal checklist, and displays this checklist upon flight crew request.
- **Failure Mode**
  Automatically displays the appropriate emergency/abnormal procedures, in addition to their associated system synoptic.
  Automatically adds deferred procedures linked to the failure, to the list of normal checklists.
- **Advisory Mode**
  Automatically displays the appropriate system synoptic, associated with a drifting parameter.
- **Manual Mode**
  Enables the flight crew to manually select any system synoptic via the ECAM Control Panel (ECP).
  Enables the flight crew to manually display any abnormal procedure corresponding to a non-detected failure.

Most warnings and cautions are inhibited during critical phases of flight (T/O INHIBIT – LDG INHIBIT), because most system failures will not affect the aircraft's ability to continue a takeoff or landing.

FAILURE LEVELS

The ECAM has three levels of warnings and cautions. Each level is based on the associated operational consequence(s) of the failure. Failures will appear in a specific color, according to defined color-coding system, that advises the flight crew of the urgency of a situation in an instinctive, unambiguous manner. In addition, Level 2 and 3 failures are accompanied by a specific aural warning: A Continuous Repetitive Chime (CRC) indicates a Level 3 failure, and a Single Chime (SC) indicates a Level 2 failure.

Failure Level	Priority	Color Coding	Aural Warning	Recommended Crew Action
Level 3	Safety	Red	CRC	Immediate
Level 2	Abnormal	Amber	SC	Awareness, then action
Level 1	Degradation	Amber	None	Awareness, then monitoring

When there are several failures, the FWC displays them on the Engine Warning Display (E/WD) in an order of priority, determined by the severity of the operational consequences. This ensures that the flight crew sees the most important failures first.

FEEDBACK

The ECAM provides the flight crew with feedback, after action is taken on affected controls:

- The System Synoptic:
  Displays the status change of affected components.
- The Memo:
  Displays the status of a number of systems selected by the flight crew (e.g. anti ice).
- The Normal Checklists
  When the flight crew has performed a required action, the related line of the checklist is shown in green (except for some systems or actions, for which feedback is not available).
- The Procedures
  When the flight crew performs a required action on the cockpit panel, the applicable line of the checklist usually changes from blue to white color (except for some systems or actions, for which feedback is not available).

The ECAM reacts to both failures and pilot action.

GENERAL

Applicable to: ALL

On ground, the ECAM MEMO is reviewed for feedback on temporarily-selected items (e.g. SEAT BELTS / IGNITION / ENG A-ICE), and to check whether IRs are aligned. If alignment is not complete, the time remaining will be displayed. It is, therefore, not necessary to refer to the Overhead panel.
In cruise, the main systems should periodically be reviewed during flight (ENG, BLEED, ELEC AC/DC, HYD, FUEL, F/CTL), to ensure that they are operating normally, and to detect any potential problem in advance.
The ECAM and PFD MEMO must be included in the instrument review. In cruise, in most of the cases, they should be blank. They help to make the flight crew aware of any system that a flight crewmember temporarily selected, but forgot to deselect.
An STS label, displayed at the bottom of the MEMO/limitations page of the E/WD, indicates that there is a STATUS to be reviewed. When STATUS review is an item of a checklist, it takes into account the STATUS content. It is displayed as green line if the STATUS is empty. It is displayed as a blue “NOT DETECTED” item, if it has to be reviewed.
If there is an STS at engine shutdown, it will pulse at the bottom of the E/WD. If this is the case, the STATUS page should be reviewed for help in completing the technical log.

HOW TO USE THE NORMAL CHECKLIST

Applicable to: ALL

INTRODUCTION

Airbus normal checklists are of a “non-action” type (i.e. all actions should be completed from memory before the flight crew performs the checklist).
The normal checklist includes nine flight phases. The BEFORE START, BEFORE TAKEOFF, and AFTER TAKEOFF checklists are divided in two sections: The “Down to the Line” section, and the “Below the Line” section. This format is designed to help flight crews to manage the workload.
For example, the “BEFORE START ” checklist may be called out, as soon as the Load and Trim Sheet is available and takeoff data is set, but it will be held at "down to the line". The “BEFORE START” checklist will be continued "below the line" after obtaining the start-up clearance.

HOW TO START A CHECKLIST

The Captain requests the NORMAL CHECKLIST on the ground. In-flight, the Pilot Flying(PF) requests the NORMAL CHECKLIST.
The First Officer reads the checklist on the ground. In-flight, the Pilot Monitoring(PM) reads the checklist. The pilot who is in charge of reading the checklists presses the C/L pb on the ECP,

selects the appropriate checklist using the "tick" pushbutton and reads the checklist title, then the checklist items.

NOT DETECTED ITEMS

The not detected items are referred to as “challenge/response”-type actions, and are identified by an open blue box to the left of the action. The PM/FIRST OFFICER reads the left part of the line, and the PF/CAPTAIN “responds” to the “challenge” only after checking the current status of the aircraft.
If the current status of the aircraft does not correspond to the checklist response, the PF/CAPTAIN must take corrective action before “responding” to the “challenge”. If corrective action is not possible, then the PF/CAPTAIN must modify the response to reflect the real situation (with a specific answer). When necessary, the other flight crewmember must crosscheck the validity of the response.
The challenger (PM/FIRST OFFICER) waits for a response corresponding to the checklist , before validating the item, using the TICK pb.
For the checklist items that are identified as “AS RQRD”, the response should correspond to the real condition or configuration of the system.

DETECTED ITEMS

The completed items detected by the ECAM appear in green. The PM/FIRST OFFICER does not read these items.
The items monitored by ECAM, which are not yet completed, appear as “challenge/response”-type actions, in blue color. The PM/FIRST OFFICER reads the left part of the line, and the PF/CAPTAIN must take corrective action before “responding” to the “challenge”. As for not detected items, if corrective action is not possible, then the PF/CAPTAIN must modify the response to reflect the real situation (with a specific answer).

HOW TO CLOSE A CHECKLIST

When the PM/FIRST OFFICER completes the last item of the down to the line section, he calls “DOWN TO THE LINE“. When the PF/Captain wants to continue the checklist, he calls “BELOW THE LINE“.
When the all checklist is completed, the PM/FIRST OFFICER must announce, for example: “LANDING CHECKLIST COMPLETED”.
The PF/CAPTAIN must check that there is no blue line on the screen, before responding “CHECKED”.
Then, the PM/FIRST OFFICER ticks the last line “C/L COMPLETED”.

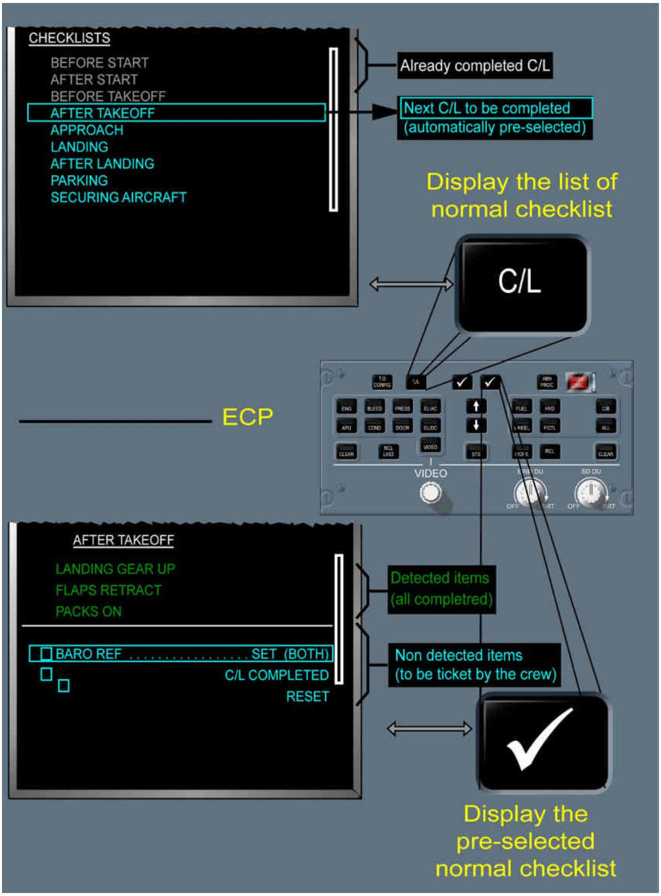
Note: If some checklist items are not validated intentionally, the "C/L COMPLETED" line can still be validated and the checklist will be considered as completed. This may be the case after a system failure, which may prevent some checklist items from being completed. As result on the checklist menu the checklist will appear as a grey line.

CHECKLIST RESET

In some particular cases the flight crew may want to do again a completed checklist (for example, the takeoff checklist after a long standby, or any checklist after an error). For this purpose, he must select the checklist, then tick the RESET line. This automatically resets all the subsequent checklists as well

Note:
1. The first checklist of the flight must be manually reset.
2. In case of go-around, the after takeoff checklist (and following checklists) are reset.

checklists


CHECKLISTS
BEFORE START
AFTER START
BEFORE TAKEOFF
AFTER TAKEOFF
APPROACH
LANDING
AFTER LANDING
PARKING
SECURING AIRCRAFT
Already completed C/L
Next C/L to be completed
(automatically pre-selected)
Display the list of
normal checklist
C/L
ECP
VIDEO
AFTER TAKEOFF
LANDING GEAR UP
FLAPS RETRACT
PACKS ON
BARO REF .... SET (BOTH)
C/L COMPLETED
RESET
Detected items
(all completred)
Non detected items
(to be ticket by the crew)
Display the
pre-selected
normal checklist

HANDLING OF ADVISORY

Applicable to: ALL

The flight crew member that first notices an advisory announces: "ADVISORY on XYZ system". Then, the PF/CAPTAIN requests the PM/FIRST OFFICER to review the drifting parameter. If time permits, the PM/FIRST OFFICER may refer to the FCOM on the OIS, containing recommended actions in various advisory situations.

IN CASE OF ECAM WARNING OR CAUTION

Applicable to: ALL

TASK SHARING RULES

When the ECAM triggers a warning or a caution, the first priority of the flight crew is to maintain a safe flight path.

The success of any ECAM procedure depends on the flight crew's ability to:
- Correctly read and apply of the procedure
- Effectively share tasks
- Consciously monitor and carefully crosscheck.

It is important to remember that after the PF announces "ECAM ACTIONS"::
- The PF's task is to fly the aircraft, navigate, and communicate.
- The PM's task is to manage the applicable failure, if and when requested by the PF.

The PF usually remains the PF for the entire flight, unless the Captain decides to take control. For standard callout, *Refer to NO-260 PF/PNF Duties Transfer*.

The PF has the responsibility to:
- Control the aircraft flight path, aircraft speed, aircraft configuration and the engines
- Manage aircraft navigation and communication
- Initiate the ECAM actions to be performed by the PM
- Request the PNF to perform applicable actions. For standard callout, *Refer to NO-260 PF/PM Duties Transfer*
- Check and ensure the ECAM actions are correctly completed.

The PM has the responsibility to manage the ECAM actions after the PF announces "ECAM ACTIONS", and to assist the PF on request as follow:
- Read the ECAM actions and checklist aloud
- Perform actions on PF request
- Obtain PF confirmation before clearing any actions.

Note: *The PM must never operate or touch the thrust levers, even if requested by the ECAM.*

Before operating or selecting some controls (i.e. ENG MASTER sw, FIRE pb, IR MODE selector, , all guarded switches (e.g. DRIVE pb), and reset buttons), the PF and the PNF must crosscheck these controls. This crosscheck prevents the flight crew from performing inadvertently any irreversible actions.
The cockpit overhead panels are clearly labelled, in order to help the flight crew to correctly identify all applicable systems and controls. When the ECAM requires the flight crew to perform an action on the controls of the overhead panel, the flight crew is able to rapidly identify and find the correct system panel via the white label (uppercase) that is on the side or top of each panel.
The PM should call out information in the following sequence before performing any action: "Name of the system, then name of the selector, then the action (e.g. “AIR, CROSSBLEED, CLOSE”).
The use of this approach, and announcement of a planned action enable the PM to keep the PF informed of the progress of the procedure.
It is important for flight crew to remember that, after the PF announces "ECAM ACTIONS" , in the case of system failure, the FAULT light of the applicable control will come on in amber, in order to enable the flight crew to correctly identify the applicable system control on the overhead panel.
After the selection of a control, the PM should check the SD to verify that the selected action occurred (e.g. The closure of the crossbleed valves shouldchange the indications that appear on the SD).

PF	PM
•First pilot who notices MASTER CAUTION/MASTER WARNING............. RESET ANNOUNCE....................................“TITLE OF FAILURE”	
FLY THE AIRCRAFT PFD LIMITATIONS...................................... CHECK ORDER.................................... "ECAM ACTIONS" (2)	ECAM..CONFIRM (1)
(3) ECAM ACTION COMPLETE......................... CHECK CONFIRM.."CLEAR"	ECAM ACTIONS...PERFORM REQUEST.."CLEAR [Name of system]” ECAM..."CLEAR" (4)
(5) CONFIRM.."CLEAR"	SYSTEM PAGE...ANALYSE REQUEST.."CLEAR [Name of system]” SYSTEM DISPLAY... CLEAR
CONFIRM .... "STATUS" (6) **•If DEFERRED PROCEDURE is indicated** (7) REQUEST.. "READ FOR APPROACH: DEFERRED PROC"	ANNOUNCE..."STATUS" STATUS ....READ ANNOUNCE...................... "FOR APPROACH: DEFERRED PROC" C/L pb ....PRESS (8) FOR APPROACH DEFERRED PROC.............. SELECT and READ REQUEST............ "CLEAR FOR APPROACH: DEFERRED PROC"

Continued on the following page

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PF	PM
CONFIRM.. CLEAR	FOR APPROACH DEFERRED PROC........................ CLEAR C/L MENU PAGE..CLEAR
•If LIMITATIONS are indicated: *(9)*	
REQUEST.......................... "READ LIMITATIONS" *(10)*	ANNOUNCE.."LIMITATIONS" LIMITATIONS..READ REQUEST.. "REMOVE STATUS"

Continued on the following page

Continued from the previous page

PF	PM
CONFIRM................................ REMOVE STATUS	STATUS...REMOVE ANNOUNCE......................... "ECAM ACTIONS COMPLETED" (11)
SITUATION ASSESMENT/DECISION/INFORMATION (12)	

(1) *The PM should review the overhead panel and/or associated SD to analyze and confirm the failure, prior to taking any action and should bear in mind that the sensors used for the overhead panel and/or SD are different from the sensors that trigger failure.*

(2) *In the case of a failure during takeoff or go-around, ECAM actions should be delayed until the aircraft reaches approximately 400 feet, and is stabilized on a safe trajectory. This is an appropriate compromise between stabilizing the aircraft and delaying action.*

(3) *When the ECAM displays several failures, the sequence (action, then request and confirmation, before clearance) should be repeated for each failure. When all necessary actions are completed, amber messages and red titles will no longer appear on the E/WD.*

(4) *Before using the CLEAR pb, the PM should look at the “CLEAR” bar, on the right side of screen. It indicates the lines that are going to be cleared. Even if the procedure is in overflow, the CLEAR bar clears only what is displayed on the screen.*

(5) *When the ECAM displays several system pages, the sequence (request and confirmation before clearance) should be repeated for each system page. For some system pages, “MORE” option is proposed, to be reviewed at Flight Crew discretion.*

(6) *The PF may call out “STOP ECAM” at any time, if other specific actions must be performed (normal C/L, or performing a system reset). When the ECAM is stopped to carry out a normal C/L, a white FAILURE PENDING message appears on the EWD to remind the crew that the abnormal C/L is not completed. When the action is completed, the PF must call out: “CONTINUE ECAM”.*

(7) *Deferred procedure can be “All phases”, “for approach” or “for landing”. When several deferred procedures are displayed (for example deferred for approach and deferred for landing), the sequence should be repeated for each deferred procedure. At this stage, referring to the DEFERRED PROCEDURES is only a quick review to evaluate the workload for each flight phase.*

(8) *Deferred procedure are inserted in the NORMAL C/L menu.*
If a deferred procedure shows “LDG DIST COMPUTATION...CONFIRM” or “LDG PERF COMPUTATION...CONFIRM”, the flight crew should use the OIS PERF application when ECAM ACTIONS are completed, to compute the corresponding landing distance penalty for decision making.

(9) *The C/L menu page must be cleared from the upper screen, so as to revert to basic display (MEMO/limitations).*
All the limitations are displayed on the EWD. Limitations that have an immediate impact on the flight (e.g. max speed) are repeated on the lower part of the PFD thus enhancing the crew awareness.

(10) *In the case of STATUS overflow, the PM will scroll the STATUS pages using the STS pb. If “MORE” is proposed on the last STATUS page, MORE information can be reviewed, at Flight Crew discretion, after complete review of the STATUS.*
To remove the STATUS, the PM presses the STS pb.

(11) *When ECAM actions have been completed, and the ECAM status has been reviewed, the PM may refer to the FCOM procedure on the OIS for supplementary information, if time permits. However, in critical situations the flight should not be prolonged only to consult the FCOM.*

(12) *When the ECAM actions are completed, FCOM consulted as required, it is time for situation assessment, decision and information:*

Situation assessment consists in making a synthesis of the failure operational impacts for the remaining of the flight. The crew will also take into consideration any impact on RVSM, RNP (FCOM/Special operations) and CATII/III operations.
Decision should take into consideration the operational, maintenance and commercial aspects.
Information should be given to cabin crew, passengers, ATC and airline as required.

IF THE ECAM WARNING (OR CAUTION) DISAPPEARS WHILE APPLYING THE PROCEDURE:

If an ECAM warning disappears, while a procedure is being applied, the warning can be considered no longer applicable. Application of the procedure can be stopped.
For example, during the application of an engine fire procedure, if the fire is successfully extinguished with the first fire extinguisher bottle, the ENG FIRE warning disappears and the procedure no longer applies. Any remaining ECAM procedures should be performed as usual.

IN APPROACH

Applicable to: ALL

STATUS, deferred procedures and pertinent limitations will be reviewed during the approach preparation.
When necessary, the flight crew will use the OIS PERF application to compute the VAPP and landing distance.
Then, when the flight crew selects CONF 1 for approach, or sets QNH (QFE) during descent (when APPR C/L should be requested), the SD automatically displays the STATUS (if not empty).
When performing the APPROACH C/L, the flight crew must use the STS pbto remove the STATUS page. This is because, at that time, any action on the CLEAR pb would clear the checklist, but not the STATUS page.

NOT-SENSED PROCEDURE

Applicable to: ALL

Some emergency and abnormal procedures are not automatically displayed on the ECAM . These procedures also referred to as not-sensed procedures, and are manually requested by the flight crew. The not-sensed procedures are available on the ABNORMAL PROC menu of the ECAM . The flight crew can access and display on the EWD the ABNORMAL PROC menu by pressing the ABN PROC pb on the ECP . The emergency procedures that require immediate access, appear on the first part of the ABNORMAL PROC menu. The other abnormal procedures are in system submenus.
For more information, *Refer to FCOM/DSC-31-40-10-00001135 Sensed and Not-Sensed Procedures*
.

When the flight crew displays a not-sensed ABN PROC, the procedure appears in grey. This prevents the flight crew:
- To apply the procedure without activating the procedure,
- To display limitations or memos associated to this procedure.

To activate the procedure, the flight crew validates the ACTIVATE line of the procedure. When the procedure is activated, the flight crew carries out the procedure as any other procedure automatically displayed by the ECAM .
If the procedure is no longer applicable, the flight crew must deactivate the procedure (by deselecting the ACTIVATE line), in order to remove any aircraft limitations or memos associated to this procedure.
For instance, following the not-sensed emergency procedure FIRE SMOKE/FUMES application, the source of smoke has been identified and stopped. Thus, the FIRE SMOKE/FUMES emergency procedure must be deactivated to remove the limitation LAND ASAP .

The flight crew must not activate a not-sensed procedure to consult or discuss a procedure for the following reasons:
- If limitations and/or memos are associated with this procedure they will appear on the PFD and/or the EWD
- When some not-sensed procedures are activated (e.g. VOLCANIC ASH ENCOUNTER), a message is sent to the ground in order to inform the maintenance crew
- Some not-sensed procedures have many lines, and the EWD may not display the procedure on a single page. In such a case, if the flight crew consults the procedure, while the procedure is not activated, the flight crew will not have access to the lines of the procedure in the overflow.

Therefore, if the flight crew needs to consult, or discuss a not-sensed procedure, the flight crew must use the FCOM .
When the flight crew knows the not-sensed procedure to apply, the flight crew applies the following task sharing to activate the not-sensed procedure.

PF	PNF
ORDER.................................... SELECT "Tittle" ABN PROC	"Title" ABN PROC............................ SEARCH and SELECT
When the "Title" ABN PROC appears on the EWD	
ORDER.. ECAM ACTIONS	
Resume normal task sharing (1)	

(1) After the PF orders "ECAM ACTIONS", the PNF will activate the not-sensed procedure and will handle the ACTIVATE line as any other ECAM line.

ADDITIONAL ITEMS

Applicable to: ALL

MEMORY ITEMS

There are very few memory items

- Emergency descent initiation
- First reaction, in case of an unreliable speed indication
- Loss of braking
- Windshear (reactive & predictive)
- TAWS

LAND ASAP / LAND ANSA

In some cases, the ECAM displays:

- RED LAND ASAP:
  Land as soon as possible at the nearest suitable airport at which a safe approach and landing can be made.
- AMBER LAND ANSA :
  Advice to the flight crew to consider landing at the nearest suitable airport.

Note: *The CLOSEST AIRPORTS MFD page may help the flight crew to determine the nearest suitable airport: This page displays the four airports that are the nearest to the aircraft's current position. These airports are found in the navigation database, and are displayed regardless of their suitability. The flight crew should keep in mind that the four closest airports are sorted according to distance, and should refer to the Estimated Time of Arrival (ETA)*

CONDITIONAL ITEMS

Some parts of a procedure have to be applied only under some conditions.
In most cases, the ECAM displays the condition with a tick box, and the associated lines are grey (that means: not applicable), until the crew tick the condition. In some particular cases, when the procedure is long, the associated action lines are hidden until the flight crew tick the condition. When the condition is met, the flight crew tick the box and the associated action lines are displayed in blue as they become applicable.

IN CASE OF AN ECAM SYSTEM FAULT

Applicable to: ALL

DISPLAY UNIT FAILURE

If one ECAM screen fails, the remaining one will display the E/WD.

A double ECAM screen configuration can be recovered using the RECONF pb on the PNF side.
- If the Captain is the PM, the SD will be recovered on his MFD screen
- If the First Officer is the PM, the SD will be recovered on his ND screen

ECP FAILURE

In the case of an ECP failure, the CLR pb, RCL pb, STS pb, ALL pb, EMER CANC pb, tick and up/down arrow keys will continue to operate, because they are hardwired to the FWS. Therefore, the ALL key can be used to scroll all SD pages and display the desired one (by releasing the key, when the desired SD page appears).

FLUCTUATING CAUTION

Any fluctuating caution can be deleted with the EMER CANC pb. When pressed, the EMER CANC pb deletes both the aural alert, and the caution for the remainder of the flight. This is indicated on the STATUS MORE page, by the “CANCELLED CAUTION” title. Any caution messages that have been inhibited via the EMER CANC pb can be recalled by pressing and holding the RCL key for more than three seconds.
The EMER CANC pb inhibits any aural warning that is associated with a red warning, but does not affect the warning itself.

NORMAL OPERATIONS

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NO-PLP PRELIMINARY PAGES

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NO-220 Landing

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NO-240 Parking

NO-260 Standard Callouts

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GENERAL

Applicable to: ALL

The Normal Operations chapter outlines the techniques that the flight crew should apply during each flight phase, in order to optimize the use of the aircraft. The flight crew should read the Normal Operations chapter in complement of the FCOM which provides the normal procedures and their associated tasksharing, callouts, and checklists.
All of the following flying techniques are applicable to normal conditions.
The Adverse Weather part of the Supplementary Information chapter addresses other techniques applicable to adverse weather conditions.

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MEL

Applicable to: ALL

GENERAL

The Master Minimum Equipment List (MMEL) is published by the aircraft manufacturer. It is an approved document that enables an aircraft to be dispatched, with some equipment, systems, or functions inoperative, for a limited period of time. Some limitations, operational procedures and/or maintenance procedures may have to be performed.
The Minimum Equipment List (MEL) is published by the operator, and approved by local authorities. It must be at least as restrictive as the MMEL. The MMEL cannot be used to replace the MEL.
Aircraft can be dispatched with one, or more, secondary airframe parts missing. In this case, the flight crew must refer to the Configuration Deviation List (CDL), in the Aircraft Flight Manual.

MMEL PHILOSOPHY

To introduce an item in the MMEL, the manufacturer must demonstrate first that the consequences of the system failure are no more than minor on the flight. The manufacturer must demonstrate then, that the next critical failure, i.e. the failure that has the most critical effect on aircraft operation when added to the initial failure, maintains the level of safety.
In some cases, this level of safety is maintained provided operational (o) or maintenance (m) procedures are observed.

ATA 100 FORMAT

All items/equipment listed in the MEL are identified using the Air Transport Association (ATA) format. The ATA is the preferred reference for the classification of aircraft systems and/or functions. The aircraft systems/functions are classified with six digits. For example, 29-10-08 refers to:

29: ATA 29: Hydraulic
10: Main Hydraulic Power
08: EDP Disconnection Function

MEL DESCRIPTION

The MEL has three main sections:

- MEL Entries
- List of items that may be inoperative for dispatch
- Associated operational procedures

Some MEL may also contain the associated maintenance procedures.

MEL OPERATIONAL USE

The MEL applies to revenue flights, and should be consulted before taxi out. If a failure occurs during taxi out, and before the take off roll starts, the decision to continue the flight is subject to pilot judgment and good airmanship. The Captain may consult the MEL before deciding to continue the flight (particularly if the failure has an effect on the takeoff performance).
During preliminary cockpit preparation, the flight crew must press the RCL P/B, for at least 3 seconds, in order to recall any previous cautions or warnings that have been cleared or cancelled. The flight crew must also consult the technical logbook to confirm that the indications are compatible with the MEL.
The purpose of the MEL ENTRIES section is to help the flight crew to determine the MEL entry point. It provides the relationship between the failure symptom (ECAM alerts, ECAM advisories, crew observation) and MEL items, if applicable.
If a failed item does not appear in the MEL, it is not possible to dispatch the aircraft, except if the item is not related to airworthiness or operating requirements (for example galley equipment, entertainment systems, or passenger convenience items). The dispatch applicability of these items is not relevant to the MEL.

In most cases, if the failed item appears in the MEL, the dispatch of the aircraft is authorized, provided that all dispatch conditions are fulfilled:

- Check the rectification time interval has not expired
  - A: No standard interval is specified, however, items in this category shall be rectified in accordance with the conditions stated in remark column
  - B: Items in this category shall be rectified within three consecutive calendar days, excluding the day of discovery
  - C: Items in this category shall be rectified within ten consecutive calendar days, excluding the day of discovery
  - D: Items in this category shall be rectified within one hundred and twenty consecutive calendar days, excluding the day of discovery
- Consider location and, where repair is possible
- (x) Means that an INOP placard is required
- (o) Means that a specific operational procedure or limitation is required (Refer to MEL Operational Procedures chapter)
- (m) Means that a specific maintenance procedure is required.

The flight crew should also tick the check box of the related item, so as to have it taken into account for performance computation.

When several flights are performed with the same inoperative item, the operational procedure should be repeated before each flight. The periodicity of the maintenance procedure is usually indicated in the MEL.

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GENERAL

Applicable to: ALL

The preliminary cockpit preparation has 5 steps:
- Power-up, only if the aircraft is not yet electrically supplied
- OIS initialization
- ECAM/Logbook check
- Fire tests and APU start
- OIS preparation.

AIRCRAFT POWER-UP

Applicable to: ALL

The flight crew should not perform this step if the aircraft is already electrically supplied.
The objective of this step is to perform the initial safety checks, before applying electrical power.
The electrical starting sequence can take up to 30 s before all displays are available.

APU AND ENG FIRE TEST/ APU START

Applicable to: ALL

The flight crew performs the engine and APU fire tests by using one common TEST pb. Therefore, even if the APU is already running, the flight crew should press the TEST pb to test the ENG FIRE system.
The flight crew should set to ON the RMP before the APU start, and select the appropriate frequency for an emergency call, if necessary (e.g. APU fire).

OIS PREPARATION

Applicable to: ALL

Usually, during the preliminary cockpit preparation phase, the workload of the flight crew is not too heavy. Both flight crewmembers should therefore take this opportunity to work together. Each flight crewmember should enter the necessary data in the OIS T.O PERF application, taking into account any applicable MEL/CDL items, and compute the preliminary takeoff performance data.
Both flight crewmembers should independently perform the preliminary takeoff performance computation, and then crosscheck the results. This crosscheck validates the entries made by both flight crew members. The CAPT announces the results, the F/O crosschecks with his/her own computation. These preliminary takeoff performance results are then available for the flight crew to enter them in the FMS during the cockpit preparation. Additionally, both OITs are ready for takeoff performance computation, if the takeoff conditions change at the last minute.

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BEFORE WALKAROUND

Applicable to: ALL

The flight crew must check the systems, even if the maintenance personnel performs the walkaround.

OXYGEN

The DOOR SD page displays the oxygen pressure. If the oxygen pressure for cockpit or cabin is below a defined threshold, an amber half-frame highlights the value. This advises the flight crew that the bottle should be refilled. The flight crew should refer to the minimum oxygen pressure that is provided in the FCOM Limitations. *Refer to FCOM/Cockpit Oxygen Limitation* or *Refer to FCOM/Cabin Oxygen Limitation* . The prolonged dispatch of the aircraft in such condition is not recommended.

EXTERIOR WALKAROUND

Applicable to: ALL

Standard Operating Procedures (SOP) outline the various elements that the flight crew must review in detail. The objectives of the exterior walkaround are:

- To obtain a global assessment of the aircraft status
  The flight crew checks any missing parts or panels. They should consult the Configuration Deviation List (CDL) for dispatch, and evaluate any operational consequences.
- To ensure that main control surfaces are in the appropriate position compared to the surface control levers
- To check that there are no leaks: E.g. engine drain mast, hydraulic lines
- To check the condition of the essential visible sensors, i.e. MFP, pitot and static probes
- To observe any abnormal condition of the landing gear:
  - Cuts, wear, or cracks on wheels and tires
  - Safety pins should be removed
  - Brakes conditions
    Check the length of the brake wear pin on the body landing gears, with parking brake set to ON.
  - Length of shocks absorbers.
- To observe any abnormal condition of the engines:
  - Fan blades, turbine exhaust, engine cowl and pylon condition
  - Access door should be closed
  - Thrust reverser door condition.

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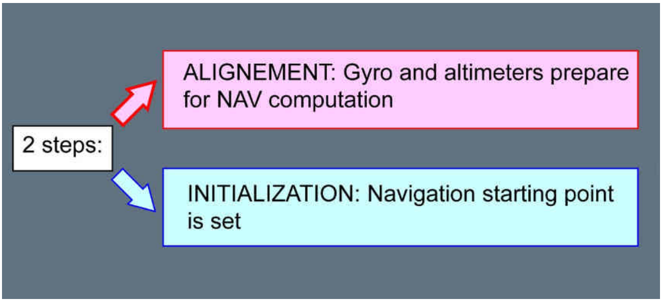
ADIRS INITIALIZATION

Applicable to: ALL



ALIGNEMENT

At the beginning of the pre-flight checks, the crew sets the ADIRS selectors to NAV, in order to start alignment.
The alignment takes approximately 10 minutes, and must be completed before pushback (before any aircraft movement).

IN TRANSIT:

ADIRS re-alignment is only necessary, if one of the ADIRS displays a residual ground speed greater than 5 kt.
In this case, a rapid re-alignment should be performed on all 3 IRSs (by setting all the ADIRS to OFF, then all back to ON within 5 seconds). The fast alignment takes approximately one minute.
It involves setting the ground speed to 0, and updating the IRS position to the position of the coordinates on the INIT page .

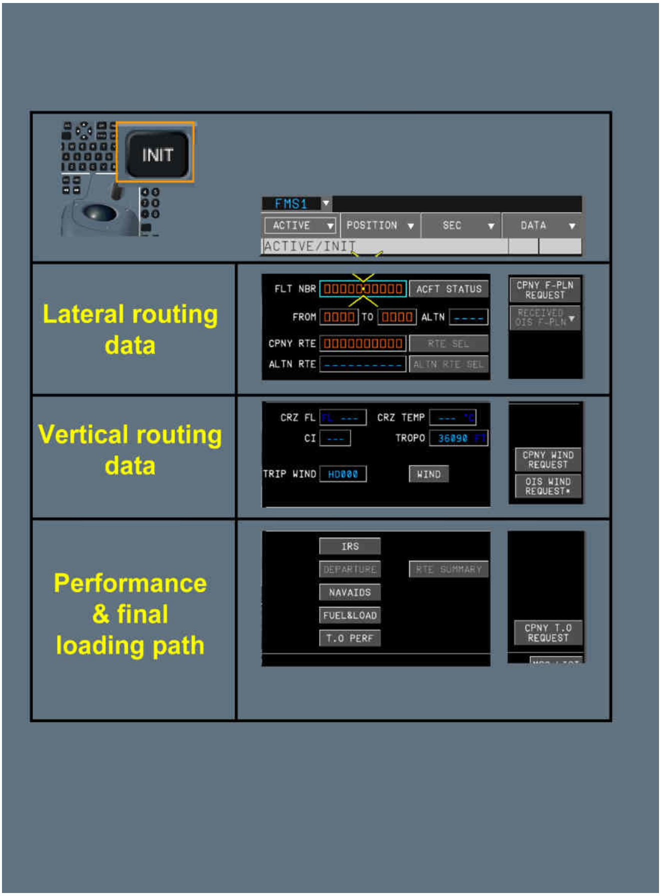
INITIALIZATION

The ADIRS are automatically initialized at the GPS position. These GPS coordinates are displayed on the MFD POSITION/MONITOR page, in replacement of the airport reference coordinates, after the pilot entered the FROM-TO city pair.
When performing the BEFORE START C/L, the crew will check that the IRS IN ALIGN ECAM MEMO has disappeared, as a confirmation that the ADIRS are in NAV mode.

FMS PROGRAMMING

Applicable to: ALL

FMS programming involves inserting lateral data, vertical data and then the final loading path. The FMS programming is launched with the INIT function. The automatic cursor jump eases to review each active area. If the automatic FMS programming path is left, whatever the reason, it should be resumed.



It is to be noted that:

- Amber boxed fields must be filled
- Blue fields inform the crew that entry is permitted
- Green fields are used for FMS generated data, and cannot be changed
- Magenta characters identify limits (altitude, speed or time), that FMS will attempt to meet
- Yellow characters indicate a temporary flight plan display
- Amber characters signify that the item being displayed is important and requires immediate action

- Small green font signifies that data is FMS computed
- Large blue font signifies manually entered data
- (*) indicates that the parameter change will affect the active situation of the aircraft
- --- indicates data being computed for display
- ∆ adjacent to a waypoint that the aircraft must over fly the waypoint

To obtain correct predictions, the fields of the various pages must be completed correctly, with available planned data for the flight.
At power up, the DATA/STATUS page comes automatically. The database validity, pilot stored elements and PERF FACTOR can be checked at this stage. For transit stop, the DATA/STATUS page is not necessarily displayed but is reviewed through the automatic cursor jump.
The FMS programming is launched with the INIT short cut. Then, the automatic cursor jumps should be followed.

LATERAL ROUTING DATA

- Define the route, and alternate

VERTICAL ROUTING DATA

The trip wind facility is available if the wind profile has not already been entered. The FMS uses the trip wind for the entire flight from origin to destination. The trip wind is an average wind component that may be extracted from the Computerized Flight Plan (CFP).

ACTIVE/WIND page:
The history wind is the vertical wind profile, that has been encountered during the previous descent and should be entered at this stage if it is representative of the vertical wind profile for the flight. If this field is selected, it will erase the "trip wind" previously inserted.

PERFORMANCE AND FINAL LOADING PATH

POSITION/IRS page:
GPS position is shown. It will be used automatically for ADIRS initialization.

DEPARTURE

ACTIVE/FPLN/DEPARTURE page:
tobe completed thoroughly including:

- The take-off runway
- SID
- Correct transition to the cruise waypoint

→ ACTIVE/FPLN page:

- Check altitude and speed constraints
- Insert intended step climb/descents, according to the Computerized Flight Plan (CFP).
- If time permits, the wind profile along the flight plan may be inserted using vertical revision through wind prompt.
- The flight crew should also check the overall route distance (lower part of the ACTIVE/F-PLN page), versus CFP distance.

NAVAIDS

POSITION/NAVAIDS page:
When required, NAVAID should be manually entered using ident.
If a NAVAID is reported on NOTAM as unreliable, it must be deselected on the TUNED FOR FMS NAV next index. To deselect a navaid, enter the NAVAID ident on the list of deselected NAVAIDS.
The crew will pay particular attention not to mismatch with the GPS box.

ACTIVE/FUEL & LOAD page:
The flight crew:

- Inserts the expected ZFW/ZFWCG and the block fuel to initialize a F-PLN computation
- Checks fuel figures consistent with flight preparation fuel figures

ACTIVE/PERF page:
The thrust reduction altitude/acceleration altitude (THR RED / ACC) are set to default at 1500ft, or at a value defined by airline policy. They may be changed , if required. The flight crew should consider the applicable noise abatement procedure.
The one-engine-out acceleration altitude must:

- Be at least 400 ft above airport altitude
- Ensure that the net flight path is 35 ft above obstacles (50 ft in turn)
- Ensure that the maximum time for takeoff thrust is not exceeded.

The one-engine-out acceleration altitude is usually defaulted to 1500 ft AGL, and may be updated as required.
The flight crew uses the ACTIVE/PERF CLB page to pre-select a speed. For example, "Green Dot" speed for a sharp turn after take-off.
The crew may also check the CRZ FL, MAX REC FL and OPT FL on any ACTIVE/PERF page.

F-PLN CROSS CHECK

When the FMS has been programmed by the FIRST OFFICER, the CAPTAIN should then cross check the FMS programation.
When the predictions are available, the crew may print the preflight data. This print provides all the predictions that may be used during the initial part of the flight.

SECONDARY F-PLN

When the F-PLN has been crosschecked, the SEC/INDEX page is accessed through the SEC INDEX function

Three secondary FPLNs are available. The secondary FPLNs should be used to consider:

- A return to departure airfield or a routing to a take-off alternate
- An alternate runway and corresponding SID for take-off
- SEC3 should be dedicated to uplink.

The SWAP/ACTIVE key allows swapping the dedicated SEC FPLN with the active FPLN (Active F-PLN remains available).
SEC pages are quite similar to ACTIVE pages (EX: ACTIVE/PERF and SEC/PERF). As a general rule, it is a good practice, before programming any MFD page, to read each page title to avoid any mismatch.

TAKEOFF BRIEFING

Applicable to: ALL

The PF should perform the takeoff briefing at the gate, when the flight crew workload permits, cockpit preparation has been completed and, before engine start.
The takeoff briefing should be relevant, concise and chronological. When a main parameter is referred to by the PF, both flight crewmembers must crosscheck that the parameters have been set or programmed correctly.
The PF will use the KCCU keys (INIT for FUEL& LOAD, PERF, F-PLN) to select the relevant MFD pages.
The takeoff briefing covers the following:

1. Miscellaneous	
Aircraft technical status (relevant MEL and CDL considerations, relevant OEB) NOTAMS Weather RWY conditions Use of ENG/Wings Anti Ice Expected Taxi Clearance (if required, for instance: complex airports) Use of Radar Use of Packs for Takeoff	
2. FUEL & LOAD PAGE	
Block Fuel √	**(FOB on EW/D)**
Estimated TOW Extra Fuel/time at destination	
3. PERF TO PAGE	
T/O RWY T/O CONF	
FLEX / TOGA √	**(FLEX / TOGA on EW/D)**
V1, VR, V2 √	**(V1, V2 on PFD)**
TRANS ALT THR RED / ACC Altitude	
4. F-PLN PAGE	
Minimum Safe Altitude	**(paper charts versus VD)**
First assigned FL √	**(altitude target in blue on PFD)**
Flight Plan description √	**(SID on MFD FPLN page)**
Only if GPS PRIMARY not Avail:	
RAD NAV √	(RAD NAV on ND)
Abnormal operations	

Continued on the following page

Continued from the previous page

In case of failure before V1:

CAPT will call “STOP” or “GO”

In case of failure after V1:

Continue T/O, No action should be done before 400ft AGL (except gear up) and flight path stabilized
Reaching 400ft AGL, ECAM actions
Reaching EO ACC altitude, Stop ECAM, Push for ALT, acceleration and clean up
At green dot: OP CLB, MCT, continue ECAM, after T/O C/L, status
ENG Out routing: EOSID, SID, radar vector, immediate return, overweight landing

√ Items that must be cross-checked on the associated display.

FMS UPDATING

Applicable to: ALL

When the load and trim sheet is available, the flight crew will update as required the figures in the FUEL & LOAD page:
- Updates the ZFWCG/ZFW,
- Checks that the TOW is consistent with the load sheet,
- Checks the updated fuel figures.

And the ACTIVE/PERF TO page:
- Computes the FLEX TEMP and the take-off speeds as required
- Enters the THS position
- Uses the AUTO GND XFER as required

FINAL TAKEOFF PERFORMANCE

Applicable to: ALL

If takeoff conditions change before engine start, both flight crew members should update the affected/applicable parameter(s) in the OIS PERF TAKEOFF application, recompute the takeoff performance data, and crosscheck the results.

Experience has demonstrated that a simple visual check by one flight crew member of the entries made by the other flight crew member does not prevent significant errors. Therefore, both flight crew members should recompute the data independently, as follows:
- The First Officer should enter the resulting data in theMFD PERF TAKEOFF page, and
- The Captain should crosscheck theFIRST OFFICER'S entries with his own results.

Crosschecking the results also ensures that both OITS are immediately ready for any additional computations, by any flight crew member, if necessary (e.g. in the case of a runway change, or takeoff condition change during taxiing).

SEATING POSITION

Applicable to: ALL

To achieve a correct seating position, the aircraft is fitted with an eye-position indicator on the centre windscreen post. The eye-position indicator has two balls on it. When the balls are superimposed on each other, they indicate that the pilot's eyes are in the correct position.
The flight crew should not sit too low, to avoid reducing the visual segment. During Low Visibility Procedures (LVP), it is important that the pilot's eyes are positioned correctly, in order to maximize the visual segment, and consequently, increase the possibility of achieving the required visual reference for landing as early as possible.

After adjusting the seat, each pilot should adjust the outboard armrest, so that the forearm rests comfortably on it, when holding the sidestick.
There should be no gaps between the pilot's forearm and the armrest. The pilot's wrist should not be bent when holding the sidestick. This ensures that the pilot can accomplish flight maneuvers by moving the wrist instead of lifting the forearm from the armrest.
Symptoms of incorrect armrest adjustment include over-controlling, and not being able to make small, precise inputs.
The rudder pedals must then be adjusted to ensure the pilot can achieve both full rudder pedal displacement, and full braking simultaneously on the same side.
The armrest and the rudder pedals have position indicators. These positions should be noted and set accordingly for each flight.

INTRODUCTION

Applicable to: ALL

Engines usually start using the Automatic Starting function. The Full Authority Digital Engine Control (FADEC) systems control this engine Automatic Starting function, and takes appropriate action, if engine parameters are exceeded. This function extends significantly the duration of engine life.
The thrust levers must be confirmed at ”idle” before engine-start. If the thrust levers are not at ”idle”, the thrust increases above idle after engine-start, and can result in a hazardous situation. However, an ENG START FAULT ECAM alert triggers, to indicate that the flight crew must set the thrust levers to “idle”.

AUTOMATIC STARTING SEQUENCE

Applicable to: ALL

The APU bleed enables to start two engines simultaneously. The engines are started in sequence: Engines 1 and 2, then engines 3 and 4.
When the ENG START selector is set to START, the FADECs are electrically-supplied. When there is sufficient BLEED pressure, the CAPTAIN begins the start sequence by setting the ENG MASTER levers 1 and 2 to ON. A white attention-getting box identifies the starting engines parameters. The flight crew should monitor the start sequence:

- Start valve opens
- N2 increases
- IGN A(B)
- Fuel flow
- EGT
- N1
- Oil pressure increases
- Start valve closes
- IGN indication off.

After reaching the peak EGT , or when AVAIL appears on the EWD , the CAPTAIN can start engines 3 and 4.
For more information, *Refer to FCOM/Automatic engine start.*

AVERAGE IDLE ENGINE PARAMETERS

Applicable to: ALL

As soon as the engine-start is complete, the flight crew should check the stabilized parameters. At ISA sea level:

THR~3.5 %	N1~20 %	N2~66 %	EGT~430 °C	Fuel Flow~1 280 lbs/h

The flight crew should check the relative engine vibration level.

ENGINE START MALFUNCTION

Applicable to: ALL

If the start is not successful, the flight crew must apply the ECAM actions as usually done, and avoid instinctively selecting the ENG MASTER switch to "OFF". This would interrupt the FADEC protective actions (e. g. cranking after hot start).
After an aborted engine start, the flight crew must consider dry cranking the engine before performing another engine start. (*Refer to FCOM/FCOM Limitations Engines*).

MANUAL ENGINE START

Applicable to: ALL

The flight crew should only perform a manual start if:

- The EGT margins are low
- The residual EGT is high
- A dry crank is performed.

It may be appropriate to perform a manual start in high altitude operations, or after an aborted engine start.
The MANUAL ENGINE START procedure is a "read and do" procedure. *Refer to FCOM/Supplementary Procedures - Manual Engine Start* , before starting a manual engine start.
The FADEC has limited control over the manual start process. It ensures that the engine start valve closes at 58 % N2. It monitors engine parameters, and generates an associated warning when necessary.

It is recommended that the flight crew use the stop watch to ensure that:
- the starter engagement time remains within the limits
- The EGT increases within 20s.

TAILPIPE FIRE

Applicable to: ALL

An engine tailpipe fire may occur at engine-start, and may be the result of either excess fuel in the combustion chamber, or an oil leak in the low-pressure turbine. A tailpipe fire is an internal fire within the engine. No critical areas are affected. The right way to deal with an engine tail pipe fire is to ventilate the engine.
This procedure is not referred as memo items. The TAIL PIPE FIRE C/L is available in the ABN PROC menu.

If the ground crew reports a tailpipe fire, the flight crew must perform the following actions:

- Shut down the engine (MASTER switch set to OFF)
- Do NOT press the ENG FIRE pushbutton
- Crank the engine, by using either the bleed opposite the engine, the APU bleed, or external pneumatic power (Set ENG START selector to CRANK, then set the MAN START switch to ON).

Do NOT use the ENG FIRE pushbutton, this would stop power to the FADECs, and would stop the motoring sequence. The fire extinguisher must not be used, as it will not extinguish an internal engine fire. As a first priority, the engine must be ventilated.
If the ground crew reports a tailpipe fire, and bleed air is not readily available, a ground fire-extinguisher can be used as last result: Chemical or dry chemical powder causes serious corrosive damage to the engine.

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ENGINE WARM-UP PERIOD

Applicable to: ALL

After engine-start, and in order to avoid thermal shock of the engine, the engines should be operated at idle or near idle for a minimum of 3 minutes (5 minutes recommended) prior to take-off before setting the thrust lever to high power. The warm-up can include any taxi time at idle.

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INTRODUCTION

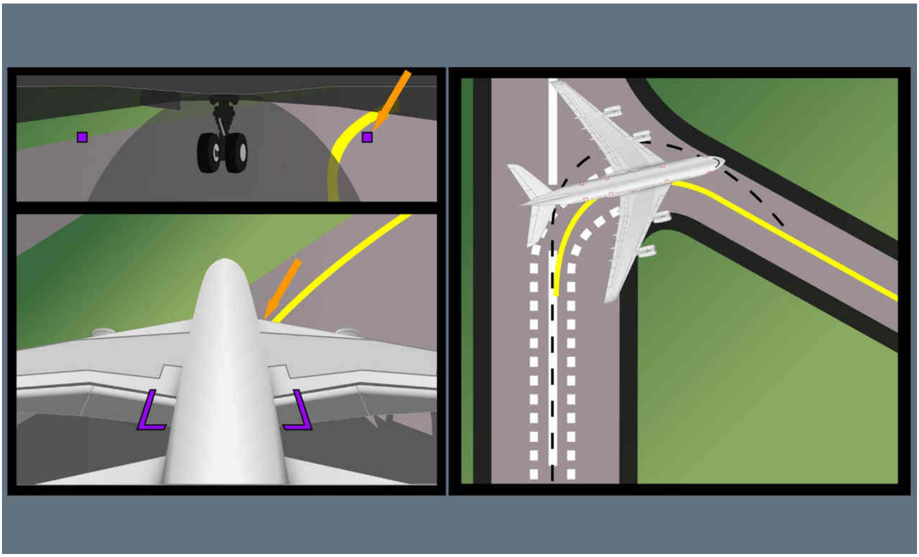
Applicable to: ALL

When ready to taxi, crew members should select as required:
- TAXI for the ETACS
- ZOOM for Onboard Airport Navigation System (OANS) on both ND

TAXI CAMERA

Applicable to: ALL

The External Taxi Aid Camera System (ETACS) is designed to assist the flight crew by determining the nose and main gear position before and during taxi. Looking out of the cockpit window remains the primary means of determining when to initiate turns, and of verifying the aircraft's position relative to the ground track.
The ETACS can assist the flight crew during pushback: The flight crew is able to see and check that the tow truck is connected, that the aircraft's environment is clear of obstacles, and that the ground crew personnel is in the appropriate position.
The magenta squares on the upper ETACS display, help the flight crew initiate turns with a correct over-steer. When the turn is established, the aircraft is correctly turning if the wing root continues over the yellow line.



During taxi, the flight crew can monitor how close the wheels are to the edges of the runway, by referring to the bottom ETACS image.
To correctly turn and taxi, flight crew must primarily refer to external cues. The ETACS is merely a tool that assists the flight crew, and is an MEL "GO" item.

ONBOARD AIRPORT NAVIGATION SYSTEM

Applicable to: ALL

The Onboard Airport Navigation System (OANS) is designed to improve flight crew situational awareness at complex and busy airports, in order to:

- Enhance safety, by helping to prevent dangerous errors such as runway incursions, or takeoffs from the wrong runway
- Enhance the operational efficiency.

It is important to emphasize that the OANS is not a guidance system. Therefore, the flight crew should not use the OANS as a substitute for taxi procedures. Such taxi procedures include looking outside the aircraft, and using airport signs and ground markings. The flight crew must confirm the validity of all information displayed on the OANS by visually comparing this information to outside references.
The OANS does not provide information about temporary airport taxi restrictions, and may not include the most recent buildings, and construction sites. Therefore, the flight crew must consult NOTAMS before beginning the taxi phase, and can update the moving airport map on the ND, by using flags and crosses, as necessary.
During taxi, the CAPTAIN and the FIRST OFFICER can display the OANS on their ND, by selecting "ZOOM", in either the ARC, NAV, or PLAN mode. The CAPTAIN may refer to the ND during taxi, if necessary. However, the CAPTAIN ' s primary reference should always be the outside of the aircraft. The FIRST OFFICER will assist the CAPTAIN during taxi, as necessary, by referring to the ND, in order to locate taxiways and runways.
When visibility is reduced, the FIRST OFFICER should announce the aircraft ' s approach to active runways.
The flight crew members should deselect the OANS on both NDS before line-up at the latest.

BRAKES

Applicable to: ALL

BRAKE CHECK

When cleared to taxi, the CAPTAIN should set the Parking Brake to "OFF". When the aircraft starts to move, the CAPTAIN should check the efficiency of the normal braking system by gently pressing the brake pedals, to ensure that the aircraft slows down. The FIRST OFFICER should also check the triple brake indicator to ensure that brake pressure drops to zero. This indicates a successful changeover to the normal braking system.

CARBON BRAKE WEAR

Carbon brake wear depends on the number of brake applications and on brake temperature. It does not depend on the applied pressure, or the duration of the braking. The temperature at which maximum brake wear occurs depends on the brake manufacturer. Therefore, the only way the pilot can minimize brake wear is to reduce the number of brake applications.

TAXI SPEED AND BRAKING

The GS indication on the TAXI video display should be used to assess taxi speed.
On long straight taxiways and with no ATC or other ground traffic constraints, the CAPTAI should allow the aircraft accelerate to30, kt and should then use one smooth brake application to decelerate to10 kt . The CAPTAIN should not "ride" the brakes.
For sharp turn, the CAPTAIN should reduce the taxi speed to 5 to 8 kt prior initiating the turn. The Body Wheel Steering limits the drag during the turn and consequently, the aircraft speed during the turn should not decrease and no thrust readjustment should be required.

BRAKE TEMPERATURE

The FCOM limits brake temperature to300 °C. before takeoff is started. This limit ensures that any hydraulic fluid that may come into contact with the brake units will not be ignited in the wheelwell after gear retraction

BRAKING ANOMALIES

If the ACCU PRESS drops below the green band, the flight crew should be aware that the Parking Brake can, quite suddenly, become less efficient. This explains the amber range on the hydraulic pressure gauge of the ACCU PRESS .
If the flight crew encounters any braking problems during taxi, they should call "LOSS OF BRAKING" and release the brakes, set the A/SKID to OFF then apply pedal braking again. The pressure on the brakes is automatically limited and there is no use to refer to the hydraulic triple indicator. If braking is still inoperative, the crew will use the PARK BRK. These items are not supported by an ECAM procedure and will be considered as memo items.

TAXI ROLL AND STEERING

Applicable to: ALL

GENERAL

Before taxi, check that the amber "NWS DISC" ECAM MEMO is not displayed, to ensure that steering is fully available.

THRUST USE

Little, if any, thrust above idle may be necessary to get the aircraft moving (approximately up to 10% THR at heavy weight). Excessive thrust application on engines can result in exhaust-blast damage e.g, on airport signs. Thrust should be used symmetrically. Once the aircraft begins to move, reduce thrust as necessary.
It can be noticed that the use of engine anti-ice slightly increases ground idle thrust.
If the inner engines are located over unconsolidated or unprepared ground during taxi, avoid high thrust settings on the inner engines (engine ingestion -FOD- risk increase). If additional thrust is required, the use of the outer engines is preferred."

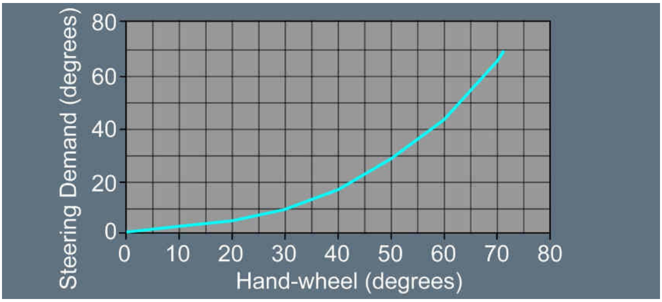
TILLER AND RUDDER PEDALS USE

Pedals control nosewheel steering at low speed (± 6 degrees with full pedal deflection). Therefore, on straight taxiways and on shallow turns, the pilot can use the pedals to steer the aircraft, keeping a hand on the tiller. In sharper turns, the pilot must use the tiller.

STEERING TECHNIQUE

Nose-wheel steering is "by-wire" with no mechanical connection between the tiller and the nose-wheel.
The relationship between tiller deflection and nose-wheel angle is not linear and the tiller forces are light.
Therefore, the CAPTAIN should move the tiller smoothly and maintain the tiller's position. Any correction should be small and smooth, and maintained for enough time to enable the pilot to assess the outcome. Being over-active on the tiller will cause uncomfortable oscillations.
If both pilots act on the tiller or pedals, their inputs are added until the maximum value of the steering angle (programmed within the BSCU) is reached.
When the seating position is correct, the cut-off angle is about 19 ° , and the visual ground geometry provides an obscured segment of about 68 feet/21 meters).
In order to monitor taxi, press the TAXI P/B on EFIS-CP ; this provides a combined video image of the 2 cameras located under the belly of the aircraft and at the top of the fin. This combined view of the aircraft allows the taxiing pilot to properly track the aircraft along the taxiways or runways in straightline or in turns.

If the TAXI display is not available or not clear (e.g heavy rain showers), while taxiing on a straightline the taxiing pilot should see the taxiway (runway) centreline arriving between PFD & ND
Asymmetric thrust from the outer engines can be used to initiate a tight turn and to keep the aircraft moving during the turn. Asymmetric thrust from inner engines is not recommended due to FOD risk on certain taxiways. If nosewheel lateral skidding occurs while turning, reduce taxi speed or increase turn radius.
When exiting a tight turn, the CAPTAIN should anticipate the steer out. Additionally, the CAPTAIN should allow the aircraft to roll forward for a short distance to minimize the stress on the main gears.



For 180 ° turn, *Refer to FCOM/FCOM SOP*

180 DEG TURN

Applicable to: ALL

Refer to FCOM/Standard Operating Procedures

TAKEOFF BRIEFING CONFIRMATION

Applicable to: ALL

Takeoff briefing should usually be a brief confirmation of the full takeoff briefing made at the parking bay and should include any changes that may have occurred, e.g. change of SID, change in runway conditions etc.

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MISCELLANEOUS

Applicable to: ALL

STROBE LIGHT

When the STROBE lights are set to AUTO, they come on automatically when the aircraft is airborne. The ON position must be used to turn on the lights on ground for crossing, backtracking or entering a runway.

PACKS

If takeoff must be completed without air bleed from the engines (for performance reasons), but air conditioning is desired, then APU bleed may be used with the packs set to ON. This will maintain the engine performance level, and passenger comfort. In the event of an APU auto-shutdown during takeoff, engine thrust is frozen until the thrust is manually-reduced. The packs revert to engine bleed that causes an increase of EGT, in order to maintain THR.
If one pack is failed before takeoff, it is recommended that the flight crew set the failed pack to OFF. The takeoff can be performed with the other pack ON with TOGA or FLEX thrust, the pack being supplied by the onside bleeds. In this asymmetric bleed configuration, the N1 takeoff value is limited to the value corresponding to the bleed ON configuration .

CLEARANCE CHANGE

If ATC clears the aircraft to maintain specific heading after take-off, turn the AFS-CP HDG selector (on the FCU) to disarm NAV. The current aircraft heading will be displayed on the AFS-CP and ND, and the fight crew can then set the cleared heading. Once airborne, and above 30 ft RA, RWY TRK engages. To follow the clearance, the AFS-CP HDG knob should be pulled. Once cleared to resume the SID, a HDG adjustment may be necessary to intercept the desired track for NAV capture.

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THRUST SETTING

Applicable to: ALL

The PF should announce "Take-off". The PF then applies power as follows:

- From idle to 25 % THR by reference to the TLA indicator on the THR gauge.
- When the engine parameters have stabilized, to the FLX/MCT or TOGA detent as appropriate.

This procedure ensures that all engines will accelerate similarly. If not properly applied, this may lead to asymmetrical thrust increase, and, consequently, to severe directional control problem.
If the thrust levers are not set to the proper take-off detent, e.g. FLX instead of TOGA, a message comes up on the ECAM.
When the thrust levers are set, the PF announces the changes on the FMA. The PM must check that the thrust is set by 80 kt and must announce “Thrust Set”.

TAKEOFF ROLL

Applicable to: ALL

The Captain must keep his hand on the thrust levers when the thrust levers are set to TOGA/FLX notch and until V1.
The PF should use pedals to keep the aircraft straight. The nosewheel steering will be effective (until reaching 150 kt) but its authority decreases at a pre-determined rate as the groundspeed increases and the rudder becomes more effective. The use the tiller is not recommended during takeoff roll, because of its high efficiency, which might lead to aircraft overreaction.
For crosswind takeoffs, routine use of into wind aileron is not necessary. In strong crosswind conditions, small lateral stick input may be used, if deemed necessary due to into wind wing reaction, but avoid using large deflections, resulting in excessive spoiler deployment which increase the aircraft tendency to turn into the wind.
In case of low visibility take-off, visual cues are primary means to track the runway centerline. The PFD yaw bar provides an assistance in case of expected fog patches if ILS available.

ROTATION TECHNIQUE

Applicable to: ALL

Rotation is conventional. The PF must perform the rotation mainly head-up, using outside visual reference until airborne, or at least until visual cues are lost, depending on visibility conditions. The PF must then monitor the pitch attitude on the PFD.
The higher the inertia of the aircraft is, the more it is important to initiate the rotation with a smooth positive backward sidestick input. Avoid aggressive and sharp inputs.
The typical all engine operating attitude after lift-off is about 12.5 ° .
If the established pitch rate is not satisfactory, the pilot must make smooth corrections on the stick. He must avoid rapid and large corrections, which cause sharp reaction in pitch from the aircraft. If, to

increase the rotation rate, a further and late aft sidestick input is made around the time of lift-off, the possibility of tailstrike increases significantly.
During rotation, the crew must not chase the FD pitch bar, since it does not give any pitch rate order, and might lead to overreaction.
Once airborne only, the crew must refine the aircraft pitch attitude using the FD, which is then representative of the SRS orders. The fly-by-wire control laws change into flight normal law, with automatic pitch trim active.
A pitch limit indication is provided on the PFD at takeoff. It is displayed from the power application up to 3 seconds after lift off.

TAILSTRIKE AVOIDANCE

Applicable to: ALL

INTRODUCTION

Tail strikes can cause extensive structural damage, which can jeopardize the flight and lead to heavy maintenance action. They most often occur in such adverse conditions as crosswind, turbulence, windshear, etc.

AIRCRAFT GEOMETRY

MAX PITCH ATTITUDE ON GROUND depending on main gear oleo position	
fully extended	fully compressed
13.5 °	11.5 °

MAIN FACTORS

EARLY ROTATION

Early rotation occurs when rotation is initiated below the scheduled VR. The potential reasons for this are:

- The calculated VR is incorrect for the aircraft weight or flap configuration.
- The PF commands rotation below VR due to gusts, windshear or an obstacle on the runway.

Whatever the cause of the early rotation, the result will be an increased pitch attitude at lift-off, and consequently a reduced tail clearance.

ROTATION TECHNIQUE

The recommendation given in the ROTATION TECHNIQUE paragraph should be applied.
A fast rotation rate increases the risk of tailstrike, but a slow rate increases take-off distance.
The recommended rate is between 2 and 3 degs/sec, which reflects the average rates achieved during flight test, and is also the reference rate for performance calculations.

CONFIGURATION

When performance is limiting the takeoff weight, the flight crew uses TOGA thrust and selects the configuration that provides the highest takeoff weight.
When the actual takeoff weight is lower than the permissible one, the flight crew uses FLEX TO thrust. For a given aircraft weight, a variety of flap configurations are possible. Usually, the flight crew selects the configuration that provides the maximum FLEX temperature. This is done to prolong engine life.
The configuration that provides the maximum FLEX temperature varies with the runway length. On long runways, CONF 1+F becomes the optimum configuration, in term of FLEX temperature. However, the flight crew should keep in mind that the tail clearance at lift off depends on the configuration. The highest flap configuration gives the highest tailstrike margin.

TAKEOFF TRIM SETTING

The main purpose of the pitch trim setting for take-off is to provide consistent rotation characteristics. Takeoff pitch trim setting is automatic on ground.
The aircraft performs a safe takeoff, provided the pitch trim setting is within the green band on the pitch trim display, on the PFD.

However, the pitch trim setting significantly affects the aircraft behaviour during rotation:
- With a forward CG and the pitch trim set to the nose-down limit the pilots will feel an aircraft heavy to rotate" and aircraft rotation will be very slow in response to the normal take off stick displacement.
- With an aft CG and the pitch trim set to the nose-up limit the pilots will most probably have to counteract an early autorotation until VR is reached.

In either case the pilot may have to modify his normal control input in order to achieve the desired rotation rate, but should be cautious not to overreact.

CROSSWIND TAKEOFF

It is said in the TAKEOFF ROLL paragraph that care should be taken to avoid using large deflection, resulting in excessive spoiler deployment. A direct effect of the reduction in lift due to the extension of the spoilers on one wing will be a reduction in tail clearance and an increased risk of tailstrike.

OLEO INFLATION

The correct extension of the main landing gear shock absorber (and thus the nominal increase in tail clearance during the rotation) relies on the correct inflation of the oleos. An under inflated oleo will delay the start of the bogie rotation and reduce tail clearances.

ACTION IN CASE OF TAILSTRIKE

If a tailstrike occurs at takeoff, flight at attitude requiring a pressurized cabin must be avoided and a return to the originating airport should be performed for damage assessment.

FLIGHT GUIDANCE

Applicable to: ALL

GENERAL

The AP can be engaged 5 seconds after takeoff and above 100ft RA.

VERTICAL PROFILE

SRS engages when the thrust levers are set to the applicable detent for take-off and will remain engaged until the acceleration altitude.
In SRS mode, the aircraft maintains a speed target equal to V2 + 10 kt (in normal engine configuration).
The SRS guidance law also includes :

- Attitude protection to reduce aircraft nose-up effect during takeoff 14 °
- Flight path angle protection that ensures a positive climb.

LATERAL PROFILE

Under most circumstances, the crew can expect to follow the programmed SID. In this case, NAV is armed on selecting the thrust levers to the applicable detent for take-off and engages once above 30 ft RA.

THRUST REDUCTION ALTITUDE

Applicable to: ALL

At the thrust reduction altitude, "LVR CLB" flashes on the FMA. When hand flying, lower slightly the nose, as applicable, to anticipate the pitch down FD order. Bring the thrust levers back to CLB detent. The A/THR is now active (A/THR on the FMA changes from blue to white).
The FD pitch down order depends upon the amount of thrust decrease between TOGA or FLX and CLB.
If take-off was performed packs OFF, the packs will be selected back to ON after thrust reduction because of the potential resulting EGT increase.

ACCELERATION ALTITUDE

Applicable to: ALL

At the acceleration altitude, the FD pitch mode changes from SRS to CLB or OP CLB mode. The target speed, displayed as a triangle, jumps:

- Either to the managed target speed (eg; speed constraint, speed limit or ECON climb speed),
- Or to the preselected climb speed (entered by the pilot on PERF CLB page before takeoff).

The short term managed speed, displayed as a magenta dot, jumps to the lowest of VFE-5 ktof the present aircraft configuration and initial climb speed.
During takeoff phase, F and S speeds are the minimum speeds for retracting the surfaces:

- At F speed, the aircraft accelerating (positive speed trend): retract to 1.
- At S speed, the aircraft accelerating (positive speed trend): retract to 0.

TAKEOFF AT HEAVY WEIGHT

Applicable to: ALL

GENERAL

If take-off is carried out at heavy weight, the maneuvring speed F may be close to VFE Conf 2 and S speed is above VFE Conf1+F. In this case, two protections intervene:

- The Automatic Retraction System (ARS)
- The α Lock function

THE AUTOMATIC RETRACTION SYSTEM

While in Conf 1+F and IAS reaches 212 kt , the ARS is activated. The ARS automatically retracts flaps to 0 °. The VFE displayed on the PFD changes from $VFE_{CONF1+F}$ to VFE_{CONF1} .
As the aircraft accelerates above S speed, the flap lever can be selected to 0. If IAS decreases below 212 kt , the flaps will not extend back to 1+F.

THE ALPHA/SPEED LOCK FUNCTION

The slats alpha/speed lock function inhibits the slat retraction at high AOA and/or at very low speed, when the flight crew sets to 0 the FLAPS lever. A. LOCK pulses in the slats/flaps display on the PFD.
The inhibition is removed and the slats retract when both alpha and speed come back to normal values.

The triggering of the alpha/speed lock function is a normal situation at high weight. If the slats alpha/speed lock function is triggered, the flight crew continues the scheduled acceleration to enable later slats retraction.

IMMEDIATE TURN AFTER TAKEOFF

Applicable to: ALL

Obstacle clearance, noise abatement, or departure procedures may require an immediate turn after take-off. Provided FD commands are followed accurately, the flaps and slats may be retracted using the normal procedure as FD orders provide bank angle limits with respect to speed and configuration.

LOW ALTITUDE LEVEL OFF

Applicable to: ALL

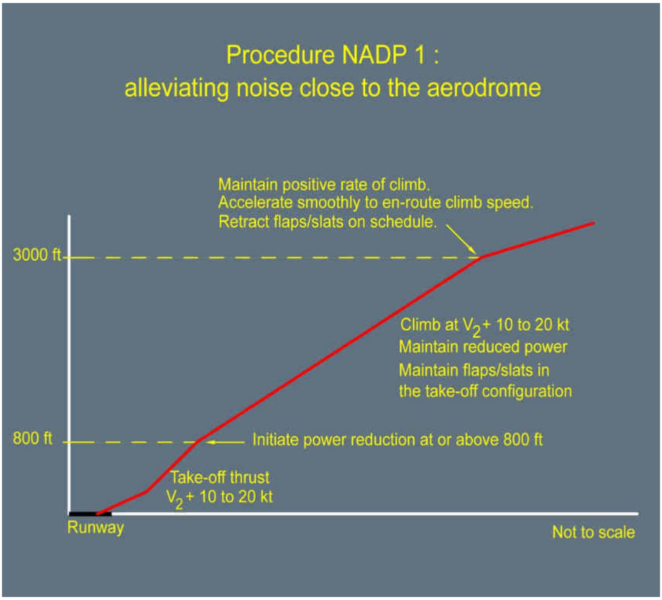
If the aircraft is required to level off below the acceleration altitude, ALT* engages and SRS disengages. The "LVR CLB" message flashes on the FMA and the target speed goes to the initial climb speed. In this case, the crew should expect a faster than normal acceleration, and be prepared to retract the flaps and slats promptly.

NOISE ABATMENT TAKEOFF

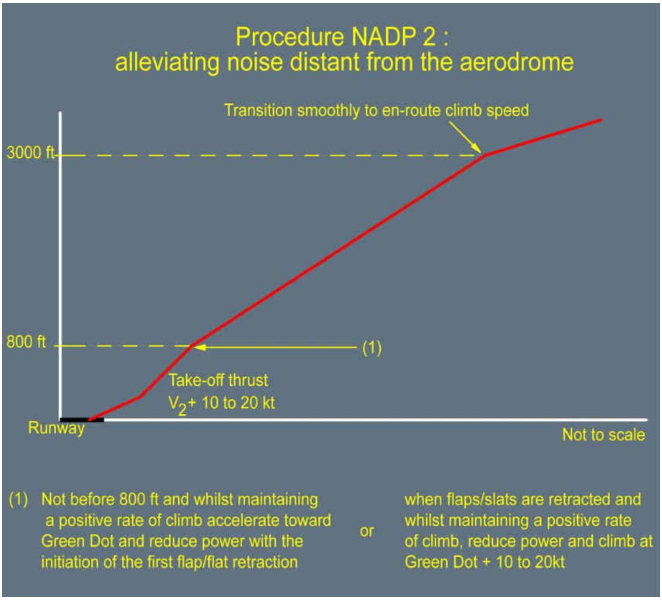
Applicable to: ALL

Noise Abatement Procedures will not be conducted in conditions of significant turbulence or windshear.

NADP1


Procedure NADP 1 :
alleviating noise close to the aerodrome
Maintain positive rate of climb.
Accelerate smoothly to en-route climb speed.
Retract flaps/slats on schedule.
3000 ft
Climb at V2 + 10 to 20 kt
Maintain reduced power
Maintain flaps/slats in
the take-off configuration
800 ft
Initiate power reduction at or above 800 ft
Take-off thrust
V2 + 10 to 20 kt
Runway
Not to scale

NADP2


Procedure NADP 2 :
alleviating noise distant from the aerodrome
Transition smoothly to en-route climb speed
3000 ft
800 ft
(1)
Take-off thrust
V2+ 10 to 20 kt
Runway
Not to scale
(1) Not before 800 ft and whilst maintaining a positive rate of climb accelerate toward Green Dot and reduce power with the initiation of the first flap/flat retraction
or
when flaps/slats are retracted and whilst maintaining a positive rate of climb, reduce power and climb at Green Dot + 10 to 20kt

AP/FD CLIMB MODES

Applicable to: ALL

The AP/FD climb modes may be either:

- Managed
- Selected

MANAGED

The managed AP/FD mode in climb is CLB. Its use is recommended as long as the aircraft is cleared along the F-PLN.

SELECTED

The selected AP/FD modes in climb are OP CLB or V/S.
OP CLB is to be used if ATC gives radar vector or clears the aircraft direct to a given FL without any climb constraints.
If the crew selects a high V/S, it may happen that the aircraft is unable to climb with this high V/S and to maintain the target speed with Max Climb thrust, for performance reasons. In that case, the AP/FD will guide to the target V/S, and the A/THR will command up to Max Climb thrust, in order to try to keep the target speed; but the aircraft will decelerate and its speed might reach VLS. When VLS is reached the AP will pitch the aircraft down so as to fly a V/S, which allows maintaining VLS. In this case, the V/S indication on the FMA pulses and is boxed amber. A triple click is generated.
Whenever V/S is used, pilots should pay particular attention to the speed trend as V/S takes precedence over speed requirements.
The crew should be aware that altitude constraints on the MFD ACTIVE/F-PLN page are observed only when the climb is managed, i.e. when CLB is displayed on the FMA. Any other vertical mode will disregard any altitude constraints.
A likely scenario would be, when the FCU altitude is set above an altitude constraint and the pilot selects V/S when below that constraint to avoid a potential TCAS TA. In this case, the aircraft will disregard the altitude constraint.

SMALL ALTITUDE CHANGES

Applicable to: ALL

CLB or OP CLB mode will be preferred to V/S mode for climb even for small altitude changes. Indeed, in the small altitude change case, the THR CLB mode is limited in order to give 1000 fpm making this altitude change smoother and more comfortable for the passengers.

SPEED CONSIDERATIONS

Applicable to: ALL

The climb speed may be either:

- Managed
- Selected

MANAGED

The managed climb speed, computed by the FMS, provides the most economical climb profile as it takes into account weight, actual and predicted winds, ISA deviation and Cost Index (CI). The managed climb speed also takes into account any speed constraints, e.g. the default speed limit which is 250 kt up to 10 000 ft.

SELECTED

If necessary, the climb speed can be either pre-selected on ground prior to take-off on the MFD ACTIVE/PERF CLB page or selected on the AFS-CP (on the FCU) as required.
On ground, prior take-off, speed target at acceleration altitude can be pre-selected on the MFD ACTIVE/PERF CLB page. It is to be used when the F-PLN has a sharp turn after take-off, when high angle of climb is required or for ATC clearance compliance.
Once airborne, the speed can be selected on AFS-CP (on the FCU) to achieve:

- the maximum rate of climb, i.e. to reach a given altitude in the shortest time,
- or the maximum gradient of climb. i.e. to reach a given altitude in a shortest distance.

These speeds are displayed on the MFD ACTIVE/PERF CLB page, as well as the corresponding time and distance required to achieve the selected altitude.
Avoid reducing to green dot at high altitude, particularly at heavy weight, as it can take a long time to accelerate to ECON mach. Pilots should be aware that it is possible to select and fly a speed below green dot but there would be no operational benefit in doing this.
When selected speed is used, the predictions on the F-PLN page assume the selected speed is kept till the next planned speed modification, e.g. 250 kt /10.000 ft, where managed speed is supposed to be resumed. Consequently, the FM predictions remain meaningful.
When IAS is selected in lower altitude, there is an automatic change to Mach at a specific crossover altitude.
Finally, as selected speed does not provide the optimum climb profile, it should only be used when operationally required, e.g. ATC constraint or weather.

VERTICAL PERFORMANCE PREDICTIONS

Applicable to: ALL

The FMS ACTIVE/PERF page displays the MAX REC ALT and the OPT ALT information (*Refer to Cruise/Altitude Considerations*). The flight crew uses this information to rapidly answer the ATC request: “CAN YOU CLIMB TO FL XXX?”.
The CLB panel of the FMS ACTIVE/PERF page displays time and distance predictions for a given FL for the managed speed and selected speed. This default value of this FL is the AFS CP target altitude. The flight crew can change the default value. The flight crew uses this information to rapidly answer the ATC request: “CAN YOU MAKE FL XXX by ZZZ waypoint?”.

VERTICAL DISPLAY

Applicable to: ALL

When switching the altimeter setting from QNH (or QFE if available) to STD, the safety altitude that was graphically displayed (safe altitude within the VD area), switches to a numerical value.
Since this numerical value is equal to the highest safe altitude along the F-PLN on the VD range, this may result in the aircraft being below the displayed safe altitude. This functionality increases the crew awareness regarding the safe altitude.
The vertical flight plan profile induces a change of practice in the way to avoid cells. Indeed, as the VD provides the predicted vertical clearance with cells, it may push the crew to over fly the cells with low vertical margins.
If the flight crew is unable to establish whether or not the vertical clearance above the cell is sufficient enough to overfly safely, he should avoid the cell laterally. The cells displayed on VD are vertical cut along the green solid line. Lateral spacing of the aircraft versus the cell may be refined using the AZIM function.

LATERAL MODE

Applicable to: ALL

If the aircraft is following the programmed SID, the AP/FD should be in NAV. If ATC vectors the aircraft, HDG will be used until a time when clearance is given to either resume the SID or track direct to a specific waypoint. In either case, the crew must ensure that the waypoints are properly sequenced.
The crew should keep in mind that the use of HDG mode e.g. following ATC radar vectors, will revert CLB to OP CLB and any altitude constraints in the MFD F-PLN page will not be observed unless they are selected on the FCU.

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PREFACE

Applicable to: ALL

Once the cruise flight level is reached, “ALT CRZ” is displayed on the FMA. The cruise Mach number is targeted and cruise fuel consumption is optimized.

FMS USE

Applicable to: ALL

MFD USE

Once the ALT CRZ is displayed on the FMA, The FMS sequences from the climb phase to the cruise phase.
The POSITION MONITOR page can be accessed from the PERF page via a short cut and provides information on the navigation accuracy and BRG/DIST.
The PNF MFD should display in ACTIVE/FPLN page

CRUISE FL

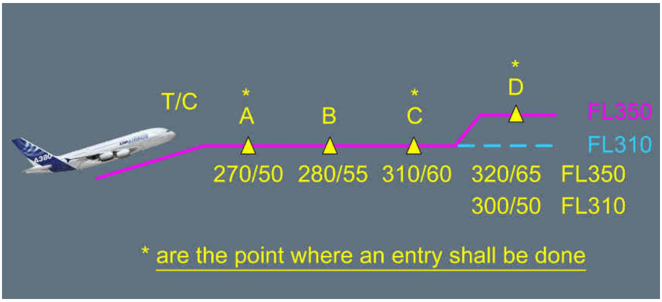
If the aircraft is cleared to a lower cruise flight level than the pre-planned cruise flight level displayed on MFD ACTIVE/PERF page, “ALT CRZ” will not be displayed on the FMA and cruise Mach number will not be targeted. The crew will update the MFD ACTIVE/PERF page accordingly.
When in cruise i.e. ALT CRZ on FMA, the thrust control is soft. This means that the thrust will allow small speed variation around the cruise Mach (typically +/- 4 kt to 6 kt) while limiting thrust readjustment . This optimizes the fuel consumption and increase passengers comfort.

WIND AND TEMPERATURE

When reaching cruise FL, the crew will ensure that the wind and temperatures are correctly entered and the lateral and vertical F-PLN reflect the CFP. Entries should be made at waypoints when there is a difference of either 30° in direction or 30 kt in velocity for the wind data and 5 °C for temperature deviation. These entries should be made up to four different levels to reflect the actual wind and temperature profile. This will ensure that the FMS fuel and time predictions are as accurate as possible and provide an accurate OPT FL computation.

STEP CLIMB

If there is a STEP in the F-PLN, the crew will ensure that the wind is properly set at the first waypoint beyond the step (D on the following example) at both initial FL and step FL.



If at D waypoint, the CFP provides the wind at FL 350 but not at FL 310, it is recommended to insert the same wind at FL 310 as the one at FL 350. This is due to wind propagation rules, which might affect the optimum FL computation.

F-PLN INFO

On the MFD ACTIVE/F-PLN page, the F-PLN INFO key gives a quick access to several useful functions, which are not associated to a waypoint::

- ALTERNATE
- CLOSEST AIRPORTS
- EQUI-TIME POINT
- FIX INFO
- LL CROSSING
- TIME MARKER
- CPNY F-PLN REPORT

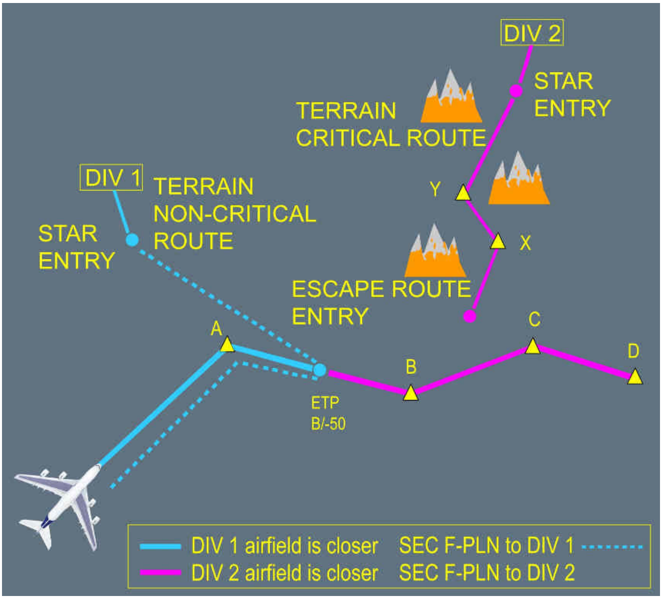
The ALTERNATE airport page permits

- To get valuable distance, bearing time and fuel information to several alternates
- To update the alternate if required

The CLOSEST AIRPORT page provides valuable distance, bearing time and fuel information to the four closest airports from the aircraft present position (PPOS), as well as to an airport the crew may define. The fuel and time predictions are a function of the average wind between the aircraft and the airport.
The EQUI-TIME POINT (ETP) function should be used to assist the crew in making a decision should an en-route diversion be required. Suitable airport pairs, REF1 and REF2, diversion FL and wind should be entered. The ETP calculation is based on the entered average wind at diversion FL with actual speed.
The SECF-PLN function is a useful tool and should be used practically. The ETP should be inserted as a waypoint and the route to diversion airfield should be finalized. By programming a potential en-route diversion, the crew would reduce their workload should a failure occur. This is

particularly true when terrain considerations apply to the intended diversion route. When an ETP is sequenced, the crew will:

- Access to the ETP page in FPLN info
- Insert the next suitable diversion airfield
- Read new ETP and insert as waypoint
- Import the ACTIVE F-PLN in one SEC F-PLN
- Insert the new diversion as NEW DEST in the SEC F-PLN from new ETP



MISCELLANEOUS

If ATC requires for a position report, the crew will use the MFD POSITION/REPORT page.
If ATC modifies the routing, the crew will revise the F-PLN. Once achieved, the crew may perform a new F-PLN print.
If ATC requires to report on a given radial, the crew will use a FIX INFO page, that can be accessed from the F-PLN INFO key.
If ATC requires a report at a given time, the crew will insert a TIME MARKER pseudo waypoint. TIME MARKER function is also available from the F-PLN INFO key.
If there is weather, the crew will use the OFFSET function, which can be accessed from a revision on the MFD ACTIVE/F-PLN page at any waypoints. The crew will determine how many NM are required to avoid the weather. Once cleared by ATC, the crew will insert the offset.

If ATC gives a DIR TO clearance to a waypoint far from present position, the crew will use the ABEAM facility. This facility allows both a better crew orientation and the previously entered winds to be still considered.

COST INDEX

Applicable to: ALL

The Cost Index (CI) is used to take into account the relationship between fuel and time related costs in order to minimize the trip cost. The CI is calculated by the airline for each sector. From an operational point of view, the CI affects the speeds (ECON SPEED/MACH) and cruise altitude (OPT ALT). CI=0 corresponds to maximum range whereas the CI=999 corresponds to minimum time.
The CI is a strategic parameter, which applies to the whole flight. However, the CI can be modified by the crew in flight for valid strategic operational reasons. For example, if the crew needs to reduce the speed for the entire flight to comply with curfew requirements or fuel management requirements (XTRA gets close to 0), then it would be appropriate to reduce the CI.
The SEC F-PLN can be used to check the predictions associated with new CI. If they are satisfactory, the crew will then modify the CI in the primary F-PLN. However, the crew should be aware that any modification of the CI would affect trip cost.

SPEED CONSIDERATIONS

Applicable to: ALL

The cruise speed may be either:

- Managed
- Selected

MANAGED

When the cruise altitude is reached, i.e. "ALT CRZ " on the FMA, the A/THR operates in SPEED/MACH mode. The optimum cruise Mach number is automatically targeted. Its value depends on:

- CI
- Cruise flight level
- Temperature deviation
- Weight
- Headwind component.

The crew should be aware that the optimum Mach number will vary according to the above mentioned parameters, e.g. it will increase with an increasing headwind.
Should ATC require a specific time over a waypoint, the crew can perform a vertical revision on that waypoint and enter a time constraint. The managed Mach number would be modified

accordingly, between green dot and MMO, to achieve this constraint. If the constraint can be met, i.e. within +/- 2 minutes, a magenta asterix will be displayed on the MFD; if the constraint cannot be met, an amber asterix will be displayed. Once the constrained waypoint is sequenced, the ECON Mach is resumed.
The Constant Mach Segment (CMS) option enables to fly cruise segment at constant Mach. This guidance is performed under managed speed control and is taken into account for cruise predictions
This CMS option may be accessed through ACTIVE/FPLN page or ACTIVE/PERF/CRZ page. This facility is also available in the SEC FPLN to evaluate any speed strategy change.

SELECTED

Should ATC requires a speed constraint for a limited period of time, the pilot will select the cruise speed on the AFS-CP (on the FCU). FMS predictions are updated accordingly until reaching either the next step climb or top of descent, where the managed speed applies again. The FMS predictions remain therefore realistic.
The MFD ACTIVE/PERF CRZ page displays Long Range Cruise (LRC) speed and TURB speed. At high altitude, the speed should not be reduced below GREEN DOT as this may create a situation where it is impossible to maintain speed and/or altitude as the increased drag may exceed the available thrust.

ALTITUDE CONSIDERATIONS

Applicable to: ALL

The MFD ACTIVE/PERF page displays:

- REC MAX FL
- OPT FL

REC MAX FL

REC MAX FL reflects the present engine and wing performance and does not take into account the cost aspect. It provides a 0.3g buffet margin. If the crew inserts a FL higher than REC MAX as CRZ FL, it will be accepted only if it provides a buffet margin greater than 0.2g. Unless there are overriding operational considerations, e.g. either to accept a cruise FL higher than REC MAX or to be held significantly lower for a long period, REC MAX should be considered as the upper cruise limit.

OPT FL

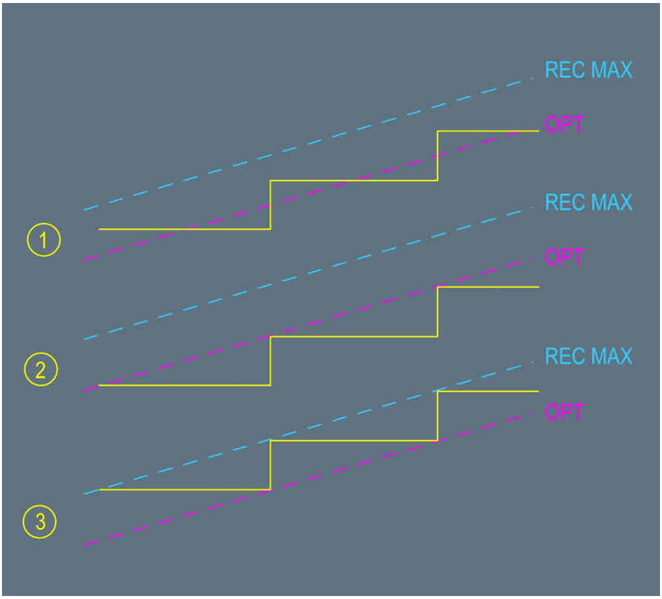
OPT FL displayed on the MFD is the cruise altitude for minimum cost when ECON MACH is flown and should be followed whenever possible. It is important to note that the OPT FL displayed on the MFD ACTIVE/PERF page is meaningful only if the wind and temperature profile has been

accurately entered. The crew should be aware that flying at a level other than the OPT FL would adversely affect the trip cost.
For each Mach number, there will be a different OPT FL. Should an FMS failure occur, the crew should refer to the OIS PERF application to determine the OPT FL.

STEP CLIMB

Applicable to: ALL

Since the optimum altitude increases as fuel is consumed during the flight, from a cost point of view, it is preferable to climb to a higher cruise altitude when aircraft weight permits. This technique, referred to as a Step Climb, is typically accomplished by initially climbing approximately 2000 ft above the optimum altitude and then cruising at that flight level until approximately 4000 ft below optimum.
Step climbs can either be planned at waypoints or be optimum step points calculated by the FMS.
In order to determine the optimum location of the next FL change, the crew will use the OPT STEP facility on the ACTIVE/F-PLN/VERT REV/STEP ALTS page and insert the next FL. If predictions are satisfactory in term of time and fuel saving, the crew will insert it in F-PLN provided it is compatible with ATC. The inserted step climb is set as a geographic waypoint. It may be updated by pressing the UPDATE* prompt on the STEP page
The OPT STEP computation will be accurate if vertical wind profile has been properly entered. Refer to FMS USE of this section.
It may be advantageous to request an initial cruise altitude above optimum if altitude changes are difficult to obtain on specific routes. This minimizes the possibility of being held at a low altitude and high fuel consumption condition for long periods of time. The requested/cleared cruise altitude should be compared to the REC MAX altitude. Before accepting an altitude above optimum, the crew should determine that it will continue to be acceptable considering the projected flight conditions such as turbulence, standing waves or temperature change.



The diagram above shows three step climb strategies with respect to OPT and REC MAX FL. Strategy 1 provides the best trip cost, followed by 2 then 3.

FUEL MONITORING

Applicable to: ALL

The flight plan fuel burn from departure to destination is based on certain assumed conditions. These include gross weight, cruise altitude, route of flight, temperature, cruise wind and cruise speed. Actual fuel consumption should be compared with the flight plan fuel consumption at least once every 30 minutes.
The crew should be aware that many factors influence fuel consumption, such as actual flight level, cruise speed and unexpected meteorological conditions. These parameters should normally be reflected in the FMS.
The crew must keep in mind that:

- A significant deviation between planned and actual fuel figures without reason
- An excessive fuel flow leading to a potential imbalance
- An abnormal decrease in total fuel quantity (FOB+FU)

May indicate a fuel leak and the associated procedure should be applied.

FUEL TEMPERATURE

Applicable to: ALL

Fuel freeze refers to the formation of wax crystals suspended in the fuel, which can accumulate when fuel temperature is below the freeze point (-47°C for jet A1) and can prevent proper fuel feed to the engines.
During normal operations, fuel temperature rarely decreases to the point that it becomes limiting. However, extended cruise operations increase the potential for fuel temperatures to reach the freeze point. Fuel temperature will slowly reduce towards TAT.
If fuel temperature approaches the minimum allowed, consideration should be given to achieving a higher TAT:

- Descending or diverting to a warmer air mass may be considered. Below the tropopause, a 4000 ft descent gives a 7°C increase in TAT. In severe cases, a descent to as low as 25,000 ft may be required.
- Increasing Mach number will also increase TAT. An increase of 0.01 Mach produces approximately 0.7°C increase in TAT.

In either case, up to one hour may be required for fuel temperature to stabilise. The crew should consider the fuel penalty associated with either of these actions.

APPROACH PREPARATION

Applicable to: ALL

The latest destination weather should be obtained approximately 15 minutes prior to descent and the FMS programmed for the descent and arrival. During FMS programming the PM will be head down, so it is important that the PF does not become involved in any tasks other than flying the aircraft.
The fuel predictions will be accurate if the F-PLN is correctly entered in terms of arrival, go-around and alternate routing.
The three first boxes of the FMS menu will be reviewed as required to update the FMS:

FPLN

Update landing runway, STAR, Approach, Go-around procedure, FPLN to alternate.
Check altitude and speed constraints.
Compare MFD FPLN versus the approach chart .

PERF

PERF APPR:

- Destination airfield weather (QNH, Temperature and wind). The entered wind should be the average wind given by the ATC or ATIS. Do not enter gust values, for example, if the wind is 150/20-25, insert the lower speed 150/20 (With managed speed mode in approach, ground speed mini-function will cope with the gusts). The QNH (QFE) setting will be updated at that time by presetting the barometer reference selector.
- Minima (DH for CAT 2 or 3 approach and MDA for others approaches)
- Landing configuration (wind shear anticipated or in case of failure).

PERF GO AROUND: Check thrust reduction and acceleration altitude.
The MFD PERF page provides a quick access to MFD POSITION MONITOR for BRG/DIST function which is a useful tool to monitor the descent. Insert VOR/DME or landing runway threshold of destination airfield in the BRG/DIST field as required.

FUEL & LOAD

Check estimated landing weight, EFOB and extra fuel.

NAVAIDS

Manually tune the VOR/DME and/or NDB if required.
Check ILS ident, frequency and associated course of destination airfield as required. It is not recommended manually forcing the ILS identifier as, in case of late runway change, the associated ILS would not be automatically tuned.

SEC INDEX

To cover contingencies e.g. runway change, circling or diversion.
Once the FMS has been programmed, the PF should then cross check the information prior to the approach briefing.

LANDING BRIEFING

Applicable to: ALL

The main objective of the approach briefing is for the PF to inform the PM of his intended course of action for the approach. The briefing should be practical and relevant to the actual weather conditions expected. It should be concise and conducted in a logical manner. It should be given at a time of low workload if possible, to enable the crew to concentrate on the content. It is very important that any misunderstandings are resolved at this time.

PF briefing	Associated cross check
technical status (relevant MEL and CDL considerations, relevant OEB)	
NOTAM	
Weather • Accessibility • Runway in use	
Fuel • Extra fuel	FUEL & LOAD page
Descent • TOD (time, position) • MORA, STAR, MSA • Altitude and speed constraints	F-PLN page Paper chart and VD F-PLN page
Holding (If expected) • Entry in holding pattern • MHA and MAX speed	
Approach • Approach type • Altitude and FAF identification • Descent gradient • MDA/DH • Missed approach procedure • Alternate considerations	F-PLN and ND F-PLN PERF APPR and FMA F-PLN F-PLN

Continued on the following page

Continued from the previous page

Landing • Runway condition, length and wind • Use of Autobrake • Expected taxi clearance	
Radio aids	POSITION/NAVAIDS

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PREFACE

Applicable to: ALL

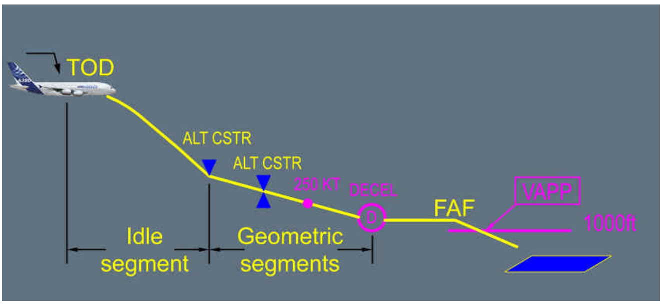
The PM will set preferably the MFD ACTIVE/PERF page, as it provides predictions down to any inserted altitude in DES/OP DES modes, and VERT DEV in NAV MODE. He may also select the POSITION/MONITOR page, for BRG/DIST information.
The PM will set the MFD ACTIVE/F-PLN page.
If use of radar is required, consider selecting the radar display on the PM side and TERR on PNF side only.

COMPUTATION PRINCIPLE

Applicable to: ALL

TOD AND PROFILE COMPUTATION

The FMS calculates the Top Of Descent point (TOD) backwards from a position 1000 ft on the final approach with speed at VAPP. It takes into account any descent speed and altitude constraints and assumes managed speed is used. The first segment of the descent will always be idle segment until the first altitude constraint is reached. Subsequent segments will be "geometric", i.e. the descent will be flown at a specific angle, taking into account any subsequent constraints. If the STAR includes a holding pattern, it is not considered for TOD or fuel computation. The TOD is displayed on the ND track as a symbol.
The idle segment assumes a given managed speed flown with idle thrust plus a small amount of thrust. This gives some flexibility to keep the aircraft on the descent path if engine anti-ice is used or if winds vary. This explains THR DES on the FMA.
The TOD computed by the FMS is reliable provided the flight plan is properly documented down to the approach.



MANAGED DESCENT SPEED PROFILE

The managed speed is equal to:

- The ECON speed (which may have been modified by the crew on the MFD ACTIVE/PERF DES page, before entering DESCENT phase), or
- The speed constraint or limit when applicable.

GUIDANCE AND MONITORING

Applicable to: ALL

INTRODUCTION

To carry out the descent, the crew can use either the managed descent mode (DES) or the selected descent modes (OP DES or V/S). Both descent modes can be flown either with selected speed or managed speed.
The modes and monitoring means are actually linked.
The managed DES mode guides the aircraft along the FMS pre-computed descent profile, as long as it flies along the lateral F.PLN: i.e. DES mode is available if NAV is engaged.
As a general rule when DES mode is used, the descent is monitored using VDEV called "yoyo" on PFD, or its digital value on the MFD ACTIVE/PERF page, as well as the level arrow symbol on the ND.
The selected OPDES or V/S modes are used when HDG is selected or when ALT CSTR may be disregarded or for various tactical purposes.
As a general rule when OPDES or V/S modes are used, the descent is monitored using the Energy Circle, (displayed if HDG or TRK modes and indicating the required distance to descend, decelerate and land from present position) and the level arrow symbol on the ND. When the aircraft is not far away from the lateral F.PLN (small XTKi.e. less than 5 nm) , the yoyo on PFD is also a good indicator.

MANAGED DESCENT MODE

The managed descent profile from high altitude is approximately 2.5°.
As an estimation of the distance to touchdown is required to enable descent profile monitoring, it is important to ensure that the MFD ACTIVE/F-PLN plan page reflects the expected approach routing. Any gross errors noted in the descent profile are usually a result of incorrect routing entered on the MFD or non-sequencing of F-PLN waypoints, giving a false distance to touchdown.

DESCENT INITIATION

To initiate a managed descent, the pilot will set the ATC cleared altitude on the AFS-CP and push the ALT selector selector. DES mode engages and is annunciated on the FMA. If an early descent were required by ATC, DES mode would give 1000 fpm rate of descent, until regaining the computed profile.
If the descent is delayed, speed should be reduced towards green dot, and when cleared for descent, the pilot will push for DES and push for managed speed. The speed reduction prior to

descent will enable the aircraft to recover the computed profile more quickly as it accelerates to the managed descent speed.

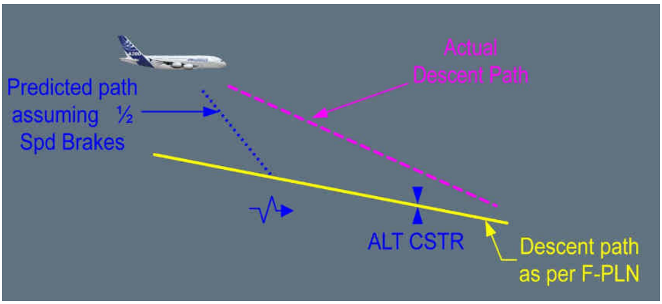
DESCENT PROFILE

When DES with managed speed is engaged, the AP/FD guides the aircraft along the pre-computed descent path determined by a number of factors such as altitude constraints, wind and descent speed. However, as the actual conditions may differ from those planned, the DES mode operates within a 20 kts speed range around the managed target speed to maintain the descent path.

If the aircraft gets high on the computed descent path:

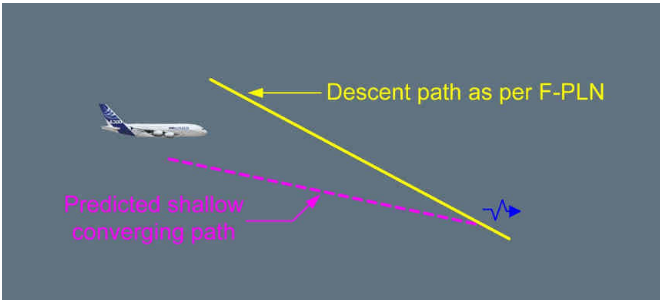
- The speed will increase towards the upper limit of the speed range, to keep the aircraft on the path with IDLE thrust.
- If the speed reaches the upper limit, THR IDLE is maintained, but the autopilot does not allow the speed to increase any more, thus the VDEV will slowly increase.
- A path intercept point, which assumes half speedbrake extension, will be displayed on the ND descent track.
- If speed brakes are not extended, the intercept point will move forward. If it gets close to a an altitude constrained waypoint, then a message "EXTEND SPD BRK" will be displayed on the PFD.

This technique allows an altitude constraint to be matched with minimum use of speedbrakes. When regaining the descent profile, the speedbrakes should be retracted to prevent the A/THR applying thrust against speedbrakes. If the speedbrakes are not retracted, the speedbrake symbol becomes amber and "RETRACT SPD BRK" is displayed in white on the PFD.



If the aircraft gets low on the computed descent path:

The speed will decrease towards the lower limit of the speed range with idle thrust. When the lower speed limit is reached the A/THR will revert to SPEED/MACH mode and apply thrust to maintain the descent path at this lower speed. The path intercept point will be displayed on the ND, to indicate where the descent profile will be regained.



If selected speed is used:

The computed descent profile remains unchanged. As the selected speed may differ from the speed taken into account for pre-computed descent profile and speed deviation range does not apply, the aircraft may deviate from the descent profile e.g. if the pilot selects 275 kts with a pre-computed descent profile assuming managed speed 300 kts, VDEV will increase.

SELECTED DESCENT MODE

There are 2 modes for flying a selected descent, namely OP DES and V/S. These modes will be used for pilot tactical interventions.
V/S mode is automatically selected when HDG or TRK mode is selected by the pilot, while in DES mode. Furthermore, in HDG or TRK mode, only V/S or OP DES modes are available for descent.
To initiate a selected descent, the pilot should set the ATC cleared altitude on the AFS-CP and pull the ALT selector. OP DES mode engages and is annunciated on the FMA. In OP DES mode, the A/THR commands THR IDLE and the speed is controlled by the THS.
Speed may be either managed or selected. In managed speed, the descent speed is displayed only as a magenta target but there is no longer a speed target range since the pre-computed flight profile does not apply.
The AP/FD will not consider any MFD descent altitude constraints and will fly an unrestricted descent down to the AFS-CP selected altitude.
If the crew wishes to steep the descent down, OP DES mode can be used, selecting a higher speed. Speedbrake is very effective in increasing descent rate but should be used with caution at high altitude due to the associated increase in VLS.
If the pilot wishes to shallow the descent path, V/S can be used. A/THR reverts to SPEED mode. In this configuration, the use of speedbrakes is not recommended to reduce speed, since this would lead to thrust increase and the speed would be maintained.

DESCENT CONSTRAINT

Applicable to: ALL

Descent constraints may be automatically included in the route as part of an arrival procedure or they may be manually entered through the MFD ACTIVE/FPLN page. The aircraft will attempt to meet these as long as DES mode is being used.
The crew should be aware that an ATC "DIR TO" clearance automatically removes the requirement to comply with the speed/altitude constraints assigned to the waypoints deleted from the F-PLN. However, if intermediate waypoints are relevant, e.g. for terrain awareness, then "DIR TO" with ABEAMS may be an appropriate selection as constraints can be re-entered into these waypoints if required.
Following the selection of HDG, DES mode will switch automatically to V/S, and altitude constraints will no longer be taken into account.

MODE REVERSION

Applicable to: ALL

If a high V/S target is selected (or typically after a DES → V/S reversion), the autopilot will pitch the aircraft down to fly the target V/S. Thus the aircraft will tend to accelerate, while ATHR commands idle thrust to try to keep the speed. When IAS will reach a speed close to VMO or VFE, the autopilot will pitch the aircraft up, so as to fly a V/S allowing VMO or VFE to be maintained with idle thrust.

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PREFACE

Applicable to: ALL

Whenever holding is anticipated, it is preferable to maintain cruise level and reduce speed to green dot, with ATC clearance, to minimize the holding requirement. As a rule of thumb, a M 0.05 decrease during one hour equates to 4 minhold. However, other operational constraints might make this option inappropriate.
A holding pattern can be inserted at any point in the flight plan or may be included as part of the STAR. In either case, the crew can modify the holding pattern.

HOLDING SPEED AND CONFIGURATION

Applicable to: ALL

If a hold is to be flown, provided NAV mode is engaged and the speed is managed, an automatic speed reduction will occur to achieve green dot speed when entering the holding pattern. Green dot speed corresponds to an approximation of the best lift to drag ratio and provides the lowest hourly fuel consumption.
If green dot speed is greater than the ICAO or state maximum holding speed, the crew should select flap 1 below 20.000 ft and fly S speed. Fuel consumption will be increased when holding in anything other than clean configuration and green dot speed.

IN THE HOLDING PATTERN

Applicable to: ALL

The holding pattern is not included in the descent path computation since the FMS does not know how many patterns will be flown. When the holding fix is sequenced, the FMS assumes that only one holding pattern will be flown and updates predictions accordingly. Once in the holding pattern, the VDEV indicates the vertical deviation between current aircraft altitude and the altitude at which the aircraft should cross the exit fix in order to be on the descent profile.
The DES mode guides the aircraft down at –1000 fpm whilst in the holding pattern until reaching the cleared altitude or altitude constraint.

When in the holding pattern, LAST EXIT UTC/FUEL information is displayed on the MFD HOLD page. These predictions are based upon the fuel policy requirements specified on the MFD FUEL & LOAD page with no extra fuel, assuming the aircraft will divert. The crew should be aware that this information is computed with defined assumptions e.g.:
- Aircraft weight being equal to landing weight at primary destination
- Flight at FL 220 if distance to ALTN is less than 200 nm , otherwise FL 310performed at maximum range speed i.e. CI=0
- Constant wind (as entered in alternate field of the DES WIND page).

- Constant delta ISA (equal to delta ISA at primary destination)
- Airway distance for a company route, otherwise direct distance.

Alternate airport may be modified using the MFD ALTN airport page which can be accessed by a revision at destination.

To exit the holding pattern, the crew should select either
- IMM EXIT (The aircraft will return immediately to the hold fix, exit the holding pattern and resume its navigation) or
- HDG if radar vectors or and sequence the FPLN as required
- DIR TO if cleared to a waypoint.

PREFACE

Applicable to: ALL

This section covers general information applicable to all approach types. Techniques, which apply to specific approach types, will be covered in dedicated chapters.
All approaches are divided into three parts (initial, intermediate and final) where various drills have to be achieved regardless of the approach type.

INITIAL APPROACH

Applicable to: ALL

USE OF VD

Within 25 NM of the NAVAID relative to the selected arrival or approach procedure, the minimum altitude displayed switches from MORA to MSA. MSA displayed on VD will be that of the NAVAIDs relative to the selected procedure.
The crew should keep in mind that crossing the safe altitudes during an approach doesn't always represent a constraint violation, as long as the flight monitoring is supported by another means, e.g. radar control. This is why the safe altitude is not displayed as a red line (but as a magenta one). However, crossing the safety altitude should trigger crew alertness regarding aircraft position and ATC clearance i.e. "I will go below if I am sure of my position and I am allowed to do it (radar or procedure)".

NAVIGATION ACCURACY

No navigation accuracy check is required as long as GPS PRIMARY is available.
Without GPS PRIMARY, navigation accuracy check has to be carried out prior to any approach.
The navigation accuracy determines which guidance modes the crew should use and the type of display to be shown on the ND.

THE FLYING MODE

It is recommended to select HDG/ VS for ILS approaches and TRK/FPA for Non precision approaches. However, since the FD are selected ON, the FD bars will be the flight reference in all cases.

APPROACH PHASE ACTIVATION

Activation of the approach phase will initiate a deceleration towards VAPP or the speed constraint inserted at FAF, whichever applies.
When in NAV mode with managed speed, the approach phase activates automatically when sequencing the deceleration pseudo-waypoint D. If an early deceleration is required, the approach phase can be activated on the MFD PERF APPR page.
When in HDG mode, e.g. for radar vectoring, the crew will activate the approach phase manually.

When the approach phase is activated, the magenta triangle (target speed) drops to VAPP, whereas the short term managed speed appears as a magenta dot, equal to green dot in clean configuration, S in CONF 1, etc...
There are two approach techniques:

- The decelerated approach
- The stabilized approach

THE DECELERATED APPROACH

This technique refers to an approach where the aircraft reaches 1 000 ft AGL in the landing configuration at VAPP. In most cases, this equates to the aircraft being in CONF 2 and at F speed at 2 500 ft AGL
This is the preferred technique for ILS approach or FLS approach in the F-APP or F-APP+RAW cases. The deceleration pseudo waypoint D computed by the FM assumes a decelerated approach technique.

THE STABILIZED APPROACH

This technique refers to an approach where the aircraft reaches the FAF in the landing configuration at VAPP.
To get a valuable deceleration pseudo waypoint and to ensure a timely deceleration, the pilot should enter VAPP as a speed constraint at the FAF.

F-PLN SEQUENCING

When in NAV mode, the F-PLN will sequence automatically. In HDG/TRK mode, the F-PLN waypoints will sequence automatically only if the aircraft flies close to the programmed route.

Correct F-PLN sequencing is important to ensure that
- The Vertical Display is meaningful and
- the programmed missed approach route is available in case of go-around.
- The predictions are correct

A good cue to monitor the proper F-PLN sequencing is the TO waypoint on the upper right side of the ND.
If under radar vectors and automatic waypoint sequencing does not occur, it is recommended to sequence the F-PLN using the DIR TO COURSE IN function .
Using DIR TO or DIR TO COURSE IN function arms the NAV mode. If NAV mode is not appropriate, pull the HDG knob to disarm it.

INTERMEDIATE APPROACH

Applicable to: ALL

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

DECELERATION AND CONFIGURATION CHANGE

Managed speed is recommended for the approach. Once the approach phase has been activated, the A/THR will guide aircraft speed towards the short-term managed speed displayed as a magenta dot. It corresponds to the target speed of the current configuration, whenever higher than VAPP, e.g. green dot for Config 0, S speed for Config 1 etc.
The managed speed target, displayed either with the numeric value when out of the speed scale or with a magenta triangle when within the speed scale, drops to VAPP.
The Automatic Extension System (AES) automatically limits the slats/flaps extension to “1” as long as the speed exceeds 205 kt. When the speed drops below 205 kt, the slats/flaps extends to “1 + F”. .
To achieve a constant deceleration and to minimize thrust variation, the crew should extend the next configuration when reaching the short term target speed + 10 kts (IAS must be lower than VFE next), e.g. when the speed reaches green dot + 10 kts, the crew should select Config 1.
If selected speed is to be used to comply with ATC, the requested speed should be selected on AFS-CP(on the FCU). A speed below the manoeuvring speed of the present configuration may be selected provided it is above VLS. When the ATC speed constraint no longer applies, the pilot should push the AFS-CP speed selector to resume managed speed.
When flying the intermediate approach in selected speed, the crew will activate the approach phase. This will ensure further proper speed deceleration when resuming managed speed; otherwise the aircraft will accelerate to the previous applicable descent phase speed. For this concern, the position of the magenta dot with regard to the selected speed is a valuable cue.
Speedbrakes can be used to increase the deceleration rate but the crew should be aware of:

- The increase in VLS with the use of speedbrakes
- The limited effect at low speeds

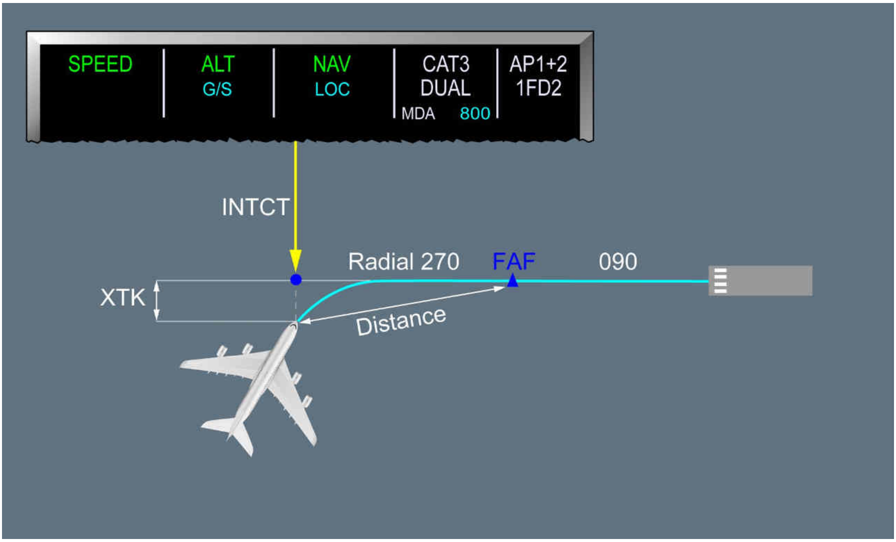
INTERCEPTION OF FINAL APPROACH COURSE

To ensure a smooth interception of final approach course, the aircraft ground speed will be appropriate, depending upon interception angle and distance to runway threshold. The pilot will refer to applicable raw data (LOC, needles), XTK information on ND and wind component for the selection of an appropriate IAS.
If ATC provides radar vectors, the crew will use the DIR TO COURSE IN facility. This ensures

- A proper F-PLN sequencing
- A comprehensive ND display

- An assistance for lateral interception
- The VDEV to be computed on reasonable distance assumptions.

However, deceleration will not occur automatically as long as lateral mode is HDG
When established on the LOC, a DIR TO should not be performed to sequence the FPLN as this will result in the FMS reverting to NAV mode. In this case, the LOC will have to be re-armed and re-captured, increasing workload unduly.
The final approach course interception in NAV mode is possible if GPS is PRIMARY or if the navigation accuracy check is positive.



If ATC gives a new wind for landing, the crew will update it on MFD ACTIVE/PERF APPR page.
Once cleared for the approach, the crew will press the APPR P/B to arm the approach modes when applicable.

FINAL APPROACH

Applicable to: ALL

FINAL APPROACH MODE ENGAGEMENT MONITORING

The crew will monitor the engagement of G/S* for ILS approach, F-G/S* for fully managed NPA or will select the Flight Path Angle (FPA) reaching FAF for selected NPA. If the capture or engagement is abnormal, the pilot will either use an appropriate selected mode or take over manually.

SPEED CONSIDERATION

VAPP

The approach speed (VAPP) is defined by the crew to perform the safest approach. It is function of gross weight, configuration, headwind, A/THR ON/OFF, icing and downburst.
In most cases, the FMS provides valuable VAPP on MFD ACTIVE/PERF APPR page, once tower wind and FLAP3 or FLAP FULL landing configuration has been inserted (Vapp=Vls + max of {5kt, 1/3 tower head wind component on landing RWY in the F-PLN}).
The crew can insert a lower VAPP on the MFD APPR page, down to VLS, if landing is performed with A/THR OFF, with no wind, no downburst and no icing.
He can insert a higher VAPP in case of strong suspected downburst, but this increment is limited to 15 kts.
In case of strong or gusty crosswind greater than 20 kt, VAPP should be at least VLS + 5 kt; the 5 kt increment above VLS may be increased up to 15 kt at the flight crew's discretion.
The crew will bear in mind that the wind entered in MFD ACTIVE/PERF APPR page considers the wind direction to be in the same reference as the runway direction e. g. if airport if magnetic referenced, the crew will insert magnetic wind.
The wind direction provided by ATIS and tower is given in the same reference as the runway direction whereas the wind provided by VOLMET, METAR or TAF is always true referenced.
VAPP is computed at predicted landing weight while the aircraft is in CRZ or DES phase. Once the approach phase is activated, VAPP is computed using current gross weight.
Managed speed should be used for final approach as it provides Ground Speed mini (GS mini) protection, even when the VAPP has been manually inserted.

GROUND SPEED MINI

Purpose

The purpose of the ground speed mini function is to keep the aircraft energy level above a minimum value, whatever the wind variations or gusts.
This allows an efficient management of the thrust in gusts or longitudinal shears. Thrust varies in the right sense, but in a smaller range in gusty situations, which explains why it is recommended in such situations.
It provides additional but rational safety margins in shears.
It allows pilots "to understand what is going on" in perturbed approaches by monitoring the target speed magenta bugs: when target goes up = head wind gust.

Computation

This minimum energy level is the energy the aircraft will have at landing with the expected tower wind; it is materialized by the ground speed of the aircraft at that time which is called GS mini:

GS mini = VAPP – Tower head wind component

In order to achieve that goal, the aircraft ground speed should never drop below GS mini in the approach, while the winds are changing. Thus the aircraft IAS must vary while flying down, in order to cope with the gusts or wind changes.
In order to make this possible for the pilot or for the ATHR, the FMS continuously computes an IAS target speed, which ensures that the aircraft ground speed is at least equal to GS mini; the FMS uses the instantaneous wind component experienced by the aircraft:

IAS Target Speed = GS mini + Current headwind component
This target speed is limited by VFE-5 in case of very strong gusts, by VAPP in case of tailwind or if instantaneous wind is lower than the tower wind; below 400 ft, the effect of the current wind variations is smoothly decreased so as to avoid too high speeds in the flare (1/3 of current wind variations taken into account).

USE OF A/THR

The pilot should use the A/THR for approaches as it provides accurate speed control.
During final approach, the managed target speed moves along the speed scale as a function of wind variation. The pilot should ideally check the reasonableness of the target speed by referring to GS on the top left on ND. If the A/THR performance is unsatisfactory, the pilot should disconnect it and control the thrust manually.
If the pilot is going to perform the landing using manual thrust, the A/THR should be disconnected by 1000 feet on the final approach.

GO-AROUND ALTITUDE SETTING

When established on final approach, the go-around altitude must be set on AFS-CP (FCU).
This can be done at any time when G/S or F-G/S mode engages. However, on a selected Non Precision Approach, i.e. when either FPA or V/S is used, the missed approach altitude must only be set when the current aircraft altitude is below the missed approach altitude, in order to avoid unwanted ALT*.

TRAJECTORY STABILIZATION

The first prerequisite for safe final approach and landing is to stabilize the aircraft on the final approach flight path laterally and longitudinally, in landing configuration, at VAPP speed, i.e:
- Only small corrections are necessary to rectify minor deviations from stabilized conditions
- The thrust is stabilized, usually above idle, to maintain the target approach speed along the desired final approach path.

Airbus policy requires that stabilized conditions be reached at 1 000 ft above airfield elevation in IMC and 500 ft above airfield elevation in VMC.

If, for any reason, one flight parameter deviates from stabilized conditions, the PM will make a callout as stated below:

Exceedance and associated PM callout				
Parameter		Exceedance		Callout
IAS		VAPP +10 kt / -5 kt		"SPEED"
V/S		< -1 000 ft/min		"SINK RATE"
Pitch attitude		+7 ° / -3 °		"PITCH"
Bank angle		5 °		"BANK"
ILS only	Localizer	Excess deviation	1/4 dot PFD	"LOCALIZER"
ILS only	Glide slope	Excess deviation	1 dot PFD	"GLIDE SLOPE"
NPA selected	Course	Excess deviation: 1/2 dot on PFD (or 2.5 ° (VOR) / 5 ° (ADF))		"COURSE"
NPA selected	Altitude at check points	Deviation		"x FT HIGH (LOW)"
NPA FLS	Localizer	-	1/4 dot PFD	"F-LOC"(1)
NPA FLS	Glide slope	-	1 dot PFD	"F-GLIDE"(1)

(1) *Reaching the minima, if the required visual conditions are met to continue the approach, external visual cues prevail.*

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

REACHING THE MINIMA

Decision to land or go-around must be made at MDA/DH at the latest. Reaching the MDA/DH, at MINIMUM call out:

- If suitable visual reference can be maintained and the aircraft is properly established, continue and land.
- If not, go-around

The MDA/DH should not be set as target altitude on the AFS-CP (on the FCU). If the MDA/DH were inserted on the AFS-CP, this would cause a spurious ALT* when approaching MDA/DH, resulting in the approach becoming destabilised at a critical stage.

AP DISCONNECTION

During the final approach with the AP engaged, the aircraft will be stabilised. Therefore, when disconnecting the AP for a manual landing, the pilot should avoid the temptation to make large inputs on the sidestick.

The pilot should disconnect the autopilot early enough to resume manual control of the aircraft and to evaluate the drift before flare. During crosswind conditions, the pilot should avoid any tendency to drift downwind.

Some common errors include:
- Descending below the final path, and/or
- reducing the drift too early .

PREFACE

Applicable to: ALL

This chapter deals with some characteristics of the ILS approach. Recommendations mentioned in APPROACH GENERAL chapter apply.
For CATI ILS, the crew will insert DA/DH values into MDA (or MDH if QFE function is available) field on MFD ACTIVE/PERF APPR page, since these values are baro referenced.
For CATII or CATIII ILS, the crew will insert DH into DH field on MFD ACTIVE/PERF APPR page, since this value is a radio altitude referenced.

INITIAL APPROACH

Applicable to: ALL

NAVIGATION ACCURACY

When GPS PRIMARY is available, no NAV ACCURACY monitoring is required.
When GPS PRIMARY is lost the crew will check on MFD POS MONITOR page that the required navigation accuracy is appropriate. If NAV ACCURACY DOWNGRAD is displayed, the crew will use raw data for navigation accuracy check. The navigation accuracy determines which AP modes the crew should use and the type of display to be shown on the ND.

<table>
<tr><th rowspan="2">NAVIGATION ACCURACY</th><th colspan="2">ND</th><th rowspan="2">AP/FD mode</th></tr>
<tr><th>PF</th><th>PM</th></tr>
<tr><td>GPS PRIMARY</td><td colspan="2" rowspan="3">ARC or ROSE NAV with navaid raw data</td><td rowspan="3">NAV</td></tr>
<tr><td>NAV ACCUR HIGH</td></tr>
<tr><td>NAV ACCUR LOW and NAV ACCURACY check ≤1NM</td></tr>
<tr><td>GPS PRIMARY LOST and NAV ACCUR LOW and NAV ACCURACY check>1NM</td><td rowspan="2">ROSE ILS</td><td rowspan="2">ARC or ROSE NAV or ROSE ILS with navaid raw data</td><td rowspan="2">HDG or TRK</td></tr>
<tr><td>GPS PRIMARY LOST and aircraft flying within unreliable radio navaid area</td></tr>
</table>

FLYING MODE

FD are the flight reference. The crew will select HDG V/S on the AFS-CP (on the FCU).

APPROACH PHASE ACTIVATION

For a standard ILS, the crew should plan a decelerated approach. However, if the G/S angle is greater than3.5 °or if forecast tail wind at landing exceeds10 kt (if permitted by the AFM), a stabilized approach is recommended.

MISCELLANEOUS

The LS PB is to be checked pressed in the first stage of the approach. The crew will check that:

- LOC and GS scales and deviations are displayed on PFD
- IDENT is properly displayed on the PFD.

INTERMEDIATE APPROACH

Applicable to: ALL

INTERCEPTION OF FINAL APPROACH COURSE

When cleared for the ILS, the APPR pb should be pressed. This arms the approach mode and LOC and GS are displayed in blue on the FMA. At this stage the second AP, if available, should be selected.
The VV pb may be pressed, to display the small black bird, as a TRK/FPA information. It is particularly useful for crosswind conditions, to improve the situation awareness and smoothen the transition from instrument references to visual references.
If the ATC clears for a LOC capture only, the crew will press LOC p/b on the AFS-CP(FCU)..
If the ATC clears for approach at a significant distance, e.g. 30 nm , the crew should be aware that the G/S may be perturbed and CAT 1 will be displayed on FMA till a valid Radio Altimeter signal is received.
The AP uses the FMS aircraft position versus the runway axis to smooth the LOC capture.

FINAL APPROACH

Applicable to: ALL

GLIDE SLOPE INTERCEPTION FROM ABOVE

The following procedure should only be applied when established on the localizer. There are a number of factors which might lead to a glide slope interception from above. In such a case, the crew must react without delay to ensure the aircraft is configured for landing before 1 000 ft AAL. In order to get the best rate of descent when cleared by ATC and below the limiting speeds, the crew should lower the landing gear and select CONFIG 2. Speedbrakes may also be used, noting the considerations detailed in the sub-section "Deceleration and configuration change" earlier in this chapter. When cleared to intercept the glide slope, the crew should:

- Select the FCU altitude above aircraft altitude to avoid unwanted ALT*.
- Select V/S –1500 fpm initially. V/S in excess of 2000 fpm will result in the speed increasing tow.ards VFE
- Press the APPR pb on AFS-CP(on the FCU) and confirm G/S is armed

It is vital to use V/S rather than OP DES to ensure that the A/THR is in speed mode rather than IDLE mode. The rate of descent will be carefully monitored to avoid exceeding VFE . When

approaching the G/S, G/S* will engage. The crew will monitor the capture with raw data (pitch and G/S deviation). The missed approach altitude will be set on the AFS-CP (on the FCU) and speed reduced so as to be configured for landing by 1 000 ft.
In such a situation, taking into account the ground obstacles and if ATC permits, it may be appropriate to carry out a 360 °turn before resuming the approach.

MINIMA

For CATI ILS, the crew will insert MDA values into MINIMUM BARO field on MFD PERF APPR page.
For CATII or CATIII ILS, the crew will insert DH into MINIMUM RADIO field on MFD PERF APPR page.

MISCELLANEOUS

Close to the ground, avoid large down corrections. Give priority to attitude and sink rate.
In case of double receiver failure, the red LOC/GS flags are displayed, ILS scales are removed, the AP trips off and the FDS revert to HDG/VS mode.
In case of the ILS ground transmitter failure, the AP/FD with LOC/GS modes will remain ON. This is because such a failure is commonly transient. In such a case, ILS scales and FD bars are flashing.

ILS RAW DATA

Applicable to: ALL

PREFACE

ILS raw data refers to an ILS flying technique without FD.

INITIAL APPROACH

FLYING REFERENCE

The big green bird is the flight reference.
The crew will select TRK FPA on the AFS-CP(on the FCU).

APPROACH PHASE ACTIVATION

The approach technique is the stabilized approach.

INTERMEDIATE APPROACH

The TRK index will be set to the ILS course and, once established on the LOC, the tail of the bird should be coincident with the blue TRK index. This method allows accurate LOC tracking taking into account the drift.
Should the LOC deviate, the pilot will fly the bird in the direction of the LOC index, and when re-established on the LOC, set the tail of the bird on the TRK index again. If there is further LOC

deviation, a slight IRS drift should be suspected. The bird is computed out of IRS data. Thus, it may be affected by IRS data drift. A typical TRK error at the end of the flight is 1 °to 2 °.
The ILS course pointer and the TRK diamond are also displayed on PFD compass.

FINAL APPROACH

When 1/2 dot below the G/S, the pilot should initiate the interception of the G/S by smoothly flying the bird down to the glide path angle. The bird almost sitting on the -5 °pitch scale on PFD, provides a -3 °flight path angle. Should the G/S deviate, the pilot will make small corrections in the direction of the deviation and when re-established on the G/S, reset the bird to the G/S angle.

PREFACE

Applicable to: ALL

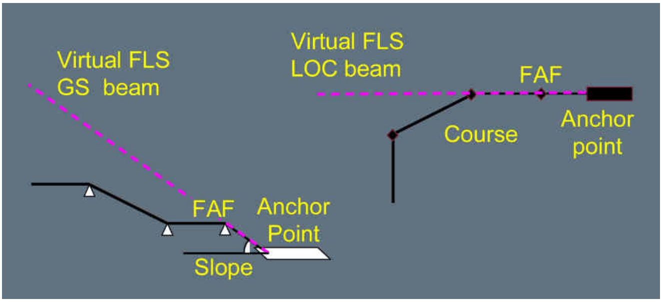
This chapter deals with some characteristics of the Non Precision Approach (NPA). General recommendations mentioned in APPROACH GENERAL chapter apply.
Most of VOR, NDB, RNAV and GPS approaches may be flown with the FMS Landing System (FLS) function.
The LOC GS OUT, LOC ONLY, LOC BC approaches are flown laterally using a radio beam and will be discussed in a dedicated section.
Flying a NPA without the FLS function is discussed in the PARTICULAR CASE section.

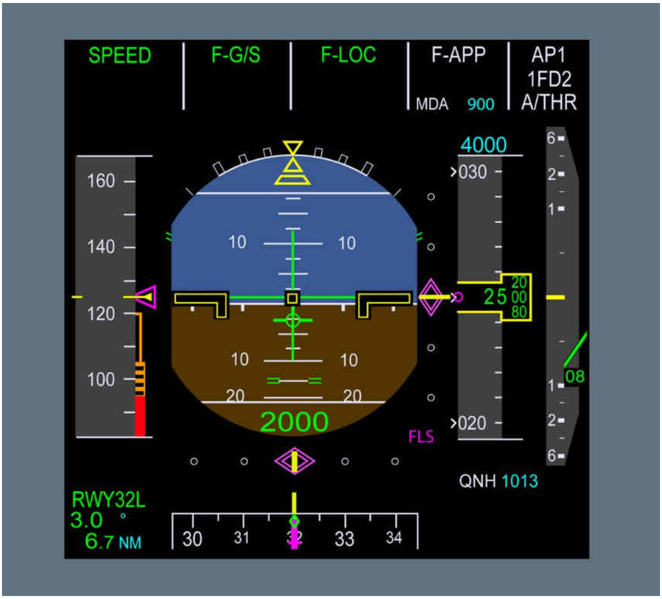
FLS PRINCIPLE

Applicable to: ALL

GENERAL

The FMS outputs a virtual FLS beam from the Navigation Database and sends it as well as the FM position, to the Multi Mode Receiver (MMR). The MMR computes and displays the lateral and vertical angular deviations from this FLS virtual beam like an ILS approach. These deviations are materialized with double diamonds both on PFD & ND. The FLS virtual beam may be followed with F-LOC and F-G/S AP/FD modes.





The virtual FLS beam is characterized by:

- An anchor point (The anchor point IDENT is RWY it is located on the runway threshold, EP in the others cases)
- A slope
- A double course pointer on the PFD heading scale.

APPROACH CAPABILITY

The approach capability is displayed on FMA. This approach capability dictates the crew strategy to carry out the NPA:

- F-APP: Rely on FLS deviations and F-G/S, F-LOC guidance
- F-APP+RAW: Refer to FLS deviations and cross-check wirh navaid raw data i.e. VOR, NDB and/or DME
- RAW ONLY : Disregard FLS information and refer exclusively to NAVAID raw data i.e. VOR, NDB and/or DME to perform the approach (Discussed in PARTICULAR CASE section)

Note: *1. Any approach capability degradation is accompanied by a triple click (as for ILS) and indicates the new strategy for the crew.*
2. The term RAW on the FMA refers to NAVAID but does not mean to deselect the FD.

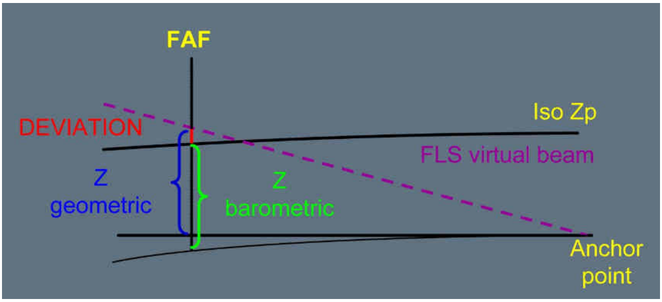
F-G/S DEVIATIONS REFERENCE

Unlike the ILS G/S, the F-G/S deviations are baro referenced i.e. a 1 hPaaltimeter setting error will move the F-G/S vertical profile 30 ftup or down. The crew will thus pay particular attention to the altimeter setting, and any altimeter setting change during the approach must be reflected both on EFIS CP and on the MFD PERF page.

Whatever the altimeter setting used prior or during the approach, i.e. STD, QNH, or QFE (if installed), the virtual FLS GS beam is always based on QNH. The QNH value used for FLS beam will be either:
- The QNH value entered on PERF APPR page (as long as STD is used for baro ref),
- The QNH value entered on FCU (when QNH is used for baro ref),
- Computed from the QFE (if installed) set on FCU and the runway elevation from the FM data base (when QFE is used for baro ref)

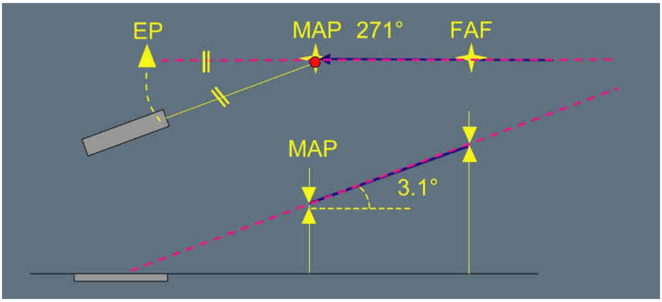
EARTH CURVATURE EFFECT

For NPA flown with the FLS function, the final path crossing altitudes are geometric altitudes referring to the anchor point. When intercepting the final approach path, and due to the earth curvature effect, a slight altitude deviation between the altimeter and the published approach chart may be noticed. Typically, at FAF, the F-GS virtual beam is about 50 fthigher.



PARTICULAR CASE

Depending on the approach procedure construction, the anchor point may be different than the runway threshold and may be located abeam this threshold. The anchor point ident is EPXX.



- During the instrument part of the approach, down to MDA, the distance and slope information on the PFD are representative of distance and slope to runway the threshold.
- When flying the visual part of the approach i.e. below the MDA,

- The distance displayed on PFD will no longer be representative of distance to the threshold (indeed, the distance may increase as the aircraft is converging towards the runway threshold)
- As the aircraft is leaving the F-LOC beam toward the runway threshold, the F-G/S deviation becomes meaningless and must be disregarded.

FLS FUNCTION USE

Applicable to: ALL

FLS FUNCTION USE

PREFACE

All published NPA coded in the FM database may be flown using the FLS function provided:

- The offset between final approach course and runway course does not exceed 50°
- At least one FM and one MMR are available
- The approach capability is at least F-APP or F-APP+RAW.

If the FLS function is not available due to the approach construction, a white MFD message “NO FLS FOR THIS APPR” would be displayed when selecting the NPA on the ACTIVE/FPLN/ARRIVAL page.
If the FLS function is not available or limited e.g. F-APP+RAW or RAW ONLY due to system failures, this would be displayed in the ECAM STATUS page.
When available and usable, the FLS function should be preferred.

FLYING TECHNIQUE

The double diamond symbol permits flying the FLS approach

- Using standard ILS approach pilot skill (beam concept) while
- Maintaining the crew awareness (double diamond are FM computed data)

The FLS deviations may be flown with or without guidance (AP /FD)

APPROACH PREPARATION

It is essential to understand that the FLS virtual beam is generated from the FMS approach coding and thus, must not be followed unless

- The FMS approach coding has been crosschecked against the published approach procedure and
- The final approach leg has not been modified by the crew.

The crew will review the aircraft STATUS to check the FLS function capability.
Except for RNAV approach, NAVAID must be available for display. The crew will thus pre-select the appropriate NAVAID on NAVAID page to anticipate any approach capability degradation.
The briefing will outline the key elements such as:

- Check of the approach coding in the FM data base
- Preparation of the NAVAID page
- Strategy in case of approach capability degradation:
- The flying technique below minima. (The RWY or EP anchor coding may be consulted when switching LS pb temporarily)

Note: *1. If the approach capability downgrades to F-APP+RAW, and the NAVAID raw data is not available, e.g. for RNAV approach, a go-around must be initiated unless the required conditions to continue are met.*
2. It must be noted that the distance available on the lower left part of the PFD is FMS computed and not radio computed and must be considered as such.
3. If the approach capability downgrades to RAW ONLY, see PARTICULAR CASE section hereafter.

DESCENT (CROSSING FL100)

When the LS pb is selected ON during descent, the crew will check:

- The FLS virtual beam course, flight path angle and anchor point on the lower left part of the PFD
- The approach capability displayed on FMA confirms the crew strategy for approach

Note: *1. The flight path angle on the PFD is expressed in term of degree whereas it is expressed in % in some Non Precision Approach chart e.g. 3 °equates to 5.2 %.*
2. If the final approach slope information is not provided on the approach chart e.g. for some NDB approaches, the FMS gives a defaulted final approach slope (normally 3 °).

INITIAL APPROACH

FLYING REFERENCE

In all cases, it is recommended to use the FD bars for NPA approach with the TRK/FPA selection on AFS-CP.

APPROACH PHASE ACTIVATION

The decelerated approach technique may be used.

INTERMEDIATE APPROACH

The FLS virtual beam is displayed in magenta and is 80 nmlong. It could be intercepted at any point along the magenta line. **The crew must bear in mind however, that the obstacle clearance outside the published approach is his responsibility.**
When cleared for final approach course interception, the pilot will press APPR p/b on AFS-CP. Verify F-G/S and F-LOC become armed on the FMA.

FINAL APPROACH

When the aircraft reaches the FAF, the flight crew monitors the engagement of F-G/S.
As for ILS, the final descent point will be validated by an appropriate means for the approach e.g. DME for VOR/DME approach, FMS WPT sequencing for RNAV or GPS approach.

REACHING THE MINIMA

The applicable minima are those associated with the NPA. Reaching MDA, “MINIMUM” is either monitored or called by the PNF. The current altitude value becomes amber.
If the required visual conditions are not met by MDA, a missed approach must be initiated.

If the required visual conditions are met:
- The PF must disengage the AP
  As a reminder, if the AP is still engaged at minimum minus50 ft, the DISCONNECT AP FOR LDG message pulses on the FMA.
- The PF orders the PNF to set the FDs off
- The PF orders the PNF to set the runway track
- If the F-LOC beam is aligned with the runway: As FLS deviations remain meaningful, the LS pb may be kept on. The flight crew can use FLS deviations as pilot aid. The visual reference must always prevail.
- If the F-LOC beam is not aligned with the runway: The LS pb must be set to off.

The F-LOC beam can be considered as aligned with the runway, if the difference between the final approach course and the runway course is less than 4 °.

ILS WITH G/S OUT, LOC ONLY, LOC B/C APPROACH

Applicable to: ALL

LOC GS OUT, LOC ONLY, LOC BC APPROACH

PREFACE

These NPA may be flown with or without AP/FD guidance.

- The lateral deviation and guidance refer to a radio beam
- The vertical deviation and guidance refer to the FMS computed glide

Hereafter are listed some particularities of these approaches.

APPROACH PREPARATION (LOC GS OUT CASE)

LOC GS OUT CASE

The crew will select the ILS approach in the FM during the approach preparation. As the G/S deviations and guidance modes are not available, the vertical FLS deviation (double diamond) and mode (F-G/S) may be made available by the “DESELECT GLIDE” prompt available in the MFD POSITION/NAVAID/ tuned for display tab.

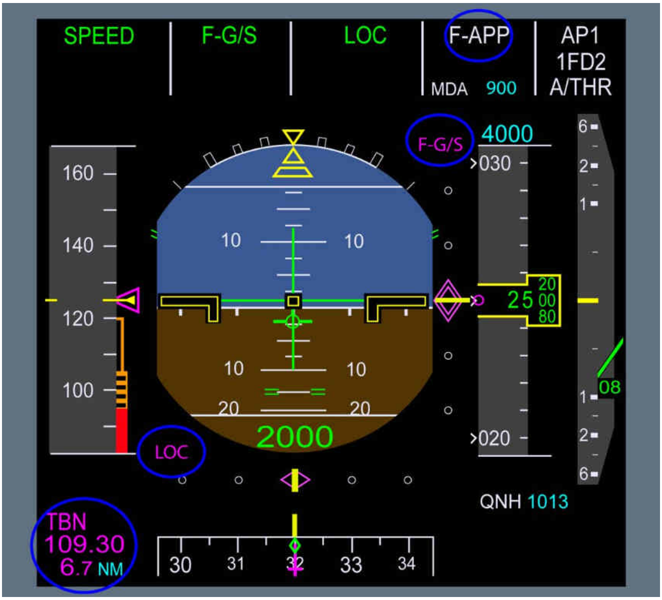
LOC ONLY, LOC BC CASE

The crew will select the LOC or LOC BC approach as required in the FM during the approach preparation.

DESCENT (CROSSING FL 100)

When the LS pb is selected ON during descent, the crew will check:

- FLS approach capability (displayed on FMA but addresses to the vertical mode only).
- The LOC deviation is displayed as single diamond (radio data).
- The F-G/S deviation is displayed as a double diamond (FM computed data).
- The LOC IDENT, frequency and DME distance



FINAL APPROACH

If the approach capability reverts to RAW ONLY, the **F-G/S vertical deviations remain but must be disregarded.** The crew will select a Flight Path Angle to deselect F-G/S mode.

REACHING THE MINIMA

The applicable minima are those associated with the NPA. Reaching MDA, “MINIMUM” is either monitored or called by the PNF. The current altitude value becomes amber.

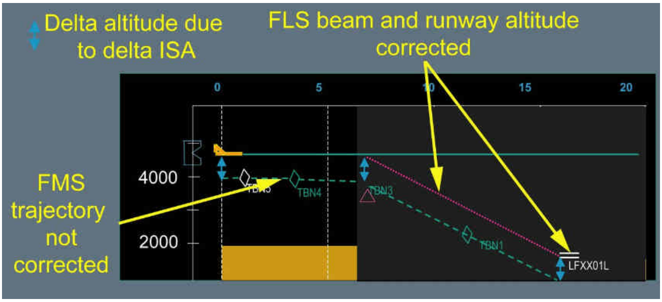
- If the required visual conditions are not met by MDA, a missed approach must be initiated.
- If the required visual conditions are met, the PF must disengage the AP (if not previously done) and continue visually. As a reminder, an amber “DISCONNECT AP FOR LDG” message appears on the FMA at minima minus 50 ft AP is still engaged.
- Below the minimas, visual references shall prevail. However, FD guidance and LS deviations remain meaningful and may be used as pilot aid.

COLD WEATHER OPERATIONS

Applicable to: ALL

COLD WEATHER OPERATIONS

The virtual FLS beam is corrected for temperature below ISA thanks to the ground temperature entered in the MFD PERF APP page.
When established on the final approach, the barometric altitudes read on PFD will be consequently higher and should be validated after the altitude correction has been made.
For the same reason, the MDA must be updated.
The FMS trajectory is not corrected for temperature below ISA. This may lead for low ISA to the non-superposition of the FMS trajectory to the FLS beam.



When the F-G/S mode engages, the FMS trajectory (green) moves toward the FLS beam trajectory (magenta).
Refer FCTM 04.010 ADVERSE WEATHER section for altitude correction in cold weather operations.

NPA FLOWN WITHOUT FLS FUNCTION

Applicable to: ALL

PARTICULAR CASES

PREFACE

This section deals with the NPA when the FLS tool is not available. This can be due to:

- The NPA construction e.g. where the offset between final approach course and runway exceeds 50°.
- A multiple failure condition e.g. MMR 1+2 failure
- RAW ONLY degradation e.g. in the FMS LOW accuracy case.

In these cases, the FLS function must not be used. The lateral guidance may be either NAV or TRK and the vertical guidance will be FPA.
Hereafter are listed some particularities of these approaches.

INITIAL APPROACH

FLYING REFERENCE

In all cases, it is recommended to use the FD bars for NPA approach.
The TRK/FPA selection is recommended with the bird as cross-reference to the FD bars.

APPROACH PHASE ACTIVATION

The stabilized approach technique is recommended

INTERMEDIATE APPROACH

When cleared for final approach course interception, the pilot will:

- For GPS PRIMARY or NAV ACCY check positive (error<1 nm):
  Keep NAV mode and validate the final interception course with raw data. Under radar vectoring, the crew should use the DIR TO COURSE IN facility.

Or

- For the others cases:
  Select appropriate TRK on AFS-CP, in order to establish final course tracking with reference to NAVAIDS raw data.

FINAL APPROACH

FPA should be preset on the AFS-CP no later than1 nm prior to the FAF. A smooth interception of the final approach path can be achieved by pulling the FPA selector 0.2 nm prior to the FAF.
The crew will refer only to NAVAID raw data and altitude versus distance throughout the final approach for the RAW ONLY case.

REACHING THE MINIMA

- If the required visual conditions are not met by MDA, a missed approach must be initiated.
- If the required visual conditions are met, the PF must disengage the AP (if not previously done) and order the PNF

- FDS off.
- Set runway track

CIRCLING

Applicable to: ALL

PREFACE

The circling approach is flown when the tower wind is such that the landing runway is different from the runway fitted with an instrument approach, which is used for the descent and approach in order to get visual of the airfield.

APPROACH PREPARATION

The approach preparation follows the same schema as described in APPROACH PREPARATION section in Descent Preparation section. However, some characteristics need to be highlighted:

FPLN

Lateral: STAR, instrument approach procedure.
Vertical: Insert F speed as constraint at FAF since the approach will be flown flaps 3, landing gear down and F speed (stabilized approach); Check altitude constraints.

SEC FPLN

When planning for a circling approach, the landing runway will be inserted into the SEC F-PLN. The crew will update the SEC F-PLN as follows:

- SEC F-PLN then IMPORT ACTIVE
- Lateral revision on destination and insert landing runway
- Keep the F-PLN discontinuity

FINAL INSTRUMENT APPROACH

The crew will fly a stabilized approach at F speed, configuration 3 and landing gear down.

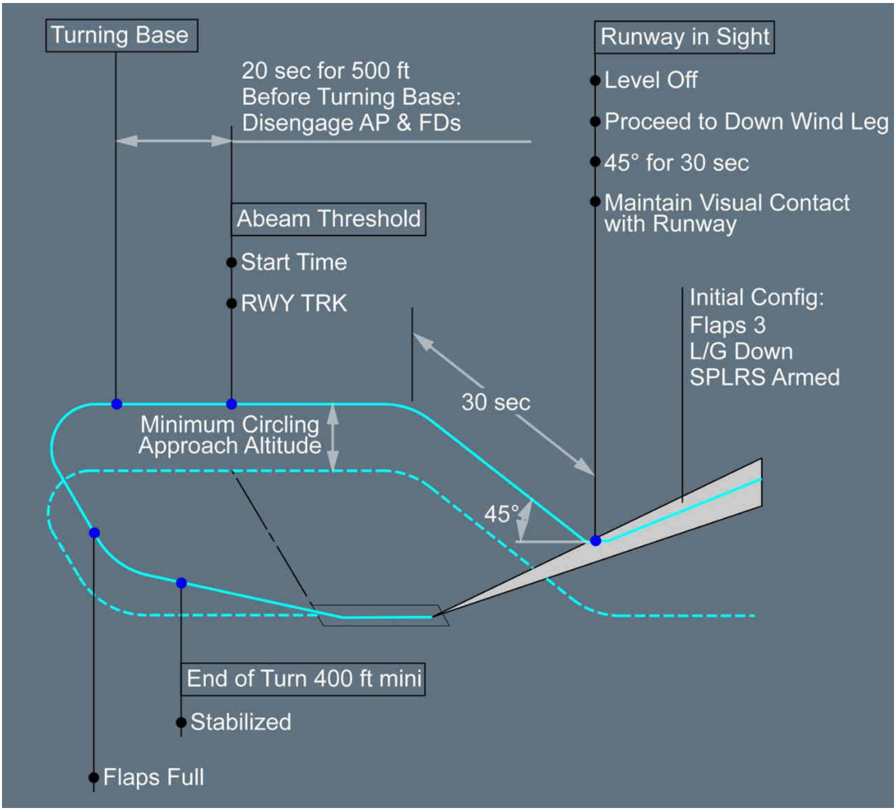
CIRCLING APPROACH

When reaching circling minima and with sufficient visual reference for circling:

- Push the FCU ALT P/B.
- Select TRK/FPA
- Select a TRK of 45 °away from the final approach course (or as required by the published procedure
- When wings level, start the chrono
- Once established downwind, activate the SEC F-PLN to take credit of the "GS mini" protection in final approach when managed speed is used. Additionally, the landing runway will be shown on the ND and the 10 nm range should be selected to assist in positioning onto final approach
- By the end of the downwind leg, disconnect the AP, select FDs off and keep the A/THR
- When leaving the circling altitude, select the landing configuration
- Once fully configured, complete the Landing Checklist.

Once the SEC F-PLN is activated, the go-around procedure in the MFD will be that for the landing runway rather than the one associated with the instrument approach just carried out. Therefore, if visual references were lost during the circling approach, the go-around would have to be flown using selected guidance, following the pre-briefed missed approach procedure.

LOW VISIBILITY CIRCLING APPROACH



GENERAL

Applicable to: ALL

CAT II and CAT III approaches are flown to very low DH (or without DH) with very low RVR. The guidance of the aircraft on the ILS beam and the guidance of the aircraft speed must be consistently of high performance and accurate so that an automatic landing and roll out can be performed in good conditions and, the acquisition of visual cues is achieved the aircraft properly stabilized. Hence,

- The automatic landing is required in CAT III operations including roll out in CAT IIIB.
- The automatic landing is the preferred landing technique in CATII conditions
- Any failures of the automated systems shall not significantly affect the aircraft automatic landing system performance
- The crew procedures and task sharing allow to rapidly detect any anomaly and thus lead to the right decision

DEFINITION

Applicable to: ALL

DECISION HEIGHT

The Decision Height (DH) is the wheel height above the runway elevation by which a go around must be initiated unless adequate visual reference has been established and the aircraft position and the approach path have been assessed as satisfactory to continue the automatic approach and landing in safety. The DH is based on RA.

ALERT HEIGHT

The Alert Height (AH) is the height above the runway, based on the characteristics of the aeroplane and its fail-operational automatic landing system, above which a CAT III approach would be discontinued and a missed approach initiated if a failure occurred in one of the redundant part of the automatic landing system, or in the relevant ground equipment.
In others AH definition, it is generally stated that if a failure affecting the fail-operational criteria occurs below the AH, it would be ignored and the approach continued (except if AUTOLAND warning is triggered). The AH concept is relevant when CAT3 DUAL is displayed on FMA.
For the A380, the AH =200 ft (100 ft for KAL) .

CAT 3 SINGLE

CAT 3 SINGLE is announced when the airborne systems are fail passive which means that a single failure will lead to the AP disconnection without any significant out of trim condition or deviation of the flight path or attitude. Manual flight is then required. This minimum DH is 50 ft.

CAT 3 DUAL

CAT 3 DUAL is announced when the airborne systems are fail-operational. In case of a single failure, the AP will continue to guide the aircraft on the flight path and the automatic landing system will operate as a fail-passive system. In the event of a failure below the AH, the approach, flare and landing can be completed by the remaining part of the automatic system. In that case, no capability degradation is indicated. Such a redundancy allows CAT III operations with or without DH.

CAT II OR CAT III APPROACHES

		ICAO	FAA	JAA
CAT II	DH	100 ft≤DH<200 ft	100 ft≤DH<200 ft	100 ft≤DH<200 ft
	RVR	RVR ≥350 m RVR≥1 200 ft	350 m≤RVR<800 m 1 200 ft≤RVR<2 400 ft	RVR≥300 m RVR≥1 000 ft
CAT IIIA	DH	No DH or DH<100 ft	No DH or DH<100 ft	DH<100 ft (1)
	RVR	RVR ≥200 m RVR≥ 700 ft	RVR ≥200 m RVR≥ 700 ft	RVR ≥200 m RVR≥ 700 ft
CAT IIIB	DH	No DH or DH<50 ft	No DH or DH<50 ft	No DH or DH<50 ft
	RVR	50 m≤RVR<200 m 150 ft≤RVR<700 ft	50 m≤RVR<200 m 150 ft≤RVR<700 ft	75 m≤RVR<200 m 250 ft≤RVR<700 ft

(1) *DH≥50 ft if fail passive*

FLIGHT PREPARATION

Applicable to: ALL

In addition to the normal flight preparation, the following preparation must be performed when CAT II or CAT III approach is planned:

- Ensure that destination airport meets CAT II or CAT III requirements
- Check aircraft required equipment for CAT II or CAT III in QRH
- Check that crew qualification is current
- Consider extra fuel for possible approach delay
- Consider weather at alternate

APPROACH PREPARATION

Applicable to: ALL

LIMITATIONS

- The crew will check that tower wind remains within the limit for CAT II or CAT III approaches (*Refer to FCOM/Limitations*).
- The autoland maximum altitude must be observed.

AIRCRAFT CAPABILITY

The failures that may affect the aircraft's CAT 2/3 capability are listed in the FCOM . Most of these failures are monitored by the FMS and the landing capability will be displayed on the FMA once the APPR pb is pressed, i.e. CAT 2, CAT 3 SINGLE, CAT 3 DUAL. However, there are a number of failures which affect the aircraft's landing capability which are not monitored by the FMS and, consequently, not reflected on the FMA . It is very important, therefore, that the crew refer to the FCOM to establish the actual landing capability if some equipment are listed inoperative.

AIRPORT FACILITIES

The airport authorities are responsible for establishing and maintaining the equipment required for CAT II/III approach and landing. The airport authorities will activate the LVP procedures as the need arises based on RVR . Prior performing a CAT II/III approach, the crew must ensure that LVP procedures are in force.

CREW QUALIFICATION

The captain must ensure that both crew members are qualified and that their qualification is current for the planned approach.

SEATING POSITION

The crew must realise the importance of eye position during low visibility approaches and landing. A too low seat position may greatly reduce the visual segment. When the eye reference position is lower than intended, the visual segment is further reduced by the cut-off angle of the glareshield or nose.

USE OF LANDING LIGHTS

The use of landing lights at night in low visibility can be detrimental to the acquisition of visual reference. Reflected lights from water droplets or snow may actually reduce visibility. The landing lights would, therefore, not normally be used in CAT II/III weather conditions.

APPROACH STRATEGY

Irrespective of the actual weather conditions, the crew should plan the approach using the best approach capability. This would normally be CAT 3 DUAL with autoland, depending upon aircraft status. The crew should then assess the weather with respect to possible downgrade capability.

Conditions	CATI	CATII	CATIII	
			WITH DH	NO DH
Flying technique	Hand flying or AP / FD , A/THR	AP / FD , A/THR down to DH	AP / FD / ATHR and Autoland	

Continued on the following page

Continued from the previous page

Minima & weather	DA (DH) Baro ref Visibility	DH with RA RVR	
Autoland	Possible with precautions	Recommended	Mandatory

GO AROUND STRATEGY

The crew must be ready mentally for go-around at any stage of the approach. Should a failure occur above 1 000 ft RA , all ECAM actions (and DH amendment if required) should be completed before reaching 1 000 ft RA , otherwise a go-around should be initiated. This ensures proper task sharing for the remainder of the approach. Any alert generated below 1 000 ft should lead to a go-around.

LANDING BRIEFING

Before commencing a CAT II/III approach a number of factors must be considered by the crew. In addition to the standard approach briefing, the following points should be emphasised during an approach briefing for a low visibility approach:
- Aircraft capability
- Airport facilities
- Crew qualification
- Weather minima
- Task sharing
- Call-outs
- Go-around strategy

APPROACH PROCEDURE

Applicable to: ALL

TASK SHARING

The workload is distributed in such a way that the PF primary tasks are supervising and decision making and the PM primary task is monitoring the operation of the automatic system.

The PF supervises the approach (trajectory, attitude, speed) and takes appropriate decision in case of failure and at DH. Since the approach is flown with AP/FD/A-THR, the PF must be continuously ready to take-over:
- If any AP hard over is experienced
- If a major failure occurs.
- If any doubt arises

The PF announces "LAND", when displayed on FMA.

The PM is head down throughout the approach and landing. The PM monitors:
- The FMA and calls mode change as required (except "LAND")
- The Auto call out
- The aircraft trajectory or attitude exceedance
- Any failures

The PM should be go-around minded.

VISUAL REFERENCE

Approaching the DH, the PF starts to look for visual references, progressively increasing external scanning. It should be stressed that the DH is the lower limit of the decision zone. The captain should come to this zone prepared for a go-around but with no pre-established judgement.

Required conditions to continue
- With DH
  In CATII operations, the conditions required at DH to continue the approach are that the visual references should be adequate to monitor the continued approach and landing and that the flight path should be acceptable. If both these conditions are not satisfied, it is mandatory to initiate a go-around. A 3 lights segment and a lateral light element is the minimum visual cue for JAR OPS.
  In CATIII operations, the condition required at DH is that there should be visual references which confirm that the aircraft is over the touch down zone. Go-around is mandatory if the visual references do not confirm this. A 3 lights segment is required by JAR OPS for fail passive system and 1 centerline light segment for fail operational system.
- Without DH
  The decision to continue does not depend on visual references, even though a minimum RVR is specified. The decision depends only on the operational status of the aircraft and ground equipment. If a failure occurs prior to reaching the AH, a go-around will be initiated. A go-around must nevertheless be performed if AUTOLAND warning is triggered below AH. However, it is good airmanship for the PF to acquire visual cues during flare and to monitor the roll out.

Loss of visual reference
- With DH before touch down
  If decision to continue has been made by DH and the visual references subsequently become insufficient a go-around must be initiated.
  A late go-around may result in ground contact. If touch down occurs after TOGA is engaged, the AP remains engaged in that mode and A/THR remains in TOGA. The ground spoilers and auto-brake are inhibited.
- With DH or without DH after touch down
  If visual references are lost after touch down, a go-around should not be attempted. The roll-out should be continued with AP in ROLL OUT mode down to taxi speed.

FLARE/LANDING/ROLL OUT

During the flare, decrab and roll-out, the PF will watch outside to assess that the autoland is properly carried out, considering the available visual references.
For CATII approaches, autoland is recommended. If manual landing is preferred, the PF will take-over at 80 ftat the latest. This ensures a smooth transition for the manual landing.
Pull to reverse IDLE at main landing gear touchdown (not before). When REV is indicated in green on ECAM, MAX reverse may be applied. The use of auto-brake is recommended as it ensures a symmetrical brake pressure application. However, the crew should be aware of possible dissymmetry in case of crosswind and wet runways.
The PM will use standard call out. Additionally, he will advise ATC when aircraft is properly controlled (speed and lateral trajectory).

FAILURE AND ASSOCIATED ACTIONS

Applicable to: ALL

As a general rule, if a failure occurs above 1 000 ft AGL, the approach may be continued, ECAM actions completed, approach briefing update performed and a higher DH set if required.
Below 1 000 ft(and down to AH in CAT3 DUAL), the occurrence of any failure implies a go-around and a reassessment of the system capability. Another approach may be under taken according to the new system capability. It has been considered that below 1 000 ft, not enough time is available for the crew to perform the necessary switching, to check system configuration and limitation and brief for minima.
In CAT3 DUAL and below AH, as a general rule, a single failure does not necessitate a go-around. A go-around is required if the AUTOLAND warning is triggered.

AUTOLAND IN CAT I OR BETTER WEATHER CONDITIONS

Applicable to: ALL

The crew may wish to practice automatic landings in CAT I or better weather conditions for training purposes. This type of approach should be carried out only with the airline authorization. The crew should be aware that fluctuations of the LOC and/or GS might occur due to the fact that protection of ILS sensitive areas, which applies during LVP, will not necessarily be in force. It is essential, therefore, that the PF is prepared to take over manually at any time during a practice approach and rollout, should the performance of the AP become unsatisfactory.

VISUAL APPROACH

Applicable to: ALL

The crew must keep in mind that the pattern is flown visually. However, the XTK is a good cue of the aircraft lateral position versus the runway centreline. This is done using DIR TO CF CRS IN.

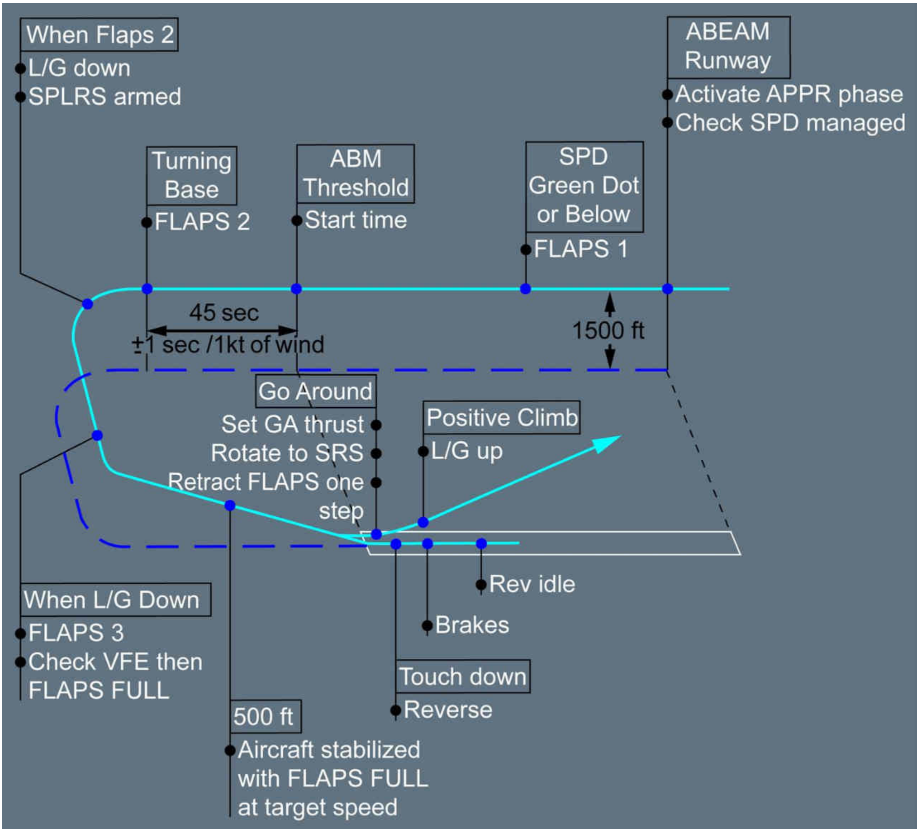
The crew will aim to get the following configuration on commencement of the downwind leg:
- Both AP and FDS will be selected off
- BIRD ON
- A/THR confirmed active in speed mode, i.e. SPEED on the FMA
- Managed speed will be used to enable the "GS mini" function
- The downwind track will be selected on the FCU to assist in downwind tracking
- The downwind track altitude will be set on FCU.

INTERMEDIATE/FINAL APPROACH

Applicable to: ALL

Assuming a 1 500 ft AAL circuit, the base turn should be commenced 45 s after passing abeam the downwind threshold (+/- 1 second/kt of head/tailwind).
Initially the rate of descent should be 400 ft/min , increasing to 700 ft/minwhen established on the correct descent path.
The pilot will aim to be configured for landing at VAPP by 500 ft AAL, at the latest. If not stabilised, a go-around must be carried out.

VISUAL APPROACH



PREFACE

Applicable to: ALL

Failure to recognize the need for and to execute a go-around, when required, is a major cause of approach and landing accidents. Because a go-around is an infrequent occurrence, it is important to be “go-around minded”. The decision to go-around should not be delayed, as an early go-around is safer than a last minute one at lower altitude.

CONSIDERATIONS ABOUT GO-AROUND

Applicable to: ALL

A go-around must be considered if:

- There is a loss or a doubt about situation awareness
- If there is a malfunction which jeopardizes the safe completion of the approach e.g. major navigation problem
- ATC changes the final approach clearance resulting in rushed action from the crew or potentially unstable approach
- The approach is unstable in speed, altitude, and flight path in such a way that stability will not be obtained by 1000 ft IMC or 500 ft VMC
- Any TAWS, TCAS or windshears alert occur
- Adequate visual cues are not obtained reaching the minima.

AP/FD GO-AROUND PHASE ACTIVATION

Applicable to: ALL

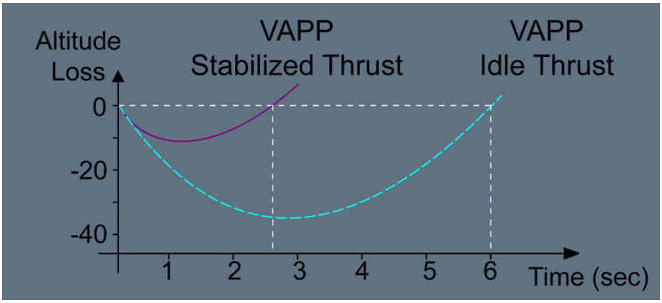
The go-around phase is activated when the thrust levers are set to TOGA, provided the flap lever is selected to Flap 1 or greater.
The FD bars with HDG/VS are displayed automatically, SRS and GA TRK modes engage and speed brakes, if extended, retract automatically.
For the go-around, the appropriate flight reference is the attitude, because go-around is a dynamic maneuver. If the "bird" is on, it is automatically removed and HDG/VS automatically selected on the FCU (AFS-CP).
The missed approach becomes the active F-PLN and the previously flown approach is strung back into the F-PLN.

GO-AROUND PHASE

Applicable to: ALL

The SRS mode guides the aircraft with a maximum speed of VAPP, or IAS at time of TOGA selection (limited to maximum of VLS + 25 with all engines operative or VLS + 15 with one engine inoperative) until the acceleration altitude where the target speed increases to the CLB speed.
The GA TRK mode guides the aircraft on the track memorised at the time of TOGA selection. The missed approach trajectory becomes the ACTIVE F-PLN provided the waypoints have been correctly sequenced on the approach. Pushing for NAV enables the missed approach F-PLN to be followed.
When the pilot sets TOGA thrust for go-around, it takes some time for the engines to spool up due to the acceleration capability of the high by pass ratio engines. Therefore, the pilot must be aware that the aircraft will initially loose some altitude. This altitude loss will be greater if initial thrust is close to idle and/or the aircraft speed is lower than VAPP.

Attitude Loss Following a Go-Around



Above the go-around acceleration altitude, the target speed is CLB speed.

LEAVING THE GO-AROUND PHASE

Applicable to: ALL

GENERAL

The purpose of leaving the go-around phase is to obtain the proper target speed and proper predictions depending upon the strategy chosen by the crew. During the missed approach, the crew will elect either of the following strategies :
- Fly a second approach
- Carry out a diversion

SECOND APPROACH

If a second approach is to be flown, the crew will activate the approach phase on the MFD ACTIVE/PERF page. The FMS switches to Approach phase, the short term target speed displayed as a magenta dot, moves according to the flaps lever setting, e.g. green dot for Flaps 0 and VAPP is displayed as a magenta triangle.
The crew will ensure proper waypoint sequencing during the second approach in order to have the missed approach route available, should a further go-around be required.

DIVERSION

Once the aircraft path is established and clearance has been obtained, the crew will enter the ALTN FPLN as ACTIVE FPLN:

- If the crew has prepared the ALTN FPLN in the active F-PLN, on selecting the ENABLE ALTN prompt on the TO WPT revision menu, the lateral mode reverts to HDG if previously in NAV. The aircraft will be flown towards the next waypoint using HDG or NAV via a DIR TO entry.
- If the crew has prepared the ALTN FPLN in one SEC F-PLN, the MFD SEC INDEX page will be accessed and SEC F-PLN for diversion will be swapped to active. The crew will use the DIR TO function as required to sequence the FPLN.
- If the crew has not prepared the ALTN FPLN, climb will be initially carried out in OP CLB mode. Once established in climb and clear of terrain, the crew will use the “DIR TO” function to the next cleared waypoint, make a lateral revision at this waypoint to insert a NEW DEST and finalize the ALTN FPLN. The route and a CRZ FL (on PERF page) can be updated as required.

REJECTED LANDING

Applicable to: ALL

A rejected landing is defined as a go-around manoeuvre initiated below the minima.
Once the decision is made to reject the landing, the flight crew must be committed to proceed with the go-around manoeuvre and not be tempted to retard the thrust levers in a late decision to complete the landing.
TOGA thrust must be applied but a delayed flap retraction should be considered. If the aircraft is on the runway when thrust is applied, a CONFIG warning will be generated if the flaps are in CONF FULL. The landing gear should be retracted when a positive rate of climb is established with no risk of further touch down. Climb out as for a standard go-around.
In any case, if reverse thrust has been applied, a full stop landing must be completed.

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PREFACE

Applicable to: ALL

When Transitioning from IMC to VMC, the crew will watch the bird versus the aircraft attitude symbol in the center of the PFD. This provides a good assessment of the drift, thus in which direction to look for the runway.
But, then:

- Do not turn towards the runway
- Do not duck under

FLARE

Applicable to: ALL

NORMAL CONDITIONS

When reaching 100 ft , auto-trim ceases and the pitch law is modified to become a flare law, i.e. a smoother direct law (as described in OPERATIONAL PHILOSOPHY Chapter).
Indeed, the normal pitch law, which provides trajectory stability, is not the best adapted to the flare manoeuvre.
At 50 ft, a term that increase the static stability is introduced, function of ground speed.
Consequently, as the speed reduces, the flight crew has to pull backstick to maintain a constant path.
The flare technique is thus conventional.
Start the flare by progressively increasing and maintaining backstick. From stabilized conditions, the flare height is about 40 ft. This height varies with different parameters, such as weight, rate of descent, wind variations…

Avoid under flaring:
- Prior to the initiation of the flare, the flight crew must control the rate of descent (i.e. nominal 3 °slope and rate not increasing)
- Start the flare by progressively increasing and maintaining backstick as necessary
- Avoid significant forward stick movement when the flare is initiated (releasing back-pressure is acceptable).

At 20 ft , the “RETARD” auto call-out reminds the flight crew to retard thrust levers. It is a reminder rather than an order. When best adapted, the flight crew will rapidly retard all thrust levers : Depending on the conditions, the flight crew will retard earlier or later.
However, the flight crew must ensure that all thrust levers are at IDLE detent at the latest at touchdown, to ensure ground spoilers extension at touchdown.

CROSSWIND CONDITIONS

The flare technique described above applies.

The recommended technique is to use the rudder to align the aircraft with the runway heading during the flare, while using lateral control to maintain the aircraft on the runway center line.
The lateral law compensates the roll induced by the rudder input, thus the routine use of into-wind aileron is not needed.
In strong wind conditions, the aircraft may land with a residual drift of 5 °maximum.

CALL OUT

Applicable to: ALL

"PITCH, PITCH" auto call out is provided.

DEROTATION

Applicable to: ALL

When the aircraft is on the ground, pitch and roll control operates in Direct Law. Consequently, when the aircraft touches down, the pilot flies the nose down conventionally, varying sidestick input as required, to control the derotation rate.
After touch down, when reverse thrust is selected (on at least one engine) and one main landing gear strut is compressed, the ground spoilers partially extend to establish ground contact. The ground spoilers fully extend when both main landing gears are compressed.

ROLL OUT

Applicable to: ALL

NORMAL CONDITIONS

During the roll out, the rudder pedals will be used to steer the aircraft on the runway centreline.
At high speed, directional control is achieved with rudder. As the speed reduces, the Nose Wheel Steering (NWS) becomes active. However, the NWS tiller will not be used until taxi speed is reached.

CROSSWIND CONDITIONS

The above-mentioned technique applies. Additionally, the pilot will avoid to set stick into the wind as it increases the weathercock effect. Indeed, it creates a differential down force on the wheels into the wind side.
The reversers have a destabilizing effect on the airflow around the rudder and thus decrease the efficiency of the rudder. Furthermore they create a side force, in case of a remaining crab angle, which increases the lateral skidding tendency of the aircraft. This adverse effect is quite noticeable on contaminated runways with crosswind. In case a lateral control problem occurs in high crosswind landing, the pilot will consider to set reversers back to Idle.

At lower speeds, the directional control of the aircraft is more problematic, more specifically on wet and contaminated runways. Differential braking is to be used if necessary. On wet and contaminated runways, the same braking effect may be reached with full or half deflection of the pedals; additionally the anti skid system releases the brake pressure on both sides very early when the pilot presses on the pedals. Thus if differential braking is to be used, the crew will totally release the pedal on the opposite side to the expected turn direction.

BRAKING

Applicable to: ALL

GENERAL

Once on the ground, the importance of the timely use of all means of stopping the aircraft cannot be overemphasised. Three systems are involved in braking once the aircraft is on the ground:

- The ground spoilers
- The thrust reversers
- The wheel brakes

THE GROUND SPOILERS

When the aircraft touches down with at least one main landing gear and when at least one thrust lever is in the reverse sector, the ground spoilers partially automatically deploy to ensure that the aircraft is properly sit down on ground. This is the partial lift dumping function. Then, the ground spoilers automatically fully deploy.
The ground spoilers contribute to aircraft deceleration by increasing aerodynamic drag at high speed. Wheel braking efficiency is improved due to the increased load on the wheels. Additionally, the ground spoiler extension signal is used for auto-brake activation.

THE THRUST REVERSERS

Thrust reverser efficiency is proportional to the square of the speed. So, it is recommended to use reverse thrust at high speeds.
Only inboard engines are equipped with thrust reversers as this provides enough braking capability.
Select MAX REV immediately after the main landing gear touches down.
Below 70 kt , reversers efficiency decreases rapidly, and below 60 kt with maximum reverse selected, there is a risk of engine stall. Therefore, it is recommended to smoothly reduce the reverse thrust to idle at 80 kt . However, the use of maximum reverse is allowed down to aircraft stop in case of emergency.
If airport regulations restrict the use of reverse, select and maintain reverse idle until taxi speed is reached.

Stow the reversers before leaving the runway to avoid foreign object ingestion.

THE WHEEL BRAKES

Wheel brakes contribute the most to aircraft deceleration on the ground. Many factors may affect efficient braking such as load on the wheels, tire pressure, runway pavement characteristics and runway contamination and braking technique. The only factor over which the pilot has any control is the use of the correct braking technique, as discussed below.

ANTI-SKID

The anti-skid system adapts pilot applied brake pressure to runway conditions by sensing an impending skid condition and adjusting the brake pressure to each individual wheel as required. The anti-skid system maintains the skidding factor (slip ratio) close to the maximum friction force point. This will provide the optimum deceleration with respect to the pilot input.

BRAKES

The use of autobrake versus pedal braking should observe the following guidelines:

- The use of A/BRK is usually preferable because it minimizes the number of application of brake and thus reduces brake wear. Additionally, the A/BRK provides a symmetrical brake pressure application which ensures an equal braking effect on both main landing gear wheels on wet or evenly contaminated runway. More particularly, the A/BRK is recommended on short, wet, contaminated runway, in poor visibility conditions and in Auto land.
  The use of LO autobrake should be preferred on long and dry runways whereas the use of HI autobrake should be preferred for short or contaminated runways.
- HI mode produces a smooth but high level of deceleration, that may be useful in case of emergency or short runway situation.
- On very long runways, the use of pedal braking may be envisaged if the pilot anticipates that braking will not be needed. To reduce brake wear, the number of brake application should be limited.
- In case of pedal braking, do not ride the brakes but apply pedal braking when required and modulate the pressure without releasing. This minimizes brake wear.

The BRK X, displayed in green on the FMA, indicates that AUTOBRAKE is active.
The DECEL on the lower part of the air speed indicator indicates that the selected deceleration rate is or is not achieved, when the autobrake is active. For example DECEL might not come up when the autobrake is selected on a contaminated runway, because the deceleration rate is not reached with the autobrake properly functioning.
Since the auto brake system senses deceleration and modulates brake pressure accordingly, the timely application of MAX reverse thrust will reduce the actual operation of the brakes themselves, thus the brake wear and temperature.

Autobrake does not relieve the pilot of the responsibility of achieving a safe stop within the available runway length.

TAILSTRIKE AVOIDANCE

Applicable to: ALL

INTRODUCTION

Although most of tail strikes are due to deviations from normal landing techniques, some are associated with such external conditions as turbulence and wind gradient.

DEVIATION FROM NORMAL TECHNIQUES

Deviations from normal landing techniques are the most common causes of tail strikes. The main reasons for this are due to:

- Allowing the speed to decrease well below VAPP before flare
  Flying at too low speed means high angle of attack and high pitch attitude, thus reducing ground clearance. When reaching the flare height, the pilot will have to significantly increase the pitch attitude to reduce the sink rate. This may cause the pitch to go beyond the critical angle.
- Prolonged hold off for a smooth touch down
  As the pitch increases, the pilot needs to focus further ahead to assess the aircraft's position in relation to the ground. The attitude and distance relationship can lead to a pitch attitude increase beyond the critical angle.
- Too high flare
  A high flare can result in a combined decrease in airspeed and a long float. Since both lead to an increase in pitch attitude, the result is reduced tail clearance.
- Too high sink rate, just prior reaching the flare height
  In case of too high sink rate close to the ground, the pilot may attempt to avoid a firm touch down by commanding a high pitch rate. This action will significantly increase the pitch attitude and, as the resulting lift increase may be insufficient to significantly reduce the sink rate, the high pitch rate may be difficult to control after touch down, particularly in case of bounce.
- Bouncing at touch down
  In case of bouncing at touch down, the pilot may be tempted to increase the pitch attitude to ensure a smooth second touch down. If the bounce results from a firm touch down, associated with high pitch rate, it is important to control the pitch so that it does not further increase beyond the critical angle.

APPROACH AND LANDING TECHNIQUES

A stabilized approach is essential for achieving successful landings. It is imperative that the flare height be reached at the appropriate airspeed and flight path angle. The A/THR and bird (Velocity Vector) are effective aids to the pilot.

VAPP should be determined with the wind corrections by using the FMS functions. As a reminder, when the aircraft is close to the ground, the wind intensity tends to decrease and the wind direction to turn (direction in degrees decreasing in the northern latitudes). Both effects may reduce the head wind component close to the ground and the wind correction to VAPP is there to compensate for this effect.
When the aircraft is close to the ground, high sink rate should be avoided, even in an attempt to maintain a close tracking of the glideslope. Priority should be given to the attitude and sink rate. If a normal touchdown distance is not possible, a go-around should be performed.
If the aircraft has reached the flare height at VAPP, with a stabilized flight path angle, the normal SOP landing technique will lead to repetitive touch down attitude and airspeed.
During the flare, the pilot should not concentrate on the airspeed, but only on the attitude with external cues.
Specific PNF call outs have been reinforced for excessive pitch attitude at landing.

Note: *a "PITCH-PITCH" aural warning is activated if the pitch attitude, monitored by the flight controls, reaches a given limit. This aural warning is only available in manual flight at landing when the aircraft height is lower than 50 ft. In addition, a pitch limit indication is provided on the PFD at landing under 400 ft.*

After touch down, the pilot must "fly" the nosewheel smoothly, but without delay, on to the runway, and must be ready to counteract any residual pitch up effect of the ground spoilers. However, the main part of the spoiler pitch up effect is compensated by the flight control law itself.

BOUNCING AT TOUCH DOWN

In case of light bounce, maintain the pitch attitude and complete the landing, while keeping the thrust at idle. Do not allow the pitch attitude to increase, particularly following a firm touch down with a high pitch rate.
In case of high bounce, maintain the pitch attitude and initiate a go-around. Do not try to avoid a second touch down during the go-around. Should it happen, it would be soft enough to prevent damage to the aircraft, if pitch attitude is maintained.
Only when safely established in the go-around, retract flaps one step and the landing gear. A landing should not be attempted immediately after high bounce, as thrust may be required to soften the second touch down and the remaining runway length may be insufficient to stop the aircraft.

CUMULATIVE EFFECTS

No single factor should result in a tail strike, but accumulation of several can significantly reduce the margin.

BRAKE TEMPERATURE

Applicable to: ALL

The use of brake fans could increase oxidation of the brake surface hot spots if brakes are not thermally equalized, leading to the rapid degradation of the brakes. For this reason, selection of brake fans should be delayed until approximately five minutes after touchdown or just prior to stopping at the gate (whichever occurs first).
When reaching the gate, if there is a significant difference in brake temperature between the wheels of the same gear, this materializes a potential problem with brake e.g. if one wheel reaches the limit temperature of 600°C while all others wheels brakes indicate less than 450°C, this indicates that there is a potential problem of brake binding or permanent brake application on that wheel. Conversely, if one wheel brake is at or below 60°C whereas the others are beyond 150°C, this indicates that there is a potential loss of braking on that wheel.
If brake temperature is above 500°C with fans OFF (350°C fans ON), use of the parking brake, unless operationally necessary, should be avoided to prevent brake damage.
The MMEL provides information regarding brake ground cooling time, both with and without brake fans.

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ENGINES COOLING PERIOD

Applicable to: ALL

To avoid engine thermal stress, it is required that the engine be operated at, or near, idle for a cooling period. For description *Refer to FCOM/FCOM SOP* .

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COMMUNICATIONS AND STANDARD TERMS

Applicable to: ALL

Standard phraseology is essential to ensure effective crew communication. The phraseology should be concise and exact. The following section lists the callouts that should be used as standard. They supplement the callouts identified in the SOP. These standard Airbus callouts are also designed to promote situational awareness, and to ensure crew understanding of systems and their use in line operation.

CHECKLIST CALLOUTS

Applicable to: ALL

- “CHECK” : A command for the other pilot to check an item.
- “CHECKED” : A response that an item has been checked.
- “CROSSCHECKED” : A callout verifying information from both pilot stations.
- “ROGER” : A response that an item has been understood.

If a checklist needs to be interrupted, announce : “STANDBY CHECKLIST” and “CONTINUE CHECKLIST” for the continuation. Upon completion of a checklist announce : “__CHECKLIST COMPLETE”.

ACTIONS COMMANDED BY PF

Applicable to: ALL

The following commands do not necessarily initiate a guidance mode change, e.g. : selected to managed, or managed to selected. The intent is to ensure clear, consistent, standard communication between crewmembers. All actions performed on the AFS CP and FMS must be checked on the PFD and ND: E.g. “FL 350 blue”, “FL 200 magenta”. Ensure that the correct AFS CP knob is used, then verify indications on the PFD/ND.

SET

The “SET” command means using an AFS CP knob to set a value, but not to change a mode. SET is accomplished by only rotating the appropriate selection knob. Example:

- ”SET GO AROUND ALTITUDE__”
- ”SET QNH __”
- “SET FL __”
- “SET HDG __”

MANAGE/PULL

The “MANAGE” command means pushing an AFS CP knob to engage, or arm, a managed mode or target.

The “PULL” command means pulling an AFS CP knob to engage a selected mode or target.
Example :

- “PULL HDG 090” (Heading knob is pulled and turned).
- MANAGE NAV (Heading knob is pushed).
- “FL 190 PULL” (Altitude knob is turned and pulled).
- “FL 190 MANAGE” (Altitude knob is turned and pushed).
- “PULL SPEED 250 kt ” (Speed knob is pulled and turned).
- “MANAGE SPEED” (Speed knob is pushed).

Note: *If the value was previously set, there is no requirement to repeat the figure. Simply callout e.g. PULL HDG : PULL SPEED : FL PULL*

The VS/FPA selector knob has no managed function. The standard callouts for the use of this knob are as follows :
V/S Plus (or Minus) 700 PULL or
FPA Minus3 ° PULL (V/S (FPA) knob is turned and pulled)

PRESS ALT

The ALT pb enables to immediately start a level off. The standard callout for the use of the ALT pb is "PRESS ALT".

ARM

The “ARM __” command means arming a system by pushing the specified AFS CP button.
e.g. : “ARM APPROACH”
e.g. : “ARM LOC.”

ON/OFF

The simple ON or OFF command is used for the autopilot, flight directors, autothrust and the bird (velocity vector).

FMA

Applicable to: ALL

Unless listed otherwise (e.g. CAT II & III task sharing), all FMA changes will be called out by the PF and checked by the PM :

- All armed modes are announced by calling out their associated color (blue, magenta) e.g. : “G/S blue”, “LOC blue”.
- All active modes are announced without calling out the color (green, white) e.g. : “NAV”, “ALT”.

ALTITUDE

Applicable to: ALL

The PM calls out “One thousand to level” when passing 1 000 ft before the cleared altitude or FL, and the PF calls out “checked”.

FLAPS OR GEAR CONFIGURATION

Applicable to: ALL

FLAPS’ CALLOUTS

FLAPS’ CONFIGURATION	CALL
1	"FLAPS ONE"
1+F	"FLAPS ONE"
0	"FLAPS ZERO"

The reply will be given when selecting the new flap position. e.g. :

	CALLOUT	REMARK
PF	″FLAPS ONE″	
PM	″SPEED CHECKED″	PM checks the speed : – Above the S or F speed and accelerating (Takeoff) – Below VFE next and decelerating (Approach)
	″FLAPS ONE″	PM selects the flaps lever position and replies after checking the blue number on the ECAM flaps indicator to confirm the correct selection has been made.

GEAR CALLOUTS

	CALLOUT	REMARK
PF	″GEAR UP (DOWN)″	
PM	″GEAR UP (DOWN)″	The PM selects the gear lever position and replies after checking the red lights on the landing gear indicator to confirm gear operation.

FLIGHT PARAMETERS

Applicable to: ALL

The PM calls out:
- “SPEED” if the speed decreases below VAPP -5 kt, or increases above VAPP +10 kt
- “PITCH” if the pitch attitude increases above 7 °nose up, or below 3 °nose down
- “BANK” if the bank angle increases above 5 °
- “SINK RATE” if the descent rate increases above 1 000 ft/min

- "LOC" if LOC deviation increases above 1/4 dot
- "GLIDE" if G/S deviation increases above 1 dot
- "COURSE" if the course increases above 1/2 dot VOR or 5 ° ADF
- "xx HIGH(LOW)" at altitude checks point.

Note: *The PM calls out the attitude deviations until landing.*

PF/PM DUTIES TRANSFER

Applicable to: ALL

To transfer control, flight crewmembers must use the following callouts :
To give control : The pilot calls out "YOU HAVE CONTROL". The other pilot accepts this transfer by calling out "I HAVE CONTROL", before assuming PF duties.
To take control : The pilot calls out "I HAVE CONTROL". The other pilot accepts this transfer by calling out "YOU HAVE CONTROL", before assuming PM duties.

SUMMARY FOR EACH PHASE

Applicable to: ALL

TO REMOVE THE GROUND SUPPLY		
EVENT	**CAPTAIN or FIRST OFFICER**	**GND Mech**
Initial ground contact	GROUND (from) COCKPIT	COCKPIT (from) GROUND
External __ disconnection	REMOVE EXTERNAL __	EXTERNAL__ REMOVED

BEFORE ENGINE START/PUSH BACK		
EVENT	**CAPTAIN**	**FIRST OFFICER**
Before start up clearance received	BEFORE START C/L	DOWN TO THE LINE
After start up clearance received	BELOW THE LINE	BEFORE START C/L COMPLETE

PUSH BACK/ENGINE START		
EVENT	**CAPTAIN**	**GND Mech.**
When ready for pushback, and pushback clearance received from ATC	GROUND (from) COCKPIT, CLEARED FOR PUSHBACK (or PUSHBACK APPROVED)	COCKPIT (from) GROUND, RELEASE PARKING BRAKE
Start of push	PARKING BRAKE RELEASED	
When ready to start engines	READY TO START ENGINES? STARTING ENG(S)—	CLEARED TO START ENGINES

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PUSH BACK/ENGINE START		
EVENT	**CAPTAIN**	**GND Mech.**
When pushback complete		PUSHBACK COMPLETED. SET PARKING BRAKE
	PARKING BRAKE SET	
When ready to disconnect (after engine started, and parameters are stabilized)	CLEAR TO DISCONNECT	
		STAND BY HAND SIGNAL ON THE LEFT (or RIGHT)

AFTER ENGINE START		
EVENT	**CAPTAIN**	**FIRST OFFICER**
Flight control check in the following sequence:	FLIGHT CONTROL CHECK	
1. Elevators		FULL UP, FULL DOWN, NEUTRAL
2. Ailerons/Spoilers		FULL LEFT, FULL RIGHT, NEUTRAL
3. Rudder (1)	RUDDER	FULL LEFT, FULL RIGHT, NEUTRAL
All engines started and stabilized, and GND is disconnected	AFTER START C/L	
		AFTER START C/L COMPLETE

(1) The FIRST OFFICER should follow pedal movement with his/her feet

TAXI		
EVENT	**CAPTAIN**	**FIRST OFFICER**
When taxi clearance obtained	CLEAR LEFT SIDE	
		CLEAR RIGHT SIDE
Brake transfer check	BRAKE CHECK	
		PRESSURE ZERO
During taxi	BEFORE TAKEOFF C/L	
		DOWN TO THE LINE
When takeoff or line-up clearance obtained	FINAL CLEAR, RUNWAY CLEAR (Verify clearing of own side)	
Lining up on the runway	BELOW THE LINE	
		BEFORE TAKEOFF C/L COMPLETE

TAKEOFF AND CLIMB		
EVENT	**PF**	**PM**
After obtaining takeoff clearance		"CLEARED FOR TAKEOFF" "TIME SET"
	"CLEARED FOR TAKEOFF"	
	"TAKEOFF"	
		"TIME CHECK"
	FMA SCAN	

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TAKEOFF AND CLIMB		
EVENT	**PF**	**PM**
Before passing 80 kt		THRUST SET
At 100 kt	CHECKED	ONE HUNDRED KNOTS
At V1		V1
At VR		ROTATE
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
If AP is engaged by PM	AP 1(2) ON	
Check List	AFTER TAKEOFF/CLIMB C/L	DOWN TO THE LINE
At 10000 feet	CHECK	ONE ZERO THOUSAND
When approaching or passing transition altitude	STANDARD RESET	TRANSITION, ALTIMETER RESET STANDARD
At 10000ft or transition altitude whichever comes up later	BELOW THE LINE	AFTER TAKEOFF/CLIMB C/L COMPLETE

For more information on callouts associated with a malfunction before V1 at takeoff, *Refer to AO-90 Abnormal and Emergency Callouts*.

DESCENT		
EVENT	**PF**	**PM**
At 20,000feet (or TOD if CRZ LEVEL is below 20,000feet)	SEAT BELTS ---------- AS RQRD (3 chimes then Auto or On) CABIN CREW PREPARE FOR LANDING (PA by captain)	
When approaching or passing transition level	___ inHg or hPa RESET	TRANSITION, ALTIMETER RESET ______ inHg or hPa
At 10,000feet	CHECKED	ONE ZERO THOUSAND
	APPROACH C/L	APPROACH C/L COMPLETE

APPROACH AND LANDING		
EVENT	**PF**	**PM**
Activation of approach phase	ACTIVATE APPROACH PHASE	APPROACH PHASE ACTIVATED

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APPROACH AND LANDING		
EVENT	**PF**	**PM**
RA alive	CHECKED	RADIO ALTIMETER ALIVE (1) (2)
At "GS*" or below GA altitude for NPA	SET GA ALTITUDE_FT	GA ALTITUDE—SET,
FAF	CHECKED	PASSING__(Fix Name),__FT,
Landing check list	LANDING C/L	LANDING C/L COMPLETE
1 000 ft RA	"STABILIZED" or "CORRECTING" or If unstabilized "VMC-CORRECTING" in VMC or "GO-AROUND FLAPS" GA	"ONE THOUSAND, CLEARED TO LAND" or "ONE THOUSAND, CONTINUE" (Call out any unstable conditions)(2)
100 ft above MDA/DH	CHECKED	ONE HUNDRED ABOVE
MDA/DH visual reference	CONTINUE	MINIMUM
MDA/DH no visual reference	GO AROUND-FLAPS	MINIMUM
		ONE HUNDRED FIFTY (2)
After touchdown Ground spoilers extended REV green on EWD		SPOILERS (3) REVERSE GREEN (4)
Deceleration		DECEL (5)
At 80 kt	CHECKED	EIGHTY KNOTS

(1) Crew awareness: The flight crew should now keep RA in scan to landing.
(2) The PM monitors the pin-programmed auto callouts, or announces if they are inoperative.
(3) If the spoilers are not extended, announce NO SPOILER.
(4) If the reverse deployment is not as expected, call NO REVERSE ENGINE_or NO REVERSE, as appropriate.
(5) In the case of failure or no positive deceleration: NO DECEL
DECEL callout means that the deceleration is felt by the flight crew, and confirmed by the speed trend on the PFD. It can also be confirmed by the DECEL indication on the PFD, if the autobrake is active.
However, the DECEL indication appears when the current deceleration reaches 80 % of the selected deceleration rate. Therefore it is not an indication of the correct autobrake functioning, but it indicates that the deceleration rate is reached. E.g. the DECEL indication may not appear on a contaminated runway, with the autobrake active, due to the effect of the anti-skid.
The DECEL indication may also appear on a dry runway, with the autobrake set to LO: In this case, the deceleration may be reached due to the only use of reversers, and without the autobrake activation.

GO AROUND		
EVENT	**PF**	**PM**
GO AROUND EXECUTION	GO AROUND – FLAPS	
Flaps retraction		FLAPS—
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
Check list	AFTER TAKEOFF/CLIMB C/L	DOWN TO THE LINE
At transition altitude	BELOW THE LINE	AFTER TAKEOFF/CLIMB C/L COMPLETE

AFTER LANDING		
EVENT	**CAPTAIN**	**FIRST OFFICER**
Check List	AFTER LANDING C/L	AFTER LANDING C/L COMPLETE

PARKING		
EVENT	**CAPTAIN**	**FIRST OFFICER**
Check List	PARKING C/L	PARKING C/L COMPLETE

SECURING THE AIRCRAFT		
EVENT	**CAPTAIN**	**FIRST OFFICER**
Check List	SECURING THE AIRCRAFT C/L	SECURING THE AIRCRAFT C/L COMPLETE

ABNORMAL OPERATIONS

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AO-PLP PRELIMINARY PAGES

AO-10 General

AO-15 Cockpit/Cabin Communication

AO-20 Operating Techniques

AO-22 Auto flight

AO-24 Electrical

AO-26 Fire Protection

AO-27 Flight Controls

AO-29 Hydraulic

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AO-70 Power Plant

AO-80 Miscellaneous

AO-90 Abnormal and Emergency Callouts

PREFACE

Applicable to: ALL

The ABNORMAL OPERATIONS chapter highlights techniques that will be used in some abnormal and emergency operations. Some of the procedures discussed in this chapter are the result of double or triple failures. Whilst it is very unlikely that any of these failures will be encountered, it is useful to have a background understanding of the effect that they have on the handling and management of the aircraft. In all cases, the ECAM should be handled as described in FCTM OPERATIONAL PHILOSOPHY- ECAM 01.040 (*Refer to Section ECAM*).

QUICK REFERENCE HANDBOOK

Applicable to: ALL
Impacted DU: 00011429 Quick Reference Handbook

Four emergency procedures are available on a paper QUICK REFERENCE HANDBOOK (QRH):

- EMER EVAC
- SMOKE/FUMES
- SMOKE/FUMES REMOVAL
- UNRELIABLE AIR SPEED INDICATION (Below FL 250 and Above FL 250).

The EMER EVAC procedure is also available on ECAM (i.e. available in the ECAM ABNORMAL PROC menu).
All other abnormal and emergency procedures are available on the ECAM.

QUICK REFERENCE HANDBOOK

Applicable to: ALL
Impacted by TDU: 00023135 Quick Reference Handbook

Three emergency procedures are available on a paper QUICK REFERENCE HANDBOOK (QRH):

- EMER EVAC
- SMOKE/FUMES
- SMOKE/FUMES REMOVAL.

The EMER EVAC procedure is also available on ECAM (i.e. available in the ECAM ABNORMAL PROC menu).
All other abnormal and emergency procedures are available on the ECAM.

LANDING COMPUTATION

Applicable to: ALL

The use of the OIS LDG PERF application for the computation of landing performance following in-flight failure is driven by the ECAM. Several cases are considered depending on the messages that appear on the ECAM.
The following table summarizes how to use the OIS LDG PERF according to the ECAM displays.
Before launching landing performance computation the flight crew will update the landing weight, if a diversion is performed.

Definition:
- LDG DIST means that only the landing distance is affected
- LDG PERF means that both approach speed and landing distance are affected.

ECAM Displays	Conditions	Flight Crew Actions
Procedure & Limitations: LDG DIST AFFECTED STATUS page: LDG DIST COEF < 1.XX ON DRY RUNWAY	- Single failure - No VAPP increase - Landing distance penalty below 1.50.	If LDG at destination airport: - Dry runway : Computation of the LDG distance is not necessary because LDG distance penalty is below the regulatory margins (1.66). The penalties apply to the actual landing distance. However, the flight crew can compute the landing distance with the OIS LDG PERF application in order to assess the stop margin. *Note:* *When an aircraft is dispatched under MEL, with an inoperative system that impacts landing performance, the flight crew must always use the OIS LDG PERF application, even if the ECAM displays LDG DIST COEFF < 1.XX ON DRY RUNAWAY. The ECAM cannot combine MEL items with in-flight failures.* - Wet or contaminated runway : Computation of the LDG distance with the OIS LDG PERF application is required. If diversion: - Computation of the LDG distance with the OIS LDG PERF application is required.

Note: *XX indicates a variable value, and has a value of 40, or 45, or 50*

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ECAM Displays	Conditions	Flight Crew Actions
Procedure & Limitations: LDG DIST AFFECTED Deferred Procedure: LDG DIST COMPUTATION CONFIRM	- No VAPP increase but landing distance penalty at 1.50 or above, or - No VAPP increase but multiple failures affecting the landing distance.	Computation of the LDG distance with the OIS LDG PERF application is required.
Procedure & Limitations: LDG PERF AFFECTED Deferred Procedure: LDG PERF COMPUTATION CONFIRM	VAPP increase and landing distance penalty (regardless it is).	Computation of the LDG distance and the VAPP with the OIS LDG PERF application is required, because it is necessary to assess the LDG distance and the VAPP .
Procedure: LDG PERF : COMPUTE Limitations: LDG PERF AFFECTED	- Slats or flaps failure - VAPP increase and landing distance penalty.	Computation of the LDG distance and the VAPP with the OIS LDG PERF application is required, because it is necessary to assess the LDG distance and the VAPP . <u>Note:</u> *A slats or flaps failure can happen after takeoff or in approach during slats/flaps retraction or extension. As a consequence, the computation of the landing distance is required in the associated procedures.*
Procedure: LDG DIST IMPACT ON WET/CONTAM RWY ONLY	One or both thrust reversers are failed	Runway is: Dry : computation of the LDG distance is not required. Benefit of the reversers is not taken into account on dry runway. Wet or contaminated runway : computation of the LDG distance with the OIS LDG PERF application is required.

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COCKPIT/CABIN COMMUNICATION

Applicable to: ALL

EMERGENCY COMMUNICATION

For more information on the cabin/cockpit communications:
- *Refer to CCOM/Emergency Communications*
- *Refer to CCOM/Planned Emergency Landing*

EMERGENCY CALL

From	To	Communication Actions	Remark
Cockpit	Cabin	Passenger Address (PA) system: "CHIEF PURSER TO COCKPIT, PLEASE!"	The Chief Purser goes immediately to the cockpit to be briefed by the Captain. If time permits, the Captain should allow the Chief Purser to brief the cabin crew.
Cabin	Cockpit	Interphone: Press PRIO then CAPT	In the case of an abnormal or emergency situation in the cabin, any cabin crewmember must inform the flight crew. The flight crew must reply.

EMERGENCY ALERT

From	To	Communication Actions	Remark
Cockpit	Cabin	Passenger Address (PA) system: "ATTENTION CREW! AT STATIONS!"	The flight crew announces shortly and briefly that an emergency evacuation may be soon required. The cabin crew must proceed to their emergency stations and fasten their seat belts.

NOTIFICATION TO PASSENGERS

From	To	Communication Actions	Remark
Cockpit	Cabin	SIGNS set to ON. If duties permit, use the Passenger Address (PA) system	For psychological reason, the flight crew should inform the passengers of an intended emergency landing.

FINISH PREPARATION

From	To	Communication Actions	Remark
Cockpit	Cabin	Passenger Address (PA) system: "FINISH PREPARATION"	The flight crew announces that the preparation is finished a short time before the emergency landing.

BRACE FOR IMPACT

From	To	Communication Actions	Remark
Cockpit	Cabin	Passenger Address (PA) system: "BRACE FOR IMPACT"	The flight crew announces to brace for impact approximately 1 minbefore landing.

INITIATE EVACUATION

From	To	Communication Actions	Remark
Cockpit	Cabin	Press the EVAC CMD pb. Passenger Address (PA) system: "EVACUATE, EVACUATE"	The Captain orders an immediate evacuation. The cabin crew directs passengers to all available emergency exits.

EVACUATION NOT REQUIRED

From	To	Communication Actions	Remark
Cockpit	Cabin	Passenger Address (PA) system: "CABIN CREW and PASSENGERS REMAIN SEATED"	If the Captain decides that an evacuation is not necessary, the flight crew immediately announces the decision.

CROSS-COCKPIT COMMUNICATION

The term “cross-cockpit communication“ refers to communication between the PF and the PM. This communication is vital for any flight crew. Each time one flight crewmember adjusts or changes information and/or equipment on the flight deck, the other flight crewmember must be informed, and an acknowledgement must be obtained.

Such adjustments and changes include:
- FMS alterations
- Changes in speed or Mach
- Tuning of navigation aids
- Flight path modifications
- System selections (e.g. anti-ice system).

When using cross-cockpit communication, standard phraseology is essential to ensure effective flight crew communication. This phraseology should be concise and exact, and is defined in the callouts chapters.

For more information on the callouts:
- *Refer to NO-260 Communications and Standard Terms*
- *Refer to AO-90 Abnormal and Emergency Callouts*.

The flight crew must use the headset:
- From the ENGINE START phase until the TOP OF CLIMB phase
- From the TOP OF DESCENT phase until the aircraft is parked.

"STERILE" COCKPIT RULE

When the aircraft is below 10 000 ft, the flight crew should avoid any conversation that is not essential. This includes conversations in the cockpit, or between the flight crew and the cabin crew. It is important to apply this policy, in order to facilitate communication between both flight crewmembers, and to ensure the effective communication between the flight crew and the cabin crew to exchange emergency or safety-related information.

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STALL RECOVERY

Applicable to: ALL

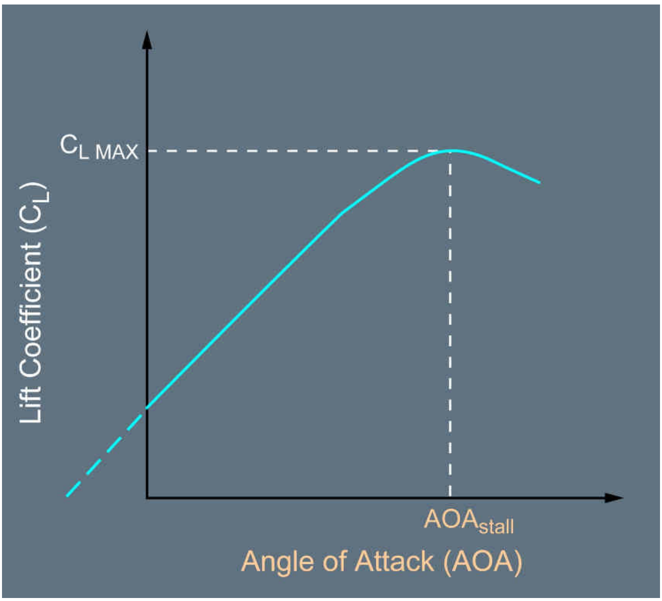
DEFINITION OF THE STALL

The stall is a condition in aerodynamics where the Angle of Attack (AOA) increases beyond a point such that the lift begins to decrease.

As per basic aerodynamic rules, the lift coefficient (CL) increases linearly with the AOA up to a point where the airflow starts to separate from the upper surface of the wing. At and beyond this point, the flight crew may observe:
- Buffeting, which depends on the slats/flaps configuration and increases at high altitude due to the high Mach number
- Pitch up effect, mainly for swept wings and aft CG. This effect further increases the AOA.

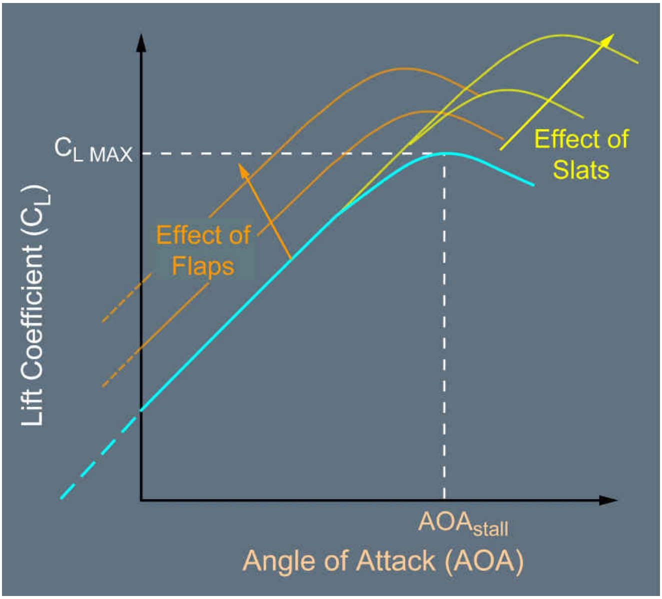
If the AOA further increases up to a value called AOA_{stall}, the lift coefficient will reach a maximum value called $C_{L\ MAX}$.
When AOA is higher than AOA_{stall}, the airflow separates from the wing surface and the lift coefficient decreases. This is the stall.
The stall will always occur at the same AOA for a given configuration, Mach number and altitude.

Lift Coefficient versus Angle of Attack



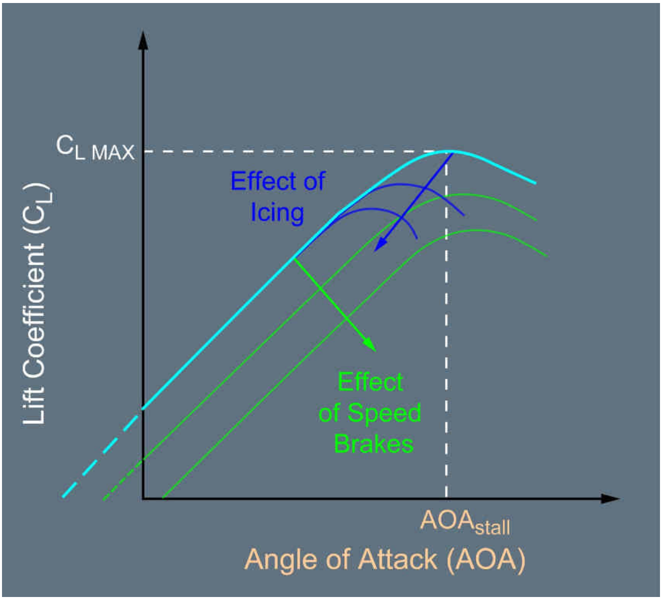
Slats and flaps have a different impact on the lift coefficient obtained for a given AOA. Both slats and flaps create an increase in the maximum lift coefficient.

Influence of Slats and Flaps on Lift Coefficient versus Angle of Attack



On the contrary, speed brake extension and ice accretion reduce the maximum lift coefficient. Flight control laws and stall warning threshold take into account these possible degradations.

Influence of Speed Brakes and Icing on Lift Coefficient versus Angle of Attack



To summarize, loss of lift is only dependant on AOA. The AOA $_{stall}$ depends on:

- Aircraft configuration (slats, flaps, speed brakes)
- Mach and altitude
- Wing contamination.

STALL RECOGNITION

The flight crew must apply the stall recovery procedure as soon as they recognize any of the following stall indications:

- The STALL aural alert
  The STALL aural alert sounds when the AOA exceeds a given threshold, which depends on the aircraft configuration and Mach number. This alert provides sufficient margin to alert the flight crew in advance of the actual stall even with contaminated wings.
  For more information on the stall aural alert, *Refer to FCOM/DSC-31-40-20 FWS Audio Indicators* and *Refer to FCOM/DSC-22-27-10-20 V alpha sw* .
- Stall buffet
  Buffet is recognized by airframe vibrations that are caused by the non-stationary airflow separation from the wing surface when approaching AOA_{stall} . When the Mach number increases, both the AOA_{stall} and $C_{L\ MAX}$ will decrease. The STALL aural alert is set close to the AOA at which the buffet starts. For some Mach numbers, the buffet may appear just before the STALL aural alert.

STALL RECOVERY

- The immediate key action is to reduce the AOA:
  The reduction of AOA will allow the wing to regain lift. The flight crew must achieve this by applying a nose down pitch order on the side stick. This flight crew action ensures an immediate aircraft response and reduction of the AOA.
  In the case of lack of pitch down authority, it may be necessary to reduce thrust.
  Simultaneously, the flight crew must ensure that the wings are level in order to reduce the lift necessary for the flight, and as a consequence the required AOA.
  As a general rule, minimizing the loss of altitude is secondary to the reduction of the a AOA as the first priority is to regain lift. When the AOA reduces below the AOA_{stall}, lift and drag will return to their normal values.
- The secondary action is to increase energy:
  When stall indications have stopped, the flight crew should increase thrust smoothly as needed and must ensure that the speed brakes are retracted.
  Immediate maximum thrust application upon stall recognition is not appropriate. Due to the engine spool up time, the aircraft speed increase that results from thrust increase, is slow and does not enable to reduce the AOA instantaneously. Furthermore, for under wing mounted engines, the thrust increase will generate a pitch up that may prevent the required reduction of angle of attack.

When stall indications have stopped, and when the aircraft has recovered sufficient energy, the flight crew can smoothly recover the initial flight path.

LOW SPEED ENGINE FAILURE

Applicable to: ALL

If an engine failure occurs at low speed, the resultant yaw may be significant, leading to rapid displacement from the runway centreline. For this reason, it is essential that the Captain keeps his hand on the thrust levers once take-off thrust has been set. Directional control is achieved by immediately closing the thrust levers and using maximum rudder and braking. If necessary, the nosewheel tiller should be used to avoid runway departure.

REJECTED TAKEOFF

Applicable to: ALL

Applicable to: ALL

FACTORS AFFECTING THE REJECTED TAKEOFF (RTO)

Experience indicates that a rejected takeoff can be hazardous, even if the flight crew applies the correct procedures. The following factors can impact on the rejected takeoff:

- Tire damage
- Brakes worn or brakes that do not function correctly
- Error in gross weight determination
- Erroneous performance calculations
- Erroneous runway line-up technique
- Initial brake temperature
- Delay in the initialization of the stop procedure
- Runway friction coefficient less than expected.

Thorough preflight preparation and a detailed exterior inspection can eliminate the effect of some of these factors.

Applicable to: ALL

DECISION MAKING

A rejected takeoff can possibly be a hazardous maneuver, and the time for decision making is limited. To minimize the possibility of decisions that are not appropriate to reject a takeoff, many alerts are inhibited between 80 kt and 400 ft. Therefore, the flight crew must consider as significant any alert triggered during this period.
To assist the flight crew in the decision making, the takeoff is divided into low speed and high speed phases, separated by the 100 kt speed. The speed of 100 kt is not critical. It is selected in order to help the Captain make the decision, and to avoid inadvertent stops from high speed.

- Below 100 kt, the Captain considers stopping the takeoff, if any ECAM alert is triggered
- Above 100 kt, and when the aircraft approaches V1:

  The Captain should be "Go-minded". The Captain should only reject the takeoff in the case of:
  - A fire alert, or severe damage, or
  - A sudden loss of engine thrust, or
  - Any indication that the aircraft will not fly safely, or
  - If an ECAM alert is triggered.

  In the case of a tire damage between V1 minus 20 kt and V1, and unless debris from the tire causes noticeable engine parameter fluctuations, it would be preferable to take off, to reduce the fuel load, and to land with a full runway length available.

The Captain must decide to reject the takeoff and to stop the aircraft before it reaches V1.

- If a failure occurs before V1, for which the Captain does not intend to reject the takeoff, he announces "GO"
- If the Captain decides to reject the takeoff, the Captain announces "STOP".
  The "STOP" announcement both confirms the decision to reject the takeoff, and indicates that the Captain has control. It is the only situation where taking over control is not associated with the "I have control" announcement.

If the failure occurs above V1, the flight crew must continue the takeoff because it may not be possible to stop the aircraft on the remaining runway.

Applicable to: ALL

REJECTED TAKEOFF PROCEDURE

If the flight crew performs a RTO , they should apply the RTO procedure in the FCOM : *Refer to FCOM/PRO-ABN-NECA-10-10 Rejected takeoff- Desc* .

For more information on the associated announcements:
- *Refer to AO-90 Abnormal and Emergency Callouts*
- *Refer to AO-15 Cockpit/Cabin Communication* .

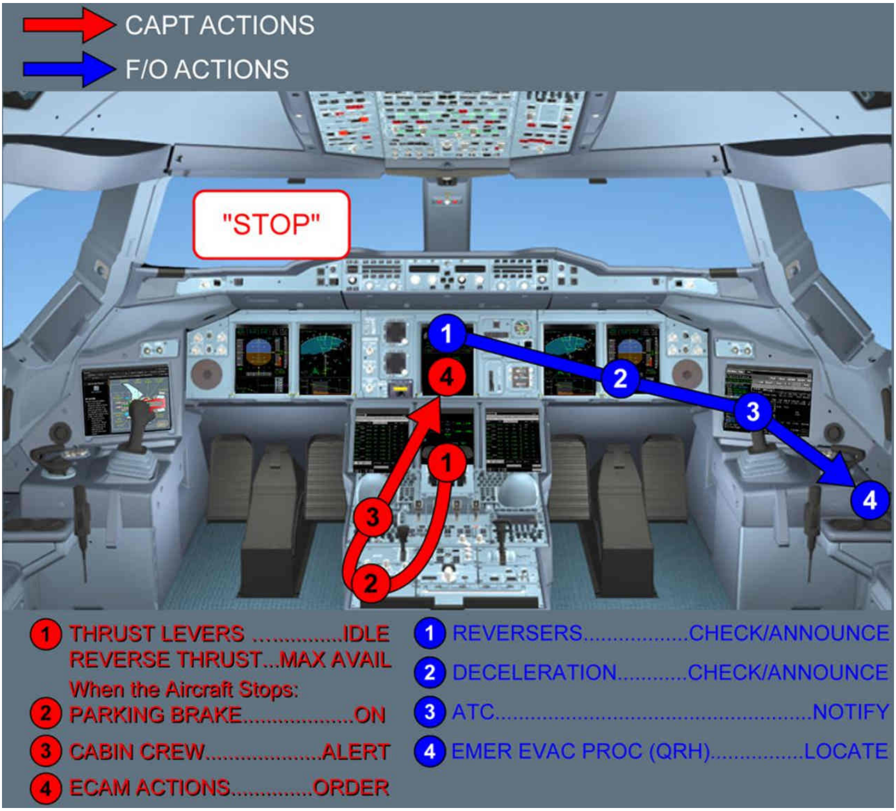
Applicable to: ALL

OPERATIONAL RECOMMENDATIONS

If the flight crew initiates a rejected takeoff, and when the autobrake decelerates the aircraft, the captain should not press the pedals (which may be a reflex action). If the Captain does not feel the deceleration of the aircraft, he can apply full braking pedals.

Applicable to: ALL

RTO FLOW PATTERN



EMERGENCY EVACUATION

Applicable to: ALL

INTRODUCTION

The typical case, which may require an emergency evacuation, is an uncontrollable on ground engine fire. This situation, which may occur following a rejected take-off or after landing, requires good crew coordination to cope with a high workload situation.

- In the rejected take-off case, the captain calls STOP. This confirms that the captain has controls.
- in all other cases, the captain calls "I HAVE CONTROL" if required to state the control hand over.

DECISION MAKING

As soon as the aircraft is stopped, the parking brake is set, the captain notifies the cabin crew and the F/O notifies ATC. The Captain calls for ECAM ACTIONS. At this stage, the task sharing is defined as follow:

- The first officer carries out the ECAM actions until evacuation decision point.
- The captain builds up his decision to evacuate depending on the circumstances. Considerations should be given to:
  - Fire remaining out of control after having discharged the fire agents
  - Possible passenger evacuation of the aircraft on the runway.
  - Positioning the aircraft to keep the fire away from the fuselage, taking into account the wind direction.
  - Communicating intentions or requests to ATC.

If fire remains out of control after having discharged the fire agents, the captain calls for the EVACUATION. The applicable actions are displayed on the ECAM (included in the ENG FIRE ON GROUND ECAM procedure).

EVACUATION PROCEDURE:

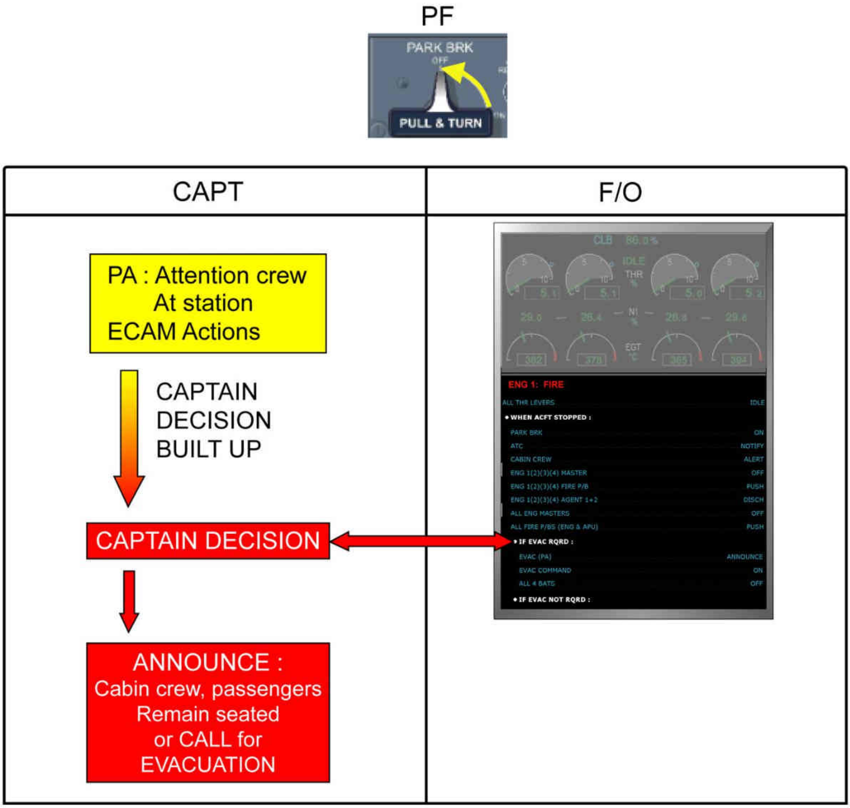
If an evacuation is required for an other reason than ENGINE FIRE ON GROUND, the flight crew will find the EMER EVAC procedure in the ECAM ABN PROC menu.
This procedure is also available on the QRH.

Some items need to be highlighted:

- CABIN CREW (PA)…ALERT
  reminds the captain for the “ATTENTION CREW AT STATION” call. (In case of RTO, this is done during the RTO flow pattern). Cabin crew must be aware that the flight crew is still in control of the situation. In certain circumstances, this will avoid any unwanted or unnecessary evacuation initiated by the cabin crew
- EVACUATION (PA)….ANNOUNCE
  requires the captain confirmation that the emergency evacuation is still required. If still required, the captain:
  - Notifies the cabin crew to launch the evacuation
  - Activates the EVAC command.
  - Advises ATC if required

This will be done preferably in this order for a clear understanding by cabin crew.
The captain can locate the EVAC command pushbutton by sweeping his hand up from the bottom of the left side of the overhead panel until reaching the CAPT/CAPT&PURS switch and then moving to the second pushbutton on the left.
The crew will keep in mind that as long as the evacuation order is not triggered, the crew may differ or cancel the passengers’ evacuation. As soon as the evacuation order is triggered, this decision is irreversible.
At any time during an ECAM procedure, if captain estimates that lives are at risk, he calls for the EVACUATION

When applying the EMERGENCY EVACUATION procedure, the F/O can select the engine master OFF and push the fire pushbutton, without any confirmation from the Captain.



ENGINE FAILURE AFTER V1

Applicable to: ALL

AIRCRAFT HANDLING

If an engine fails after V1 the flight crew must continue the takeoff. The essential and primary tasks are associated with the aircraft handling. The flight crew must stabilize the aircraft at the correct pitch and airspeed, and establish the aircraft on the correct track before the beginning of the ECAM procedure.

ON THE GROUND

Use the rudder as usual in order to maintain the aircraft on the runway centerline. When the rudder input is more than 2/3 of the full rudder deflection, the ground laws order ailerons and spoiler 3 deflection in order to ease the lateral control of the aircraft.
At VR, rotate the aircraft smoothly at a slower rate than with all engines that operate, with a continuous pitch rate up to an initial pitch attitude of 10 °. The combination of high FLEX temperatures and low speeds requires precise handling during rotation and liftoff. The 10 °pitch target enables the aircraft to become airborne.

WHEN SAFELY AIRBORNE

The flight crew should then follow the SRS orders that may request a lower pitch attitude in order to obtain or maintain V2.
When the aircraft reaches a positive rate of climb and when the radio altitude increases, the PM announces “positive climb”. This advises the PF to retract the landing gear.

Note: *For a specific combination of angle of attack and sideslip angle, and depending on the conditions (e.g. AIR DATA selector position, time since liftoff), the SPD flag can temporarily appear on one PFD, during landing gear retraction. In this case, the flight crew should crosscheck airspeed indications. If necessary, the PF should transfer the controls to the PNF.*

Shortly after liftoff, the lateral normal law orders rudder surface deflection in order to minimize the sideslip (there is no feedback of this command to the pedals). Therefore, the lateral behavior of the aircraft is safe and the flight crew should take their time to react on the rudder pedals and to center the beta target.
In the case of an engine failure at takeoff, the blue beta target appears instead of the usual sideslip indication on the PFD. The lateral normal law does not order the entire rudder surface deflection that is necessary to center the beta target. Therefore, the flight crew must adjust the rudder pedals as usual to center the beta target.
When the beta target is centered, it minimizes the drag even if the aircraft flies with a small sideslip. The calculation of the beta target is a compromise between the drag induced by the deflection of the control surfaces and the airframe drag produced by a small sideslip. When the beta target is centered, it causes less drag than centering a conventional ball, because rudder, aileron, and spoiler deflection, and aircraft attitudes are all taken into account.
The flight crew should keep in mind that the flight controls react to a detected sideslip.
This means that with hands off the sidestick and no rudder input, the aircraft bank angle is approximately 5 °maximum and then remains stabilized. Therefore, the aircraft is laterally stable and it is not urgent to laterally trim the aircraft. The flight crew should control the heading as usual with the bank angle, and center the beta target with the rudder. The flight crew should accelerate if it is not possible to center the beta target by applying full rudder. Trim the rudder as usual.

The use of the autopilot is STRONGLY recommended. After an engine failure, the flight crew should laterally trim the aircraft with the rudder before they engage the autopilot.
When the AP is engaged, the rudder trim is managed via the AP and therefore, manual rudder trim command that includes reset, is inhibited.

THRUST CONSIDERATIONS

Consider the use of TOGA thrust, keeping in mind the following:
- For a FLEX takeoff, setting the operating engine(s) to TOGA provides an additional performance margin but is not a requirement for the reduced thrust takeoff certification.
  The application of TOGA supplies a large thrust increase very rapidly but this comes with a significant increase in yawing moment and an increased pitch rate. The selection of TOGA restores thrust margins but it may increase the workload in aircraft handling.
- For a derated takeoff, the flight crew cannot apply asymmetric TOGA thrust if the speed is below F in CONF 2 or 3, due to VMCA considerations.
- TOGA thrust is limited to 10 min.

PROCEDURE

For more information on the Engine Failure after V1 procedure described in the FCOM , *Refer to FCOM/PRO-ABN-NECA-10-GENGF Engine Failure after V1 - Continued Takeoff* .

INITIATION OF THE PROCEDURE

The PM carefully monitors the aircraft flight path. The PM cancels any Master Warning/Caution and reads the ECAM title that appears on the top line of the EWD .

Procedures are initiated on PF 's command. No action is performed (except cancel audio alerts via the MASTER WARNING light) until:
- The appropriate flight path is established
- The aircraft is at least 400 ft above the runway.
  A height of 400 ft is recommended because it is a good compromise between the necessary time for stabilization and the excessive delay beginning the procedure . In some emergency cases and provided that the flight path is established, the PF may initiate the ECAM actions before 400 ft .

When the PF stabilizes the flight path, he(she) confirms the failure. If it is necessary to delay the ECAM procedure, the PF should order “Standby”. In all other cases, the PF should announce “ ECAM actions”.
The flight crew should control the aircraft trajectory as a priority. They should not delay the acceleration phase for the purpose of applying the ENG FAIL ECAM procedure.

If the PF requires a PM action during the ECAM procedures, he(she) should order "STOP ECAM" . When ready to resume the ECAM procedure, the PF should order "CONTINUE ECAM ".
The flight crew should continue the procedure until "ENG MASTER OFF" (in the case of an engine failure without damage), or until "AGENT 1 DISCH" (in the case of an engine failure with damage), before the acceleration phase.

Note: *In the case of an engine fire, the fire drill remains the highest priority.*

ACCELERATION SEGMENT

At the Engine-Out (EO) acceleration altitude, press the ALT pb to level off and enable the speed to increase. If the flight crew manually flies the aircraft, the PF should remember that as airspeed increases, the rudder input necessary to center the beta target decreases. Retract the flaps as usual. When the flight crew sets the flaps lever to zero, the beta target reverts to the usual sideslip indication.

FINAL TAKEOFF SEGMENT

When the speed trend reaches the green dot speed, pull the ALT knob to engage OP CLB . Set the thrust levers to MCT when the LVR MCT message flashes on the FMA (This message appears when the speed index reaches green dot). Resume the climb phase with MCT . If the thrust levers are already in the FLX / MCT detent, move the thrust levers to CLB and then back to MCT .
If the engine failure occurs after takeoff, the noise abatement procedures are no longer a requirement. In addition, the acceleration altitude provides a compromise between the obstacle clearance and the engine thrust limiting time. It enables the aircraft to fly with Flap 0 and at green dot speed, that provides the best climb gradient.
When the aircraft is established on the final takeoff flight path, the flight crew should continue the ECAM procedure until the STATUS appears. At this point, the flight crew should complete the AFTER T/O checklist. They should consider the system resets and refer to the OEB s (if applicable). Then, they should review the STATUS.

ONE ENGINE-OUT FLIGHT PATH

The flight crew flies the one engine-out flight path in accordance with the takeoff briefing performed at the gate:
- The EOSID (with attention to the decision point location)
- The SID
- Radar vectors, etc.

ENGINE FAILURE DURING INITIAL CLIMB

Applicable to: ALL

Proceed as above. If the failure occurs above V2 however, maintain the SRS commanded attitude. In any event the minimum speed must be V2.
When an engine failure is detected, the FMS produces predictions based on the engine-out configuration and any pre-selected speeds entered in the MFD are deleted.

ENGINE FAILURE DURING CRUISE

Applicable to: ALL

GENERAL

There are two strategies available for dealing with an engine failure in the cruise:

- The standard strategy
- The obstacle strategy

Unless a specific procedure has been established before dispatch (considering mountainous areas), the standard strategy is used.

PROCEDURE

As soon as the engine failure is recognized, the PF will simultaneously:

- Set MCT on the remaining engine(s)
- Disconnect A/THR

Then, PF will:

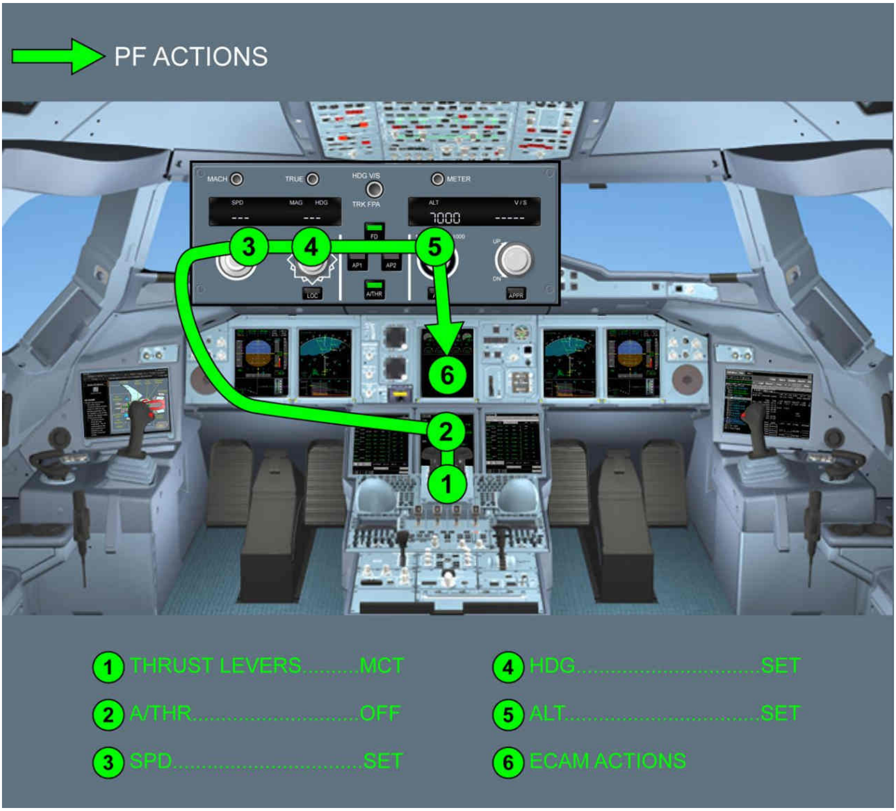
- Select the SPEED according to the strategy
- If appropriate, select a HDG to keep clear of the airway, preferably heading towards an alternate. Consideration should be given to aircraft position relative to any relevant critical point
- Select the appropriate engine inoperative altitude in the FCU ALT window and pull for OPEN DES.

Then, PF will:

- Require the ECAM actions.

At high flight levels close to limiting weights, crew actions should not be delayed, as speed will decay quickly requiring prompt crew response. The crew will avoid decelerating below green dot.

ENGINE FAILURE DURING CRUISE FLOW PATTERN



The A/THR is disconnected to avoid any engine thrust reduction when selecting speed according to strategy or when pulling for OPEN DES to initiate the descent. With the A/THR disconnected, the target speed is controlled by the elevator when in OPEN DES.
Carrying out the ECAM actions should not be hurried, as it is important to complete the drill correctly. Generally, there will be sufficient time to cross check all actions.

STANDARD STRATEGY

Set speed target .M 85/300 kt.
The EO MAX FL Cruise altitude, which equates to LRC with anti-icing off, is displayed on the MFD ACTIVE PERF page and should be set on the FCU.

If V/S becomes less than 500 ft/min, select V/S-500 ft/min and A/THR on. This is likely to occur as level off altitude is approached.
Once established at EO MAX FL, the EO LRC speed may be flown in managed mode.

Note:
- *The EO LRC speed is computed with Cost Index (CI) 30.*
- *The EO ECON speed is computed with the all engines operative CI.*
- *The EO ECON speed exceeds the EO LRC speed and may be flown at a lower FL, if fuel permits.*

OBSTACLE STRATEGY

To maintain the highest possible level due to terrain, the drift down procedure must be adopted.
The speed target in this case is green dot. The procedure is similar to the standard strategy, but as the speed target is now green dot, the rate and angle of descent will be lower.
The MFD ACTIVE PERF CRZ page in EO condition will display the DRIFT DOWN TO ceiling, assuming green dot speed. It should be set on FCU.
When clear of obstacles, revert to standard strategy.

ONE ENGINE INOPERATIVE LANDING

Applicable to: ALL

With one engine inoperative, the flight crew should use the autopilot in order to minimize the flight crew workload. The flight crew can perform an automatic approach, landing and roll out.
In anticipation of the autopilot disconnection, the autopilot trims the rudder pedals to obtain zero-sideslip after autopilot disconnection. Therefore, shortly after the autopilot disconnection and without any flight crew input, the aircraft sideslip will be zero. In such a case, roll input is necessary to control the aircraft trajectory in steady heading.
The flight crew may reset the rudder trim at any time after the autopilot disconnection but prior to engine thrust reduction. The flight crew should anticipate the force on the rudder pedals necessary to maintain the pedals deflection after the rudder trim reset.

TWO ENGINE INOPERATIVE LANDING

Applicable to: ALL

The main actions that the flight crew should perform are quite similar in the case of two engines inoperative on same side and on opposite side. However, the procedures differ regarding the use of the A/THR, the go-around altitude, and the aircraft handling during the final approach.

In the case of two engines inoperative, the flight crew should:
- Consider fuel jettison, if time permits
- Prefer a long approach, or a wide visual pattern rather than a normal straight in approach

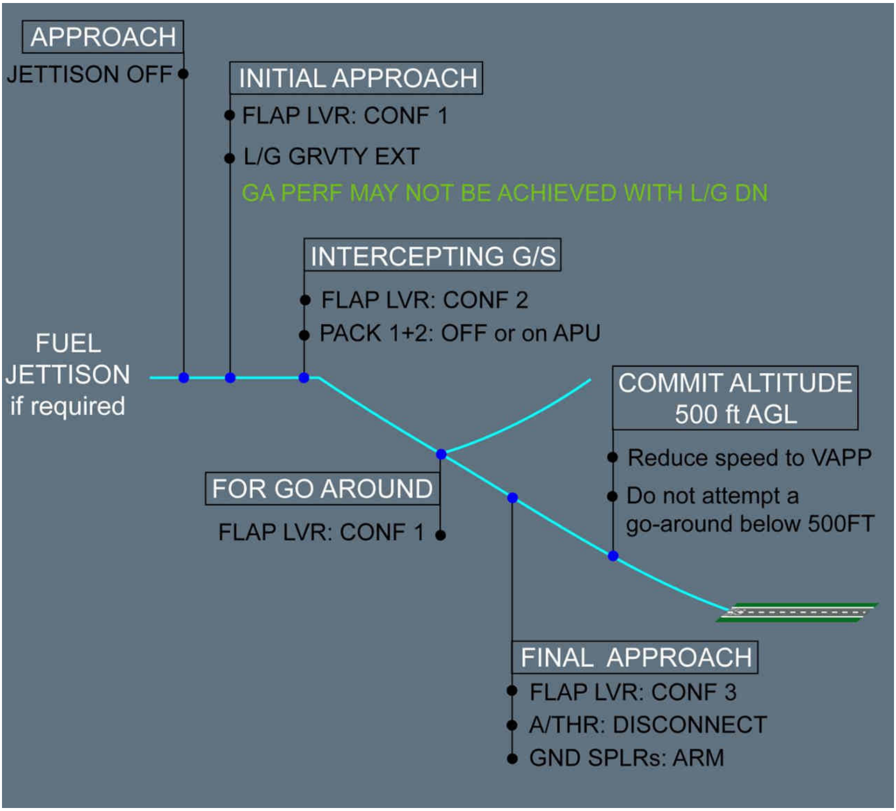
- During the approach, in order to maximize engine thrust:
  - Set the packs to OFF, or
  - Supply the packs by the APU bleed

  Note: When the ENG 1 is failed and the ENG 1 FIRE pb is pushed, the left crossbleed valve and the pack flow valve of the ENG 1 close. As a consequence, the APU bleed cannot supply the packs.
- Delay the selection of the FLAPS lever position 3 until established on final approach and on the glide slope
- For final approach, select VLS.

TWO ENGINES INOPERATIVE ON THE SAME WING

The actions that the flight crew should perform during the approach until the landing are displayed on ECAM. The following flow pattern gives an overview of the various actions, and when the flight crew should perform them.

Two Engines Inoperative on Same Side



AIRCRAFT HANDLING

In the case of two engines inoperative on the same side, in accordance with the aircraft capability (CAT 2 INOP displayed on the STATUS page), the flight crew should disconnect the autopilot at CAT I minima at the latest. As per ECAM procedure, the landing is done with the FLAPS lever in position 3.

In anticipation of the autopilot disconnection, the autopilot trims the rudder pedals as follows:
- When the FLAPS lever in position 0, or 1, or 2, the autopilot trims the rudder pedals to obtain zero sideslip after autopilot disconnection
- When the FLAPS lever is in position 3, the autopilot trims the rudder pedals so that the aircraft trajectory remains unchanged after the autopilot disconnection.

Therefore, at the autopilot disconnection, i.e. in manual flight, the aircraft behavior depends on the current flaps setting:

- The flight crew disconnects the autopilot and the FLAPS lever is in position 0, or 1, or 2: Shortly after the autopilot disconnection and without any flight crew input, the aircraft sideslip will be zero. This may result in a lateral aircraft movement. Roll input is necessary to control the aircraft trajectory in steady heading
- The flight crew disconnects the autopilot and the FLAPS lever is in position 3: There is no lateral movement/acceleration of the aircraft. The aircraft trajectory does not change. The PFD indicates the current sideslip of the aircraft.

<u>Note:</u>
- *If the flight crew disconnects the autopilot early during the approach and the FLAPS lever is in position 3, the flight crew can trim the aircraft in order to keep the sideslip indication centered. In such a case, roll input is necessary to control the aircraft trajectory in steady heading*
- *If the flight crew disconnects the autopilot late in final approach and the FLAPS lever is in position 3, the flight crew should not try to cancel the sideslip that is displayed on the PFD. The flight crew should maintain the aircraft trajectory without considering the sideslip indication.*

The flight crew may reset the rudder trim at any time after the autopilot disconnection but prior to engine thrust reduction. The flight crew should anticipate the force on the rudder pedals necessary to maintain the pedals deflection after the rudder trim reset.

L/G GRAVITY EXTENSION

The loss of green or yellow hydraulic system prevents the normal L/G extension and retraction. The flight crew must perform a gravity extension of the L/G.

GO-AROUND ALTITUDE

In the case of a go-around and above the commit altitude (I.e. 500 ft AGL), the flight crew must select FLAPS lever 1. The go-around performance may not be achieved with the L/G down.

AUTOTHRUST AND APPROACH SPEED

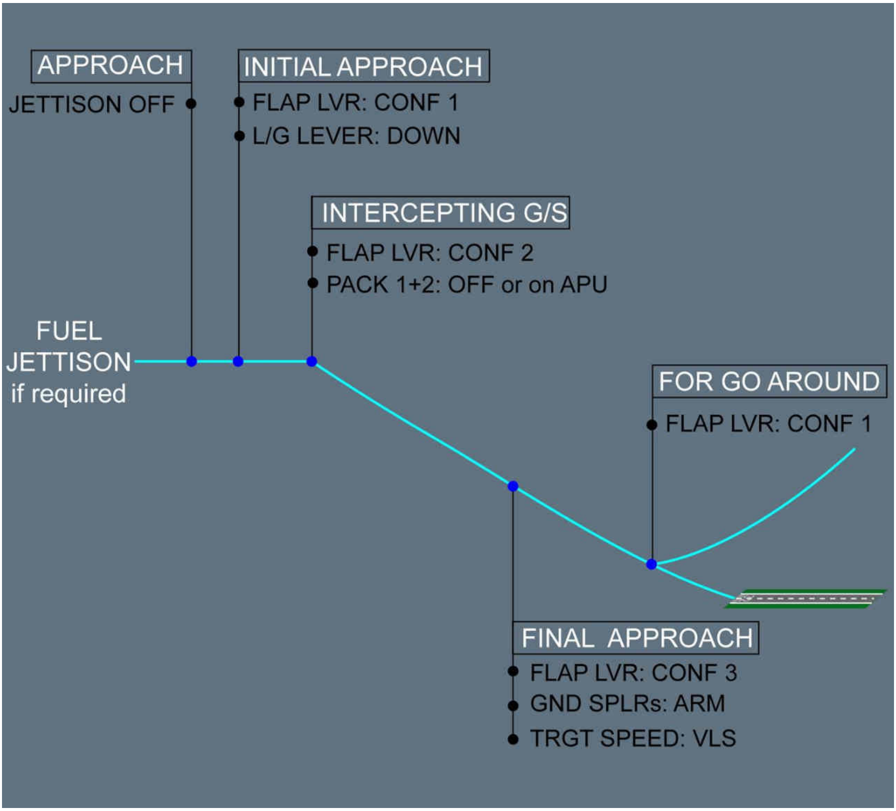
During the final approach, the flight crew should select VLS and disconnect the A/THR. When two engines are inoperative on the same wing and if there is small speed change, the A/THR may command large thrust variation. Therefore, to ease the aircraft handling with asymmetric thrust, the flight crew should manually control the thrust, and minimize the thrust variations during the final approach.
At the commit altitude (I.e.500 ft AGL), if the flight crew estimates that all the conditions to land are met, the flight crew may engage the managed speed. On the PFD, the airspeed speed target indicates the VAPP.

Depending on the aircraft gross weight, the VAPP may be below the VLS. Therefore, the flight crew must manually control the thrust to be able to reduce the speed to VAPP.

TWO ENGINES INOPERATIVE ON OPPOSITE WINGS

The actions that the flight crew should perform during the approach until the landing are displayed on ECAM. The following flow pattern gives an overview of the various actions, and when the flight crew should perform them.

Two Engines Inoperative on Opposite Side



ONE ENGINE INOPERATIVE GO AROUND

Applicable to: ALL

A one engine inoperative go-around is similar to that flown with all engines. On the application of TOGA, rudder must be applied promptly to compensate for the increase in thrust and consequently to keep the beta target centered. Provided the flap lever is selected to Flap 1 or greater, SRS will engage and will be followed.
If SRS is not available, the initial target pitch attitude is 12.5 °. The lateral FD mode will be GA TRK and this must be considered with respect to terrain clearance. ALT should be selected at the engine inoperative acceleration altitude, with the flap retraction and further climb carried out using the same technique as described earlier in "ENGINE FAILURE AFTER V1" section.

THRUST LEVERS MANAGEMENT IN THE CASE OF INOPERATIVE REVERSER(S)

Applicable to: ALL

This section provides recommendations on thrust levers management in the case of inoperative reverser(s). These recommendations are applicable in the case of in-flight failure (including engine failure) and/or in the case of MEL dispatch with deactivated reverser(s).

AT LEAST ONE REVERSER OPERATIVE

If at least one reverser is operative, the general recommendation is to select the reverser thrust on both engines during rejected takeoff (RTO) and at landing, as per normal procedures.

Note: *The ENG 2(3) REV FAULT ECAM alert may be triggered after the reverser thrust is selected. This is to remind the flight crew that one reverser is inoperative.*

NO REVERSER OPERATIVE

If no reverser is operative, the flight crew should not select the reverser thrust during RTO and at landing.
However, as per normal procedures, the PF still selects both thrust levers to IDLE detent.

BRIEFING

IMPORTANCE OF THE FLIGHT CREW BRIEFING.
Among other things, the flight crew must review the aircraft status during the flight crew briefing.

The flight crew must review any particularities at that time (i.e. operational consequences, procedures, associated task sharing and callouts). The flight crew must particularly review:
- The status of the thrust reversers and if reverse thrust can be used
- Aircraft handling during roll-out.

Intentionally left blank

AUTO FLT FMS 1+2 FAULT

Applicable to: ALL

Should FMS 1+2 FAULT occur,
- On both ND, the map disappears and a red MAP NO AVAIL message appears.
- The AP/FD and A/THR remain available as these functions are managed through the PRIMS but the AP reverts to SPEED/VS/HDG mode.

A FMS computer reset should be carried out as described in FCOM.

If unsuccessful,
- The NAVAID is tuned via the RMP.
- The navigation function is recovered through the ISIS.

The aircraft position computation is now based on GPIRS position. The navigation source and the position are displayed on the lower part of the Secondary Navigation Display (SND).
Waypoints and FIX are entered in the ISIS (Long/Lat only) thanks to ISIS menu. The flight plan is composed of ten waypoints maximum. Once the waypoint list has been entered, the pilot has to activate the navigation via the button LS/DIR TO. Navigation is followed in HDG/TRK mode. Lateral aircraft deviation may be assessed with the lines displayed on each part of the aircraft symbol. One big line represents 5 nm lateral deviation. B-RNAV capability is lost.

AUTO FLT AFS/EFIS CTL PNL FAULT

Applicable to: ALL

The Flight Control Unit (FCU) is composed of the AFS CTL PNL and the EFIS CTL PNL which may fail independently. In case of failure, the AFS or EFIS CTL PNL functions may be restored with the MFD FCU BKUP. The MFD FCU BKUP page will be activated either

- Automatically in case of detected FCU failure. In that case, an amber AUTO FLT FCU FAILURE ECAM alert will advise the crew.
- Manually in case of FCU malfunctioning detected by the crew. The FCU BACK UP is selected through the MFD FMS FCU BACK UP page.

The FCU and BACK UP FCU are exclusive i.e. when one is active, the other is in stand by.

The use of the MFD BACK UP FCU is based on the same principles as the FCU use i.e :

- Displayed as required and used on the PF side if the AP/FD is engaged or on the PNF side when the aircraft is hand flown.
- Each data inserted in the MFD BACK UP FCU page will be checked on the associated peripheral.

The use of the MFD BACK UP FCU page has some particularities that need to be highlighted:

- As the MFD BACK UP FCU is out of the peripheral vision of the opposite crew, the crew will pay particular attention to call out.
- Entries are made through the KCCU scroll (not the MFD keyboard).
- The ND mode and ND range entries are scrollable
- The ZOOM function is not available

EMERGENCY ELECTRICAL CONFIGURATION

Applicable to: ALL

INTRODUCTION

The procedure described in this section is the emergency electrical configuration after the loss of the four Variable Frequency Generators (VFG s). Although it is not very probable that the flight crew will encounter this failure, it is useful:

- To review the technical background
- To recall the general guidelines applicable in such a case.

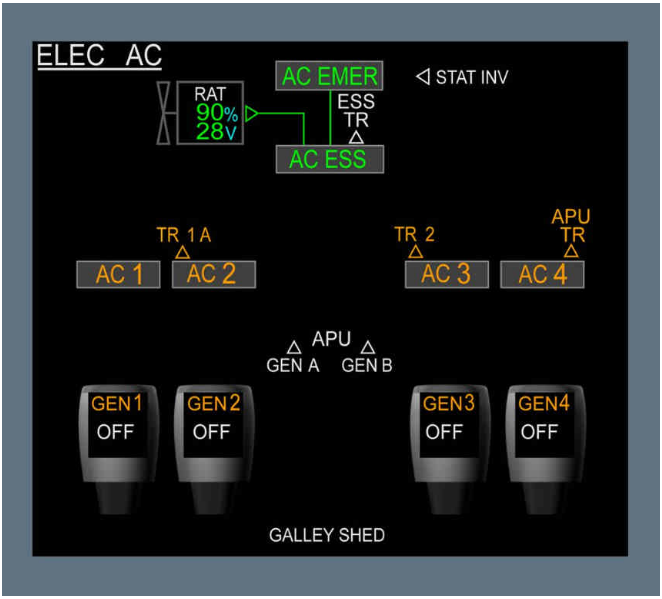
In the case of all engines flame out, the aircraft will have the same emergency electrical configuration. The ALL ENGs FLAME OUT procedure is described in the FCTM . For more information, *Refer to All engines flame out.*

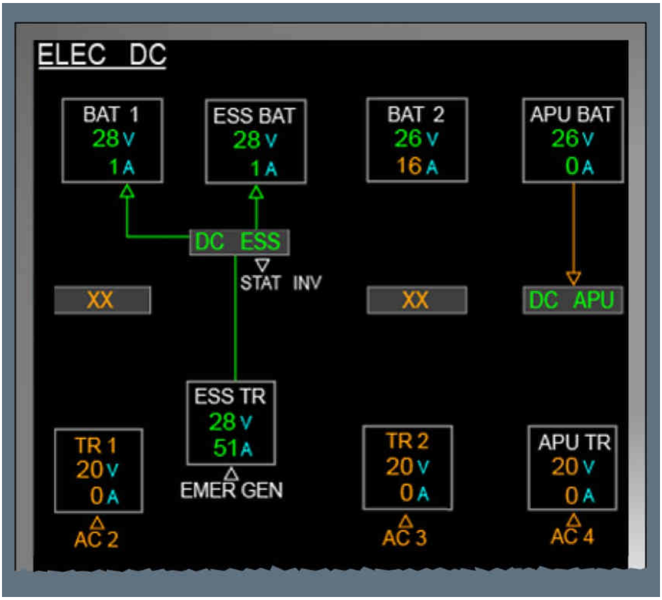
TECHNICAL BACKGROUND

The emergency electrical configuration is triggered by the loss of all AC busbars, that causes the automatic engagement of the emergency generator powered by the RAT . Depending on the aircraft speed, the emergency generator engagement takes between 2 s and 6 s .

During RAT extension:
- The batteries supply the emergency busbars only
- PRIM 1, SEC 1, and Green + Yellow hydraulics are available. The inboard ailerons, 2 out of 4 elevators, and the full rudder are available to ensure safe flight.

When the RAT is extended:
- The RAT powers the AC ESS and AC EMER busbars and the ESS TR . The ESS TR then supplies the DC ESS bus bar. The electrical power, that the RAT develops, corresponds to approximately 10 % of the total electrical power of the four electrical generators
- All flight controls are recovered except for the outer ailerons, half of the elevator surfaces and, some spoilers.


ELEC AC
AC EMER
STAT INV
RAT
90%
28V
ESS
TR
AC ESS
TR 1A
TR 2
APU
TR
AC 1
AC 2
AC 3
AC 4
APU
GEN A
GEN B
GEN1
OFF
GEN2
OFF
GEN3
OFF
GEN4
OFF
GALLEY SHED


ELEC DC
BAT 1
28V
1A
ESS BAT
28V
1A
BAT 2
26V
16A
APU BAT
26V
0A
DC ESS
STAT INV
XX
XX
DC APU
ESS TR
28V
51A
EMER GEN
TR 1
20V
0A
AC 2
TR 2
20V
0A
AC 3
APU TR
20V
0A
AC 4

PROCEDURE GUIDELINES

In the case of an emergency electrical configuration, the flight cockpit indications change significantly because the generators are disconnected from the AC busbars. The RAT is deployed in order to supply the emergency generator.
The AP/FD and ATHR are lost. CM1 has all available instruments to fly the aircraft.
The aircraft operates in direct law and the flight crew must manually trim the aircraft.
The AFS - CP is available and the IAS / MACH , HDG , and ALT blue targets are available on the PFD .
The ND 1 remains and the navigation is performed via FMS 1, VOR / DME 1 and LS 1 using the RMP in STBY NAV .
When convenient, an emergency will be notified to ATC by using VHF 1. Depending on the exact situation, assistance may be available from ATC about the position of other aircraft, safe direction, closest airport etc...

Significant remaining systems in ELEC EMER CONFIG	
FLY	PFD 1, DIRECT LAW
NAVIGATE	VOR 1, ADF 1, DME 1, LS 1, FM 1, TCAS 1, WX 1
COMMUNICATE	RMP 1, RMP 2 audio, VHF 1, ATC 1

When a safe flight path is established, the ECAM actions are performed. The EWD remains available and it is possible to recover the SD on MFD 1 via either the LH RECONF pb or the MAILBOX pb on the CAPT KCCU (for CM2).
A precise understanding of the STATUS page is essential to assess the full implications of the aircraft status. The flight crew refer to the deferred procedure and limitations at this time. For more information, *Refer to Ops philosophy, ECAM* .
In an emergency electrical configuration, the four CROSSFEED fuel valves automatically open and two remaining fuel pumps (FEED TK 2 MAIN +3 STBY) feed the four engines. An automatic fuel transfer sequence enables FEED TK 2+3 supply from the TRIM TK, then the OUTR TK , and then the FEED TK 1+4.
The fuel in the INR and MID tanks is not usable (boxed in amber). The fuel in the FEED, OUTR and TRIM tanks remains usable. As the FQMS cannot identify the fuel that is not usable, the extra fuel computed by the FMS must be decreased by the quantity of fuel that is not usable.
In addition, the fuel consumption increases due to additional drag (e.g. RAT extension), and the limitation at FL 200 .
Therefore the flight crew must not take into account the FMS fuel predictions that are not correct.
For more information how to estimate the fuel consumption with an EMERGENCY ELECTRICAL CONFIGURATION, *Refer to FCOM/ the FUEL CONSUMPT INCRSD in the INFO part of the ELEC EMER CONFIG ECAM procedure on the FCOM* .
The engines anti- ice valves are forced opened and the engines are continuously anti-iced. The wing de-icing is inoperative.
For night operations, the dome lights are available.

The Public Address (PA) remains available for passenger information.

Although the ECAM displays LAND ASAP in red, the flight crew must choose the most appropriate airfield by keeping in mind that:
- The CAT 1 approach is available
- The RAT can supply all electrical loads that are necessary for remainder of the flight and for landing.

However, prolonged flight in this configuration is not recommended.
Jettison is no longer available. The OVERWEIGHT LANDING procedure is available, if necessary, in the ECAM ABN PROC menu.

The Flight crew must refer to the OIS LANDING PERF application to compute:
- VAPP
- The landing distance.

A long straight-in approach or a wide visual pattern is preferred in order to configure the aircraft for a stabilized approach, taking into account that:
- The flight crew must not use the speed brakes
- The slats are slow
- The landing gear extension by gravity takes approximately 2 min
- The emergency braking is available on accumulator only.

When the slats are extended, the two remaining feed tank pumps stop, and the CROSSFEED fuel valves close. The engines are fed by gravity.
It is only possible to check the landing gear position with the half green arrows on the SD .
The approach speed must not be less than 140 kt to avoid the RAT stall.
The flare law is lost. The main characteristic of the flare law is to provide a smooth derotation and avoid hard nosewheel touchdown. The flight crew may therefore expect a more reactive pitch response than usual and as a result should avoid large side stick input.
The reversers are inoperative.
Emergency braking on accumulator is available. This ensures 7 full brake pedals applications. The brake pressure is automatically limited to 1 000 PSI because the anti-skid is lost.
The flight crew should anticipate with ATC if it is not possible to vacate the runway due to the loss of the nose wheel steering.
Below 140 kt , the RAT does not supply enough energy for the emergency network. In this case the batteries take over to supply the emergency network.

PREFACE

Applicable to: ALL

Fire and/or smoke in the fuselage present the crew with potentially hazardous situations. Not only will they have to deal with the emergency itself but also the passengers are likely to panic should they become aware of the situation. It is essential therefore, that action to control the source of combustion is not delayed.
An immediate diversion should be considered as soon as the smoke is detected. If the source is not immediately obvious, accessible and extinguishable, it should be initiated without delay.

SMOKE/FUMES

Applicable to: ALL

GENERAL

The FIRE SMOKE/FUMES procedure includes:
- A not-sensed ECAM procedure (*Refer to FCOM/PRO-ABN-ECAM-10-26-GSMKF FIRE SMOKE/FUMES*)
  The ECAM displays the actions that the flight crew must apply immediately (i.e immediate actions), and a reference to apply the associated paper procedure
- A Quick Reference Handbook (QRH) paper procedure (*Refer to FCOM/PRO-ABN-NECA-26-120 FIRE SMOKE/FUMES*).

When the flight crew applies the FIRE SMOKE/FUMES procedure, some action steps may trigger ECAM alerts. In this case, the flight crew must acknowledge these ECAM alerts, and delay the ECAM actions until the end of the paper procedure.

DETECTION AND PROCEDURE APPLICATION

The smoke is identified either by an ECAM alert, or by a crewmember (i.e. flight crew or cabin crew) without any ECAM alert.

SMOKE IDENTIFIED BY AN ECAM ALERT

- If the ECAM triggers an AVNCS SMOKE alert, the flight crew must apply the ECAM actions After the immediate actions, the ECAM requests to apply the QRH SMOKE/FUMES paper procedure
- If the ECAM triggers another SMOKE alert (e.g. LAVATORY SMOKE), the flight crew must apply the ECAM procedure.

If any doubt exists about the origin of the smoke, the flight crew must refer to the QRH SMOKE/FUMES paper procedure.

SMOKE IDENTIFIED BY A CREWMEMBER

If a crewmember detects smoke, without any ECAM alert, the flight crew must apply the FIRE SMOKE/FUMES procedure:

- If the visibility is sufficient to read the ECAM , the flight crew activates and applies the FIRE SMOKE/FUMES not-sensed procedure
  The activation of the not-sensed procedure enables to display LAND ASAP limitation
  After the immediate actions, the ECAM requests to apply the QRH SMOKE/FUMES paper procedure
- If the visibility is not sufficient to read the ECAM , the flight crew directly refers to the QRH SMOKES/FUMES paper procedure.

COORDINATION WITH CABIN CREW

A good coordination between cockpit and cabin crew is a key element.
In the case of smoke in the cabin, it is essential that the cabin crew estimates and informs the flight crew about the density of smoke and the severity of the situation.

QRH SMOKE/FUMES PAPER PROCEDURE

GENERAL

The QRH SMOKE/FUMES paper procedure introduces a global philosophy that is applicable to both cabin and cockpit smokes.

This philosophy includes the following main steps:

- Anticipate diversion
- Perform immediate actions

If the smoke source is not immediately isolated:

- Initiate diversion
- Identify and fight the origin of the smoke.

In addition, at any time during the application of the procedure, if smoke/fumes become the greatest threat, or if the situation becomes unmanageable, perform the boxed items.

CONSIDERATION ABOUT DIVERSION

Time is critical.
Therefore, the flight crew must immediately anticipate a diversion, as indicated by LAND ASAP in the procedure.
Then, after the immediate actions, if the smoke source is not immediately identified and isolated, the flight crew must initiate the diversion before entering the SMOKE ORIGIN IDENTIFICATION AND FIGHTING part of the procedure.

IMMEDIATE ACTIONS

The immediate actions are common to all cases of smoke and fumes, regardless of the source.

The objectives of the immediate actions are:
- Avoid any further contamination of the cockpit/cabin
- Communicate with the cabin crew
- Protect the flight crew.

SMOKE ORIGIN IDENTIFICATION AND FIGHTING

The flight crew tries to identify the smoke source by isolating systems. Some guidelines may help to identify the origin of the smoke/fumes:
- If smoke initially comes out of the cockpit ventilation outlets, or if smoke is detected in the cabin, the flight crew may suspect an air conditioning smoke
  In addition, the ECAM may immediately trigger SMOKE alerts (e.g. cargo, lavatory, avionics)
  The flight crew must apply the associated ECAM procedures
- Following an identified ENG or APU failure, smoke may come from the faulty equipment through the bleed system and be perceptible in the cockpit or the cabin
  In that case, smoke is re-circulated throughout the aircraft, until it completely disappears from the air conditioning system.
- If the ECAM only triggers the AVNCS SMOKE alert, the flight crew may suspect an avionics smoke
- If smoke is detected, while an equipment is failed, the flight crew may suspect that smoke is coming from this equipment.

According to the suspected smoke source, the flight crew enters one of the following sub-sections:
- IF AIR COND SMOKE SUSPECTED
- IF CABIN EQUIPMENT SMOKE SUSPECTED
- IF SMOKE SOURCE CANNOT BE DETERMINED AND STILL CONTINUES OR AVNCS/ELECTRICAL SMOKE SUSPECTED.

The electrical fire is the most critical case of smoke. Therefore, the flight crew must enter the last sub-section if the source of smoke is not identified, or if the application of the AIR COND/CABIN EQUIPMENT SMOKE procedure was not successful.
This procedure consists in shedding one side, then the other. If unsuccessful, the last means to isolate the smoke source is to set the electrical emergency configuration.

BOXED ITEMS

If smoke/fumes become the greatest threat, the flight crew should apply SMOKE/FUMES REMOVAL procedure. If the situation becomes unmanageable, they should consider an immediate landing.

The flight crew should consider application of these boxed items at any time during the SMOKE/FUMES procedure, but always after the immediate actions.

ABNORMAL FLAPS AND/OR SLATS CONFIGURATION

Applicable to: ALL

GENERAL

The abnormal operation of the flaps, and/or slats may be due to:
- Multiple slats control unit and/or flaps control unit failures:
  - SLAT SYS 1 and SLAT SYS 2 control the slats
  - FLAP SYS 1 and FLAP SYS 2 control the flaps
- Multiple slats and/or flaps motor power supply failures:
  - The green hydraulic system and the essential AC network power the slats motors
  - The green and yellow hydraulic systems power the flaps motors.
- Locked flaps and/or slats, i.e. the wing-tip brakes have locked the slats and/or flaps

CONSEQUENCE ON THE CONDUCT OF THE FLIGHT

The abnormal operation of the flaps and/or slats has the following consequences:
- The flight control laws revert to alternate law
- The pitch attitude during the approach and flare differ from the usual pitch attitude without failure
- The flight crew should use the selected speed
- The flight crew should prefer a stabilized approach
- The approach speed and landing distance increase
- The aircraft approach capability downgrades to CAT I
- The flight crew may need to change the go-around procedure.
  In the case of a go-around with the slats and/or flaps failed, the flight crew must maintain the slats/flaps configuration. Therefore, the go-around performance may not be achieved
- When the slats and/or flaps are extended, the fuel consumption increases. The FMS predictions do not take into account the slat and/or flap abnormal configurations. Therefore, the flight crew must disregard the FMS fuel predictions
- When the flaps/slats are extended, the maximum cruise altitude is 20 000 ft.

Note:
- *On the PFD, the speed scale displays the VLS and the VFE in accordance with the current abnormal configuration*
- *The overspeed warning and stall warning trigger according to the actual configuration*

PROCEDURE GUIDELINES

FAILURE AT TAKEOFF

When the slats and/or flaps fail at takeoff, the flight crew should pull the SPD/MACH knob on the AFS CP for selected speed in order to stop the acceleration. The short term managed speed is set to VFE-5 kt.

Note: If the flight crew does not revert to selected speed mode, the flight control laws protect the aircraft against the VFE exceedance and limit the speed to VFE-5 kt.

After the acceleration altitude, the flight crew should select the speed in order to control the acceleration to the required speed for the retraction of the remaining surfaces.

FAILURE DURING THE APPROACH

When the slats and/or flaps fail during the configuration of the aircraft for landing, the flight crew should:

- Pull the SPD/MACH knob on the AFS CP to stop the deceleration

  Note: If the autothrust and the FMS approach phase are engaged, the managed speed target becomes the next maneuvering characteristic speed, e.g. S speed when selecting flap lever to 1.
  If the flight crew does not stop the deceleration, the aircraft may decelerate to a speed close to the VLS. Depending on the slats or flaps position failure, the margin between the characteristic speeds and the VLS may be significantly reduced (e.g. 2 kt or 3 kt between the VLS and S speeds at all GW < 520 t).

- Delay the approach to complete the ECAM procedure
- Update the approach briefing, and/or decide to divert if required.

In accordance with the ECAM procedures, when the slats and/or flaps are failed, the flight crew should use the selected speed to configure the aircraft for landing. The flight crew should reduce the speed and should keep wings level during the change of the slats or flaps configuration.

To prepare the aircraft for landing the flight crew must decelerate the aircraft to the approach speed, as follows:

- Decelerate the aircraft toward the VFE NEXT-5 kt

  Note: In the case of turbulence, to avoid VFE exceedance, the flight crew may decide to decelerate to a lower speed but above the VLS

- When the aircraft reaches the selected speed, the FLAPS lever can be set one step down.

The above steps are repeated until the FLAPS lever is set to 3. When the landing configuration is established, aircraft can be decelerated to the computed approach speed.

SITUATION ASSESSMENT

The flight crew should consider the following to select the appropriate airfield:

- Landing distance available v.s. landing distance required with slats and/or flaps failed
- The aircraft gross weight

- The aircraft approach capability, i.e. CAT I
- If a diversion is required, the flight crew should review the maximum altitude for diversion and the fuel required

  Note: *When the flaps/slats are extended, the maximum cruise altitude is 20 000 ft, and the fuel consumption is increased.*

During the approach briefing, the following should be emphasized:

- Tail strike awareness
- Maintain the slats/flaps configuration for go-around
- Any deviation from standard call out
- The speeds to be flown, following a missed approach
- The use of selected speed to configure the aircraft for landing, or to control the acceleration to the required speed for the retraction of the remaining surfaces.

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G+Y HYDRAULIC FAILURES

Applicable to: ALL

Dual hydraulic failure is an amber failure and has little effect on the handling of the aircraft since AP/FD and ATHR remain available. The flight controls revert to ALTN LAW due to the loss of the outer ailerons and most spoilers.
When the landing performance penalty has been computed, it is time for decision-making. The flight crew will note that there is no requirement to LAND ASAP or LAND ANSA. The flight crew may thus decide to continue the flight taking into consideration the following aspects:

- Weather (CAT1 capability only),
- Operational (landing performances),
- Maintenance,
- Commercial.

The approach briefing will concentrate on safety issues:

- Use of the selected speeds on the AFS-CP,
- Approach configuration,
- Landing gear gravity extension,
- Approach speed VAPP,
- Stabilized approach technique,
- Tail strike awareness,
- Braking and steering considerations,
- Go around call out, aircraft configuration and speed.

DEFERRED PROC FOR APPROACH will be applied early in approach phase i.e. before IAF:

- In some abnormal slats/flaps configurations (e.g. SLATS SYS failure), the FMS does not receive the FLAPS lever position. Thus, the managed speed is not in accordance with the FLAPS lever position. Therefore, as a general rule, when the slats/flaps are in abnormal configuration (e.g. following a dual hydraulic failure, or when slats/flaps are locked), the flight crew must use the selected speed to configure the aircraft for approach and landing.
  The speed reduction and configuration changes should preferably be done with wings level.
- The VFEs NEXT displayed on the PFD takes into account the abnormal slat/flap configuration vs. placard speeds. Therefore, to configure the aircraft, the flight crew must consider the VFEs displayed on the PFD.
- The VLS displayed on the PFD takes into account the abnormal slat/flap configuration.
- As the landing gear is extended by gravity, the gear doors are mechanically locked opened. The aircraft may vacate the runway in these conditions.
- The stabilized approach technique will be preferred, and the aircraft should be configured for landing at the FAF.

DEFERRED PROC FOR LANDING will be applied early in landing phase i.e. before FAF.

The AP may be used down to 500ft AGL. As the AP is not tuned for the abnormal configurations its behavior can be less than optimum and must be monitored.
As the flaps are no longer available, the pitch attitude during the approach is increased (typically 6° to 7°), and thus increasing the risk of tail strike at touchdown. Therefore a long flare must be avoided.
The alternate braking with anti skid is available. The hydraulic power is provided by the Local Electro Hydraulic Generation System (LEHGS). Auto brake is available and braking performance is not affected.
The nose wheel steering function is done with the LEHGS (ALTN NWS).
The ALTN NWS is designed to be used until the runway is cleared (to land and to vacate runway). Therefore, the flight crew should anticipate a tug to tow the aircraft back to the gate.

Prolonged use of the ALTN NWS should be avoided because it would result in:
- An ALTN NWS overheat and its associated ECAM alert followed by
- A disconnection of the NWS itself.

ADR/IR FAULT

Applicable to: ALL

GENERAL INFORMATION

Each ADIRS has two parts (ADR and IR), which may fail independently of each other. Additionally the IR part may fail totally or may be available in ATT mode.

A single failure affects the approach capability only. A dual/triple failure may additionally affect:
- The AP/FD and ATHR availability
- The FLT CTL law

SINGLE NAV ADR FAULT OR NAV IR FAULT

Single NAV ADR FAULT or NAV IR FAULT are simple procedures, and only require action on the switching panel as indicated by the ECAM.
The AP/FD anticipates the crew action on the switching panel and thus remains available. The A/THR remains available.

DUAL NAV ADR FAILURES

In case of dual NAV ADR failures, AP/FD and A/THR are lost. The flight controls revert to ALTN LAW.
The PF/PM task sharing will be redistributed as required.

TRIPLE NAV ADR FAILURE

A total loss of reliable ADR information is mainly due to obstructed pitot tubes or static sources, as the probability of a triple ADR failure is very low.
In case of a detected triple NAV ADR failure, the crew will follow the ECAM which requires to fly with the standby instruments (ISIS) and to switch off the ADRS to recover the Back Up Speed Scale (BUSS) on both PFD.
The crew will pay particular attention in case of all air data disagree case, especially when close to the ground. As soon as the situation is not understood by the crew e.g. abnormal correlation of basic flight parameters (IAS, pitch, attitude, thrust, climb rate), the flight crew will apply the memory items:
When a safe flight path is established and above the minimum safe altitude, the crew will carry out the NAV ALL AIR DATA DISAGREE ABN PROC. This consists in identifying the reliable information by comparing ADR computed data with altitude or speed information which are not ADR computed e.g. GPS altitude. If no ADR remain available, they will be switched off and the crew will fly the BUSS.
The crew will note that if static pressure information is reliable (e.g. altitude information), the bird is reliable and will be used.

Note: *If the ISIS is available, its use should be preferred to the BUSS.*

DUAL NAV IR FAILURES

Dual NAV IR failures will cause the loss of AP/FD, A/THR and flight controls revert to ALTN LAW. The PF/PM task sharing will be redistributed as required taking into account the availability of the ISIS.

TRIPLE NAV IR FAILURE

There is no procedure NAV IR 1 + 2 + 3 failure. In this unlikely event, the standby instruments (ISIS) are the only attitude, altitude, speed and heading references.

FLYING THE BACK UP SPEED SCALE

Applicable to: ALL

GENERAL

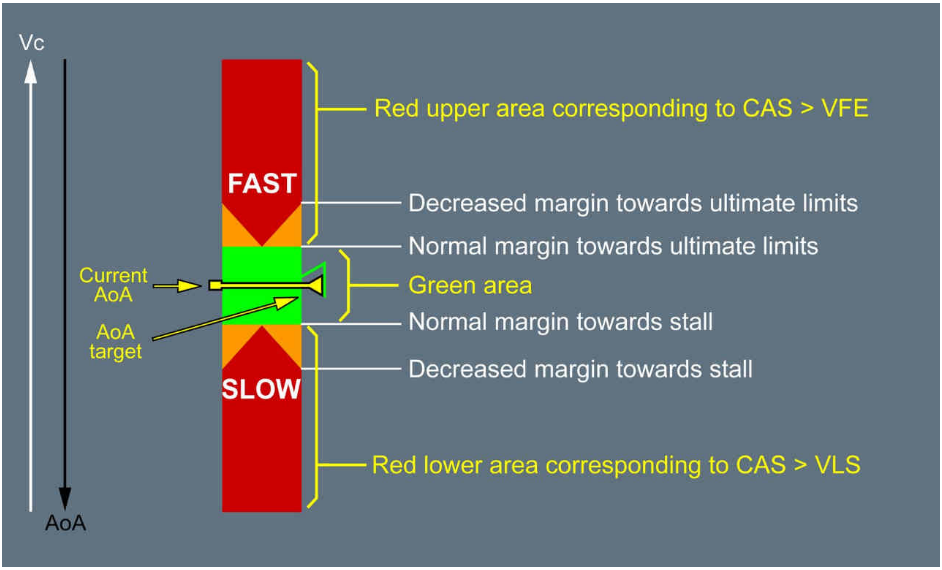
Both PFDs display the Back Up Speed Scale (BUSS) when the flight crew switches off all three ADRs following:
- A NAV ADR 1+2+3 FAULT alert, or
- A NAV ALL AIR DATA DISAGREE alert, if all air data are unreliable, or
- An unreliable airspeed situation, if all air data are unreliable.

The BUSS is based on Angle-Of-Attack information and enables to continue a safe flight and landing in the case of the lost of the three ADRs.

BUSS DESIGN

The BUSS design enables to flight in the entire flight domain (i.e. from high altitude and high Mach number to low altitude and low speed) while observing the flight domain limits.

The BUSS is divided in five areas:
- The green area corresponds to the normal speed range between ultimate limits (i.e. VMO/VFE for upper limit and stall for lower limit)
- The amber areas provide limited margin towards ultimate limits
  Flying in the amber area is acceptable for a limited period of time but the flight crew should avoid these amber areas.
- The red areas provide the speeds above the ultimate limits.
  The flight crew must avoid flying in the red area.



The BUSS is tuned for the aerodynamic model with the speed brake retracted. Therefore, the flight crew should not extend the speed brakes.

FLYING TECHNIQUE

When the BUSS is used:
- The AP/FD and A/THR are inoperative
- The flight control law is the direct law. The angle of attack protection and VMO/MMO warning are lost but the STALL aural alert remains available.

The altitude indications are based on GPS data. Because the GPS altitude is less accurate than barometric altitude, two amber dashes cover the two last digits. The vertical speed indicator is not available.

For approach, the flight crew should perform a stabilized approach. The flight crew should change the aircraft configuration with the wings levelled.

To retract/extend the flaps apply the following technique:
- Before retracting the next flaps configuration, the flight crew should fly the upper part of the green area
- Before extending the next flaps configuration, the flight crew should fly the lower part of the green area.

This technique limits the excursion in the amber area when changing the flaps configuration.

CAUTION	When flying with BUSS, do not use the speed brakes.

ALL ENGINES FLAME OUT

Applicable to: ALL

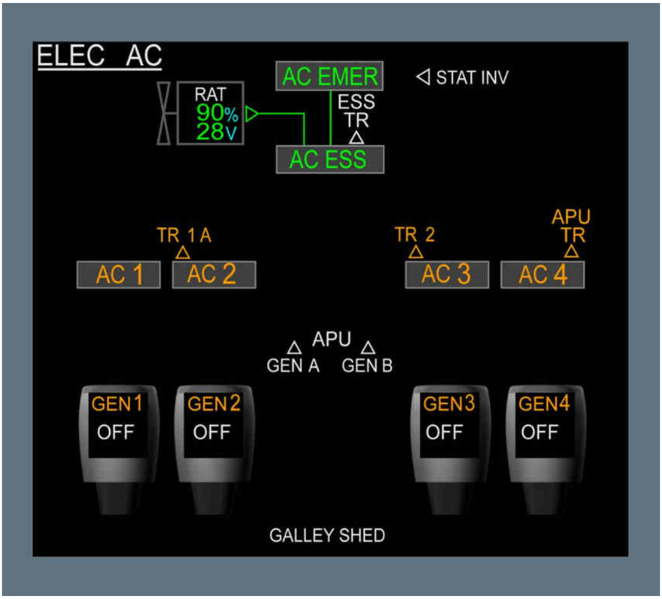
INTRODUCTION

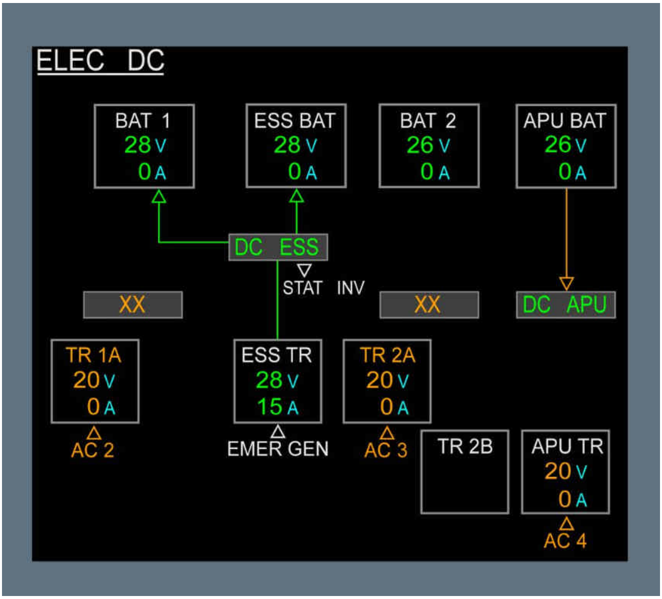
The procedure described in this section is the loss of the four engines.
This situation mainly results in an emergency electrical configuration and in the loss of the green and yellow hydraulic systems.

TECHNICAL BACKGROUND

ELECTRICAL GENERATION

In the case of an all engines flameout:
- All the AC busbars are lost
- The RAT automatically extends to power the AC ESS, EMER busbars, and the DC ESS busbar via the ESS TR.
  The RAT can supply all the electrical loads that are necessary for the remainder of the flight and for the landing.





Below FL 200, if the flight crew can start the APU, the normal electrical configuration partly recovers, i.e. half of the electrical network is supplied. In such a case, the RAT continues to supply the emergency network.

HYDRAULIC GENERATION

The green and yellow hydraulic systems are lost. When the RAT is extended, the electrical-hydraulic actuators (EHA, EBHA) ensure the aircraft control (after 10 s maximum since the last engine is detected failed).

GENERAL GUIDELINES

Following an all engines flameout and when in emergency electrical configuration, the cockpit indications and systems change significantly:

- AP, FD, and A/THR are lost
- Aircraft operates in alternate law
- F/O PFD, F/O ND and ADIRS 2+3 are lost.

When the flight crew detects an all engines flameout condition, the CM1 must immediately take over control of the aircraft, and must establish a safe flight path. CM1 is PF.

When time permits, the flight crew must transmit an emergency message to ATC using VHF1. Depending on the exact situation, assistance may be available from ATC (e.g. position of other aircraft, safe direction, closest airport).
The following table indicates the main systems that remain available to fly the aircraft, navigate and communicate:

Significant remaining systems in ALL ENGs FLAME OUT	
FLY	CAPT PFD, ADIRS1, ISIS
NAVIGATE	CAPT ND, FM1, VOR1, ADF1, DME1, LS1, TCAS1, WX1
COMMUNICATE	RMP1, VHF1

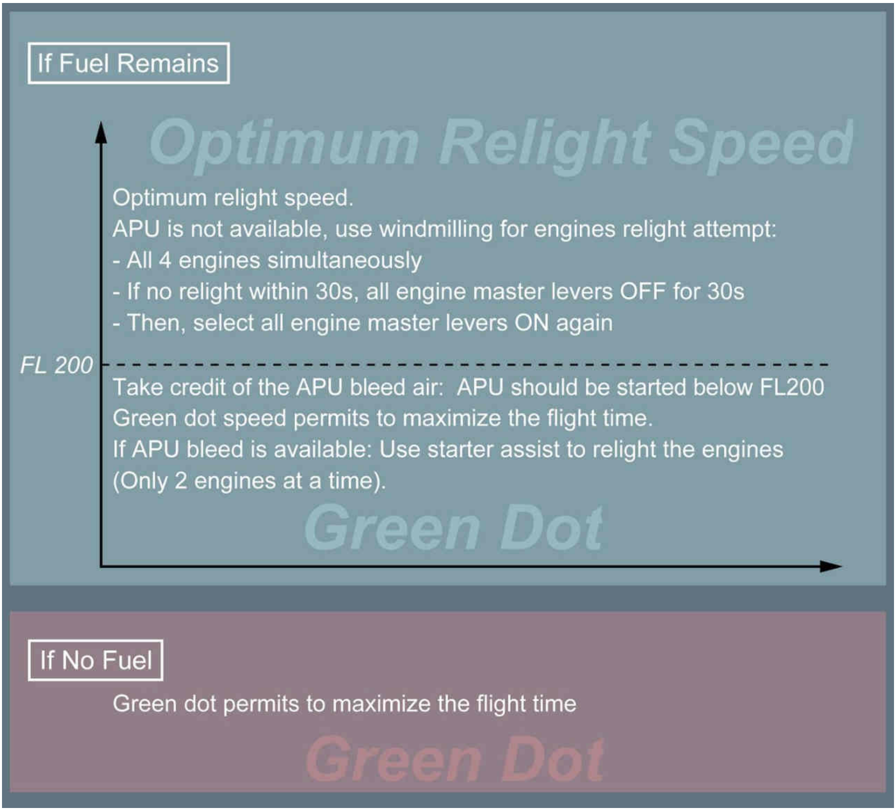
After the PF establishes a safe flight path, the flight crew should perform the ECAM actions. The EWD remains available. The PNF (F/O side) can display the SD pages on CAPT MFD by pressing the MAIL BOX pb on CAPT KCCU keyboard.
The RECONF pb on the CAPT side remains available.
The ALL ENGs FLAME OUT ECAM procedure takes into account the cases of fuel remaining or no fuel remaining, and provides ditching or forced landing procedures.

If fuel remains: The flight crew should start the actions at the optimum windmilling relight speed (without starter assist). The optimum relight speed enables an immediate windmilling engine relight without an excessive aircraft descent rate. The flight crew should perform engine relight attempts on all engines simultaneously.

- If there is no relight within 30 s, the procedure requests to set all engine master levers to off for 30 s in order to ventilate the combustion chamber. Then, the flight crew can set again all engine master levers to on. The flight crew should repeat the engine start attempts on all engines as much as possible
- If below FL 200: The flight crew can start the APU. Therefore, the flight crew can take advantage of the APU bleed air to attempt starter-assisted engine relights. However, with starter-assisted, the flight crew can only attempt a relight on two engines simultaneously.
  If the APU bleed is used, the flight crew should fly at a speed below the optimum windmilling speed to enable the FADEC to select a starter-assisted engine relight, and can reduce speed to the green dot speed to minimize the descent rate.

If no fuel remains: The first actions are similar to the case "fuel remains", except that there is no action for engine relight attempts and APU start. Green dot speed is the target speed in order to maximize the remaining time for cabin preparation and distance flown.
The flight crew should pay attention to the time to manage the ECAM procedure. An efficient procedure application is important to fully configure the aircraft for ditching or forced landing. Some items at the end of the procedure are time demanding (e.g. slats extension requires 4 min).

Sequence



APPROACH AND LANDING

If no engine relights and depending on the situation, the flight crew should prepare the aircraft either for a ditching, or for a forced landing, even if a runway can be reached. Both procedures are very similar, except for the landing gear that must be up for a ditching.
The flight crew must notify the cabin crew of a forced landing or ditching, in order to prepare the cabin.
Only slats are available. The slats extension requires 4 min.

Forced Landing

If the flight crew expects a forced landing, they must extend the landing gear, even if the landing is planned out of a runway. The L/G enables to absorb some energy, when the aircraft touchdowns the ground.
For the PF, during the initial and final approach, the main concern is the aircraft energy management. Even if the aircraft is at a correct gliding distance from an airport, it could be difficult to make a correct descent path assessment and be sure to land the aircraft on the runway.
For approach, because there is no engine to manage the energy of the aircraft, the PF should keep the aircraft higher than in a normal approach.
When the flight crew selects a runway, they may perform a visual approach, if possible.
In bad weather conditions and if possible, the flight crew may use the ILS to land, more particularly the localizer signal. The glide slope signal may not be helpful, and the PF should fly an non usual approach as the aircraft should be well above the glide slope signal in order to efficiently manage aircraft energy.
The recommended approach speed is VLS displayed on the PFD, or 140 kt, if the VLS is lower than minimum RAT speed.
When on ground, the flight crew can use the brake pedals. The brake accumulator provides the hydraulic power to the brakes, but the number of brake applications is limited. The A-SKID is not available, the brake pressure is automatically limited to 1 000 PSI. The flight crew may consider the differential braking to maintain the runway axis.

Ditching

Just before ditching, the flight crew must set the DITCHING pb to on in order to close all valves under the aircraft.
Then, the flight crew must touchdown with a minimum aircraft vertical speed.
The optimum pitch for flare is 8 °. The flight crew should maintain the optimum pitch flare until the impact on the water, and should keep the wings level.

RELIGHT OF ONE ENGINE

When at least one engine relights, the ENG ALL ENGs FLAME OUT ECAM alert is no longer applicable and the ENG 1(2)(3)(4) FAIL ECAM alerts trigger for the remaining failed engines.
In such a case, the RAT continues to supply the emergency network, and the available engine generators supply as many busbars as possible.
If at least one engine relights, the A/THR and the AP are available.
In order to optimize the relight sequence of the failed engines, and to avoid the flight crew to consider in sequence each ENG 1(2)(3)(4) FAIL procedure, each ENG 1(2)(3)(4) FAIL procedure requests to immediately apply the ENG RELIGHT IN FLIGHT, if at least three engines are failed.

The ENG RELIGHT IN FLIGHT procedure is an ECAM not-sensed procedure that the flight crew calls via the ABN pb on the ECP.

Note: When two engines are running, the aircraft can level off at a lower altitude. For the two inoperative engines, the ENG 1(2)(3)(4) FAIL procedure asks to consider the ENG RELIGHT IN FLIGHT. Therefore, depending on the circumstances (e.g. altitude, obstacle), the flight crew may decide to delay the relight of the remaining failed engines, when time permits.

The ENG RELIGHT IN FLIGHT procedure is divided into two parts, depending on the number of failed engines:

- If start attempt applies to only one engine: The procedure enables to attempt either a windmilling start, or a starter-assisted engine relight with the bleed of the other engines
- If start attempt applies to multiple engines: Similarly to the previous case, the procedure enables to attempt either a windmilling start, or a starter-assisted engine relight with the bleed of the operating engines. In addition, the procedure takes into account engine relight using APU bleed, if available.

  Note: This part of the procedure has a similar structure to the engine relight part of the ENG ALL ENGs FLAME OUT procedure:
  - *Above FL 200: The procedure asks for a windmilling engine relight for the failed engines at the optimum windmilling speed*
  - *Below FL 200: If APU is available, the procedure asks for a starter-assisted engines relight with the APU bleed, and green dot speed is the target speed in order to maximize the flight time.*

  If the flight crew enters this part of the procedure after the flight crew performed some steps of the ENG ALL ENGs FLAME OUT procedure, they may have to validate some steps already performed.

The flight crew can decide at any time to stop the ENG RELIGHT IN FLIGHT procedure, if the situation requires (e.g. remaining time and distance to fly), and continues with other ECAM alerts or procedures, if any.

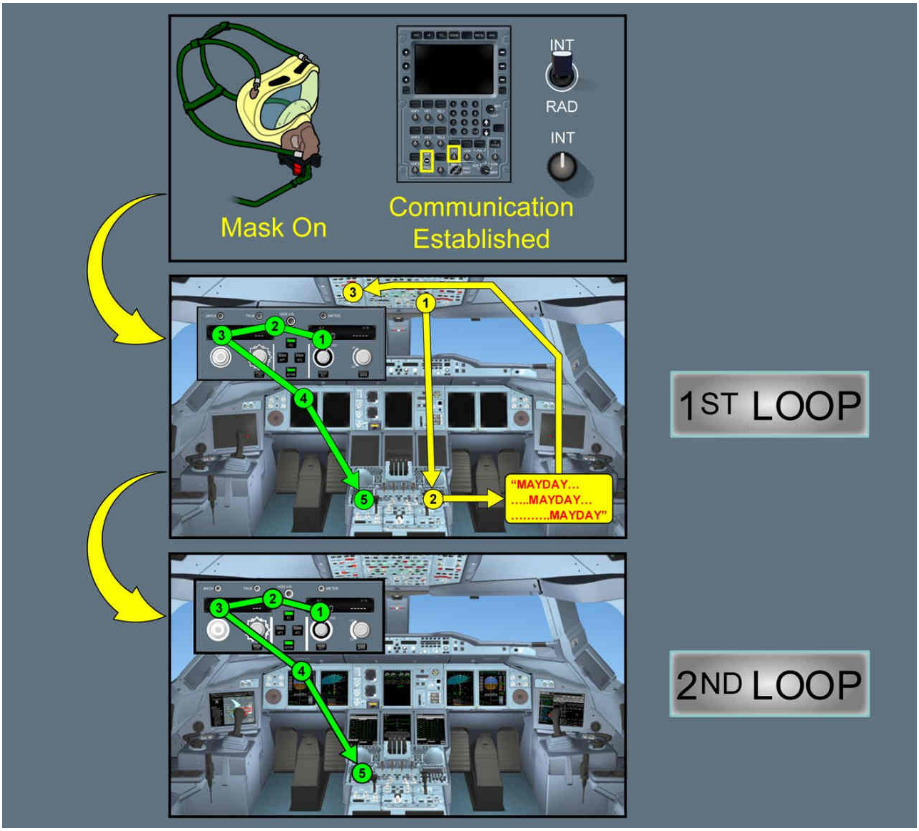
EMERGENCY DESCENT

Applicable to: ALL

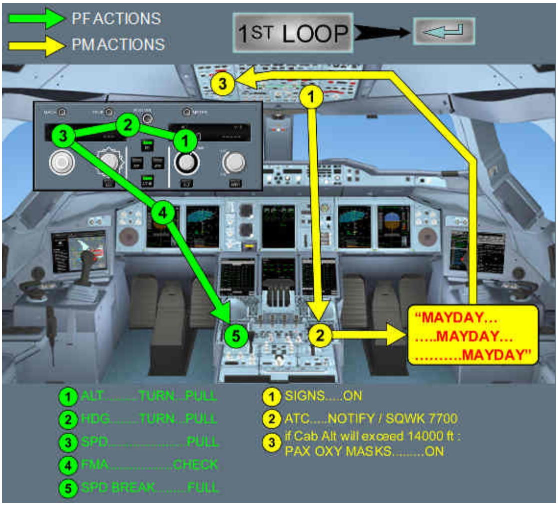
The emergency descent should only be initiated upon positive confirmation that cabin altitude and rate of climb is excessive and uncontrollable. This procedure should be carried out by the crew from memory. The use of AP and auto thrust is strongly recommended for an emergency descent. The AFS-CP (FCU) selections for an emergency descent progress from right to left, i.e. ALT, HDG, SPD.

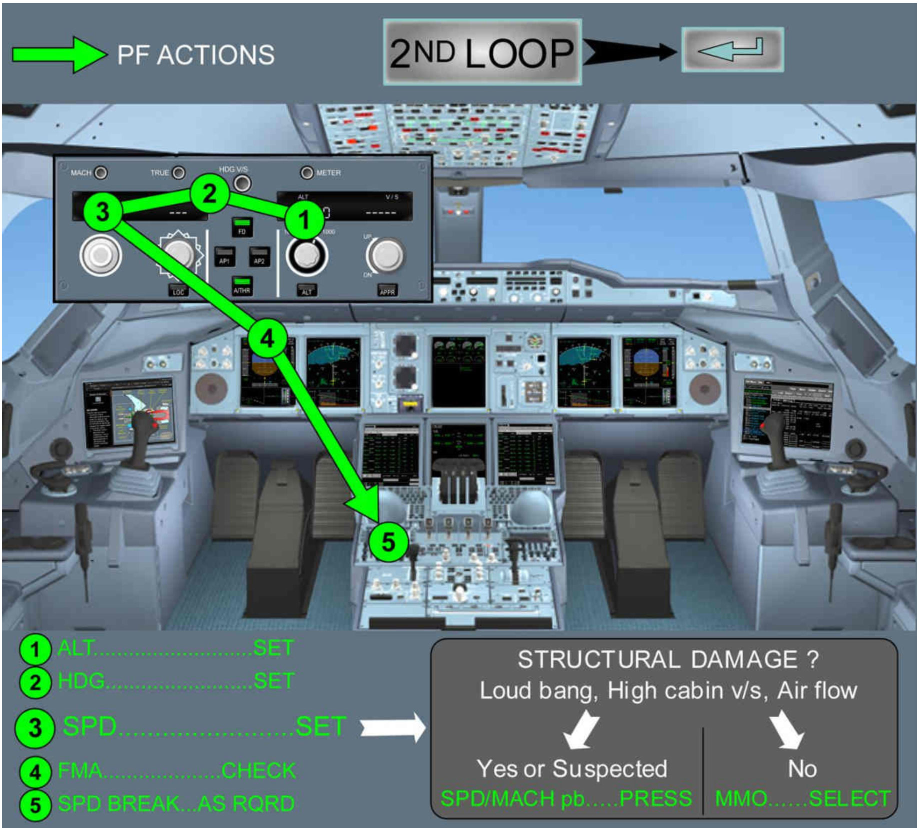
The memory items comprise two steps:
- First step: to initiate the descent
- Second step: to refine the settings

When in idle thrust, high speed and speed brake extended, the rate of descent is approximately 9000 ft/mn. To descend from FL 410to FL 100, it takes approximately 4 min and 25 nm .
The crew will bear in mind that ND MORA is the highest MORA value within a circle of 40 nm radius around the aircraft whereas the VD safety altitude is defined inside the vertical cut along the aircraft trajectory within the VD range (green solid line).
If structural damages are suspected, the crew will press SPEED/MACH pb to speed to prevent the IAS from increasing thus minimizing efforts on aircraft structure. Structural damages may be suspected in case of a loud bang or high cabin vertical speed.
The passenger oxygen MASK MAN ON pb should be pressed only when it is clear that cabin altitude will exceed 14 000 ft i.e. the crew will consider the cabin rate increase versus the aircraft rate of descent.
Once the two steps procedure has been carried out from memory, the PF will call for ECAM actions. The ECAM will automatically prioritize the abnormal C/L.
The EMER DESCENT PROC is also available in the ABN procedure menu and may be activated as required.
Following an emergency descent and once the oxygen mask are removed, the oxygen stowage box will be closed and the PRESS TO RESET oxygen slide will be pressed to deactivate the mask microphone and to recover the use of the hand mike/head set.


INT
RAD
INT
Mask On
Communication
Established
"MAYDAY...
.....MAYDAY...
..........MAYDAY"
1ST LOOP
2ND LOOP

EMERGENCY_DESCENT





CREW INCAPACITATION

Applicable to: ALL

GENERAL

Crew incapacitation is a real safety hazard which occurs most frequently than many of the other emergencies. Incapacitation can occur in many form varying from obvious sudden death to subtle, partial loss of function. It may not be preceded by any warning.

RECOGNITION

The keys to early recognition of the incapacitation are

- Routine monitoring and cross checking of flight instruments
- Crew members should have a very high index of suspicion of a subtle incapacitation
- If one crew member do not feel well, the other crew must be advised
- Others symptoms e.g. incoherent speech, pale fixed facial expression or irregular breathing could indicate the beginning of an incapacitation.

ACTION

The recovery from a detected incapacitation of the fit pilot shall follow the sequence below:

First phase

- Assume control, return the aircraft to a safe flight path, announce “I have control”, use the take-over pb and engage the on side AP as required.
- Declare an emergency to ATC
- Take whatever steps are possible to ensure the incapacitated pilot cannot interfere with the handling of the aircraft. This may include involving cabin crew to restrain the incapacitated pilot
- Request assistance from any medically qualified passenger
- Check if a type qualified company pilot is on board to replace the incapacitated crew member
- Land At the Nearest Suitable Airport after considering all pertinent factors
- Arrange medical assistance after landing giving many details about the condition of the affected crewmember

Second phase

- Prepare the approach and read the checklist earlier than usual
- Request radar vectoring and prefer a long approach to reduce workload
- Perform the landing from the fit pilot usual place

OVERWEIGHT LANDING

Applicable to: ALL

Overweight landing can be performed "in exceptional conditions" (in flight turn back or diversion), provided the flight crew follows the OVERWEIGHT LANDING procedure. The decision to jettison remains at captain discretion after the analysis of various parameters such as runway length, aircraft conditions, emergency situation.
Automatic landing is certified up to Maximum Landing Weight (MLW), but flight tests have been performed successfully up to Max Takeoff Weight (MTOW). In case of emergency, and under crew responsibility, an automatic landing may be performed up to MTOW provided that the runway is approved for automatic landing.
It is always possible to return immediately to land, at the departure runway, whatever the aircraft weight, provided that maximum reverse is used on at least one reverser.

The flight crew must press the ABN PROC pb on the ECP, than select MISC menu, to display the OVERWEIGHT LANDING procedure on the ECAM. As required by the procedure, the flight crew must compute the landing performance, using the OIS. Unless a specific landing flap setting is required by the ECAM for abnormal operations, AUTO CONF option must be selected. This ensures that CONF FULL is preferred for optimized landing performance and minimized energy. CONF 3 will be used only when necessary for go-around performance.
Should an overweight landing be required, a long straight in approach, or a wide visual pattern, should be flown in order to configure the aircraft for a stabilized approach.
The stabilized approach technique should be used, and VAPP established at the FAF. The speed will be reduced to VLS in the final stages of the approach to minimize the aircraft energy.
For go around, if the landing configuration is different from FLAP FULL, FLAP 1 must be used.
If a go-around FLAP 1 is carried out, VLS CONF 1+F may be higher than VLS CONF 3 +5 kt . The recommendation in such a case is to follow SRS orders which will accelerate the aircraft up to the displayed VLS. It should be noted, however, that VLS CONF 1+F equates to 1.23 VS1G whereas the minimum go-around speed required by regulations is 1.13 VS1G. This requirement is always satisfied.
The crew should be aware that the transition from -3 °flight path angle to go around climb gradient requires a lot of energy and therefore some altitude loss.
The maximum brake energy and maximum tire speed limiting weights are not limiting even in an overweight landing configuration.
Taking into account the runway landing distance available, the use of brakes should be modulated to avoid very hot brakes and the risk of tire deflation.

ABNORMAL AND EMERGENCY CALLOUTS

Applicable to: ALL

ECAM PROCEDURES

For more information on the callouts associated with ECAM procedures, *Refer to OP-40-40-3-40-3-2 Tasksharing Rules*.

MEMORY ITEMS

The aim of the following callouts is to announce the appropriate procedure by calling out, in most cases, the title of the procedure. This allows the flight crew to be aware of the situation and be prepared to properly react (crew coordination, task sharing, and communication).

GPWS

- **If the flight crew considers an avoidance maneuver:**
  "PULL UP TOGA"

WINDSHEAR

"WINDSHEAR TOGA"

UNRELIABLE SPEED INDICATION

"UNRELIABLE SPEED"

TCAS

- **If a TRAFFIC advisory alert is triggered:**
  "TCAS Blue"

EMERGENCY DESCENT

"EMERGENCY DESCENT"

LOSS OF BRAKING

"LOSS OF BRAKING"

MALFUNCTION BEFORE V1 AT TAKEOFF

EVENT	CAPT	F/O
If GO decision	GO	
If RTO decision:	STOP	

Continued on the following page

Continued from the previous page

EVENT	CAPT	F/O
- REV green on EWD - Deceleration		REVERSE GREEN (1) DECEL (2)

(1) If the reverse deployment is not as expected, call NO REVERSE ENGINE_ or NO REVERSE, as appropriate.

(2) In the case of failure or no positive deceleration: NO DECEL
DECEL callout means that the deceleration is felt by the flight crew, and confirmed by the speed trend on the PFD. It can also be confirmed by the DECEL indication on the PFD, if the autobrake is active.
However, the DECEL indication appears when the current deceleration reaches 80 % of the selected deceleration rate. Therefore it is not an indication of the correct autobrake functioning, but it indicates that the deceleration rate is reached. E.g. the DECEL indication may not appear on a contaminated runway, with the autobrake active, due to the effect of the anti-skid.

SUPPLEMENTARY INFORMATION

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SI-PLP PRELIMINARY PAGES

SI-10 Adverse Weather

SI-10-10-1 Cold Weather Operations and Icing Conditions

SI-10-10-2 Windshear

SI-10-10-3 Turbulence

SI-20 Flight References

SI-30 Navigation Accuracy

SI-60 TCAS

SI-70 Use of Vertical Display

SI-80 Use of Weather Radar

SI-90 Use of HUD

SI-100 Use of Onboard Information System (OIS)

GENERAL

Applicable to: ALL

For more information on the cold weather procedures described in the FCOM , *Refer to FCOM/Procedures/Supplementary Procedures/Adverse Weather/Cold Weather Procedures* .
Aircraft performance is certified on the basis of a clean wing. Ice accretion affects wing performance. When the wing is clean, the airflow smoothly follows the shape of the wing. When the wing is covered with ice, the airflow separates from the wing when the Angle-Of-Attack (AOA) increases. Therefore, the maximum lift-coefficient is reduced. As a result, the aircraft may stall at a lower AOA , and the drag may increase.
The flight crew must keep in mind that the wing temperature of the aircraft may be significantly lower than 0 °C , after a flight at high altitude and low temperature, even if the Outside Air Temperature (OAT) is higher than 0 °C . In such cases, humidity or rain cause ice accretion on the upper wing, and light frost under the wing. Only 3 mm of frost on the under-surface of the wing is acceptable.

PRELIMINARY COCKPIT PREPARATION

Applicable to: ALL

The probe and window heating may be used on ground.

EXTERIOR INSPECTION

Applicable to: ALL

When ground-icing conditions are encountered, and/or when ice accretion is suspected, the Captain should determine, on the basis of the exterior inspection, whether the aircraft requires ground deicing/anti-icing treatment. This visual inspection must take into account all vital parts of the aircraft, and must be performed from locations that offer a clear view of these parts.

AIRCRAFT DEICING/ANTI-ICING ON GROUND

Applicable to: ALL

Deicing/anti-icing fluids enable to remove ice and to prevent ice accumulation on aircraft surfaces until the beginning of the takeoff. In addition, the fluids flow off the surfaces of the aircraft during takeoff, in order not to degrade the takeoff performance.
Several types of fluids can be used. These fluids have different characteristics:

Type 1	Type 2, 3, 4
Low viscosity	High viscosity
Limited holdover time	Long holdover time
Used mainly for deicing	Used for deicing and anti-icing

The holdover time starts from the beginning of the application of the fluid. It depends on the type of fluid and on the nature and the severity of the precipitation. The flight crew should refer to applicable tables as guidelines. The should use these tables in conjunction with the pre-takeoff check.

Depending on the severity of the weather, the flight crew must apply the deicing/anti-icing procedure:
- In one step, via the single application of heated and diluted deicing/anti-icing fluid, or
  This procedure provides a short holdover time, and should only be used in low moisture conditions. The holdover time starts from the beginning of the application of the fluid.
- In two steps, by first applying the heated deicing fluid, then by applying a protective anti-icing fluid. The ground crew must apply consecutively the two fluids. The holdover time starts from the beginning of the application of the second fluid.

TAXI-OUT

Applicable to: ALL

On contaminated runways, the taxiing speed should be as low as possible, and any action that could distract the flight crew during the taxi should be delayed until the aircraft is stopped.

The flight crew should consider the following factors:
- The antiskid is inhibited at very low speed
- The engine anti-ice increases the ground idle thrust
- Avoid large tiller inputs to minimize the risk of skidding during turns
- On slippery taxiways, it may be more effective to use differential braking and/or thrust, instead of the nosewheel steering
- If there is slush or snow on the taxiways, the flight crew should delay the flap selection until reaching the holding point, in order to avoid contaminating the flap/slat mechanism
- When reaching the holding point the flight crew should perform the "Before Takeoff Down to the Line" checklist
- The flight crew must maintain the aircraft far behind the aircraft in front
- In icing conditions, when holding on ground for long periods of time, or if engine vibration occurs, the flight crew should increase the thrust before takeoff to shed any ice from the fan blades. For more information, *Refer to FCOM/PRO-NOR-SOP-90-90 After start_ENG Anti-Ice* .

TAKEOFF

Applicable to: ALL

TAKEOFF PERFORMANCE

When taking off on contaminated runways, it is not permitted to use FLEX thrust. However, derated thrust may be used, as required, in order to optimize aircraft performance. When available, a derated takeoff thrust results in lower minimum control speeds and therefore,

in a lower V1 . A reduction in the minimum control speeds can sometimes enhance takeoff performance.
If anti-ice is used, the flight crew must apply the applicable performance penalty.
Slush, standing water, and/or deep snow reduce the effectiveness of aircraft takeoff performance, because of increased rolling resistance and reduction in tire-to-ground friction. A higher flap setting increases the runway-limited takeoff weight, but reduces the second segment limited takeoff weight.

TAKEOFF ROLL

When on ground, in icing conditions, and if temperature is less than + 1 °C :

- Before the aircraft lines up on the runway for takeoff, the flight crew must ensure that the airframe has no ice or snow
- In order to shed any possible ice on the fan, the flight crew should increase the thrust on two symmetric engines at a time, just before takeoff with parking brake on or brake with pedals. For more information on the shedding procedure, *Refer to FCOM/PRO-NOR-SOP-90-90 After start_ENG Anti-Ice* .

CAUTION	Pay particular attention to the aircraft movement during this procedure. If during thrust increase, the aircraft starts to move, immediately retard the thrust levers to IDLE.

If the aircraft moves, apply the thrust on only one engine at a time.

Then, before applying thrust, the Captain should ensure that the nosewheel is straight. If there is a tendency to deviate from the runway centerline, the flight crew must immediately correct this tendency by using the rudder pedal steering, not the tiller.
On contaminated runways, the flight crew should ensure that engine thrust is set symmetrically to avoid difficult directional control.
The flight crew should consider the maximum crosswind in relation to the friction coefficient of the runway. For more information on the maximum crosswind, *Refer to FCOM/PER-TOF-CTA-CWD Crosswind Refer to FCOM/Performance/Takeoff/Runway Contamination/Crosswind* .

IN FLIGHT

Applicable to: ALL

CLIMB/DESCENT

Whenever icing conditions are encountered or expected, the flight crew should turn on the engine anti-ice. Although the TAT before entering clouds may not require engine anti-ice, the flight crew should be aware that the TAT often decreases significantly, when entering clouds.
In the climb or the cruise phase, when the SAT is less than -40 °C , the flight crew should turn off the engine anti-ice, unless flying near CB s.

If the flight crew does not apply the recommended anti-ice procedures, engine stall, over-temperature, or engine damage may occur.
The flight crew should turn on the wing anti-ice, if severe ice accretion is expected, or if there is any indication of icing on the airframe.

HOLDING

If holding is performed in icing conditions, the flight crew should maintain the clean configuration because they should avoid flying in icing conditions with the slats extended during a long period of time.

APPROACH

If significant ice accretion develops on parts of the wing that have not been deiced, the aircraft speed must be increased (*Refer to FCOM/Operations in Icing Conditions*).
When the temperature is less than ISA-10, the flight crew must correct the target altitudes (provided by the ATC), by adding the values that are indicated in the table below:

Corrections to be Added (ft)			
Height (ft)	**ISA - 10**	**ISA -20**	**ISA 30**
500	50	70	100
1000	100	140	190
2000	200	280	380
3000	290	420	570
4000	390	570	760
5000	490	710	950

These corrections correspond to approximately 4×▲ISA × Height (ft)/1000.

LANDING

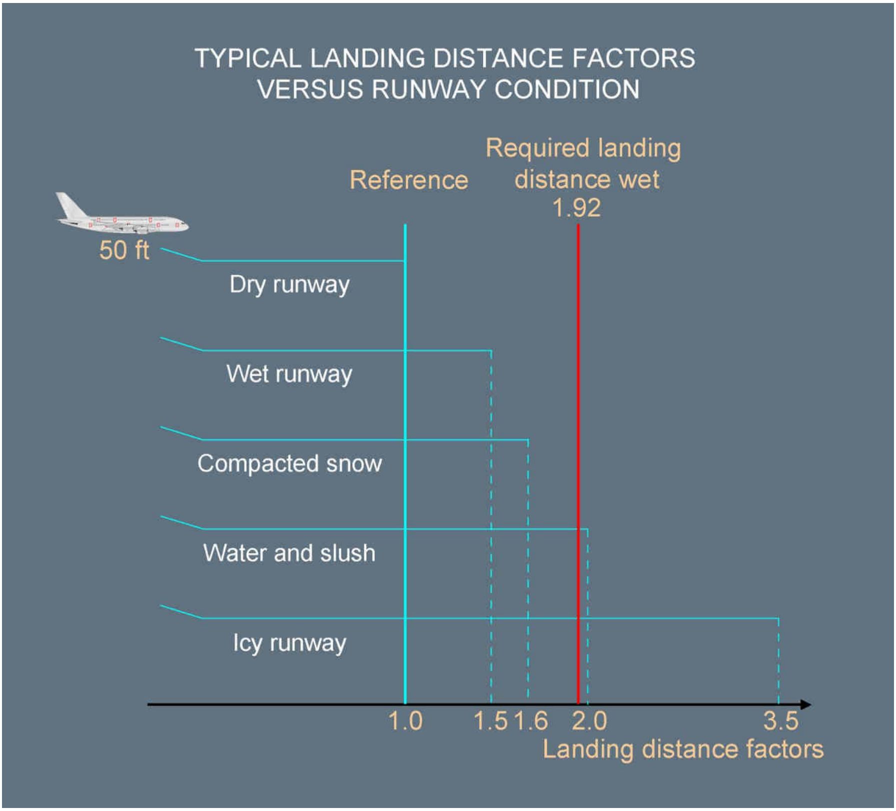
Applicable to: ALL

The flight crew should avoid landing on very slippery runways. However, if it is not possible to avoid such landings, the flight crew should consider the following factors that are linked to operations on contaminated runways:
- Braking action
- Directional control.

BRAKING ACTION

Fluid contaminants on the runway has an adverse effect on braking performance, because it reduces the friction between the tires and the surface of the runway. It also creates a layer of fluid between the tires and the runway surface, and reduces the contact area.
The flight crew should perform a firm touchdown. They should apply MAX reverse as soon as the main landing gear is on ground. Using reversers on a runway that is contaminated with dry snow

may reduce the visibility, particularly at low speeds. In such cases the flight crew should reduce the reverse thrust to idle, if necessary.
The flight crew should set to 3 the autobrake when landing on an evenly contaminated runway. It is possible that the DECEL indication on the PFD does not appear, as the predetermined deceleration may not be achieved. This does not mean that the autobrake is not working.



DIRECTIONAL CONTROL

During rollout, the flight crew must center the sidestick. This prevents asymmetric wheel loading, that results in asymmetric braking and increases the weathercock tendency of the aircraft.
The flight crew should use the ruder for directional control after touchdown, in the same way as for a normal landing. They must avoid using the tiller above taxi speed, because it may result in nosewheel skidding, and lead to a loss of directional control.

If necessary, the flight crew must apply differential braking by completely releasing the pedal on the side that is opposite to the expected direction of the turn, because on a slippery runway, full or half deflection of the pedal may lead to the same braking effect.

Landing on a contaminated runway in crosswind conditions requires careful consideration. In such case, two factors can cause directional control difficulties:
- If the aircraft touches down with crab angle, and if the flight crew applies the reverse thrust, the side-force component of reverse thrust adds to the crosswind component, and causes the aircraft to drift to the downwind side of the runway
- As the braking efficiency increases, the cornering force of the main wheels decreases.

If there is a problem with the directional control, the flight crew should:
- Set to idle the reverse thrust, in order to reduce the reverse thrust side-force component
- Release the brakes in order to increase the cornering force
- Return to the runway centerline, select again the reverse thrust, and resume braking (*Refer to Landing*).

The concept of equivalent runway condition is used to determine the maximum crosswind limitation. For more information on the maximum crosswind, *Refer to FCOM/Performance/Landing/Runway Contamination/Crosswind* .

TAXI-IN

Applicable to: ALL

During taxi-in, after landing, the flight crew should not retract the flaps/slats, because retraction could cause damage, by crushing any ice that is in the slots of the surfaces. When the aircraft arrives at the gate, and the engines are stopped, the flight crew should perform a visual inspection to check that the slats/flaps areas are free of contamination. Then, the flight crew can retract the slats/flaps by using the electric pumps.
At the end of the flight, in extreme cold conditions, cold soak protection is requested when a longer stopover is expected.

GENERAL

Applicable to: ALL

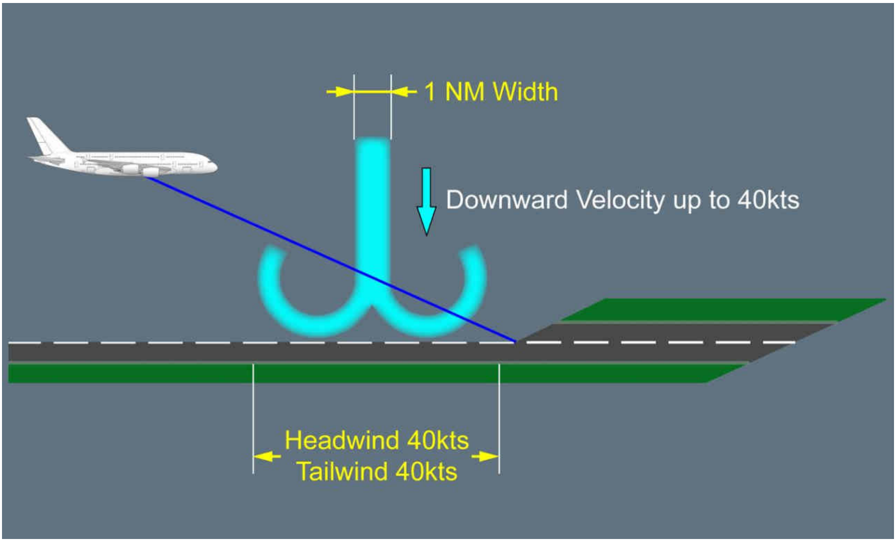
WINDSHEAR PHENOMENON

A windshear results from a cool shaft of air, that is similar to a cylinder with a width between 0.5 nm and 1.5 nm, that moves downward.

When the air hits the ground, it:
- Expands horizontally, causing a horizontal wind gradient
- Curls inward at the edges, causing vertical movement of the air mass.

Flight safety is affected, because:
- The horizontal wind gradient significantly affects lift, causing the aircraft to descend, or to reach a very high Angle-of-Attack
- The vertical movement of the air mass severely affects the aircraft flight path.

WINDSHEAR PHENOMENON



AWARENESS AND AVOIDANCE

Awareness of the weather conditions that cause windshear reduces the risk of a windshear encounter. The flight crew should study meteorological reports and listen to tower reports in order to help them assess the weather conditions expected during takeoff or landing.

If a windshear encounter is expected, the flight crew should delay takeoff or landing until the conditions improve (e.g. until the thunderstorm leaves the airport).

STRATEGY FOR COPING WITH WINDSHEAR

Windshear and microburst are hazardous phenomena for aircraft at takeoff or landing. The strategy to cope with windshear is:

- **Increase flight crew awareness** by using the Predictive Windshear Function (PWS)
- **Inform the flight crew** of air mass variations that are not expected by using Velocity Vector (VV) and approach speed variations
- **Warn the flight crew** of significant loss of energy by using "SPEED, SPEED, SPEED" and "WINDSHEAR" aural alerts
- **Provide effective tools** to escape the windshear by using ALPHA FLOOR protection, SRS pitch order, high AOA protection and Ground Speed mini protection.

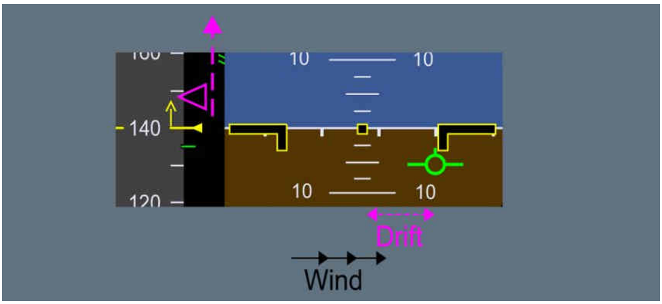
INCREASE FLIGHT CREW AWARENESS

When the microburst reaches the ground, it expands outward, carrying a large number of falling rain droplets. The weather radar measures the speed variations of the droplets, and as a result, assesses wind variations. The Predictive Windshear Function (PWS) predicts wind variations. The PWS automatically operates below 1 500 ft AGL. The PWS triggers aural and visual alerts in the case of a windshear detection.

INFORM THE FLIGHT CREW

The bird(Velocity Vector) associated with the approach speed variations (GS mini protection) is an effective way of informing the flight crew of air mass variations that are not expected. Approach speed variations and lateral bird movement reflect the horizontal wind gradient. Vertical bird movement reflects the vertical movement of the air mass.

BIRD AND TARGET SPEED – WIND INTERPRETATION



WARN THE FLIGHT CREW

The "SPEED, SPEED, SPEED" low energy warning is based on the speed, the acceleration and the flight path angle of the aircraft. This warning attracts the PF's eyes to the speed scale, and requests rapid thrust adjustment. In windshear conditions, "SPEED, SPEED, SPEED" is the first warning to appear, before the activation of the alpha floor protection.
In addition, the aircraft has a reactive windshear warning function. This function triggers, if the aircraft encounters a windshear. In this case, "WINDSHEAR WINDSHEAR WINDSHEAR" aural alert is triggered.

PROVIDE EFFECTIVE TOOLS

There are three effective tools that assist the flight crew to escape a windshear:
- The alpha floor protection
- The SRS AP/FD pitch law
- The high AOA protection.

When the alpha floor protection is triggered, the A/THR applies TOGA on all engines disregarding the thrust levers position. The FMA displays A.FLOOR, that changes to TOGA LK, when the aircraft AOA decreases. TOGA LK can only be disengaged by disconnecting the A/THR.
The SRS pitch mode ensures the best aircraft climb performance. Therefore, the procedure requests that the flight crew follows the SRS pitch bar and possibly apply full backstick, in order to follow the SRS orders and minimize the loss of height.
The high AOA protection enables the PF to safely pull full backstick, if needed, in order to follow the SRS pitch order, or to rapidly counteract a down movement. This provides maximum lift and minimum drag, by automatically retracting the speed brakes, if they are extended.

OPERATIONAL RECOMMENDATIONS

Applicable to: ALL

TAKEOFF

PREDICTIVE WINDSHEAR ("WINDSHEAR AHEAD" AURAL ALERT)

The Predictive Windshear Function detected a windshear.
If a predictive windshear aural alert is triggered on the runway before takeoff, the flight crew must delay takeoff.
If a predictive windshear aural alert is triggered during the takeoff roll, the Captain must reject the takeoff (the aural alert is inhibited at speeds more than 100 kt).

If a predictive windshear aural alert is triggered during initial climb, the flight crew must:
- Set TOGA
- Closely monitor the speed and the speed trend

- Ensure that the flight path does not include areas with suspected windshears
- Change the aircraft configuration, provided that the aircraft does not enter windshear.

REACTIVE WINDSHEAR ("WINDSHEAR, WINDSHEAR, WINDSHEAR" AURAL ALERT) OR WINDSHEAR DETECTED BY FLIGHT CREW OBSERVATION

The PRIMs detected a windshear.
If the windshear occurs before V1, with significant speed and speed trend variations, the Captain must initiate a rejected takeoff.

If the windshear occurs after V1, the flight crew must select TOGA. The flight crew must pay attention to the following:
- The flight crew should not change the configuration, until the aircraft is out of the windshear, because operating the landing gear doors causes additional drag
- The PF must fly SRS pitch orders rapidly and smoothly, but not aggressively, and must consider pulling full backstick, if necessary, to minimize height loss
- The PNF should call out the wind variations from the ND and V/S and, when clear of the windshear, report the encounter to the ATC
- During a derated takeoff and in the case of windshear encounter, the flight crew cannot apply TOGA thrust, if the speed is less than F speed in CONF 2 or 3, due to VMCA considerations.

APPROACH

PREDICTIVE WINDSHEAR

The Predictive Windshear Function detected a windshear.

If "MONITOR RADAR DISPLAY" or the visual alert appears, the flight crew should either delay the approach or divert to another airport. However, if the flight crew decides to continue the approach, they should:
- Assess the weather severity with the radar display
- Consider the most appropriate runway
- Select FLAPS 3 for landing, in order to optimize the climb gradient capability in the case of a go-around
- Use managed speed, because it provides the GS mini function
- Increase the VAPP displayed on the FMS PERF APP page up to a maximum of VLS + 15 kt
- Consider using the VV pb or ILS, for an earlier detection of vertical path deviation
- In the case of "GO AROUND WINDSHEAR AHEAD" triggering, the PF must set TOGA for a go-around. The flight crew can change the aircraft configuration, provided that the windshear is not entered. Full backstick should be applied, if required, to follow the SRS, or to minimize the loss of height.

REACTIVE WINDSHEAR

The PRIMs detected a windshear.

In the case of a "WINDSHEAR, WINDSHEAR, WINDSHEAR" aural alert, the PF must set TOGA for a go-around. However, the flight crew must not change the configuration (slats/flaps and gear) until out of the windshear, and must closely monitor the flight path and speed.

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PREFACE

Applicable to: ALL

The flight crew must use weather reports and charts to determine the location and altitude of possible CBs, storms, and Clear Air Turbulence (CAT). If turbulence is expected, the flight crew must turn on the seatbelt signs, in order to prepare passengers and prevent injury.

USE OF THE RADAR

Applicable to: ALL

Areas of known turbulence, associated with CBs, must be avoided.
Usually, the gain should be left in AUTO. However, selective use of manual gain may help to assess the general weather conditions. Manual gain is particularly useful, when operating in heavy rain, if the radar picture is saturated. In this case, reduced gain will help the flight crew to identify the areas of heaviest rainfall, that are usually associated with active CB cells. After using manual gain, it should be reset to AUTO, in order to recover optimum radar sensitivity.
A weak echo should not be a reason for the flight crew to underestimate a CB, because only the wet parts of the CB are detected. The decision to avoid a CB must be taken as early as possible, and lateral avoidance should, ideally, be at 20 nmupwind.

PROCEDURE

Applicable to: ALL

If moderate turbulence is encountered, the flight crew should set the AP and A/THR to ON with managed speed.
If severe turbulence is encountered, the flight crew should display the SEVERE TURBULENCE IN CRUISE procedure, by pressing the ECP ABN pushbutton, then selecting the MISCELLANEOUS Menu.
The ECAM procedure indicates 300 kt/M 0.85as MAX TURB SPEED, and green dot as MIN TURB SPEED. This range protects the aircraft structure from wind gusts, and maintains the buffet margin, especially during vertical wind gusts.
The ECAM procedure also recommends to set the AP to ON, and to disconnect the autothrust in case of excessive thrust variations.
Use of the A/THR is, however, recommended during approach, in order to benefit from the GS mini.
If the aircraft is flown manually, the flight crew should be aware of the fact that flight control laws are designed to cope with turbulence. Therefore, they should avoid the temptation to fight turbulence, and should not over-control the sidestick.
The flight crew must set the harness to on, check that the seat belts signs are on and use all white lights in thunderstorms.

CONSIDERATIONS ON CLEAR AIR TURBULENCE (CAT)

Applicable to: ALL

Clear Air Turbulence (CAT) can be expected by referring to weather charts and pilot reports.
However, the radar cannot detect CAT, because it is "dry turbulence".
If CAT is encountered, the flight crew may consider avoiding it vertically, keeping in mind that the buffet margin reduces as the altitude increases.

MISCELLANEOUS

Applicable to: ALL

It is not necessary to set the ENG START selector to IGN. In the case of an engine flameout, the igniters will trigger automatically.
The handling characteristics of "fly-by-wire" aircraft are independent of the CG in normal and alternate law. Therefore, it is not necessary to command a FWD fuel transfer, in the event of heavy turbulence in cruise.

PREFACE

Applicable to: ALL

For visual **manual** flight, Airbus recommends to fly **FD off** In this case, two flight references may be used on the PFD:

- The attitude
- The Velocity Vector, called the "bird"

In this case, the pilot selects the bird with the HDG/VS-TRK/FPA pb on the FCU (AFS-CP).

Note: *When the FD are ON, the bird can also be displayed, however, only as an information, not as a reference.*

FLYING MANUALLY - FD OFF

Applicable to: ALL

For visual circuits, the PF should use the "bird" as the flight reference.
→ TRK/FPA on the FCU
→ Fly the big green bird.
For dynamic maneuvers (such as takeoff or go around), the PF should use the attitude flight reference. An action on the sidestick has an immediate effect on the aircraft attitude (while the "bird" is directly affected by the aircraft inertia and has a delayed reaction).The flight crew can monitor the attitude flight reference directly and accurately during these maneuvers. This is why, at go-around initiation, HDG/VS is automatically selected (FD are automatically displayed) and the bird is removed.

FD ON

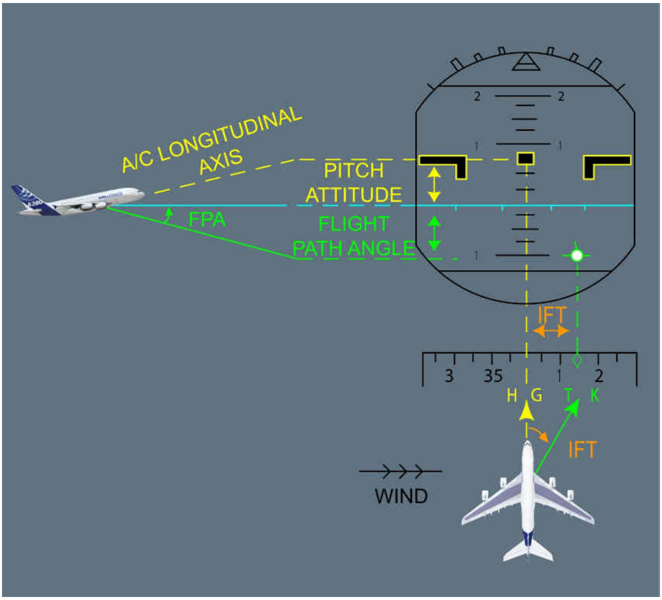
Applicable to: ALL

When the FD is ON, the FD bars remain the reference, even if the bird is displayed.
The bird can be displayed, as a slope and track information. However the PF should not fly the bird. This is why the symbol is smaller.
If TRK/FPA is selected on the FCU (AFS-CP), the bird is automatically displayed in green (small green bird).
If HDG/VS is selected on the FCU (AFS-CP), the bird is not automatically displayed. However, the flight crew can display it manually in black color, using the VV pb on the EFIS control panel (small black bird).

INFORMATION PRESENTATION

Applicable to: ALL

Whatever the selected modes, whatever its size and its color, the bird indicates the track and flight path angle in relation to the ground.
The track is indicated on the PFD by a green diamond on the track/heading scale, in addition to the lateral movement of the bird in relation to the fixed aircraft symbol. On the ND, the track is indicated by a green diamond on the compass scale. The difference in angle between track and heading indicates the drift.
The flight path angle is indicated on the PFD by the vertical movement of the bird in relation to the pitch scale.
With both FDS pb set to off, the blue track index appears on the PFD horizon



PRACTICAL USES OF THE BIRD

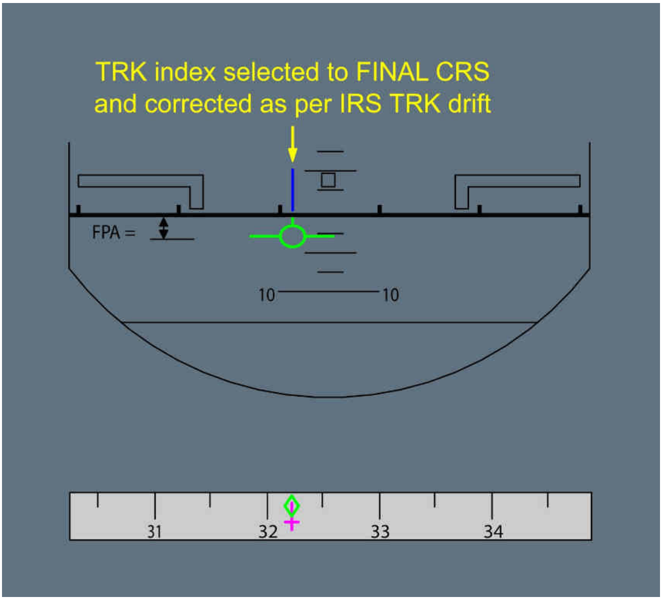
Applicable to: ALL

GENERAL

As a general rule, when using the bird as a reference (FD OFF), the pilot should first change attitude, and then check the result with reference to the bird.

VISUAL CIRCUITS (FD OFF)

The bird can be used as a cross-reference, when flying visual circuits. On the downwind leg, the pilot should position the wings of the bird on the horizon, in order to maintain level flight. The downwind track should be set on the FCU (AFS-CP). The pilot should position the tail of the bird on the blue track index on the PFD , in order to maintain the desired downwind track.
On final approach, the track index should be set to the final approach course of the runway. A standard 3° approach path is indicated, when the top of the bird's tail is immediately below the horizon, and the bottom of the bird is immediately above the 5° nose down marker.

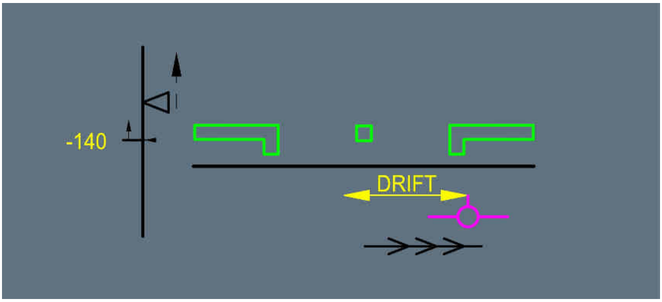


NON-PRECISION APPROACH (FD ON)

The small green bird (automatically displayed) is particularly useful for monitoring the approach flight path in non-precision approaches.
However, pilots should understand that the bird only indicates a flight path angle and track, and does not provide guidance to a ground-based radio facility. Therefore, even if the bird indicates that the aircraft is flying with the correct flight path angle and track, this does not necessarily mean that the aircraft is on the correct final approach path.

FINAL APPROACH

The bird provides the trajectory parameters, and quickly warns the pilot of downburst. In addition, together with the GS MINI protection, it is an excellent indicator of shears or wind variations. If nothing else, the position of the "bird" in relation to the fixed aircraft symbol provides an immediate indication of the wind direction. Therefore, when approaching the minima, the pilot knows in which direction to search for the runway.



The target approach speed symbol moves upward (and the bird moves downward), indicating that there is headwind gust.
The bird drifts to the right, indicating that there is wind from the left.

RELIABILITY

Applicable to: ALL

The bird is computed from IRS data, therefore, it is affected by ADIRS errors. An error may be indicated by a small track error, usually of up to +/- 2°. This can be easily determined during the approach.
The bird is also computed from static pressure information. Therefore, the bird must be considered as not reliable, if altitude information is not reliable.

GENERAL

Applicable to: ALL

The primary function of the FMS is navigation, i.e. to compute the aircraft's position as accurately as possible.
Three types of sources may be used to compute the FMS aircraft position:

- The GPS
- The IRS
- Radio navigation

The accuracy of the FMS navigation determines the validity of all others FMS functions and consequently the crew's strategy for using the AP/FD modes, in addition to the ND display.

FMS POSITION COMPUTATION

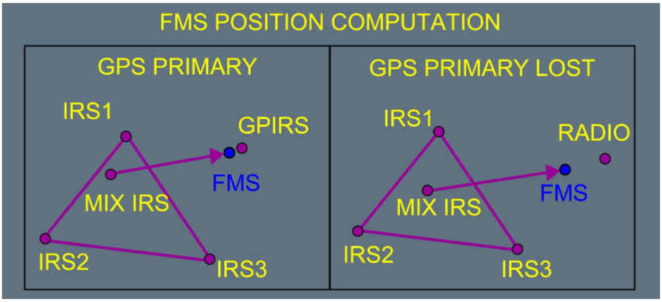
Applicable to: ALL

PRINCIPLE

The FMS position computation is based on the MIX IRS position. This MIX IRS position is continuously updated via a BIAS taking into account :

- The GPIRS position when in GPS PRIMARY
- The radio position when in GPS PRIMARY LOST

Therefore, the FMS position tends toward the GPIRS position when in GPS PRIMARY whereas it tends toward the radio position when in GPS PRIMARY LOST.



NAVIGATION ACCURACY

The navigation accuracy is quantified by the Estimated Position Uncertainty (EPU) parameter. Depending on the navigation mode i.e. GPS PRIMARY, GPS PRIMARY LOST, IRS only, the EPU computation is different.

GPS PRIMARY

The GPS position is characterized by two parameters:

- Integrity
- Accuracy.

Integrity is a direct function of the number of satellites in view of the aircraft. If five or more satellites are in view, several combinations of the satellite signal may be used to process “several positions” and to carry out reasonableness tests on the satellite signals themselves.
Accuracy functions is in direct connection with the satellite constellation in view of the aircraft. If the satellites are low on horizon, or not in appropriate positions, accuracy will be poor. It is provided as a “figure of merit”.
If the GPS position fulfils both the integrity and the accuracy criteria, GPS PRIMARY is displayed on the MFD POSITION / MONITOR page and the GPS position is the best raw data position available. The EPU is low.

GPS PRIMARY LOST

To compute the EPU, the FMS considers the immediately available radio navigation means in the FMS position computation and applies defined tolerances for each of them. These tolerances assume that the radio navigation means are working properly. They ignore any possible excessive IRS drift or erroneous locations of radio navaids. The MFD POSITION/MONITOR page displays the HIGH/LOW indications, according to the EPU. These indications reflect the probable accuracy of the FMS navigation compared to the determined accuracy criteria.

FMS POSITION COMPUTATION PER FLIGHT PHASE

Applicable to: ALL

GPS PRIMARY

PREFLIGHT

The three IRS take the GPS position as the alignment reference point. It is not recommended to modify the coordinates of the alignment reference point. (See FCTM 02.060)

TAKEOFF

No FMS position update.

IN FLIGHT

The FMS position tends to the GPIRS position as long as the GPS satellites are available.

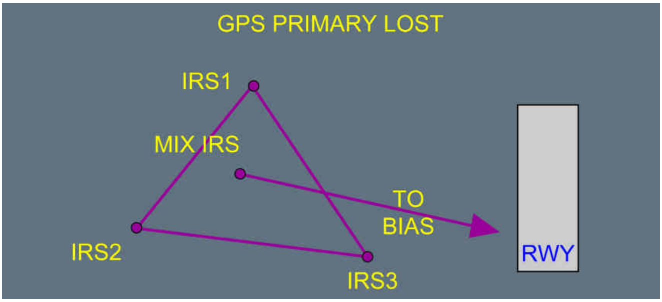
GPS PRIMARY LOST

PREFLIGHT

As the GPS position is not reliable to initialize the IRS, the crew must use the “ALIGN ON OTHER REF” prompt on the MFD POSITION/IRS page.

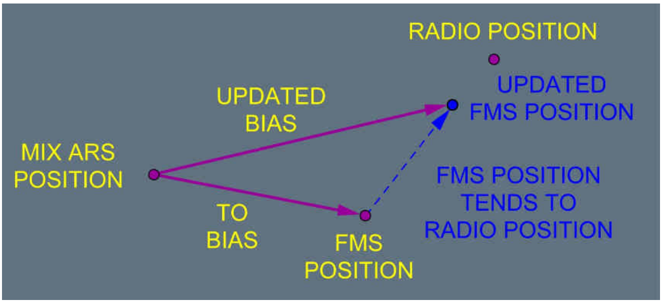
TAKEOFF

Each FMC uses the MIX IRS position as its position, until the thrust levers are pushed forward to TOGA. The FMS position is then updated to the runway threshold coordinates. The difference between the MIX IRS position and the FMS position is referred to as the TO BIAS. The TO BIAS is added to the MIX IRS position, for the subsequent FMS position.



IN FLIGHT

The original TO BIAS is continuously updated with the current radio aid and the FMS position tends to the radio position.



SUMMARY

FMS POSITION			
Flight phase		GPS PRIMARY LOST	GPS PRIMARY
Preflight		MIX IRS position	Tends toward GPIRS position
Takeoff		Updated at runway threshold (shift)	Tends toward GPIRS position
In flight	With RADIO	Tends toward RADIOposition	Tends toward GPIRS position
	Without RADIO	MIX IRS position + last updated BIAS	Tends toward GPIRS position

FMS POSITION MONITORING

Applicable to: ALL

FMS POSITION MONITORING

The FMS position monitoring is managed through several MFD pages:

POSITION/MONITOR PAGE

This page indicates the GPS PRIMARY capacity.
The POSITION/MONITOR page displays the Required Navigation Performance (RNP) in blue (this can be changed). The required navigation accuracy thresholds are determined, depending on the flight phase, or can be manually entered. The EPU is compared with the RNP to define whether accuracy is HIGH or LOW. These indications are used when flying within RNP airspace.

POSITION/NAVAIDS PAGE

The POSITIO/NAVAIDS page displays the navaids

- Tuned for display
- Tuned for FMS NAV

The “Tuned for FMS NAV” page has deselect prompt to deselect Navaids if reported unserviceable on NOTAMS
The “Tuned for FMS NAV” page has deselect prompt to deselect GPS that enables the flight crew to prevent the FMS from using the GPS data to compute the position, in the case of a major problem. GPS PRIMARY LOST is then displayed on MFD and ND. The GPS can be reselected.

POSITION/GPS PAGE

The GPS PREDICTED AVAILABILITY may be accessed on the MFD POSITION/GPS page. The GPS PRIMARY criteria depend upon the satellite constellation status (position and number) and this is predictable. The crew can assess the GPS PRIMARY status at destination or alternate.

POSITION/IRS PAGE

The IRS table provides information on:

- The IRS status i.e. NAV or ATT
- The residual alignment time (also available on ECAM) and HDG entry when one IRS is in ATT mode
- The IRS drift and residual ground speed information when the flight is completed

ND/MFD

A GPS PRIMARY message is displayed when GPS PRIMARY is again available. This message is clearable.
A GPS PRIMARY LOST message is displayed when GPS PRIMARY is lost. This message is clearable on MFD but not on ND.
When the class of navigation accuracy is downgraded from HIGH to LOW (LOW to HIGH), a NAV ACCUR DOWNGRADE (UPGRADE) is displayed on ND and MFD

NAVIGATION ACCURACY CROSSCHECK AND CREW STRATEGY

Applicable to: ALL

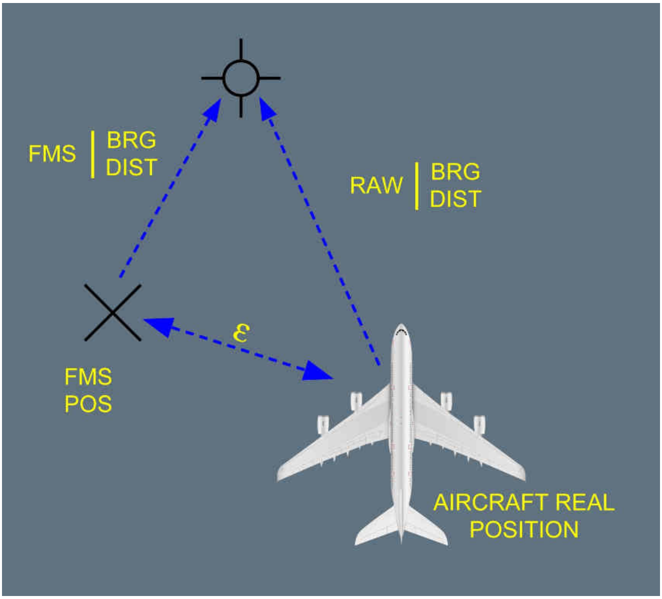
NAVIGATION ACCURACY INDICATIONS

The navigation accuracy indications are available on the MFD POSITION/MONITOR page. The following guidelines apply:

- If GPS PRIMARY is displayed, no navigation cross-check is required
- If GPS PRIMARY LOST, navigation crosscheck is required in climb, in cruise, about every 45 minutes, before the Top Of Descent, reaching TMA and IAF and whenever a navigation doubt occurs.
- The crew will use, IRS only, LOW and NAV ACCY DOWNGRADED messages as indications to trigger a navigation accuracy check.

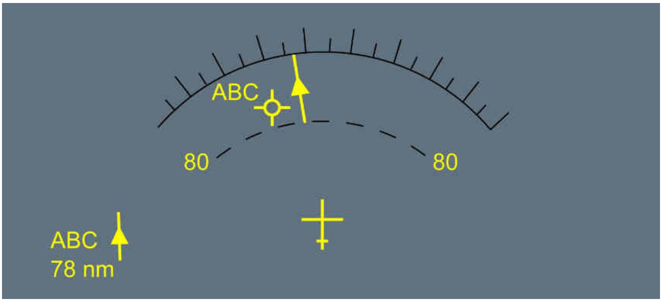
NAVIGATION ACCURACY CROSSCHECK TECHNIQUE

The principle consists in comparing the FMS position with the RADIO position (aircraft real position).



There are two possible techniques:

- The flight crew inserts a radio ident in the MCDU PROG page that provides a bearing/distance in relation to the FMS position. They then compare these values with the raw data received from the navaid, that indicates the real position of the aircraft. This enables the flight crew to quantify the error ε.
- On the ND, the flight crew compares: The position of the needle and its associated DME distance (the real position of the aircraft) with the position of the navaid symbol and its associated distance, indicated by the range markers (these markers provide a bearing/distance, in relation to the FMS position).



OPERATIONAL CONSEQUENCES

The result of the crosscheck of the navigation accuracy determines the pilot's strategy for using the ND display, the AP/FD modes and the EGPWS.

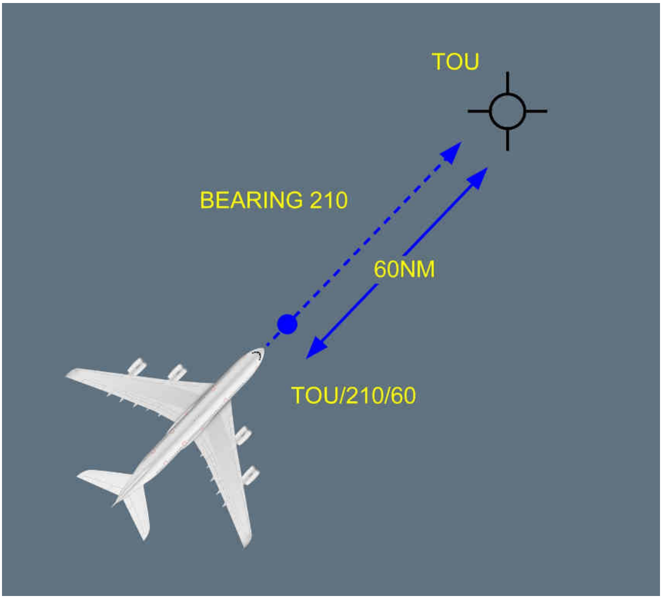
			ND		AP/FD mode	EGPWS
			PF	PNF		
GPS primary		-	ARC or ROSE NAV with raw data when required		Lateral and Vertical managed modes	ON
GPS primary lost or No GPS	Cruise	Navigation accuracy check positive (≤3 nm)	ARC or ROSE NAV with raw data when required		Lateral and Vertical managed modes	ON
GPS primary lost or No GPS	Cruise	Navigation accuracy check negative (>3 nm)	ARC or ROSE NAV may be used with care and with raw data		Lateral and Vertical managed modes with care with raw data	OFF
GPS primary lost or No GPS	Approach (1)	Navigation accuracy check positive (≤1 nm)	ARC or ROSE NAV with raw data		Lateral and Vertical managed modes	ON
GPS primary lost or No GPS	Approach (1)	Navigation accuracy check negative (>1 nm)	ROSE VOR or ILS as required	ARC or ROSE NAV or ROSE ILS with raw data	Lateral and Vertical selected modes	OFF

(1) A GPS-defined Non-Precision Approach must be interrupted, if the GPS PRIMARY LOST message is displayed

POSITION UPDATE

In the case of an obvious and major map shift, indicated by messages, such as "CHECK A/C POSITION, FM1/FM2 POS MISMATCH", the FMS position may be updated on the MFD POSITION/MONITOR page. There are two possible techniques:
The recommended technique is to update the FMS position over a beacon by pressing the CONFIRM UPDATE prompt once estimating that the aircraft overflies the beacon using the associated needle. The potential error induced is approximately 4 to 5 nm. When the position update is achieved, the EPU is automatically set to a higher value and the navigation accuracy is low.

The second technique consists of updating the FMS position, when flying over a Point/Bearing/Distance (P/B/D) with reference to beacon raw data (Needle + Distance) rather than the beacon itself. The potential for error is far less when the distance is greater than 60 nm. The flight crew will keep in mind the potential 180 degree error on bearing.



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GENERAL

Applicable to: ALL

The Traffic Alert and Collision Avoidance System (TCAS) provides the flight crew with traffic information and warnings of possible conflicts with vertical avoidance instructions. The TCAS can only detect and indicate other aircraft that are equipped with a transponder.

The ND displays traffic information, and:
- The bearing and range to the intruder
- The vertical movement of the intruder
- The relative altitude of the intruder.

AP/FD TCAS MODE

The AP/FD TCAS mode is a vertical guidance mode of the AP/FD.

If the TCAS generates a Resolution Advisory (RA) alert, this mode automatically engages to assist the flight crew to follow the RA orders, and to revert toward initial trajectory:
- Automatically, if the AP is engaged, or
- Manually, with the guidance of the Flight Director (FD), if the AP is not engaged.

The AP/FD TCAS mode optimizes the vertical speed for a rapid and appropriate response to an RA, and minimizes the deviations from the latest ATC clearance.

INTRUDER DETECTION

The TCAS detects intruders that are flying within a maximum of 20 nm to 60 nm (depending on the aircraft configuration and external weather conditions), and within a maximum altitude of 9 900 ft above, and 9 900 ft below, the aircraft.
Based on the received information from the intruders, the TCAS may generate the following sequence of alerts:

- **If the TCAS considers the intruder to be a possible collision threat:**
  - It generates a visual and aural Traffic Advisory (TA)
  - In that case, the AP / FD TCAS mode automatically arms: TCAS appears on the FMA to inform the flight crew that the AP / FD TCAS mode will be available in the case a Resolution Advisory (RA) is subsequently triggered.

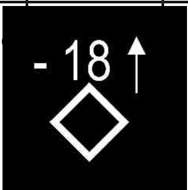
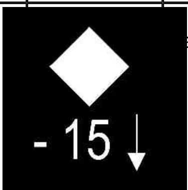
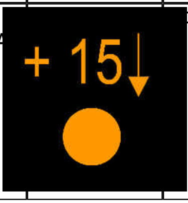
- **If the TCAS considers the intruder to be a real collision threat:**
  - It generates a visual and aural Resolution Advisory (RA)
  - The AP / FD TCAS mode automatically engages: TCAS appears on the FMA . The flight crew has vertical guidance to fly the RA orders, automatically with the AP / FD , or manually with the FD s only

- If the A/THR is disconnected, it automatically becomes armed or active, depending on the thrust lever position. When active, the speed/Mach mode engages, and the speed/Mach control becomes selected. For more information, *Refer to FCOM/When a RA is triggered / Consequence on A/THR and Speed/Mach control*
- The vertical speed scale on the PFD indicates the vertical speed range within which the aircraft should fly.

● **When the TCAS considers that there is no more collision threat:**

- It triggers the "CLEAR OF CONFLICT" aural alert
- In most of the cases, the AP / FD TCAS mode automatically reverts to V/S mode: The vertical speed target leads the aircraft toward the AFS CP selected altitude.
  If the altitude capture conditions are met at the clear of conflict, the AP / FD TCAS mode can revert to an altitude acquire, or an altitude hold mode: *Refer to FCOM/When Clear of Conflict / Consequence on AP/FD Vertical Mode* .

INTRUDER CLASSIFICATION

Intruder	Display on ND	Type of Collision Threat	Aural Alert	Flight Crew Response		
				BASIC TCAS	AP/FD TCAS without AP	AP/FD TCAS with AP
No threat traffic, or oth		No threat	-	-	-	
Proximate		Consider as no threat	-	-	-	
Traffic Advisory (TA		ssible threat	"TRAFFIC"	No evasive maneuver.	Monitor AP/FD TCAS mode arming. No evasive maneuver.	

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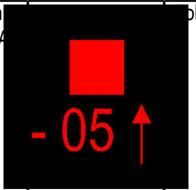
Intruder	Display on ND	Type of Collision Threat	Aural Alert	Flight Crew Response		
				BASIC TCAS	**AP/FD TCAS without AP**	**AP/FD TCAS with AP**
Resolution Advisory (RA)		Collision threat	Preventive (e.g. MONITOR V/S)	Do not alter the flight path. Maintain V/S out of red area.	Follow the FDs. Monitor V/S remains out of red area. *(1)*	Monitor V/S remains out of the red area. *(1)*
			Corrective (e.g. CLIMB)	Smoothly and firmly (0.25 g) follow the green area of the V/S scale within 5 s.	Smoothly and firmly follow the FDs. Monitor V/S gets out of red area, and remains in green area. *(1)*	Monitor V/S gets out of red area, and remains in green area. *(1)*
			Corrective (e.g. CLIMB NOW or INCREASE CLIMB)	Smoothly and firmly (0.35 g) follow the green area of the V/S scale within 2.5 s.	Smoothly and firmly follow the FDs. Monitor V/S gets out of red area, and remains in green area. *(1)*	Monitor V/S gets out of red area, and remains in green area. *(1)*

(1) In AP/FD TCAS mode, the load factor authority of the guidance law is increased.

The TCAS triggers TAs and RAs when the relative altitude between the aircraft and the intruder, at the Closure Point of Approach (CPA) is:
- Less than 850 ft for the TA and 700 ft for the RA, above FL 200
- Less than 850 ft for the TA and 600 ft for the RA, below FL 200.

RAs are inhibited if the aircraft is below:
- 900 ft AGL in descent
- 1 100 ft AGL in climb.

TAs are inhibited if the aircraft is below:
- 400 ft AGL in descent
- 600 ft AGL in climb.

OPERATIONAL RECOMMENDATIONS

Applicable to: ALL

TCAS SELECTIONS

The flight crew should select:
- ABV in climb
  The TCAS displays intruders that are between 2 700 ft below, and 9 900 ft above the aircraft.
- NORM in cruise
  The TCAS displays intruders that are between 2 700 ft below, and 2 700 ft above the aircraft.
- BLW , if the cruise altitude is within 2 000 ft of FL 430 , or in descent
  The TCAS displays intruders that are between 9 900 ft below, and 2 700 ft above the aircraft.
- TA ONLY, in the case of:
  - An engine failure
    The aircraft may not be able to achieve the RA orders because of its degraded performance.
  - A flight with the landing gear down
    The aircraft may not be able to achieve the RA orders because of its degraded performance.
  - Operations at specific airports, and during specific procedures, that an operator identifies as having a significant possibility for RA s that are not wanted and not appropriate (e.g. closely spaced parallel runways, converging runways).

Note: In TA ONLY mode, the AP / FD TCAS mode will not arm.

VERTICAL SPEED LIMITATIONS

The flight crew should comply with the vertical speed limitations during the last 2 000 ft of a climb or descent. The flight crew should limit the vertical speed to 1 500 ft/min during the last 2 000 ft of a climb or descent, particularly when the traffic converges in altitude and attempts to level off 1 000 ft above or below the flight crew's assigned altitude.

USE OF AP/FD TCAS MODE

If the TCAS generates a TA , or an RA , the flight crew should use the AP / FD TCAS mode, and apply the associated procedure, referred to as AP / FD TCAS procedures: *Refer to FCOM/Resolution Advisory Alerts / AP/FD TCAS Procedure* .
In the case the AP / FD TCAS mode is not available, e.g. the AP/FD TCAS mode is failed, or the aircraft is not equipped with the AP/FD TCAS mode, the flight crew must apply the BASIC TCAS procedures: *Refer to FCOM/Resolution Advisory Alerts / Basic TCAS Procedure* .

TRAFFIC ADVISORY

If a TA is triggered, the flight crew should check the immediate arming of the AP/FD TCAS mode, and the engagement status of the AP and A/THR.

TCAS in blue on the FMA indicates that the AP/FD TCAS mode is available, and armed.

Note: *If the AP/FD TCAS mode does not immediately arm, the flight crew must apply the BASIC TCAS procedure, in the case of a subsequent RA.*

If a TA is generated:
- The PF announces "TCAS blue"
- If the A/THR is off, the PF should request the PM to set it ON
- The PF must not initiate an evasive maneuver, only on the basis of a TA.

RESOLUTION ADVISORY

In all cases, the flight crew must always follow the TCAS RA orders, even if:
- The TCAS RA orders disagree with the ATC instructions
- It results in flying above the maximum ceiling altitude with "CLIMB, CLIMB" or "INCREASE CLIMB, INCREASE CLIMB" TCAS RA orders
- It results in crossing the altitude of the intruder.

CAUTION	Be aware that the intruder may have a TCAS , and may maneuver in response to a coordinated RA order. Therefore, not following an RA order could compromise safe separation.

AP / FD TCAS PROCEDURE

AP/FD TCAS Mode Engagement

If an RA is triggered, the AP / FD TCAS mode automatically, and immediately, engages.
If the PF uses the Head-Up Display (HUD), the PF must refer to the PFD .
The PF announces the AP / FD TCAS mode engagement, like any other FMA changes.
If the FD s are disengaged, they automatically engage. The FD pitch bar does not flash, and the triple click aural alert does not sound, in order to avoid to disturb the PF during the evasive maneuver.
If the A/THR is disconnected, it automatically becomes armed or active.
If AP s and FD s are off when the RA is triggered, HDG automatically engages.

AP/FD TCAS Procedure

If an RA is triggered:
- If the AP is engaged, the PF should keep it ON
  The AP guides the aircraft in accordance with the RA order.
- If the AP is not engaged:
  - The PF smoothly and firmly flies the FD pitch bar
    The FD orders guide the aircraft in accordance with the RA orders.
  - The PF can ask the PM to engage the AP .

- The PM monitors the evasive maneuver. He does not try to see the reported traffic.
  The flight crew checks that the guidance of AP / FD TCAS mode leads the vertical speed out of the red area of the vertical speed scale, and in the green area if any.

CAUTION	If for any reason during an RA , the aircraft vertical speed does not reach the green area of the vertical speed scale, the PF should disconnect the AP , and override the FD orders, in order to lead the aircraft vertical speed out of the red area of the vertical speed scale. If necessary, the PF must use the full speed range between $V\alpha_{max}$ and VMAX .

- If any "CLIMB" aural alert sounds during the final approach, the flight crew should first apply the AP / FD TCAS procedure. When clear of conflict, depending on the situation, they can consider a go-around.
- The PM notifies the ATC
- When clear of conflict:
  - The AP / FD TCAS mode automatically reverts to V/S , in order to capture the AFS CP selected altitude. In some cases, the AP / FD TCAS mode may revert to an altitude acquire mode, or an altitude hold mode: Refer to *Refer to FCOM/When Clear of Conflict / Consequence on AP/FD Vertical Mode* .
  - The PM notifies the ATC
  - The PF engages an appropriate vertical mode, or adjusts the vertical speed target, in accordance with ATC clearance.

Note: *The AP / FD TCAS mode is speed protected, i.e. it ensures that the aircraft speed remains between VLS - 5 kt and VMAX . Therefore, in the case the RA is triggered when the aircraft is close to its performance limits, the RA vertical speed target may not be reached with the AP / FD TCAS mode.*

BASIC TCAS PROCEDURE

If the PF uses the Head-Up Display (HUD), the PF must refer to the PFD .

- The PF disconnects the AP and requests the disconnection of the FD s, and smoothly and promptly follows the green area of the vertical speed scale within 5 s .

  Note: *The flight crew must disconnect the FD s as soon as the AP s are disconnected, in order to:*
  - *Ensure that autothrust is in SPEED / MACH mode*
  - *Avoid possible confusion between FD bar orders, and TCAS aural alerts and vertical speed orders.*

- The PM disconnects the FD s and monitors the evasive maneuver. He does not try to see the reported traffic.
- The PF avoids excessive maneuvers, and maintains the vertical speed outside the red area of the vertical speed scale and within the green area. If necessary, the PF must use the full speed range between $V\alpha_{max}$ and VMAX .
- The PM notifies the ATC .
- The flight crew should never maneuver in the opposite direction of the RA , because TCAS maneuvers are coordinated.
- In final approach, i.e. "CLIMB", "CLIMB NOW", "INCREASE CLIMB", the flight crew initiates a go-around.
- When clear of conflict, the flight crew resumes normal navigation, in accordance with ATC clearance, and using the AP / FD , as required.

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GENERAL

Applicable to: ALL

The main objectives of Vertical Display (VD) is to enhance flight crew awareness of the vertical situation by:

- Collecting existing information in the same place, to provide a synthetic view of various parameters with their relative position
- Providing a situational assessment about the current and future aircraft position in relation to:
  - Safe altitudes (check that the flight path is compliant)
  - Terrain (check the altitude constraints versus the terrain)
  - Weather information (anticipate changes caused by weather).

VERTICAL CUT

Applicable to: ALL

In normal operations (aircraft in NAV mode and on its F-PLN, or in HDG/TRACK mode), in ARC and ROSE-NAV modes, and provided that the flight crew did not pull the VD AZIM knob, the vertical cut is along the ND green solid line.
There are few exceptions to this rule. These cases are indicated by the VIEW ALONG ACFT TRK message that appears on the lower part of the VD.
Safety altitudes, terrain, and weather data are displayed along this vertical cut.

VERTICAL TRAJECTORY

Applicable to: ALL

In normal operations (aircraft in NAV mode and on its F-PLN, or in HDG/TRACK mode), in ARC and ROSE-NAV modes:

- The green solid line displayed on both the Navigation Display (ND) and the Vertical Display (VD) indicates the path that the aircraft will fly without any further action from the flight crew
- The green dotted line displayed on the VD is associated with the computed FMS trajectory
- The grey area displayed on the VD identifies the next turning point in the vertical plan (i.e. the vertical view is not straight ahead)
- The blue bracket on the ND indicates the end of the VD range.

VERTICAL CUT AND TRAJECTORY ACCORDING TO AP/FD MODES

Applicable to: ALL

MANAGED MODE

Vertical cut: Along the green solid line of the ND, i.e. the FMS flight plan
Solid line: Vertical F-PLN until AFS CP altitude

Dotted line: Vertical F-PLN above AFS CP altitude
Grey area: Identifies the next turning point in the vertical plan.

SELECTED MODE

Vertical cut: Along the green solid line of the ND, i.e. the current track
Solid line: Selected trajectory.

LATERAL MANAGED, VERTICAL SELECTED MODES

Vertical cut: Along the green solid line of the ND, i.e. the FMS flight plan
Solid line: Laterally managed/vertically selected trajectory
Dotted line: Vertical FMS F-PLN.

SAFETY ALTITUDE AND TERRAIN

Applicable to: ALL

GENERAL

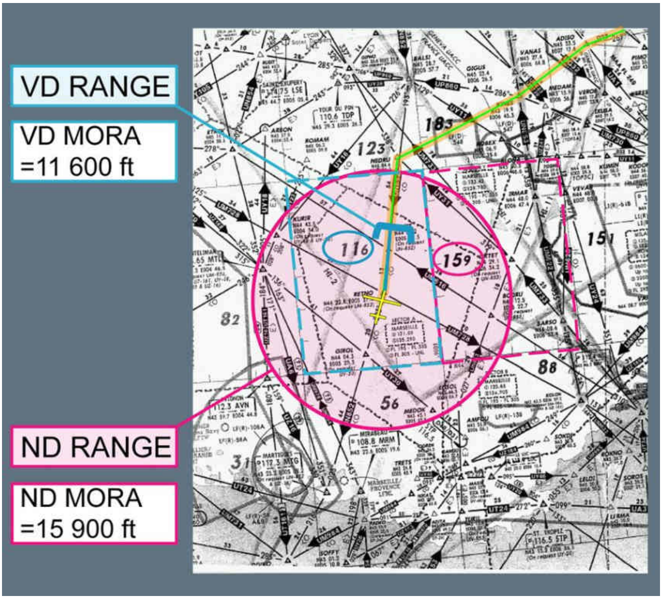
The VD improves the vertical situational awareness of the flight crew in relation to the safety altitudes (i.e. MORA and MSA) and the terrain.

On the VD, the terrain information is considered to be secondary to the safe altitudes. However, this information is necessary and complementary to the safe altitudes, particularly when the flight crew flies the aircraft below the safe altitudes, because it makes any potential hazard visible.
The display of safety altitudes enables the flight crew to anticipate hazardous situations for mid- and long-term flight planning. The VD is not designed for short-term use (e.g. for flying/guidance).
The flight crew should be aware that the use of approved charts (i.e. Electronic or paper charts) remains the primary source of information for safe altitudes, because VD data is not certified data.

SAFETY ALTITUDE DEFINITION

Both the ND and the VD provide safety altitude information.
The MSA information is based on the FMS database, and provides at least 1 000 ft of obstacle clearance within a 25 nm radius.

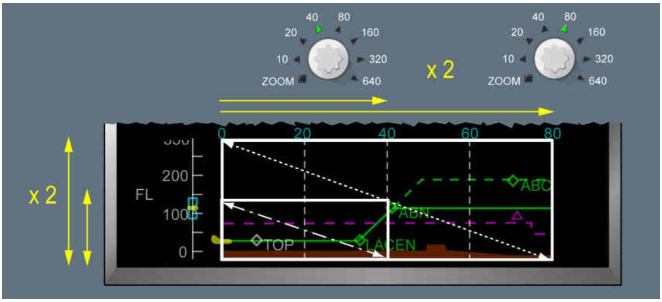
The MORA information is the grid MORA based on the FMS database. However, the MORA value displayed on the ND and the VD may be different, because the calculation assumptions are different:
- The ND displays the max MORA around the aircraft within a 40 nm fixed radius
- The VD displays the MORA and the MSA along the flight path (i.e. along the F-PLN when in NAV mode, or along the track when in HDG/TRACK mode), in a corridor linked to the RNP value, within the VD range.



Recommendations:
- Along a new path, check the MORA/MSA on the VD
- Before deviating, check the MORA on the ND and crosscheck with charts, to detect if the hazard is currently on the intended path.

TERRAIN

The height of the aircraft above the terrain displayed on the VD is geometrically correct and does not vary with the altitude setting.
The flight crew must be aware that the vertical range of the VD depends on the lateral selected range (the ratio is fixed). As a result, at high altitude, if the flight crew selects a shorter range, the terrain below the aircraft may disappear.



WEATHER

Applicable to: ALL

Refer to SI-80 General.

GENERAL

Applicable to: ALL

The weather radar has two main functions:
- Weather detection
- Ground mapping.

Weather detection is the primary function. For weather detection, the radar detects precipitation droplets. The strength of the echo is in proportion to the droplet size, composition and quantity (e.g. the reflection of water particles is five times greater than ice particles of the same size). Therefore, the weather radar does not detect weather that has small droplets (e.g. clouds or fog), or that does not have droplets (e.g. clear air turbulence).
Ground mapping is the secondary function. For ground mapping, the echo takes into account the difference between incoming and outgoing signals. Any significant difference in the signal is easily mapped (e.g. mountains or cities), but a small difference in the signal is not mapped (e.g. calm sea or even ground).
The weather radar operates automatically. It continuously scans a volume of space ahead of the aircraft, and stores this data in a three dimensional (3-D) buffer, after ground declutter. Ground returns are stored in a different buffer.
The WXR extracts data from the 3-D buffer in order to display the weather on the ND, and on the VD, according to the mode selected by the flight crew.
Ground returns are automatically removed from weather display. Therefore, if the flight crew selects the manual tilt mode, the ND will never display the ground returns, even at low tilt angles.

DISPLAY MODES AND FUNCTIONS

Applicable to: ALL

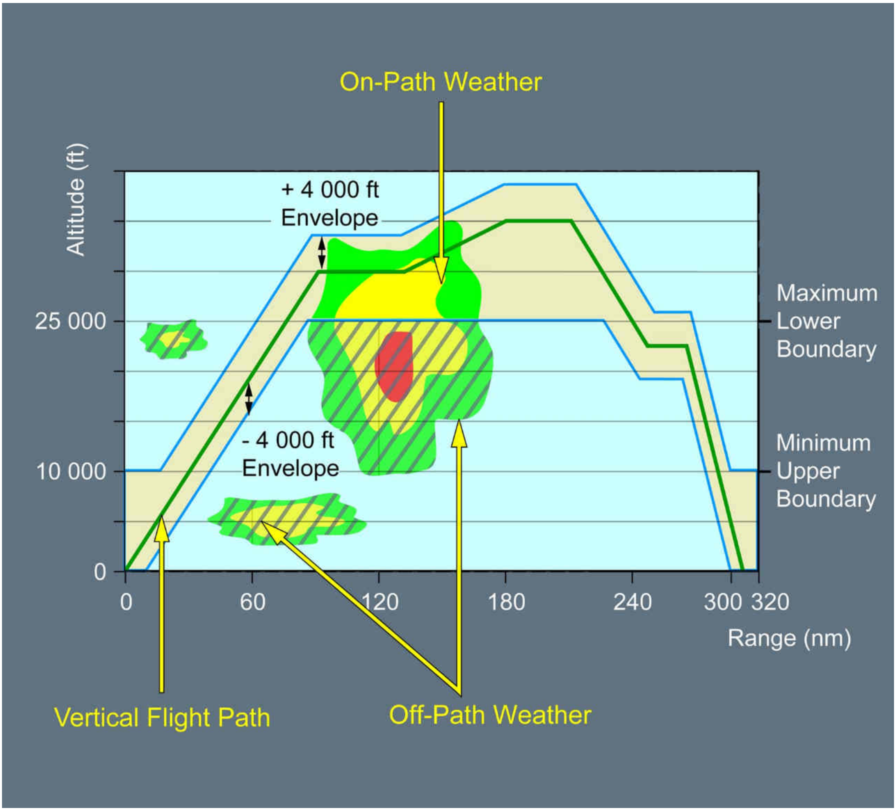
The flight crew can select the following modes, in order to display the data on the ND, and the VD.

AUTO

When the flight crew selects the AUTO mode (default mode), the weather is displayed along the flight path of the aircraft.

On the ND, the weather is displayed along the vertical FMS flight plan, or, if not available, along a flight path based on the current FPA. The WXR considers a vertical envelope, in order to differentiate:
- The on-path weather that will be encountered by the aircraft
- The off-path weather that will not be encountered by the aircraft, and that is displayed with reduced intensity and black parallel lines.

This vertical envelope is defined as indicated on the following schematic.



Note:
- *Resulting from this vertical envelope, it must be highlighted that, when the aircraft flies at high altitude (I.e. above 30 000 ft), some weather can be displayed on-path, even if it is located well below the flight path. The flight crew can use the VD to assess the altitude of the weather, compared to the flight path.*
- *The WXR may not be able to discriminate the on-path and the off-path weather at ranges above 160 nm, because of the angle of the antenna beam width. Therefore, the flight crew should not decide a diversion based on on-path weather located more than 160 nm ahead the aircraft.*

On the VD, the weather is displayed along the zero width vertical cut. For more information on the vertical cut, *Refer to SI-70 Vertical Cut*.

ELEVN/TILT

The flight crew can select these modes by using the SURV panel, or the SURV/CONTROLS page of the MFD.

For weather analysis, ELVN or TILT mode enables the ND to display the weather:
- At an altitude selected by the flight crew
- At a tilt angle selected by the flight crew

Note: The flight crew must return to the AUTO mode, when they have completed the analysis.

AZIM

The flight crew can select this mode by using the SURV panel.
The AZIM mode enables to display the weather on the VD, along a selected azimuth. It should be used to prepare a diversion.
The WXR automatically returns to AUTO after 30 s, if the flight crew does not select any azimuth value.

GAIN

The gain control is mostly used in AUTO. The flight crew can select the manual mode by using the SURV panel, or the SURV/CONTROLS page of the MFD.
The detection or evaluation of cells will always start in the AUTO mode. However, the gain may be manually tuned to detect the strongest part of a cell displayed in red on the ND. If the flight crew slowly reduces the gain value, the red areas (level 3 return) will slowly become yellow areas (level 2 return), and the yellow areas will become green areas (level 1). The last part of the cell that becomes yellow is the strongest area.
The gain must then be reset to AUTO when the flight crew has completed the analysis.

TURB FUNCTION

Turbulence detection (TURB) function mode is selected by default (AUTO on the MFD SURV page).
The TURB function displays wet turbulence up to 40 nm in front of the aircraft.
It is not affected by the gain.
The TURB function should be used in order to isolate turbulence from precipitation.

PWS FUNCTION

Refer to Adverse Weather.

OPERATIONAL RECOMMENDATIONS

Applicable to: ALL

WEATHER DETECTION

Takeoff: The flight crew must be aware that, when they press the WX pb on the EFIS CP, it takes about 30 s to fill the buffer with radar data, and to have the complete display available on the ND and on the VD.
In flight: Use the TURB function in order to isolate turbulence from precipitations.

WEATHER AVOIDANCE

Avoid cells laterally, rather than vertically.
Do not underestimate a thunderstorm, even if echo is weak (only wet parts are detected).
Avoid all red or magenta cells by at least 20 nm .
Deviate upwind instead of downwind (less probability of turbulence or hail).
Do not attempt to fly below a storm, even visual (turbulence, shear, altimetry).
Use the TURB function in order to isolate turbulence from precipitation.
There may be severe turbulence, up to 5 000 ft above a cell.
Storms with tops above 35 000 ft are hazardous.
Frequent and vivid lightning indicates a high probability of severe turbulence.

WEATHER PENETRATION

In the case of storm penetration, the flight crew must take full advantage of the weather radar. For flight crew guidelines, in the case of turbulence, *Refer to Adverse Weather*.

GROUND MAPPING

The GAIN has to be adjusted harmoniously.
Use MAP to detect PROMINENT TERRAIN (mountain, city, and coastline).

GENERAL

Applicable to: ALL

The Head-Up-Display (HUD) is an instrument in the cockpit that provides the flight crew with trajectory-related symbols. The flight symbols are superimposed to the outside view. This enables the flight crew to fly the aircraft, in relation to external parameters (e.g. terrain, runway surface, clouds, etc.).
The flight crew can use the HUD during all the flight phases.

The flight crew may consider the benefits of using the HUD:
- At takeoff
- In climb, cruise, descent in order to avoid adverse weather conditions
- During intermediate and final approach for smooth IMC/VMC transition.

However, in the following cases the flight crew must revert to the PFD and the ND:
- TCAS Resolution Advisories (RA)
- Unusual attitude recoveries.

In such cases, a specific message appears on the HUD to inform the flight crew that it is necessary to revert to the PFD and the ND.

In addition, it is also recommended that the flight crew uses the PFD and the ND for the following maneuvers:
- Controlled Flight Into Terrain (CFIT) avoidance
- Windshear recovery
- Non-Precision Approaches with the RAW ONLY capability.

The flight crew can initiate these maneuvers head-up.
The use of the HUD has no effect on the standard task sharing rules.
Only the manner in which the flight crew visually scans cockpit information is changed.

SINGLE HUD CONFIGURATION

Applicable to: ALL

The following recommendations apply when the PF is the CM1. The PF uses the HUD as follows:

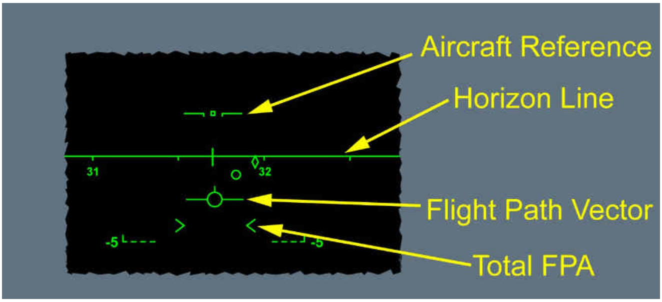
- The PF can fly the aircraft using the HUD as the main reference in the following flight phases:
  - Taxi
  - Takeoff
  - Climb/cruise/descent for avoidance of adverse weather conditions
    The PF flies the aircraft in order to maintain the trajectory symbols of the HUD out of the adverse weather.
  - Intermediate and final approach for smooth IMC/VMC transition
  - Landing
  - Rollout.
- The PF visually scans the ND and the ECAM, when using the HUD to fly the aircraft.

In the case of a HUD failure, the PF must refer to the PFD and the ND.
The PNF uses the PFD and the ND as the main references to monitor the flight parameters.
However, if the PNF is the CM1, the PNF may periodically refer to the HUD, in order to take advantage of situational awareness enhancement of the HUD during the intermediate and final approaches, especially during the IMC/VMC transition, and during the visual approach segment.
During takeoff, the PNF monitors the takeoff thrust setting on the ECAM, before reaching 80 kt.
During the final approach, the PNF monitors the pitch, the bank, and the speed of the aircraft on the PFD, for deviation callouts.

BASIC HUD SYMBOLS

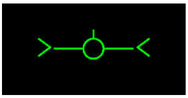
Applicable to: ALL

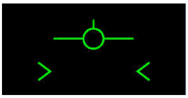
Basic HUD Symbols

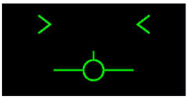


Basic HUD symbols include:

- The aircraft reference symbol, that indicates the pitch attitude of the aircraft
  However, the flight crew usually uses the FPV as the flight reference in most flight phases, except when the flight crew initiates the rotation at takeoff.
- The horizon line
  At high altitudes, the horizon line is above the earth's curve.
  The heading/track scale is included on the horizon line.
- The Flight Path Vector (FPV), also referred to as "the bird", that indicates the current trajectory of the aircraft
  If there is an obstacle (runway) on the aircraft trajectory, the FPV also indicates where the aircraft will come in contact with the obstacle (runway), if the flight crew does not change the aircraft trajectory.
- The Total Flight Path Angle (FPA), indicated by a V-shaped symbol, also referred to as "chevrons", that indicates the total energy of the aircraft.
  The position of the chevrons in relation to the FPV indicates whether the aircraft is accelerating or decelerating on the current flight path.
  The flight crew controls the chevrons by using the thrust levers, while the aircraft flies a constant flight path angle.


The aircraft is at a constant speed.


The aircraft will decelerate, if the flight crew maintains the current thrust.


The aircraft will accelerate, if the flight crew maintains the current thrust.

The flight symbols are superimposed to the outside view. Therefore, when the flight crew flies using the HUD, the flight crew must be aware that HUD symbols make deviations appear larger than on the PFD.
When the flight crew flies using the HUD, they should use the basic HUD symbols in relation to the external parameters, if they are in view. This helps the flight crew to stabilize the aircraft on a ground-related trajectory, and to improve the flight accuracy.
In addition to these four basic HUD symbols, the HUD automatically provides additional sets of symbols, during the various flight phases: I.e. taxi, takeoff, climb, cruise, descent, and approach.

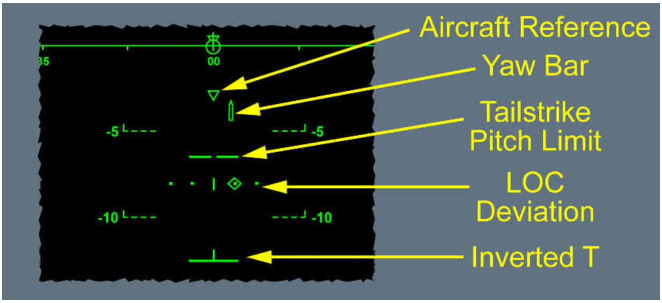
USE OF HUD FOR TAKEOFF

Applicable to: ALL

The takeoff phase can be divided into two subphases:
- The takeoff roll
- The rotation.

The HUD assists the flight crew during both of these subphases.

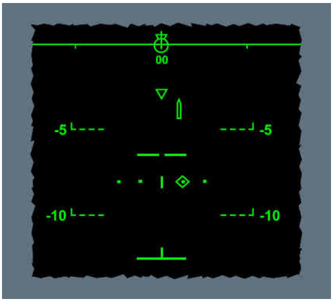
Takeoff



TAKEOFF ROLL

When the flight crew sets the thrust levers to FLX or TOGA, the aircraft reference symbol and the yaw bar (if the ILS is available) appear on the HUD.
The yaw bar indicates the correction that the flight crew must apply to the rudder pedal, in order to move the aircraft to the runway centerline.
The LOC deviation symbol indicates the position of the aircraft in relation to the runway centerline.
The combination of both helps the flight crew perform an accurate takeoff roll.
In the illustration below, the aircraft is on the left side of the runway centerline, and the yaw bar provides an order to go the right side.

Yaw Bar

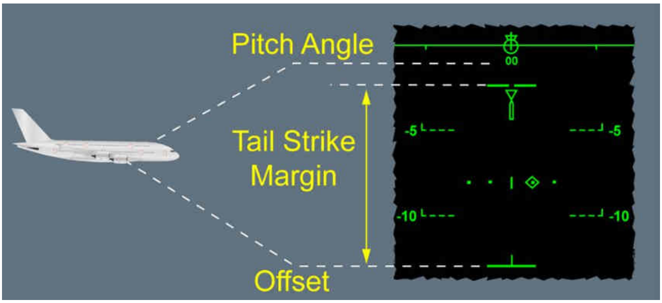


The flight crew must use both the LOC deviation and the yaw bar to smoothly direct the aircraft to the runway centerline, in addition to the external parameters.

ROTATION

At takeoff, the flight crew must control the pitch and the pitch rate. On the HUD, when the aircraft is on ground, the visible field of view above the horizon line is approximately 5 °. Therefore, it is difficult for the flight crew to use the aircraft pitch symbol at rotation, because this pitch target (e.g. 12.5 °) is out of the flight crew's field of view during the rotation. As a result, the HUD does not display the aircraft pitch symbol during the takeoff roll. Instead, the HUD provides an offset pitch symbol in the form of an inverted T. The offset pitch symbol is positioned 12.5 ° below the actual pitch attidue of the aircraft (10 ° in the case of an engine failure), due to the fact that 12.5 °(10 °) is close to the pitch target, at the end of the rotation.

Rotation



As a result, at VR:
- The PF pulls the sidestick in order to rotate the aircraft, and controls the pitch and the pitch rate monitoring the inverted T. When the inverted T is close to the horizon line, the aircraft lifts off
- During the initial rotation, the PF adjusts the rotation rate, to prevent the inverted T from reaching the tailstrike pitch limit symbol
- Next, the PF looks for the FPV and its associated FPD, in order to adjust the flight path, as per SRS TO mode. The PF then stabilizes the aircraft on the initial climb segment.

Note: *Both the inverted T and the tailstrike pitch limit symbol no longer appear after takeoff.*

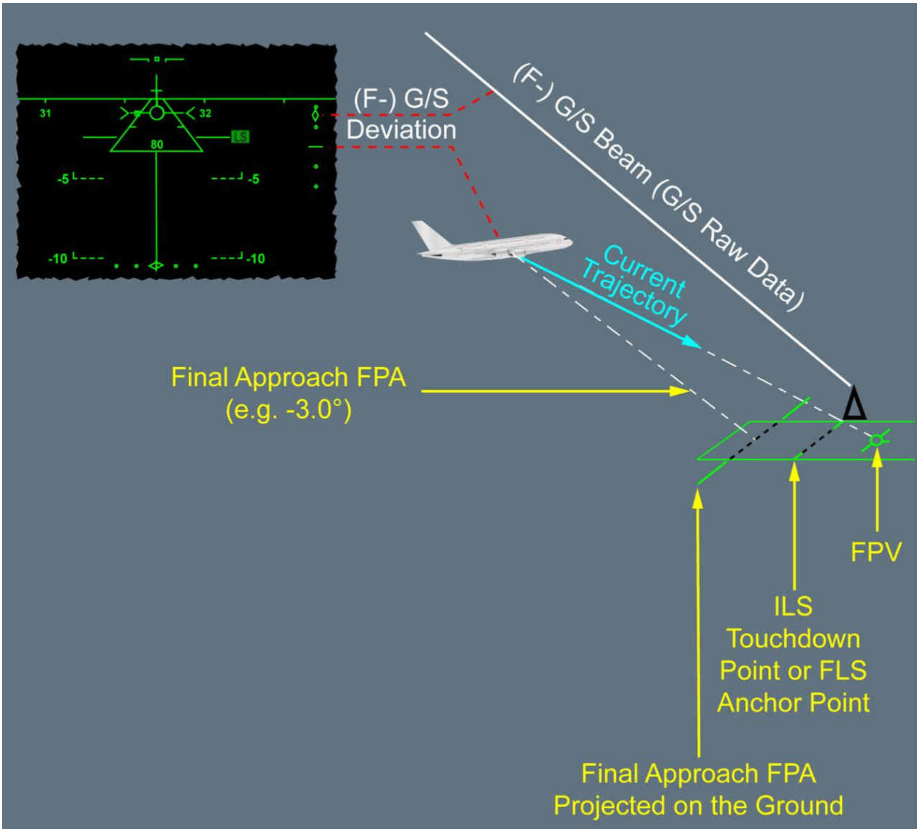
USE OF HUD FOR APPROACH

Applicable to: ALL

The HUD provides similar symbols for ILS and VMC approaches.

This is because for approaches, the same type of information helps the flight crew to stabilize the aircraft on:
- The final approach path (i.e. the published final approach path for ILS approaches, or the selected final approach path for VMC approaches)
- The lateral trajectory of the final approach, indicated either by a synthetic runway symbol, or the real runway when in view.

HUD for Approach



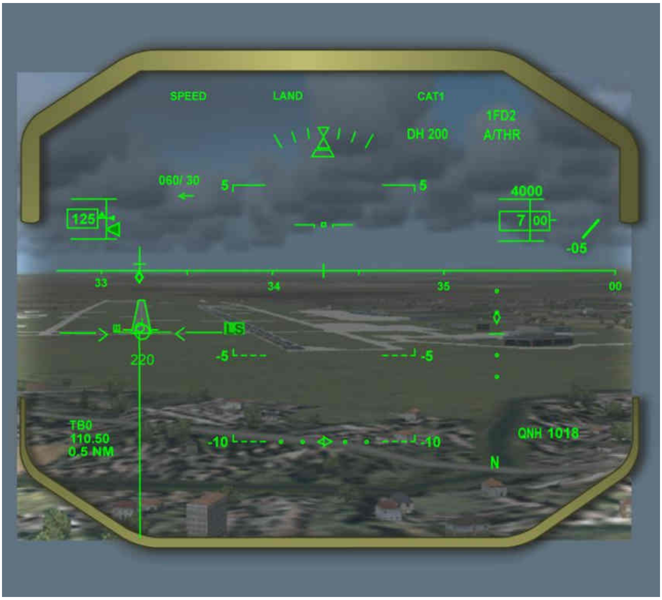
The flying technique for a VMC approach is similar to the flying technique for an ILS approach. This explains why the IMC/VMC transition is smooth, when the flight crew uses the HUD.

In order to align the aircraft with the LOC axis, the PF flies FPV to the left(right), so that the LOC axis symbol is perpendicular to the horizon.

In order to stabilize the aircraft on the final approach path, the flight crew flies the FPV above(below), or in line with the touchdown point, so that the final approach FPA symbols remain aligned with the touchdown point.

When transitioning from IMC to VMC, the real runway gradually appears through the HUD. The real runway should be superimposed by the synthetic runway symbol.

In the case of crosswind, the drift effect naturally appears on the HUD: The synthetic (real) runway appears on the HUD in relation to the drift angle. For example, if there is crosswind that comes from the right side, the synthetic runway appears on the left of the HUD, when the aircraft is on the centerline.



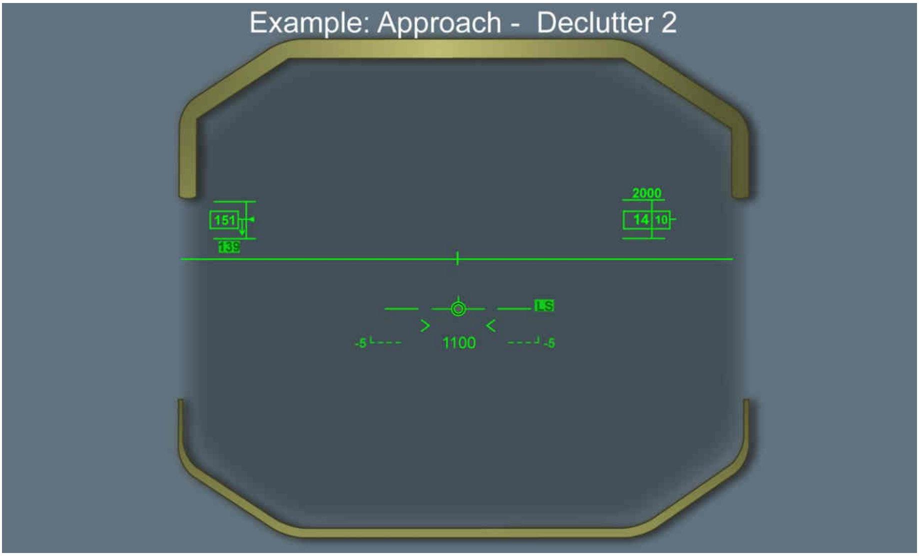
DECLUTTER MODES

Applicable to: ALL

The symbols provided on the HUD enable the PF to fly intermediate and final approaches using only the HUD. As a result, the HUD provides a full set of symbols (e.g. speed, altitude scales, FMA, etc) so that the flight crew can control the aircraft during these phases.
However, when the aircraft approaches the terrain or the runway, it is important to improve the PF's view of the external parameters through the HUD.

For this purpose, the HUD provides a declutter mode, with two levels:
- Declutter mode level 1 enables the flight crew to remove the synthetic runway, the approach axis, and the touchdown point or the FLS anchor point from the HUD
  Declutter mode level 1 is recommended for the visual acquisition of the real runway, after IMC/VMC transition.
- For stabilized approaches in VMC, declutter mode level 2 enables the flight crew to focus on external parameters, whilst using only basic trajectory, speed and altitude information on the HUD, .

Declutter 2

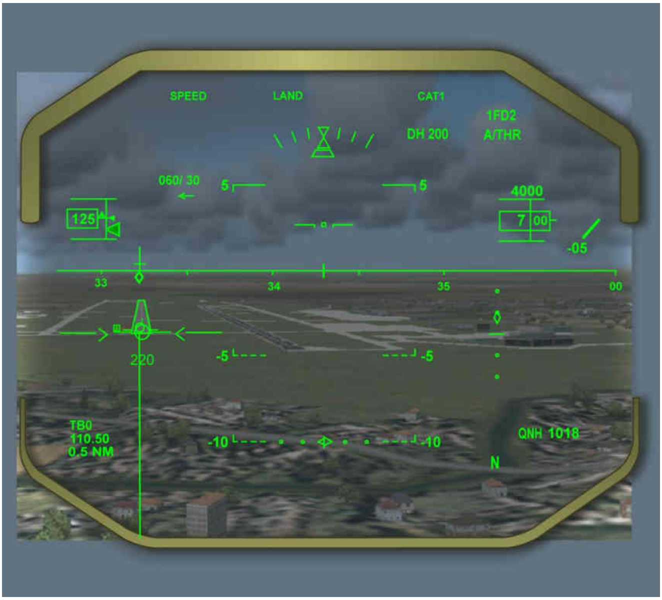


CROSSWIND MODE

Applicable to: ALL

The aim of the crosswind mode is to clear the lateral borders of the field of view, so that the flight crew can fly the FPV without interfering with the speed and altitude scales. As a result, these scales are reduced in size on the HUD.

Crosswind Mode

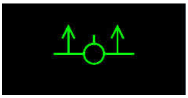


USE OF HUD FOR LANDING

Applicable to: ALL

The HUD helps the PF to perform accurate landings, due to the fact that the stabilization of the final descent path is more accurate, as the aircraft approaches the touchdown point.
The flight crew performs a conventional flare when using the HUD for landing: The flight crew uses external parameters, and looks through the HUD.
The HUD does not provide flare guidance. However, the HUD displays arrows that temporarily pulse on the FPV, as “flare reminders”.

Flare Reminder



GENERAL

Applicable to: ALL

The On board Information System (OIS) provides several applications to the flight crew, which are used from flight preparation to flight closure.
The use of this new product introduces some changes in the pilot task organization.
This chapter reviews some general and per flight phase recommendations, to optimize the use of the OIS.

OPERATIONAL RECOMMENDATIONS

Applicable to: ALL

As a general rule, when the sliding table is deployed but the OIS applications are not used, the flight crew may use the cover to avoid inadvertent entries on the OIS keyboard.
The OIS is designed to provide the flight crew with operational information only, and must be considered as such.

The OIS should be used wisely:
- When leaving the gate, the flight crew should avoid focusing on it
- In flight, the use of the Onbard Information Terminal (OIT) is restricted to the Pilot Monitoring (PM). The X-OIS function can be used to share information as required (*Refer to FCOM/DSC-46-20-30 X-OIS Function*). If required, the task sharing will be temporarily redistributed, in order to crosscheck OIS applications results.

PRELIMINARY COCKPIT PREPARATION

The Laptop takes about four minutes to start. This is the reason why, as per SOP, the flight crew switches on the laptops during the preliminary cockpit preparation.
During the preliminary cockpit preparation, after aircraft power up, the flight crew uses the OIS applications to perform all the necessary preflight tasks.

The flight crew uses the application in a logical order:
- FLT FOLDER, for flight preparation
- E-LOGBOOK, for aircraft dispatch and any limitation of system use
- OPS LIBRARY, to review any applicable MEL items
- T.O PERF, to perform a preliminary take-off computation
- NAV CHARTS to prepare charts clip
- OPS LIBRARY to review any applicable OEBs.

This workflow is defined to be consistent with the FMS initialization.

When the OIS applications have been opened, it is recommended not to close the applications, in order:
- To be able to rapidly manage non-expected events
- To keep already computed data for FLT OPS side applications.

Furthermore, keeping applications open does not increase computation times.

FLT FOLDER

The FLT FOLDER application enables the flight crew to consult the Electronic Flight Folder (EFF).

An EFF contains all the necessary data for flight preparation:
- Weather information
- NOTAMs
- Predicted load sheet
- Operational and ATC flight plans
- Specific airline data.

The flight crew can load the EFF via a USB key or via communication means (gatelink).
One flight crewmember uses the UTILITIES/LOAD BOX function to load the EFF on board.
Then, both flight crewmembers import the EFF, in the FLT FOLDER application.
At this stage, the flight crew will concentrate on the flight preparation itself and should not be tempted to carry out others tasks. The EFF enables the flight crew to confirm the feasibility of the flight. The flight crew starts to initialize the FMS, at the end of the EFF study only,
Both flight crewmembers must be in the loop. The X-OIS function may be used to enable the flight crew to prepare the flight together. Use the CHECK function while going through the different documents of the EFF.

E-LOGBOOK

The flight crew consults the e-Logbook before using any aircraft system.
If a failure occurs after the flight crew accepted the aircraft, the flight must be closed in the e-Logbook before any maintenance actions.
In the case of deferred items, the flight crew must check the dispatch conditions in the MEL.
Only the MEL on the FLT OPS side must be used as reference for the flight crew.

FMS/OIS PRE-INITIALIZATION

The FMS/OIS pre-initialization will be made through the FMS INIT page to take maximum advantage of the contextualization throughout the applications, thus minimize flight crew entries errors.
FMS/OIS pre-initialization and FLT OPS STS page should be associated.

FLT OPS STS PAGE

The flight crew accesses the FLT OPS STS page after the pre-initialization of the FMS. AC REG, FROM/TO and FLT NB fieds are automatically updated from avionics and appear in magenta on the FLT OPS STS page.
If the flight crew pre-initializes the FMS after the FLT OPS STS page is opened, the flight crew uses the UPDATE function to update the FLT OPS STS page.
If required by operational regulation, both flight crewmembers must check that the OIS version indicated on the FLT OPS STS page corresponds to the OIS version provided to the flight crew. OIS applications updates are independent on each laptop.

OPS LIBRARY

No link exists between the NSS AVNCS side and the FLT OPS side.
Therefore, the flight crew must manually enter any open MEL item from the e-Logbook application (deferred items), in the MEL of the OPS LIBRARY on the FLT OPS side.
The flight crew accepts the MEL item by ticking the relevant item. If the item has an impact on performance, it will be automatically taken into account in the performance applications (e.g. TO PERF application).
To avoid mistakes when entering the deferred items in the MEL, one flight crewmember may display the eLogbook on his OIT, and the other flight crewmember may display the MEL on the FLT OPS side.

T.O. PERF

The takeoff performance is computed during:
- The preliminary cockpit preparation with expected loading data
- Before start with actual loading data.

The take off performance computation is accurate but sensitive to entries typing error.
Therefore:
- A first computation is launched during the preliminary cockpit preparation when time pressure is low
- Computation must be made separately and crosschecked by both flight crewmembers. Any deviation in results, even small, must be explained and corrected.

For efficiency purposes, and before launching the takeoff performance computation, the flight crew explicitly shares some computation hypotheses, e.g. runway status (dry or wet) or flap setting (airline policy).
Only the MEL items affecting the take off performance appear on the T.O. PERF application.
The flight crew should select CDL items, that affect the take off performance, directly in the TO PERF application.

COCKPIT PREPARATION

NAV CHARTS

One flight crewmember prepares the takeoff airport clip. Then, the other flight crewmember may import it, by using the IMPORT FROM OFFSIDE function, in the navigation charts application.

The flight crew should note that:
- The PREVIEW function is designed to assess the nature of information on the selected page. It is not designed to read the content
- The flight crew should prepare the clip strictly in the order that they plan to use the charts: the take off clip will cover from taxi to immediate turn back to departure airport in case of engine failure
- Charts that are presented in both portrait and landscape view need to be set up properly in advance
- If a chart is zoomed when preparing the clip, the zoom is kept. If the flight crew wishes to focus on several parts of the chart, e.g. vertical profile of the final approach and go-around flight path, the flight crew should use the DUPLICATE function. This function enables to copy the same charts several times in the clip, and to have each copy focused on different parts of the chart, so that with one single input the flight crewmember is able to navigate within the chart
- The chart database crosscheck does not relieve the flight crew from checking date and effectivity on the chart itself.

The keyboard offers many abilities to navigate within the chart application and may be used during taxi out, but must be stored prior to takeoff. At that time, only the ACD must be used. The ACD enables the flight crew to select the chart to display from the charts clip.

LOADSHEET

In all cases:
- The flight crew uses the LOADSHEET application when the ECAM GWCG and the loadsheet TOCG are different. *Refer to FCOM/PRO-NOR-SOP-70-A Before Start Clearance_LOAD AND TRIM SHEET*
- The final loadsheet is signed (by clicking on the SIGN button), and exported (by clicking on the EXPORT button). The flight crew uses the EXPORT BOX, to send a copy of the loadsheet to the ground, via wireless or via a USB key
- A second click on the SIGN button unsigns the document. There is no flight crew attention getter if an unsigned document is exported.

T.O. PERF

When the final take off performance computation is launched with real figures, crosschecked and validated, the result can be stored in the EFF .

If the take off speeds are different from the initial take off performance computation, the flight crew must re-enter them in the FMS , and crosscheck.

IN FLIGHT

LDG PERF

For information about the use of the LDG PERF application in flight, *Refer to AO-10 Landing Computation*.

When using the LDG PERF application:
- The PM performs the landing computation
- The PF checks the inputs and the result, using the X-OIS function.

The flight crew should note that:
- They enter first the runway, even if this window is not located on the top left of the screen
- They enter the ZFCG from the loadsheet as aircraft CG.

In the case of diversion, there is no requirement for landing distance margin. However, the airline may impose its own margin, and the airline administrator can introduce it in the LDG PERF application. The flight crew is not aware of the administrator margin. The margin mentioned in the LDG PERF application is an extra margin, which is to be added to the administrator margin, if any.

OPS LIBRARY

If time permits, the OPS LIBRARY (FCOM and MEL) consultation is recommended in-flight, following a failure, in order to get some additional information for flight crew situation assessment, before flight crew decision.

NAV CHARTS

As for take off preparation, the destination airport clip will be prepared from STAR to taxi-in and eventually alternate airport if required.
Any landing runway change should be anticipated. The arrival briefing will be the right time to validate the charts clip.
Below 1 000 ft AGL, the sliding table must be stowed, the flight crew uses the ACD. The ACD enables the flight crew to select the chart to display from the charts clip.

RECOMMENDATIONS ON THE LAPTOP

Applicable to: ALL

LAPTOP HARD SHUTDOWN

A laptop hard shutdown occurs when a flight crewmember presses and maintains the ON-OFF sw of the laptop for at least 5 s .

In the case of a laptop freezes, a hard shutdown is not necessary. The flight crew switches off then on the laptop to recover the applications (*Refer to FCOM/PRO-ABN-ECAM-10-46-50 MISC OIS FAULT*).

The flight crew should avoid to perform a laptop hard shutdown, because:
- After a laptop hard shutdown, the applications on the laptop may not restart
- If the flight crewmember performs a hard shutdown while data loading is in progress from the loadbox of the laptop, the data loading stops. After the laptop is restarted, if the flight crewmember tries to perform the same data loading, the data loading may not work. In this case, the flight crew must contact the maintenance.