A340

FLIGHT CREW TECHNIQUES MANUAL

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TRANSMITTAL LETTER

Issue date: 01 SEP 23

This is the FLIGHT CREW TECHNIQUES MANUAL at issue date 01 SEP 23 for the A340 and replacing last issue dated 01 JUN 23

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FILING INSTRUCTIONS

Please incorporate this revision as follow:

Localization Subsection Title	Remove	Insert Rev. Date
PLP-LESS **LIST OF EFFECTIVE SECTIONS/SUBSECTIONS**	ALL	01 SEP 23
PLP-LEDU **LIST OF EFFECTIVE DOCUMENTARY UNITS**	ALL	01 SEP 23
GI-PLP-TOC **TABLE OF CONTENTS**	ALL	01 SEP 23
GI-PLP-SOH **SUMMARY OF HIGHLIGHTS**	ALL	01 SEP 23
GI **General Information**	ALL	01 SEP 23
AOP-PLP-TOC **TABLE OF CONTENTS**	ALL	01 SEP 23
AOP-PLP-SOH **SUMMARY OF HIGHLIGHTS**	ALL	01 SEP 23
AOP-10-20-30 **Utilization Principles**	ALL	01 SEP 23
AOP-20 **Tasksharing Rules and Communication**	ALL	01 SEP 23
AS-PLP-TOC **TABLE OF CONTENTS**	ALL	01 SEP 23
AS-PLP-SOH **SUMMARY OF HIGHLIGHTS**	ALL	01 SEP 23
AS-RUD **Rudder**	ALL	01 SEP 23
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PR-NP-SOP-190-GUI **Guidance Management**	ALL	01 SEP 23
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PR-AEP-BRK **BRAKES**	ALL	01 SEP 23
PR-AEP-MISC **MISC**	ALL	01 SEP 23
PR-AEP-NAV **NAV**	ALL	01 SEP 23

PRELIMINARY PAGES

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M(1)	Localization	Subsection Title	Rev. Date
R	PLP-LESS	LIST OF EFFECTIVE SECTIONS/SUBSECTIONS	01 SEP 23
	PLP-LETDU	LIST OF EFFECTIVE TEMPORARY DOCUMENTARY UNITS	01 SEP 23
R	GI	General Information	01 SEP 23
	AOP-10-10	Introduction	22 MAR 17
	AOP-10-20-10	Objective	22 MAR 17
	AOP-10-20-20	Design Principles	31 JAN 19
R	AOP-10-20-30	Utilization Principles	01 SEP 23
	AOP-10-30-10	Design Principles	22 MAR 17
	AOP-10-30-20	Utilization Principles	16 JUN 22
	AOP-10-40	Procedures Design	25 FEB 21
R	AOP-20	Tasksharing Rules and Communication	01 SEP 23
	AOP-30-10	General	22 MAR 17
	AOP-30-20	Handling of Cockpit Controls	25 FEB 21
	AOP-30-30	Handling of ECAM/QRH/OEB	16 JUN 22
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R	AS-RUD	Rudder	01 SEP 23
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R	PR-NP-SOP-120	Takeoff	01 SEP 23
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	PR-NP-SOP-150	Cruise	16 JUN 22
	PR-NP-SOP-160	Descent Preparation	01 JUN 23
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	PR-NP-SOP-190-GEN	General	22 MAR 17

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

M	Localization	DU Title	DU identification	DU date

No Temporary Documentary Unit

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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
	0546		HB-JMC	340-313
	0556		HB-JMD	340-313
	0559		HB-JME	340-313
	0561		HB-JMF	340-313
	0562		HB-JMG	340-313

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

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M(1)	CRITERION	Linked SB	Incorp. Date	Title
	H13154		07 JUN 17	LANDING GEAR - MAIN GEAR - FIT STRENGTHENED MAIN LANDING GEAR FOR GROWTH A/C
	Applicable to: ALL			
	H14072		07 JUN 17	LANDING GEAR - MAIN GEAR - INTRODUCE SCALLOP ON GROWTH MAIN FITTING TO IMPROVE FATIGUE LIFE (PRODUCTION SOLUTION)
	Applicable to: ALL			
	S13267		23 NOV 21	NAVIGATION - WEATHER RADAR SYSTEM BENDIX - ACTIVATE PREDICTIVE WINDSHEAR FUNCTION
	Applicable to: ALL			
	S13455		22 MAR 17	AUTO FLIGHT - FCU - ACTIVATE CROSSED BAR AT GO-AROUND FUNCTION
	Applicable to: ALL			
	S14954		21 APR 21	EQUIPMENT /FURNISHINGS-COCKPIT- INTRODUCE MINOR IMPROVEMENTS ON WP 430
	Applicable to: ALL			
	S16061		22 MAR 17	AUTO FLIGHT - FMGEC - INSTALL FMGEC P1A9 WITH HONEYWELL FMS2 AND CFM
	Applicable to: ALL			
	S32273		05 JUN 19	INDICATING/RECORDING SYSTEMS - FWC - INSTALL NEW FWC STANDARD L13-0 (SB ONLY)
	Applicable to: ALL			
	S33109		05 JUN 18	INDICATING/RECORDING SYSTEMS - FLIGHT WARNING COMPUTER (FWC) - INSTALL FWC STD L14(SB ONLY)
	Applicable to: ALL			
	31-4125 02		22 MAR 17	INDICATING/RECORDING SYSTEMS - FWC - INSTALL NEW FWC STANDARD L11-0 ON A340.
	Applicable to: ALL			
	34-4198 01		22 MAR 17	NAVIGATION - DME - RELOCATE DME1 POWER SUPPLY TO KEEP POWER SUPPLY IN CASE OF TOTAL ENGINE FLAME OUT.
	Applicable to: ALL			
	34-4213 02		10 SEP 18	NAVIGATION - ADIRS - INTRODUCE BACK-UP SPEED SCALE FUNCTION.
	Applicable to: ALL			

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

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GENERAL INFORMATION

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TABLE OF CONTENTS

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SUMMARY OF HIGHLIGHTS

Localization Title	Toc Index	ID	Reason
GI FCTM Content	C	1	Documentation update: Deletion of information.
GI FCTM Content	C	2	Update to remove the PIR section from the General Information.
GI FCTM Content	C	3	Update to remove the PIR section from the General Information. Documentation update: Deletion of text.
GI FCTM Content	C	4	Layout modification. No technical change.
GI FCTM Content	C	5	Layout modification. No technical change.
GI Abbreviations	E	6	Addition of ACN abbreviation.
GI Abbreviations	E	7	Addition of the abbreviation NADP

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Ident.: GI-00024474.0001001 / 05 MAY 22
Applicable to: ALL

FCTM PURPOSE

Ident.: GI-00016580.0001001 / 20 MAR 17
Applicable to: ALL

The Flight Crew Techniques Manual (FCTM) provides complementary information to the Flight Crew Operating Manual (FCOM).

The FCTM provides the flight crew with:
- The general Airbus operational philosophy (e.g. design and utilization principles, golden rules for pilots)
- Additional information to the FCOM procedures (the “why" to do and the “how" to do)
- Best practices, operating techniques on maneuvers, and handling
- Information on situation awareness.

If the FCTM data differs from the FCOM data, the FCOM remains the reference.

FCTM CONTENT

Ident.: GI-00019291.0001001 / 03 MAY 23
Applicable to: ALL

1
2 The FCTM has 4 sections:

3 GENERAL INFORMATION

This section provides information on:
- The FCTM purpose
- The FCTM content
- The abbreviations.

AIRBUS OPERATIONAL PHILOSOPHY

This section is divided into four sub-sections:

1. Design Philosophy:

   This sub-section describes the Airbus design and utilization principles of:
   - The cockpit
   - The fly-by-wire
   - The procedures.

2. Tasksharing rules and communication:
   This sub-section describes the general tasksharing and communication rules in normal and abnormal operations.
3. Management of Abnormal Operations:
   This sub-section describes how the flight crew should manage abnormal operations (e.g. Handling of ECAM alerts, QRH, ADVISORY)
4. Golden Rules for Pilots:
   This sub-section describes the Airbus "GOLDEN RULES FOR PILOTS".

4 AIRCRAFT SYSTEMS

This section provides supplementary information and operating techniques on the use of specific systems (e.g. BIRD, TCAS).

5 PROCEDURES

This section provides in normal and abnormal operations:
- Best practices (why to, how to, what if not done)
- Maneuvers and handling techniques.

This section is divided into two sub-sections:
1. Normal Procedures (including Supplementary Procedures)
2. Abnormal and Emergency Procedures.

QUESTIONS AND SUGGESTIONS

Ident.: GI-00019292.0001001 / 20 MAR 17
Applicable to: ALL

For any questions or comments related to this manual, the Operator's Flight Operations Management may contact the Airbus Flight Operations Support & Training Standards department.

ABBREVIATIONS

Ident.: GI-00019293.0001001 / 12 MAY 23
Applicable to: ALL

6 **A**

Abbreviation	Term
A/BRK	Autobrake
A/C	Aircraft
A/P	Autopilot
AP	Autopilot
A/S	Airspeed
A/SKID	Anti-skid
A/THR	Auto Thrust
AA	Airworthiness Authorities
AAR	Air to Air Refueling
AB	Abort
ABN	Abnormal
ABV	Above
AC	Alternating Current
ACARS	ARINC Communication Addressing and Reporting System
ACCEL	Acceleration
ACCU	Accumulator
ACMS	Aircraft Condition Monitoring System
ACN	Aircraft Customer Number
ACP	Audio Control Panel
ACQ	Acquire
ADF	Automatic Direction Finder
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADM	Air Data Module
ADR	Air Data Reference
ADS-B	Automatic Dependance Surveillance - Broadcast
ADV	Advisory
AEVC	Avionic Equipment Ventilation Controller
AFIS	Airbus in-Flight Information Services

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Abbreviation	Term
AFM	Airplane Flight Manual
AFS	Auto Flight System
AGL	Above Ground Level
AIDS	Aircraft Integrated Data System
AIL	Aileron
AIME	Autonomous Integrity Monitoring Extrapolation
AINS	Aircraft Information Network System
AIRB	Airborne
AIREP	Special Air Report of Braking Action
ALT	Altitude
ALTN	Alternate
AMI	Airline Modifiable Information
AMJ	Advisory Material Joint
AMU	Audio Management Unit
ANSU	Aircraft Network Server Unit
ANT	Antenna
AOA	Angle Of Attack
AOC	Airline Operational Control
APP	Approach
APPR	Approach
APPU	Asymmetry Position Pick-off Unit
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio Incorporated
ARN	Aircraft Registration Number
ARPT	Airport
ARS	Automatic Retraction System
ASAP	As Soon As Possible
ASI	Air Speed Indicator
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Service
ATSAW	Airborne Traffic Situational Awareness
ATSU	Air Traffic Service Unit
ATT	Attitude
AVNCS	Avionics
AWY	Airway

B

Abbreviation	Term
B/C	Back Course
BACF	Braking Action Computation Function
BARO	Barometric
BAT	Battery
BCL	Battery Charge Limiter
BCM	Back-up Control Module
BCRC	Bulk Crew Rest Compartment
BCU	Backup Control Unit
BEFPR	Break-Even Fuel Price Ratio
BITE	Built-In Test Equipment
BMC	Bleed Monitoring Computer
BNR	Binary
BRG	Bearing
BRK	Brake
BRT	Bright
BSCU	Braking Steering Control Unit
BTC	Bus Tie Contactor
BTL	Bottle

C

Abbreviation	Term
C/B	Circuit Breaker
CB	Circuit Breaker
C/L	Checklist
CL	Checklist
CAB	Cabin
CAPT	Captain, Capture
CAS	Calibrated Airspeed
CAT	Category
CBMU	Circuit Breaker Monitoring Unit
CCRC	Cabin Crew Rest Compartment
CDL	Configuration Deviation List
CDLS	Cockpit Door Locking System
CDSS	Cockpit Door Surveillance System
CDU	Control Display Unit
CED	Cooling Effect Detector
CF	Cost of Fuel
CG	Center of Gravity
CHG	Change

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Abbreviation	Term
CHK	Check
CI	Cost Index
CIDS	Cabin Intercommunication Data System
CINS	Cabin Information Network System
CKPT	Cockpit
CLB	Climb
CLR	Clear
CLSD	Closed
CM1	Crewmember 1 (left seat)
CM2	Crewmember 2 (right seat)
CMC	Central Maintenance Computer
CMD	Command
CMM	Calibration Memory Module
CMPTR	Computer
CMS	Central Maintenance System
CNTOR	Contactor
CO	Company
CO RTE	Company Route
COM	Communication
COND	Condition, Conditioned, Conditioning
CONF	Configuration
CONT	Continuous
CPCU	Cabin Pressure Controller Unit
CRC	Continuous Repetitive Chime
CRG	Cargo
CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CSM/G	Constant Speed Motor/Generator
CSTR	Constraint
CT	Cost of Time
CTL	Control
CTL PNL	Control Panel
CTLR	Controller
CTR	Center
CUDU	Current Unbalance Detection Unit
CVR	Cockpit Voice Recorder

D

Abbreviation	Term
DA	Drift Angle
DAR	Digital AIDS Recorder
DBUS	Digital Backup Speed
DC	Direct Current
DCDU	Datalink Control and Display Unit
DCLB	Derated Climb
DDRMI	Digital Distance and Radio Magnetic Indicator
DECEL	Deceleration
DES	Descent
DEST	Destination
DET	Detection
DEU	Decoder/Encoder Unit
DFDR	Digital Flight Data Recorder
DH	Decision Height
DIR	Direction
DIR TO	Direct To
DISC	Disconnect
DISCH	Discharge
DIST	Distance
DMC	Display Management Computer
DME	Distance Measuring Equipment
DMU	Data Management Unit (Aids)
DN	Down
DSCS	Door Slide Control System
DSDL	Dedicated Serial Data Link
DTG	Distance To Go
DTMS	Damage Tolerance Monitoring System
DTO	Derated Takeoff
DU	Display Unit / Documentary Unit

E

Abbreviation	Term
E/WD	Engine/Warning Display
EWD	Engine/Warning Display
EBCU	Emergency Braking Control Unit
ECAM	Electronic Centralized Aircraft Monitoring
ECAS	Emergency Cockpit Alerting System
ECB	Electronic Control Box (APU)
ECMU	Elec Contactor and Management Unit

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Abbreviation	Term
ECON	Economic
ECP	ECAM Control Panel
ECS	Environmental Control System
ECU	Engine Control Unit
EDP	Engine-Driven Pump
EEC	Engine Electronic Control
EFB	Electronic Flight Bag
EFCS	Electronic Flight Control System
EFIS	Electronic Flight Instruments System
EFOB	Estimated Fuel On Board
EGPWS	Enhanced Ground Proximity Warning System
EGT	Exhaust Gas Temperature
EIS	Electronic Instruments System
EIU	Engine Interface Unit or Engine Interface and Vibration Monitoring Unit
ELAN	Ethernet Local Area Network
ELEC	Electricity
ELEV	Elevator, Elevation
ELMU	Electrical Load Management Unit
ELT	Emergency Locator Transmitter
EMER	Emergency
EMER GEN	Emergency Generator
ENG	Engine
EO	Engine-Out
EPGS	Electrical Power Generation System
EP	End Point
EPR	Engine Pressure Ratio
EROPS	Extended Range Operation
ESF	Estimated Surface Friction
ESS	Essential
EST	Estimated
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
ETOPS	Extended Twin Operations
ETP	Equal Time Point
EXT PWR	External Power
EXTN	Extension

F

Abbreviation	Term
FAA	Federal Aviation Administration
FAP	Forward Attendant Panel
F/C	Flight Crew
F/D TEMP CTL	Flight Deck Temperature Control
F/O	First Officer
FO	First Officer
FADEC	Full Authority Digital Engine Control System
FAF	Final Approach Fix
FAP	Forward Attendant Panel
FAR	Federal Aviation Regulations
FAV	Fan Air Valve
FCDC	Flight Control Data Concentrator
FCMC	Fuel Control and Monitoring Computer
FCMS	Fuel Control and Monitoring System
FCOM	Flight Crew Operating Manual
FCRC	Flight Crew Rest Compartment
FCU	Flight Control Unit
FD	Flight Director
FDIU	Flight Data Interface Unit
FDU	Fire Detection Unit
FE	Flight Envelope
FF	Fuel Flow
FG	Flight Guidance
F-G/S	FLS Glideslope
F-G/S*	FLS Glideslope Capture
FL	Flight Level
FLD	Factored In-Flight Landing Distance
FLHV	Fuel Lower Heating Value
F-LOC	FLS Localizer
F-LOC*	FLS Localizer Capture
FLP	Flap
FLRS	Flap Load Relief System
FLS	FMS Landing System
FLT	Flight
F/CTL	Flight Control
FLT CTL	Flight Control
FLX TO	Flexible Takeoff
FM	Flight Management
FMA	Flight Mode Annunciator

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Abbreviation	Term
FMGEC	Flight Management Guidance and Envelope Computer
FMGES	Flight Management Guidance and Envelope System
FMS	Flight Management System
FOB	Fuel On Board
FOM	Figure Of Merit
FPA	Flight Path Angle
F-PLN	Flight Plan
FPPU	Feedback Position Pick-off Unit
FPD	Flight Path Director
FPR	Fuel Price Ratio
FPV	Flight Path Vector
FQI	Fuel Quantity Indication
FREQ	Frequency
FRV	Fuel Return Valve
FSV	Fuel Shutoff Valve
FU	Fuel Used
FWC	Flight Warning Computer
FWD	Forward
FWS	Flight Warning System

G

Abbreviation	Term
G/S	Glideslope
GA	Go-Around
GAPCU	Ground and Auxiliary Power Control Unit
GCU	Generator Control Unit
GDU	Group of Documentary Unit
GEN	Generator
GES	Ground Earth Station
GLC	Generator Line Contactor
GMT	Greenwich Mean Time
GND	Ground
GPCU	Ground Power Control Unit
GPS	Global Positioning System
GPSSU	Global Positioning System Sensor Unit
GPWC	Ground Proximity Warning Computer
GPWS	Ground Proximity Warning System
GRF	Global Reporting Format for runway surface conditions
GRND	Ground
GRU	Ground Refiguration Unit

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Abbreviation	Term
GRVTY	Gravity
GS	Ground Speed
GW	Gross Weight

H

Abbreviation	Term
HCU	Hydraulic Control Unit
HDG	Heading
HDG/S	Heading Selected
HF	High Frequency
HI	High
HLD	Hold
HM	Holding Pattern with a Manual Termination
HMU	Hydrau-Mechanical Unit
HP	High Pressure
HPA	Hectopascal
HPTCC	High Pressure Turbine Clearance Control
HPV	High Pressure Valve
HSMU	Hydraulic System Monitoring Unit
HUD	Head Up Display
HYD	Hydraulic

I

Abbreviation	Term
I/O	Inputs/Outputs
I/P	Input or Intercept Profile
IAS	Indicated Airspeed
ICAO	International Air Transport Organization
IDENT	Identification
IDG	Integrated Drive Generator
IFE	In Flight Entertainment
IFR	Instrument Flight Rules
IGN	Ignition
ILS	Instrument Landing System
IMM	Immediate
INB	Inbound
INBO	Inboard
INCREM	Increment
INIT	Initialization
INOP	Inoperative

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Abbreviation	Term
INR	Inner
INST	Instrument
INTCP	Intercept
INV	Inverter
IP	Intermediate Pressure
IPPU	Instrumentation Position Pick-off Unit
IR	Inertial Reference
IRS	Inertial Reference System
ISA	International Standard Atmosphere
ISO	International Organization for Standardization
ISOL	Isolation
ISPSS	In Seat Power Supply System
ITP	In Trail Procedure

J

Abbreviation	Term
JAR	Joint Airworthiness Requirements

K

Abbreviation	Term

L

Abbreviation	Term
L/G	Landing Gear
LAF	Load Alleviation Function
LAN	Local Area Network
LAT	Latitude
LAT REV	Lateral Revision
LAV	Lavatory
LCN	Load Classification Number
LD	Landing Distance
LDA	Landing Distance Available
LDG	Landing
LED	Light Emiting Diode
LEDU	List of Effective Documentary Units
LEFCB	List of Effective Flight Crew Bulletins
LEOEB	List of Effective Operations Engineering Bulletins
LESS	List of Effective Section/Subsections
LF	Low Frequency
LGCIU	Landing Gear Control Interface Unit

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Abbreviation	Term
LH	Left-Hand
LIM	Limitation
LK	Lock
LO	Low
LOC	Localizer
LOC BC	LOC Back Course
LONG	Longitude
LP	Low Pressure
LPTCC	Low Pressure Turbine Clearance Control
LRU	Line Replaceable Unit
LSK	Line Select Key
LVL	Level
LVL CHG	Level Change
LVR	Lever
LW	Landing Weight

M

Abbreviation	Term
MABH	Minimum Approach Break-off Height
MAC	Mean Aerodynamic Chord
MAG	Magnetic
MAG DEC	Magnetic Declination
MAG VAR	Magnetic Variation
MAINT	Maintenance
MAN	Manual
MAP	Missed Approach Point
MAX	Maximum
MAX CLB	Maximum Climb
MAX DES	Maximum Descent
MAX END	Maximum Endurance
MC	Master Caution
MCDU	Multipurpose Control and Display Unit
MCT	Maximum Continuous Thrust
MDA	Minimum Descent Altitude
MDDU	Multifunction Disk Drive Unit
MDH	Minimum Descent Height
MEA	Minimum En Route Altitude
MECH	Mechanic
MED	Medium
MEL	Minimum Equipment List

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Abbreviation	Term
METAR	Meteorological Airport Report
MFA	Memorized Fault Annunciator
MIN	Minimum
MKR	Marker
MLA	Maneuver Load Alleviation
MLS	Microwave Landing System
MLW	Maximum Landing Weight
MMEL	Master Minimum Equipment List
MMO	Maximum Operating Mach
MMR	Multi Mode Receiver
MN	Mach number
MNPS	Minimum Navigation Performance Specification
MSA	Minimum Safe Altitude
MSG	Message
MSL	Mean Sea Level
MTBF	Mean Time Between Failure
MTOW	Maximum Takeoff Weight
MW	Master Warning
MZFW	Maximum Zero Fuel Weight

7 **N**

Abbreviation	Term
N/A	Not Applicable
NA	Not Applicable
N1	Low Pressure Rotor Speed (in %)
N2	Intermediate Pressure Rotor Speed (in %) for Rolls Royce Engines High Pressure Rotor Speed (in %) for Other Engines
N3	High Pressure Rotor Speed (in %) for Rolls Royce Engines
NACA	National Advisory Committee for Aeronautics
NADP	Noise Abatement Departure Procedure
NAV	Navigation
NAVAID	Navigation Aid
NCD	Non Computed Data
ND	Navigation Display
NDB	Non Directional Beacon — Navigation Database
NORM	Normal
NOTAM	Notice To Airmen
NPA	Non Precision Approach
NW	Nosewheel
NWS	Nosewheel Steering

O

Abbreviation	Term
O/P	Output
OANS	On-board Airport Navigation System
OAT	Outside Air Temperature
OBRM	On Board Replaceable Module
OEB	Operations Engineering Bulletin
OFF/R	Off Reset
OFST	Offset
OIS	Onboard Information System
OIT	Onboard Information Terminal
OP	Open
OPP	Opposite
OPS	Operations
OPT	Optimum
OUTB	Outbound
OUTR	Outer
OVBD	Overboard
OVHD	Overhead
OVHT	Overheat
OVRD	Override
OVSPD	Overspeed
OXY	Oxygen

P

Abbreviation	Term
P/N	Part Number
PN	Part Number
PA	Passenger Address
P-ALT	Profile Altitude
PAX	Passenger
PBE	Protective Breathing Equipment
P-CLB	Profile Climb
P-DES	Profile Descent
PDB	Performance Data Base
PERF	Performance
PES	Passenger Entertainment System
PF	Pilot Flying
PFC	Porous Friction Course
PFD	Primary Flight Display
PHC	Probes Heat Computer

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Abbreviation	Term
PIM	Programming and Indication Module
P-MACH	Profile Mach
PMV	Pressure Maintenance Valve
PM	Pilot Monitoring
PNL	Panel
POB	Pressure Off Brake
POS	Position
PPOS	Present Position
PR	Pressure
PRAM	Prerecorded Announcement and Music
PRED	Prediction
PRESS	Pressure, Pressurization
PRIM	FLT CTL Primary Computer (FCPC)
PROC	Procedure
PROC T	Procedure Turn
PROF	Profile
PROG	Progress
PROT	Protection
PRV	Pressure Regulating valve
PSCU	Proximity Switch Control Unit
P-SPEED	Profile Speed
PSL	Product Structure Level
PT	Point
PTLU	Pedal Travel Limiter Unit
PTT	Push To Talk
PVI	Paravisual Indicator
PWR	Power
PWS	Predictive Windshear System

Q

Abbreviation	Term
QAR	Quick Access Recorder
QCCU	Quantity Calculation and Control Unit
QFE	Field Elevation Atmosphere Pressure
QFU	Runway Heading
QNE	Sea Level Standard Atmosphere Pressure (1013 hPa)
QNH	Sea Level Atmosphere Pressure
QRH	Quick Reference Handbook
QT	Quart (US)
QTY	Quantity

R

Abbreviation	Term
R/I	Radio/Inertial
RA	Radio Altimeter / Resolution Advisory
RACSB	Rotor Active Clearance Control Start Bleed
RAD	Radio
RAD NAV	Radio Navigation
RAIM	Receiver Autonomous Integrity Monitoring
RAT	Ram Air Turbine
RATC	Remote ATC Box
RCAM	Runway Condition Assessment Matrix
RCDR	Recorder
RCL	Recall
RCVR	Receiver
REAC	Reactive
REC	Recovery, Recommended
REG	Regulation
REL	Release
REV	Reverse
RH	Right-Hand
RLD	Required Landing Distance
RMI	Radio Magnetic Indicator
RMP	Radio Management Panel
RNAV	Area Navigation
RNG	Range
RNP	Required Navigation Performance
RPLNT	Repellent
RPM	Revolution Per Minute
RPTG	Repeating
RQRD	Required
RSV	Reserves
RSVR	Reservoir
RTE	Route
RTL	Rudder Travel Limit
RTO	Rejected Takeoff
RTOW	Runway Takeoff Weight
RUD	Rudder
RVSM	Reduced Vertical Separation Minimum
RWY	Runway
RWYCC	Runway Condition Code

S

Abbreviation	Term
S/C	Step Climb
S/D	Shut Down / Step Descent
S/F	Slats/Flaps
S/N	Serial Number
SN	Serial Number
SAE	Society of Automotive Engineers
SAT	Static Air Temperature
SATCOM	Satellite Communication
SC	Single Chime
SD	System Display
SDAC	System Data Acquisition Concentrator
SDCU	Smoke Detection Control Unit
SEC	FLT CTL Secondary Computer (FCSC)
SFCC	Slat/Flap Control Computer
SFE	Seller-Furnished Equipment
SID	Standard Instrument Departure
SIM	Simulation
SIU	Server Interface Unit
SLFT (-PM)	Sea Level Feet (-per minute)
SLT	Slat
SOP	Standard Operating Procedure
SPD	Speed
SPD LIM	Speed Limit
SPLR	Spoiler
SRS	Speed Reference System
SSM	Sign Status Matrix
STAB	Trimmable Horizontal Stabilizer
STAR	Standard Terminal Arrival Route
STAT	Static
STAT INV	Static Inverter
STBY	Standby
STD	Standard
STEER	Steering
STRG	Steering
STS	Status
SWTG	Switching
SYNC	Synchronize
SYS	System

T

Abbreviation	Term
T. TK	Trim Tank
T.O.	Takeoff
T/O	Takeoff
TO	Takeoff
T/C	Top of Climb
T/D	Top of Descent
TA	Traffic Advisory
TACS	Taxi Aid Camera System
TACT	Tactical
TAF	Terminal Aerodrome Forecast
TAS	True Air Speed
TAT	Total Air Temperature
TAU	Time to intercept
TBC	To Be Confirmed
TBD	To Be Determined
TBV	Transient Bleed Valve
TCAS	Traffic Collision Alert System Avoidance System
TDU	Temporary Documentary Unit
TEMP	Temperature
TFTS	Terrestrial Flight Telephon System
TGT	Target
THR	Thrust
THS	Trimmable Horizontal Stabilizer
TK	Tank / Track Angle
TKE	Track Angle Error
TLA	Throttle Lever Angle
TLU	Travel Limitation Unit
TMR	Timer
TOGA	Takeoff - Go-Around
TOGW	Takeoff Gross Weight
TOW	Takeoff Weight
T-P	Turn Point
TPIS	Tire Pressure Indicating System
TR	Transformer Rectifier Unit
T-R	Transmitter-Receiver
TRANS	Transition
TRK	Track
TROPO	Tropopause
TRV	Travel

Continued on the following page

Continued from the previous page

Abbreviation	Term
TTG	Time to Go
TVMC	Minimum Control Speed Temperature
TWLU	Terminal Wireless LAN Unit

U

Abbreviation	Term
ULB	Underwater Locator Beacon
UNLK	Unlock
UP	Up, Upper
UTC	Universal Coordinated Time

V

Abbreviation	Term
V/S	Vertical Speed
V1	Decision Speed
V2	Takeoff Safety Speed
VAPP	Approach Speed
VBV	Variable Bypass Valve
VCC	Video Control Center
VDEV	Vertical Deviation
VEL	Velocity
VENT	Ventilation
VERT	Vertical
VERT REV	Vertical Revisor
VFE	Maximum Speed for each Flap configuration
VFEN	VFE Next
VFTO	Final Takeoff Speed
VHF	Very High Frequency
VHV	Very High Voltage
VIB	Vibration
VLE	Maximum Landing Gear Extended Speed
VLS	Lowest Selectable Speed
VLV	Valve
VM	Maneuvering Speed
VMAX	Maximum Allowable Speed
VMCA	Minimum Control Speed in the Air
VMCG	Minimum Control Speed on Ground
VMCL	Minimum Control Speed at Landing
VMCL-2	Minimum control speed at landing with 2 engines inop on one wing
VMIN	Minimum Operating Speed

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Abbreviation	Term
VMO	Maximum Operating Speed
VMU	Minimum Unstick Speed
VOR	VHF Omnidirectional Range
VOR-D	VOR-DME
VR	Rotation Speed
VREF	Landing Reference Speed
VS	Reference Stalling Speed
VSW	Stall Warning Speed
VSA	Visual Separation on Approach
VSI	Vertical Speed Indicator
VSV	Variable Stator Vane

W

Abbreviation	Term
WARN	Warning
WBC	Weight and Balance Computer
WBS	Weight and Balance System
WHC	Window Heat Computer
WNDW	Window
WPT	Waypoint
WSHLD	Windshield
WGT	Weight
WTB	Wing Tip Brake
WXR	Weather Radar

X

Abbreviation	Term
XCVR	Transceiver
XFR	Transfer
XMTR	Transmitter
XPDR	Transponder
XTK	Crosstrack Error

Y

Abbreviation	Term

Z

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

Continued on the following page

Continued from the previous page

Abbreviation	Term
ZFWCG	Zero Fuel Weight Center of Gravity
Zp	Pressure Altitude

SYMBOLS

Abbreviation	Term
<	less than
>	more than
≤	less than or equal to
≥	more than or equal to
=	equal to

AIRBUS OPERATIONAL PHILOSOPHY

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AOP-10 Design Philosophy

[1] AOP-20 Tasksharing Rules and Communication

Continued on the following page

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SUMMARY OF HIGHLIGHTS

Localization Title	Toc Index	ID	Reason
AOP-PLP-TOC Tasksharing Rules and Communication		1	Documentation update: Deletion of "Edelweiss Briefings (FG02128)".
AOP-10-20-30 Dark Cockpit Concept for Overhead Panel	A	1	Wording enhancement. No technical change.
			Removal of the ENG ANTI ICE example as the ENG ANTI ICE is a pushbutton switch.
			Layout modification. No technical change.
AOP-20 Briefing Technique	D	1	**Added item under "Airport" tab to also consider chart NOTAMS.**
AOP-20 Types of Operational Briefing	D	2	**Added item to also consider chart NOTAMS (mPilot) during briefing.**

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INTRODUCTION

Ident.: AOP-10-10-00019330.0001001 / 20 MAR 17
Applicable to: ALL

The safe and efficient flight results from an effective interaction between:

- The Airbus cockpit philosophy
- The procedures
- The pilots (human mechanisms and behaviors).

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OBJECTIVE

Ident.: AOP-10-20-10-00016388.0001001 / 20 MAR 17
Applicable to: ALL

The Airbus cockpit is designed to achieve the operational needs of the flight crew throughout the aircraft operating environment, while ensuring the maximum of commonality within the Fly-By-Wire family.

The design of the cockpit is built according to 10 high level design requirements:
1. The flight crew is ultimately responsible for the safe operation of the aircraft
2. If required, the flight crew can exercise their full authority by performing intuitive actions, while aiming at eliminating the risks of overstress or overcontrol
3. Accommodate for a wide range of pilot skill levels and experience acquired on previous aircraft
4. Ensure safety, passenger comfort, and efficiency, in that order of priority
5. Simplify the tasks of the flight crew, by enhancing situation and aircraft status awareness
6. The automation is considered as an additional feature available to the flight crew, who can decide when to delegate and what level of assistance they need in accordance with the situation
7. The design of the Human Machine Interfaces (HMI) takes into account system features together with the strengths and weaknesses of the flight crew
8. The state of the art of the human factors considerations are applied in the system design process, in order to manage the potential errors of the flight crew
9. The overall cockpit design contributes to facilitate and to enhance the flight crew communication (e.g. tasksharing, teamworking)
10. The use of new technologies and implementation of new functionalities are imposed by:
    - Significant safety benefits
    - Obvious operational advantages
    - A clear response to the needs of the flight crew.

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ARRANGEMENT OF PANELS

Ident.: AOP-10-20-20-00016389.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

The purpose of the layout of the forward facing cockpit is to take into account the operational requirements for a two pilot-cockpit.

This layout enables:
- To significantly reduce the flight crew workload
- To optimize the tasksharing
- To minimize "Head down" time.

The location of the main controls takes into account:
- The relative importance of each system
- The frequency of operation by the pilots
- The ease with which controls can be reached
- The shape of the control (designed to prevent confusion)
- The duplication of control, if required.

OVERHEAD PANEL

The system control panels linked to an engine are vertically organized, in order to permit the accomplishment of Normal/Abnormal procedures in a straight forward and intuitive manner. In addition, this arrangement aims at minimizing the errors of the flight crew.

GLARESHIELD

The glareshield supports the short term tactical controls for the Auto Flight System (AFS).
The operation of the controls can be achieved "Head Up" and within easy access for both pilots.

MAIN INSTRUMENT PANEL

The main instrument panel mainly supports the display units which are necessary to:
- FLY (PFD/HUD ◁)
- NAVIGATE (ND)
- COMMUNICATE (DCDU ◁)
- MONITOR the various aircraft systems (ECAM).

The display units are located in the full and non-obstructed view of both pilots.

PEDESTAL

The pedestal mainly supports the controls for:
- Engine and thrust (engine master levers, thrust levers)
- Aircraft configuration (speed brake lever, flaps lever, rudder trim)

- Navigation (MCDU, FMS)
- Communication (RMP).

ALERTS

Ident.: AOP-10-20-20-00016391.0001001 / 04 DEC 18
Applicable to: ALL

ALERT TRIGGERING

As a general rule, an alert is required when:
- A system failure occurs
- The aircraft violates the normal flight envelope
- An unexpected event related to safety occurs (e.g. TCAS, TAWS)
- An outside message is coming up (e.g. cabin, ATC)
- A system automatically changes its mode of operation (e.g. AP auto-disconnection, mode reversion).

The alerts:
- Trigger visual and/or aural indications
- Are ranked by severity and priority
- Are inhibited when not relevant in some specific flight phases.

ALERT INDICATION

The alerts indications are presented to the flight crew as follows:
- Initial indication (visual or aural) via the MASTER CAUTION or MASTER WARNING
- The Warning Display (WD) displays the title of the alert related to the failure
- The System Display (SD) automatically displays the affected system
- On the overhead panel, the pushbutton/pushbutton-switch light of the affected system comes on in amber or red.

The flight crew is responsible to take any appropriate or required action to ensure a safe operation of the aircraft, even in the absence of alert(s) and shall take into account the entire operational environment.

DARK COCKPIT CONCEPT FOR OVERHEAD PANEL

Ident.: AOP-10-20-30-00016392.0001001 / 03 MAY 23
Applicable to: ALL

1

Most of the systems are controlled from the overhead panel via:
- Pushbutton
- Pushbutton switch
- Switch
- Knob, knob-selector.

Each pushbutton/pushbutton switch has one or two lights:
- The upper one is dedicated to alert or system status (e.g. FAULT light, OPEN light). If no alert or system status is required, two gray dots replace the light.
- The lower one corresponds:
  - On pushbutton switch, to the control selection of the system (e.g. ON, OFF, OVRD), or
  - On pushbutton, to the system status.

  If no control system selection is required, two gray dots replace the light.

The general operational rule is: Light out philosophy. The systems are ready and fit to fly.

COLOR CODING

Ident.: AOP-10-20-30-00016393.0001001 / 20 MAR 17
Applicable to: ALL

DISPLAY UNITS

The information provided on the display units is color coded to indicate:
- The status of the system (ECAM or FMA)
- The status of the mode (FMA)
- The nature of the information (e.g. title of an alert, action to be performed, information).

PUSHBUTTON/PUSHBUTTON SWITCH LIGHT

The information provided on the pushbutton/pushbutton switch is also color coded to indicate the status of the system:
- Amber: Indicates that a system is failed
- Red: Indicates a failure that may require an immediate corrective action
- Green: Indicates that a system operates normally
- Blue: Indicates the normal operation of a temporarily selected system
- White: Indicates the abnormal position of a pushbutton switch or maintenance/test result indication
- Blank: The system is fit to fly.

NEED TO SEE CONCEPT

Ident.: AOP-10-20-30-00016394.0001001 / 20 MAR 17
Applicable to: ALL

The DUs may display information that can potentially overload the flight crew.

In order to prevent this situation, some principles have been established to provide the flight crew with the right information, at the right time:
- The right information in a given flight phase
- Uncluttered, and non-overloaded “need to show" data
- Redundant, or consolidated data for safety related parameters
- Predictive information on essential parameters.

LESS PAPER COCKPIT

Ident.: AOP-10-20-30-00016395.0001001 / 20 MAR 17
Applicable to: ALL

The less paper cockpit concept:
- Improves the access to pilots' operational information and simplifies some of their tasks
- Reduces the number of paper documents in the cockpit and replaces them by electronic ones:
  - Improving information access and search
  - Enabling quicker and easier updates.

COCKPIT CONTROLS - BEST PRACTICES

Ident.: AOP-10-20-30-00024734.0001001 / 10 MAY 21
Applicable to: ALL

The cockpit controls (i.e. pushbuttons, levers and handles located on the overhead panel, the main instrument panel and the pedestal) are designed to ensure a safe and efficient interaction between the pilots and the aircraft systems. As best practices and in order to properly use the cockpit controls, the pilot should:

- Not use the cockpit controls as supports for the arms or for the hands. The use of armrests may prevent such positions
- As PM, not have their hand on a control before they need to use it, to avoid inadvertent activation
- Visually identify the control before selection or action on the control. Then, to close the loop, the pilot must check the result of the action
- Not request an action on a cockpit control if they suspect that the other crew member does not share the same plan of action as theirs. The application of the standard callout reduces possible confusion between cockpit controls in this situations (e.g. The sequence "POSITIVE CLIMB" announced by PM and "GEAR UP" ordered by PF ensures a common plan of action between both pilots).

In addition, at all times, the flight crew should be ready to rapidly take the appropriate actions on the cockpit controls, if required.

For information on how to handle the cockpit controls during abnormal operations, *Refer to FCTM / AOP / Management of Abnormal Operations / Handling of cockpit controls*.

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FLY-BY-WIRE

Ident.: AOP-10-30-10-00016396.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

The relationship between the pilot input on the sidestick, and the aircraft response, is called the control law.
The control law determines the handling characteristics of the aircraft.

FLIGHT CONTROL PROTECTIONS

Ident.: AOP-10-30-10-00016398.0001001 / 20 MAR 17
Applicable to: ALL

The purpose of the flight control protections is to:
- Give full authority to the flight crew, in order to enable them to obtain the best aircraft performance with an instinctive, immediate action on the related control
- Minimize the possibility of over-controlling, overstressing, or damaging the aircraft.

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 deliberately 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.

SIDESTICK

Ident.: AOP-10-30-10-00016399.0001001 / 20 MAR 17
Applicable to: ALL

OPERATIONAL BENEFITS

The main operational benefits of the side-mounted stick:
- It enables a non-obstructed view of the main instrument panel
- It is adapted for emergency situations (e.g. incapacitation, stick jamming, control failures)
- It fits comfortably into the hand with a correct adjustment of the armrest
- It makes the sliding table installation possible (e.g. for maps, documents, meals).

When the autopilot is engaged:
- The sidesticks are locked in neutral position (immediate tactile feedback)
- There is no possibility of simultaneous input from the flight crew and the autopilot
- The autopilot can be disconnected instinctively, at any time, by a firm pressure on the sidestick.

THRUST/AUTOTHRUST

Ident.: AOP-10-30-10-00016400.0001001 / 20 MAR 17
Applicable to: ALL

NON BACK-DRIVEN THRUST LEVER CONCEPT

Airbus has selected the non-back-driven thrust lever concept:
- The flight crew can easily and intuitively monitor the energy of the aircraft via current energy cues (speed, speed trend, HUD chevrons , engine parameters), and not via ambiguous thrust levers movement
- When the autothrust is engaged, the Thrust Lever Position determines the maximum authorized thrust that may be commanded by the autothrust
- When the flight crew uses manual thrust, the Thrust Lever Position determines the current thrust (as on any aircraft not equipped with autothrust).

USE OF SIDESTICK

Ident.: AOP-10-30-20-00016401.0001001 / 03 NOV 21
Applicable to: ALL

Only one flight crew flies at a time.

If the PM wants to act on the sidestick, the PM must:
- Clearly announce “I have control"
- Press and maintain the sidestick pushbutton, in order to get full control of the Fly-By-Wire system.

The flight crew should keep in mind that sidestick inputs are algebraically added. Therefore dual inputs must be avoided, and will trigger aural and visual alerts.
Either flight crew can make an input on their sidestick at any time.
Either flight crew can deactivate the other flight crew’s sidestick by pressing on their sidestick pushbutton.

FLYING IN RECONFIGURATION LAWS

Ident.: AOP-10-30-20-00019307.0001001 / 26 NOV 19
Applicable to: ALL

When the aircraft is in re-configuration law, the flight crew should consider the following:
- At high altitude, descend to a lower altitude to increase the margin to buffet. Descending by approximately 4 000 ft below the REC MAX ALT reduces significantly the occurrence of stall warning in turbulence.
- At high speed, maneuver with care and use small control inputs. Depending on the re-configuration law, the pitch control law can have different modes, but the roll control law will always be in direct law. For additional information, *Refer to FCOM/DSC-27-20-20-10 General*.

ALTERNATE LAW

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 of non protected aircraft.

DIRECT LAW

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 re-trim, and thereby avoid a large nose down trim change.

BACKUP

In the unlikely event of such a failure, backup enables the PF to safely stabilize the aircraft, using the rudder and manual pitch trim, while re-configuring the systems.
In such cases, the objective is not to fly the aircraft accurately, but to maintain the aircraft attitude safe and stabilized, in order to allow the restoration of lost systems.
The pitch trim wheel is used to control pitch. Any action on the pitch trim wheel should be applied smoothly, because the THS effect is significant due to its large size.
The rudder provides lateral control, and induces a significant roll with a slight delay. The PF should apply some rudder to turn, and wait for the aircraft reaction. To stabilize and level the wings, anticipate by releasing the rudder pedals.

WHAT FOR?

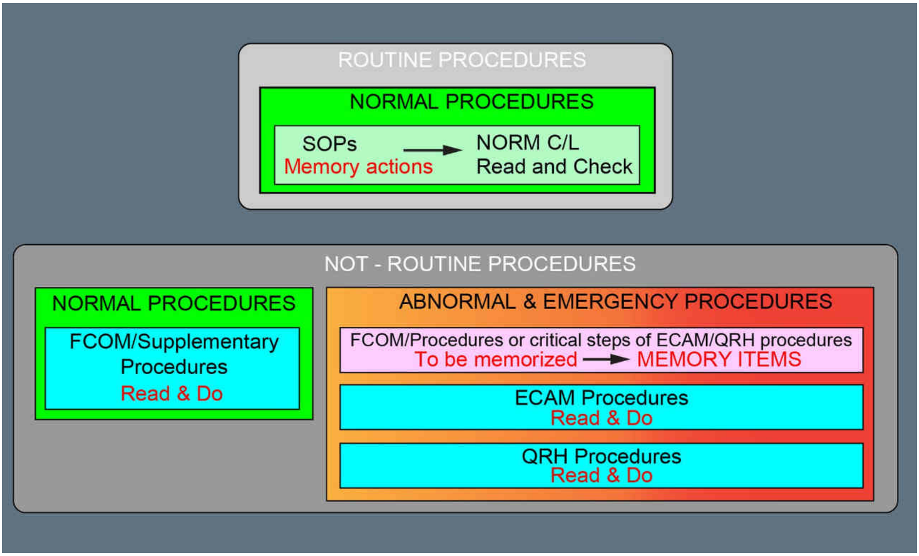
Ident.: AOP-10-40-00016402.0001001 / 20 MAR 17
Applicable to: ALL

The objectives of the procedures are to:
- Share a common practice, in order to ensure a safe and efficient flight
- Organize tasksharing and teamworking
- Guide pilots actions (interface between the flight crew and the aircraft).

GENERAL DESIGN AND UTILIZATION PRINCIPLES

Ident.: AOP-10-40-00016403.0001001 / 20 MAR 17
Applicable to: ALL

The procedures are consistent with the Airbus aircraft design philosophy.
The procedures are divided into routine, and not-routine procedures.
They are easy to identify and to understand.
The pilots are trained to use and strictly apply the procedures.
The tasksharing and a standard communication process are clearly defined, in order to ensure a safe and efficient use of the procedures.



NORMAL PROCEDURES - STANDARD OPERATING PROCEDURES (SOP)

Ident.: AOP-10-40-00016404.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

During the daily normal operations of the aircraft, the flight crew performs actions frequently. These actions are identified as routine tasks. The routine tasks are supported by the Standard Operating Procedures (SOPs).

SOP DESIGN PRINCIPLES

SOP are designed according to the following principles:
- One SOP per flight phase
- Actions are described in a chronological order
- Actions are easy to memorize and to apply (cockpit scan, actions flow).

SOP design is effective provided that:
- All systems operate normally
- All automatic functions are used normally.

Some SOP actions are checked against checklists.

SOP UTILIZATION PRINCIPLES

The flight crew should perform SOP actions by memory. The flight crew can also decide to refer to the QRH, in order to perform both the Preliminary Cockpit Preparation and Securing the Aircraft procedures.

NORMAL PROCEDURES - SUPPLEMENTARY PROCEDURES

Ident.: AOP-10-40-00016405.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

During the daily normal operations of the aircraft, the flight crew may have to perform actions which are not part of the SOP, i.e. not frequently done. These actions are identified as not-routine tasks dedicated to not-routine situation (e.g. airframe deicing/anti-icing procedures on ground, manual engine start). The not-routine tasks are supported by the Supplementary Procedures.
The flight crew must perform not-routine actions, using the READ & DO principle.

SUPPLEMENTARY PROCEDURES DESIGN PRINCIPLES

The Supplementary Procedures are designed according to the following principles:
- Easy to identify and to understand
- One Supplementary Procedure for a given situation
- Actions are described in a chronological order.

SUPPLEMENTARY PROCEDURES UTILIZATION PRINCIPLES

Supplementary Procedures utilization is effective provided that the flight crew performs the Supplementary Procedures using the READ & DO principle (generally done by the PM).

ABNORMAL AND EMERGENCY PROCEDURES

Ident.: AOP-10-40-00016406.0001001 / 04 NOV 20
Applicable to: ALL

ABNORMAL AND EMERGENCY PROCEDURES DESIGN PRINCIPLES

These procedures are not-routine, classified in abnormal or emergency, and prioritized in accordance with the criticality of the situation.

An abnormal or emergency procedure is initiated following:
- A system failure, or
- An operational context.

The design of an abnormal or emergency procedure is defined as:
- A MEMORY ITEM, when the flight crew has no time to refer to the ECAM/QRH/FCOM to ensure a safe flight path, or
- AN OEB IMMEDIATE ACTION, when the flight crew has no time to refer to specific OEB actions to ensure a safe flight path, or
- A READ & DO procedure that is handled via the ECAM, QRH, FCOM, or OEB.

The type of procedure is easy to identify:

[MEM] MEMORY ITEMS	ECAM Procedures	[QRH] Procedures
MEMORY	READ & DO	

ABNORMAL AND EMERGENCY PROCEDURES UTILIZATION PRINCIPLES

The utilization of abnormal and emergency procedures follows the here below principle:

	WHEN?	HOW?
Memory Items	Immediately	Memory
OEB Immediate Actions	Immediately	Memory
Abnormal/Emergency Procedures ECAM/QRH/FCOM/OEB	When appropriate	READ & DO

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GENERAL

Ident.: AOP-20-00016407.0001001 / 25 JUL 17
Applicable to: ALL

A correct application of tasksharing and communication rules ensures a safe and effective operation of the aircraft.

NORMAL OPERATIONS

GENERAL

It is the responsibility of the PF to:
- FLY
- NAVIGATE.

It is the responsibility of the PM to:
- MONITOR the flight path, the navigation and the aircraft systems
- COMMUNICATE.

However, when necessary, the flight crew may re-allocate the tasks, as required.

SUPPLEMENTARY PROCEDURES

For Supplementary Procedures, the flight crew should use the following tasksharing:

■ **If the procedure is related to engine start, it is recommended to read the entire procedure first, and then:**
- The PM reads the actions, and
- The PF acts on the controls.

■ **For all other supplementary procedures:**
The procedures should be applied in accordance with the READ & DO principle, i.e. the PM reads the procedure and the PF or the PM acts on the controls, depending on the context.

ABNORMAL OPERATIONS

It is the responsibility of the PF to:
- FLY,
- NAVIGATE
- COMMUNICATE after the initiation of:
  - The ECAM actions, or
  - A QRH procedure.

It is the responsibility of the PM to:
- MONITOR the flight path and the navigation
- Perform ECAM actions or apply QRH/OEB procedure.

Note: *During the ECAM management process or the application of a QRH/OEB procedure, the "COM" task is transferred to the PF, as the cognitive skills of the PM are mostly dedicated to the understanding and the application of the ECAM/QRH/OEB actions. Therefore, their situation awareness of the environment and the navigation is less effective than the PF's one.*

FCU/AFS AND EFIS CONTROL PANELS

Ident.: AOP-20-00016408.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

The FCU (AFS CP and EFIS CP) and MCDU must be used in accordance with specific rules, in order to ensure:
- Safe operation (correct entries made)
- Effective inter-pilot communication (knowing each other's intentions).

AFS CP SELECTIONS

AFS CP entries (selection or target adjustment) are performed by:
- The PF, with AP ON, or by the PM (upon PF request)
- The PM (upon PF request), with AP OFF (except AP / A/THR that may be selected on by the PF).

Selection of	Engagement by	
	PF	PM
AP / A/THR	DISCONNECTION: YES (via instinctive disconnect pb) ENGAGEMENT: YES	DISCONNECTION: NO ENGAGEMENT: upon PF request
FD	NO	Upon PF request
AFS CP knobs (AP OFF)	NO	Upon PF request
AFS CP knobs (AP ON)	YES	Upon PF request

EFIS CP SELECTIONS

Whatever the status of the AP, the PF and the PM must perform their onside EFIS CP selections.

FMS ENTRIES VIA MCDU

Ident.: AOP-20-00016409.0001001 / 20 MAR 17
Applicable to: ALL

Below 10 000 ft, entries should be restricted to those that have an operational effect:
- PERF APPR
- DIR TO
- NAVAIDS
- Late change of runway
- Activate SEC F-PLN
- ENABLE ALTN.

Time consuming entries must be performed at all times:
- By the PM upon PF request, or
- By the PF after a temporary transfer of controls to the PM.

HOW TO CONDUCT BRIEFINGS

Applicable to: ALL

Ident.: AOP-20-A-00024897.0001001 / 09 NOV 21

OBJECTIVE OF OPERATIONAL BRIEFINGS

Operational briefings are an integral element of the Threat and Error Management process for each mission. Briefings should focus on the identification of threats that affect the intended operations and agreement on mitigation (avoidance, management) of those identified threats.
The second purpose of the flight crew briefing should be the identification of significant differences or deviations to “routine” operations.
At the end of the briefing, the flight crew should have a shared mental model of the intended operations, the identified threats, their mitigations and deviations from routine operations.
The flight crew briefing should provide the PM the expected monitoring framework.
The briefing should create more capacity in thinking and acting. It should enable team confidence building and minimize the startle effect when non-standard situations are encountered. This increases resilience of the flight crew.
A briefing is complementary to SOPs but is not a repetition of SOP items. A briefing is not to be confused with setting and checking of the aircraft systems for the intended flight phase. In order to perform these tasks, the flight crew must follow the SOPs.

1

BRIEFING TECHNIQUE

GENERAL

Briefing requires out-of-the-box thinking, beyond the pure reflection of routine and standard operations. It should have a threat-focused view and identify and prioritize likely threats to the intended operation. It should then detail the actions to mitigate these threats.
Sources of the briefing are the facts gained in the flight crew pre-flight preparation, aircraft operation, but also the overall knowledge and experience of all involved flight crewmembers.
A briefing should be conversational, interactive and use open questions that involve all flight crewmembers to share their experience and expectations.

There should be a variation in the amount of detail and in the length of a briefing. A longer, more detailed briefing may be necessary and adapted to the flight crew experience, such as in the following situations:
- A flight crew not familiar with the airport or the approach
- Complex airport (e.g. CAT C)
- Procedures or techniques that are rarely flown or applied.

A shorter briefing restricted to the minimum items is possible. For example:
- Operating at a well familiar airport
- Repetitive operations by the same crew
- No or limited threats identified.

A long briefing is not necessarily a good one.
A review of Memory Items or Operating Techniques should normally only be part of the briefing when they may be potentially required for threat management (e.g. windshear reported in ATIS – a review of [MEM] Windshear). A briefing of the techniques for rejected takeoff and/or for engine failure after V1 is normally not required on a routine basis for each takeoff.

THREATS

Threats are all of the following:
- Events or errors that occur beyond the influence of the flight crew
- Increased operational complexity
- Situations that must be managed to maintain the margin of safety.

There is no limit to the possible number of threats that may occur. Using a checklist-style tool to identify threats creates an obstruction to the open-mind setting and out-of-the-box consideration. To help with threat identification, memory aids may be of help, provided that they are not used in a checklist style manner. For example (not-exhaustive):

AIRPORT	ATC	AIRCRAFT	ENVIRONMENT
- Congestion - Construction - Hotspots - Infrastructure - Runway condition - Application of chart NOTAMs	- Challenging restrictions - Language - Phraseology - Short term changes of clearance	- MEL/CDL - Aircraft defects - Supplementary procedures that are not routine	- Low visibility - Approach/runway lighting - Runway contamination
WEATHER	**OPERATIONS**	**CREW**	**TERRAIN**
- Windshear - Convective weather - Cold weather - Precipitation - Unreliable weather reports	- Schedule pressure - Delays - Late crew - Load issues	- Fatigue - Low experience - Complacency - Distraction - Training - Crew that is not Standard	- High terrain - Unfamiliar environment - Complex visual approach

Ident.: AOP-20-A-00024899.0001001 / 01 SEP 23

2

TYPES OF OPERATIONAL BRIEFING

GENERAL

The following operational briefings should be performed for each flight:
- **DEPARTURE BRIEFING** during cockpit preparation
- **ARRIVAL BRIEFING** during descent preparation.

A **DEBRIEFING** should be considered at the end of each flight. This is in order to check how the plan and the management of expected and unexpected threats and errors worked, and to see if it is possible to enhance next time in a similar scenario. In case of time constraints this debriefing should be performed no later than at the end of flight duty. Debriefing is a powerful tool for long-term safety management.

Other operational briefings:
- **CRUISE BRIEFING** when the aircraft reaches cruise level and the flight crew expects specific operational threats (e.g. high terrain enroute, weather awareness and avoidance) or before the aircraft enters areas with special operational rules (e.g. North Atlantic)
- **RELIEF CREW BRIEFING** when flight crewmembers change seat in augmented crew operation
- **RE-BRIEFING** in the case of any new identified threats or changes to the planned flight strategy (e.g. when the Departure Change checklist is applied. Also in case of major delay since the briefing was performed or in case of a major deviation from the original flight plan).

PREPARATION FOR BRIEFING

Preparation for every briefing starts with the preparation for the flight mission. Preparation continues throughout the dispatch flight preparation with the collection of data on all of the following:
- Technical condition of the aircraft
- Route planning
- Weather
- NOTAM
- Chart NOTAM (mPilot)
- Load planning
- Company operational requirements
- Fuel planning.

Flight preparation is done partly independently by PF and PM, partly shared by both pilots.

At the aircraft, the following parts of the SOP contain items to be discussed and agreed by both pilots:
- Aircraft acceptance
- Preliminary performance calculation
- Last part of cockpit preparation after FMS preparation by the PF.

These SOP items are intended to prepare a shared mental image by both pilots. They ensure that the following operational briefings are concise, effective and focus only on essential items. For more details, refer to SOPs.

DEPARTURE BRIEFING

The structure and minimum items of the departure briefing are:

Step	PF	PM
1	Cockpit door closed - Set an environment with no distraction[(1)]	
2a		Plan[(2)] - T.O RWY (Intersection) - SID designator - First cleared altitude - MSA/MORA for climb trajectory - Extra fuel and time

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Step	PF	PM
2b	Plan(2) - Hotspots of planned taxi route - Stop margin for RTO - EOSID - Return/diversion considerations - Special operation - Non-standard operation	
3a		Identified THREATS(3)
3b	Identified THREATS(3)	
4	MITIGATIONS(4)	
5	MISCELLANEOUS(5)	

(1) *For the briefing to be of good quality it is important to minimize interruptions. The cockpit door should be closed. It should be the task of the Commander (CM1) to anticipate potential disturbance and to manage this step.*
If interrupted, the briefing should resume at the beginning of the step where the interruption occurred.

(2) *The PM should start to brief the main items of the PLAN. This ensures that both pilots share the same mental image of the flight trajectory after the FMS preparation (by PF) and check (by PM) according to SOP. Then, the PF briefs the hotspots of potential taxi-routes if any, and considers at least the following items:*
- *Consideration for RTO (stop margin if available)*
- *The EOSID/Engine-out trajectory*
- *The considerations for a return landing or diversion if so required (weather/weight).*

The PF recalls any Special Operations or Supplementary procedures to be applied.
Briefing the PLAN should normally only be a high-level description. It should normally not be a repetition of the detailed setting and checking of the flight trajectory in the FMS performed in the respective SOP items.

(3) *The PM should brief the THREATS identified throughout the preparation for the mission. The PF highlights additional threats if required.*

(4) *The PF and PM discuss and agree on the MITIGATION of the identified threats.*

(5) *MISCELLANEOUS is intended to consider additional items e.g.:*
- *Intended use of automation after takeoff*
- *Supplementary Procedures if not yet briefed*
- *Observer safety briefing and duties*
- *Dangerous goods on board.*

ARRIVAL BRIEFING

The structure and minimum items of the arrival briefing are:

Step	PF	PM
1	Set an environment with no distraction(1)	
2a		Plan(2) - Arrival/transition designator - MORA/MOCA/MSA for planned trajectory - STAR - Runway and type of approach - Approach minimum - Go-around trajectory - Extra fuel and time
2b	Plan(2) - Guidance for approach - Landing flaps setting - Stop margin - Use of reverse thrust - Use of autobrake - Planned runway exit - Hotspots for taxi-in - Special operation - Non-standard operation	
3a		Identified THREATS(3)
3b	Identified THREATS(3)	

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Step	PF	PM
4	MITIGATIONS(4)	
5	MISCELLANEOUS(5)	

(1) For the briefing to be of good quality it is important to minimize interruptions. Allocating the right time before top of descent mitigates potential disturbances. It should be the task of the Commander (CM1) to anticipate potential disturbance and to manage this step.
If interrupted, the briefing should resume at the beginning of the step where the interruption occurred.

(2) The PM should start to brief the main items of the PLAN. This ensures that both pilots share the same mental image of the flight trajectory after the FMS preparation (by PF) and check (by PM) according to SOP. The PF briefs what the PF considers for landing.
Briefing the PLAN should normally only be a high-level description. It should not be a repetition of the detailed setting and checking of the flight trajectory in the FMS performed in the respective SOP items.

(3) The PM should brief the THREATS they have identified. The PF highlights additional threats if required.

(4) The PF and PM discuss and agree on the MITIGATION of the identified threats.

(5) MISCELLANEOUS is intended to consider additional items e.g.:
- *Special Operations*
- *Supplementary Procedures if not yet briefed.*

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INTRODUCTION

Ident.: AOP-30-10-00021271.0001001 / 20 MAR 17
Applicable to: ALL

Below-listed procedures are performed using the "READ & DO" principle (except MEMORY items or OEB immediate actions):
- ECAM procedures, are triggered automatically in response to an abnormal behavior of the systems monitored by the Flight Warning System (FWS)
- QRH procedures, are applied by the flight crew in response to an abnormal event detected by any flight crewmember
- OEB procedures, are triggered in some situations.

SEQUENCE OF PROCEDURE

Ident.: AOP-30-10-00021272.0001001 / 20 MAR 17
Applicable to: ALL

In most situations, the following sequence is the basic one that should be applied by the flight crew. However, this sequence may not cover all operational situations. Therefore, in all cases, the flight crew should exercise their judgment and adapt the sequence of actions to the real conditions.

In the case of abnormal or emergency situations, the flight crew should apply the procedures in the following sequence, as appropriate:
- MEMORY ITEMS or OEB immediate actions
- OEB
- ECAM
- QRH

ONE PROCEDURE AT A TIME

Ident.: AOP-30-10-00021273.0001001 / 20 MAR 17
Applicable to: ALL

When the flight crew applies a procedure, they must complete the procedure, unless:
- An action requests to apply/consider another procedure,
- The flight crew needs to update their situation assessment due to an unexpected abnormal or emergency situation (e.g. Smoke detected by the cabin crew or volcanic ash encounter).

USE OF AUTOPILOT

Ident.: AOP-30-10-00021274.0001001 / 20 MAR 17
Applicable to: ALL

The AP has not been certified in all configurations, and its performance cannot be guaranteed. If the pilot chooses to use the AP in such circumstances, extra vigilance is required, and the AP must be disconnected, if the aircraft deviates from desired or safe flight path. For additional information *Refer to FCOM/LIM-AFS-10 Autopilot Function*.

LAND ASAP DEFINITION

Ident.: AOP-30-10-00021275.0001001 / 20 MAR 17
Applicable to: ALL

If red LAND ASAP is part of the procedure, land as soon as possible at the nearest airport at which a safe landing can be made.

Note: *Red LAND ASAP information is applicable to a time-critical situation.*

If amber LAND ASAP is part of the procedure, consider landing at the nearest suitable airport.

Note: *The suitability criteria should be defined in accordance with the Operator's policy.*

GENERAL

Ident.: AOP-30-20-00021276.0001001 / 04 NOV 20
Applicable to: ALL

In flight, the PF and PM must crosscheck before any action on the following controls:
- ENG MASTER lever
- IR MODE selector
- All guarded controls
- RESET buttons.

The flight crew must crosscheck the above-listed controls, in order to prevent any inadvertent action by the flight crew with irreversible effects (e.g. when the flight crew operates red guarded controls). If the flight crew inadvertently operates a black guarded control, the subsequent effect is reversible. The flight crew must restrict the reset of systems to those listed in the FCOM/QRH.

TASKSHARING RULES FOR COCKPIT CONTROLS AND RESET BUTTONS OPERATION

Ident.: AOP-30-20-00021277.0001001 / 20 MAR 17
Applicable to: ALL

To confirm the operation of the above-listed controls, the flight crew should use the following tasksharing method:
- The PM indicates the related control and requests confirmation from the PF
- The PF verifies the control designated by the PM and gives confirmation to the PM
- The PM operates the related control, as required.

TASKSHARING RULES FOR THRUST LEVERS OPERATION

Ident.: AOP-30-20-00021278.0001001 / 20 MAR 17
Applicable to: ALL

The thrust levers are part of the controls that the PF operates, in order to ensure their “FLY" task. Therefore, the PM should not operate the thrust levers. If requested by any ECAM/QRH/OEB procedure, the PM should ask to the PF to operate the corresponding lever. The flight crew should use the following tasksharing method:
- The PF indicates the related thrust lever and requests confirmation from the PM
- The PM verifies the thrust lever indicated by the PF and gives confirmation to the PF
- The PF operates the related thrust lever, as required.

HANDLING OVERHEAD PANEL CONTROL

Ident.: AOP-30-20-00021280.0001001 / 20 MAR 17
Applicable to: ALL

The cockpit overhead panels are clearly labeled, in order to help the flight crew to correctly identify all applicable systems and controls.
When the ECAM/QRH/OEB procedure requires the flight crew to perform an action on the overhead panel or when the flight crew performs a system reset, 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 on top of each panel.

To perform any action requested by a procedure, the PM should indicate the related panel and control and announce in sequence:
- The name of the system
- The name of the control, or system reset
- The action.

E.g. “AIR, XBLEED, CLOSE".
The use of this type of approach enables the PM to keep the PF informed of the progress of the procedure and reduces the risk of the PM operating the wrong control.
It is important for the flight crew to remember that, most of the time, in the case of a system failure, the FAULT light of the applicable control comes on in amber. This enables 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 page, in order to verify that the selected action was performed (e.g. The closure of the crossbleed valve should change the indications that appear on the SD page).

GENERAL

Ident.: AOP-30-30-00021281.0001001 / 20 MAR 17
Applicable to: ALL

When an abnormal situation is detected by the flight crew, the first priority of the flight crew is to maintain a safe flight path before the flight crew performs any READ & DO actions. For takeoff or go around, the flight crew should delay READ & DO actions until the aircraft reaches a minimum of 400 ft AGL. This is an appropriate compromise between stabilization of the aircraft and a delay in the actions. However, the flight crew may initiate READ & DO actions below 400 ft AGL, provided that the flight path is safe.

When the flight crew performs a “READ & DO" ECAM/QRH/OEB procedure, they must:
- Correctly read and apply the ECAM/QRH/OEB actions
- Appropriately share tasks
- Carefully monitor and crosscheck.

However, in some time critical situations, the flight crew has no time to refer to the ECAM/QRH/OEB procedure. Therefore, the flight crew must know, and strictly apply by memory, items referred to as MEMORY ITEMS or OEB immediate actions.

TASKSHARING RULES

Ident.: AOP-30-30-00021282.0001001 / 20 MAR 17
Applicable to: ALL

The PF usually remains the PF for the entire flight, unless the Captain decides to re-allocate tasks differently, or in case of failure that impacts the "FLY" task of the PF.

In addition to the routine tasks "FLY" and "NAVIGATE" performed by the PF, it is the responsibility of the PF to perform all the following actions:
- Initiate ECAM/QRH/OEB actions that the PM must perform,
- Communicate after ECAM/QRH/OEB actions are initiated and until the PM announces:
  - "ECAM actions completed", or
  - “XXX procedure completed", in the case of QRH or OEB procedure.

In addition to the routine task “MONITOR" performed by the PM, it is the responsibility of the PM to manage the ECAM/QRH/OEB actions after the PF announces “ECAM ACTIONS" or launch a QRH procedure, as follow:
- Read & Do the ECAM/QRH/OEB actions in a spoken voice
- Obtain PF confirmation before clearing any ECAM.

HANDLING OF ECAM

Applicable to: ALL

Ident.: AOP-30-30-A-00021283.0001001 / 20 MAR 17

GENERAL

The ECAM actions are actions that the PM must perform on ground or in flight following an ECAM alert, once the aircraft trajectory is stabilized and the PF announced “ECAM actions". The ECAM actions are divided into several steps, which are clearly identified on the EWD and SD pages.

The PM must:
- “READ & DO" the ECAM procedures, identified as procedure action lines on the EWD
- Analyse the operational impact on the affected system via the SD page
- Read the STATUS page, including associated procedures.

If an ECAM procedure requests the flight crew to apply a QRH procedure, the flight crew should:
- Keep the procedure displayed on the ECAM
- Apply the requested QRH procedure.

The objective is to avoid the flight crew to be disturbed with subsequent ECAM alerts that may trigger with less priority.

Ident.: AOP-30-30-A-00021284.0001001 / 20 MAR 17

ECAM TASKSHARING

The flight crew should apply any OEB that affects an ECAM alert. To apply the ECAM procedure, the flight crew should use the following tasksharing method:

Ident.: AOP-30-30-A-00021285.0001001 / 09 FEB 18

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PF	PM
First pilot who notices MASTER WARNING/CAUTION ....RESET	
For each ECAM procedure:	
	"Title of failure"....ANNOUNCE ECAM ....CONFIRM *The PM should check/inspect the overhead panel and/or associated SD, in order to analyze and confirm the failure, before they take any action. The flight crew should keep in mind that the sensors on the overhead panel and/or SD may be different from the sensors that trigger the failure.*
OEB ....CONSIDER	

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PF	PM
"ECAM ACTIONS"....ORDER *When the ECAM displays several failures, the PF calls out "ECAM ACTIONS" for the first ECAM only.*	
Apply the Tasksharing Rules and Communication for Abnormal Operations *Refer to AOP-20 General*	
	ECAM/OEB ACTIONS....PERFORM
	"CLEAR (name of the system)?"....REQUEST
ECAM ACTIONS PERFORMED....CHECK	
"CLEAR (name of the system)"....CONFIRM	
	CLR pb ....PRESS *Before the PM presses the CLR pb, the flight crew should carefully check that all actions have been performed.*
For each System Display (SD) page:	
SD page....ANALYZE	
	"CLEAR (name of the system)?"....REQUEST
"CLEAR (name of the system)"....CONFIRM	
	CLR pb ....PRESS
When STATUS page appears:	
	"STATUS"....ANNOUNCE
"STOP ECAM"....ORDER	
	ECAM ACTIONS....STOP
Consider any normal C/L, system reset, or any additional procedure, as applicable	
"CONTINUE ECAM"....ORDER	
	STATUS....READ *The procedures associated with the STATUS should be previewed to evaluate the associated workload. They should be performed at the appropriate flight phase.*
	"REMOVE STATUS?"....REQUEST
"REMOVE STATUS"....CONFIRM	
	STS pb ....PRESS
	"ECAM ACTIONS COMPLETED"....ANNOUNCE

Ident.: AOP-30-30-A-00021286.0001001 / 03 NOV 21

STOP ECAM

When necessary, the flight crew should stop the ECAM actions when they need to perform actions which require acknowledgement, check or crosscheck from both flight crewmembers (e.g. communication to ATC, request of configuration change, baro setting). Then, they should continue with ECAM actions.

In all cases, the flight crew must stop the ECAM actions before reading the STATUS page, in order to:
- Perform any normal C/L, if applicable.
  The flight crew must perform the pending normal C/L at this stage as it is a good compromise between the necessary application of ECAM procedures and system analysis and the delay in the check of systems status (e.g. in the case of failure after takeoff, flaps and landing gear retracted).
- Consider any system reset.
  The ECAM procedure may consider reset of the system by switching OFF then ON the associated system via the usual cockpit control. However reset action may not be requested by the ECAM procedure. In this case, it is the flight crew responsibility to consider any system reset to recover the operation of the affected system, provided that the system reset is permitted in the system reset table. If the reset is successful, the STATUS page will disappear. The flight crew must not apply the system reset procedure from memory. They must refer to the QRH.
- Consider application of the ENG RELIGHT procedure after an engine failure with no damage.
  The flight crew should consider performing the ENG RELIGHT procedure at this stage as if the relight is successful the STATUS page will disappear.

STATUS PAGE

The purpose of the STATUS page is to provide an overview of the technical status of the aircraft in all flight phases. Therefore, it is important that the flight crew checks the whole STATUS page information, in order to correctly assess the situation and subsequently make appropriate decision.
The STATUS page may contain some actions, that should be performed by the flight crew at a more appropriate time. The flight crew should read the procedures associated with the STATUS page during the STATUS page review to evaluate and anticipate the workload for each flight phase.

Ident.: AOP-30-30-A-00021287.0001001 / 20 MAR 17

IF THE ECAM WARNING (OR CAUTION) DISAPPEARS

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 1(2) FIRE warning disappears and the procedure no longer applies. Any remaining ECAM procedures should be performed as usual.

HANDLING OF QRH

Ident.: AOP-30-30-00021288.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

When the flight crew needs to apply a QRH procedure, the PM should use the QRH/Abnormal and Emergency Procedures table of contents in order to search and select the applicable procedure.

IF THE CONDITIONS OF THE APPLICATION OF A QRH PROCEDURE DISAPPEAR

The flight crew can stop any abnormal QRH procedure if the conditions for its application disappear.

ECAM/QRH/OEB ACTIONS COMPLETED

Ident.: AOP-30-30-00021289.0001001 / 20 MAR 17
Applicable to: ALL

When the ECAM/QRH/OEB actions are completed, the flight crew should:
- Resume the Normal Operations Task sharing rules
- If time permits, review the FCOM for additional information on the applicable procedure(s). However, the flight crew should not prolong the flight to refer to the FCOM.
- Assess the situation
  When convenient, recall the STATUS page, in order to assess the situation:
  - Check any fuel penalty factor, and check the remaining fuel at destination or diversion airport
  - Check any landing distance penalty, and compute the landing distance at destination or diversion airport
  - Consider all the operational, maintenance and commercial aspects.
- Make the decision
- Inform the ATC, the cabin crew, the passengers, and airline operations as required.

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GENERAL

Ident.: AOP-30-40-00021290.0001001 / 20 MAR 17
Applicable to: ALL

The ADVISORY enables the flight crew to monitor the drifting parameter. The sensors used to trigger an advisory may be different from those used by the FWS to trigger an ECAM alert.

TASKSHARING RULES

Ident.: AOP-30-40-00021291.0001001 / 20 MAR 17
Applicable to: ALL

The flight crew should use the following tasksharing method:
- The flight crewmember that first notices an advisory announces “ADVISORY on XYZ system",
- Then, the PF requests the PM to monitor the drifting parameter. If time permits, the PM may refer to the QRH, in order to:
  - Check the advisory triggering conditions in various advisory situations
  - Find the associated recommended actions.

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SPURIOUS CAUTION

Ident.: AOP-30-50-00016413.0001001 / 20 MAR 17
Applicable to: ALL

Any spurious 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 page, by the "CANCELLED CAUTION" title.
The EMER CANCEL inhibits any aural warning that is associated with a red warning, but does not affect the warning itself.

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USE OF SUMMARIES

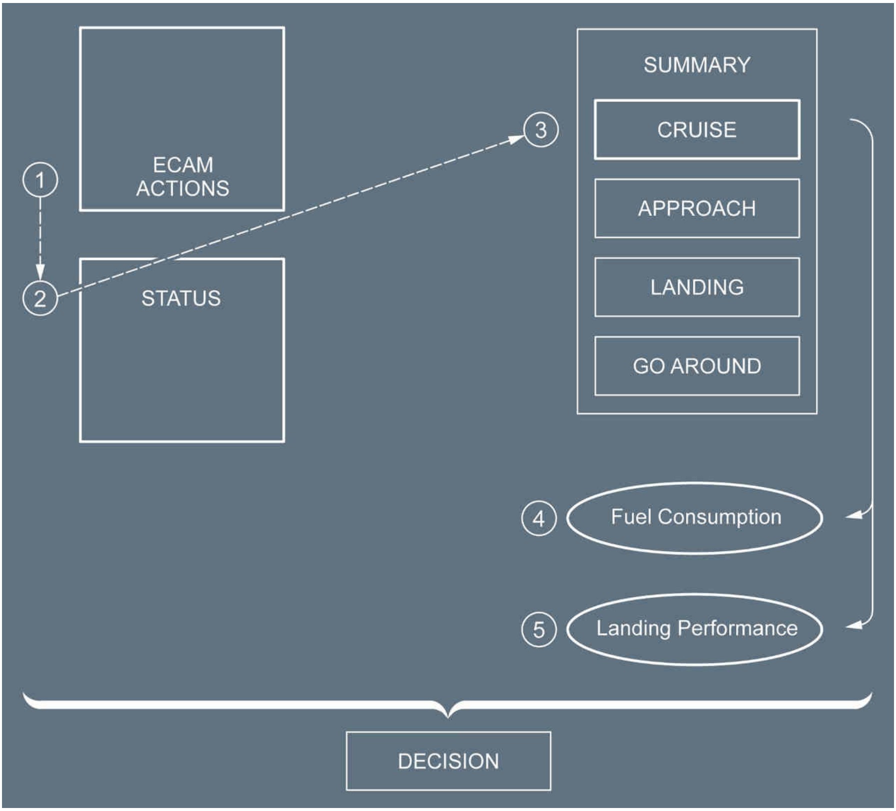
Ident.: AOP-30-60-00019296.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

The QRH summaries are QRH procedures created to help the flight crew to perform actions in the case of an ELEC EMER CONFIG or a dual hydraulic failure.
The QRH summaries are divided into four sections: CRUISE, APPROACH, LANDING, and GO-AROUND.

SITUATION ASSESSMENT WITH THE CRUISE SECTION OF THE QRH SUMMARY

Situation Assessment with the QRH Summary



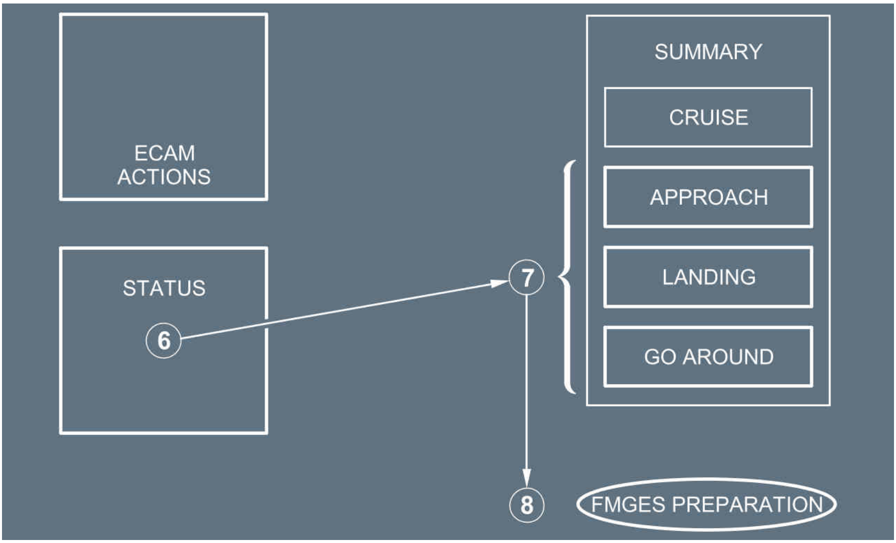
- **Steps 1 and 2: The flight crew should apply the ECAM first.** This includes both the procedure and the STATUS page. When ECAM actions are completed, the PM announces "ECAM ACTIONS COMPLETED". Then, the PM should refer to the corresponding QRH summaries.
- **Step 3:** After the check of the STATUS page, the PM should refer to the performance application, or the CRUISE section of the QRH summaries. The CRUISE section highlights the remaining systems (in ELEC EMER configuration only), the main limitations, and the flight capability of the aircraft.

The CRUISE section helps the flight crew to assess the situation and to select an appropriate runway for landing.

As indicated in the CRUISE section, the flight crew should refer to the corresponding chapters of the QRH for:
- The evaluation of increased fuel consumption (**step 4**)
- The landing performance computation at the selected airport (**step 5**).

APPROACH PREPARATION

Approach Preparation with the QRH Summary

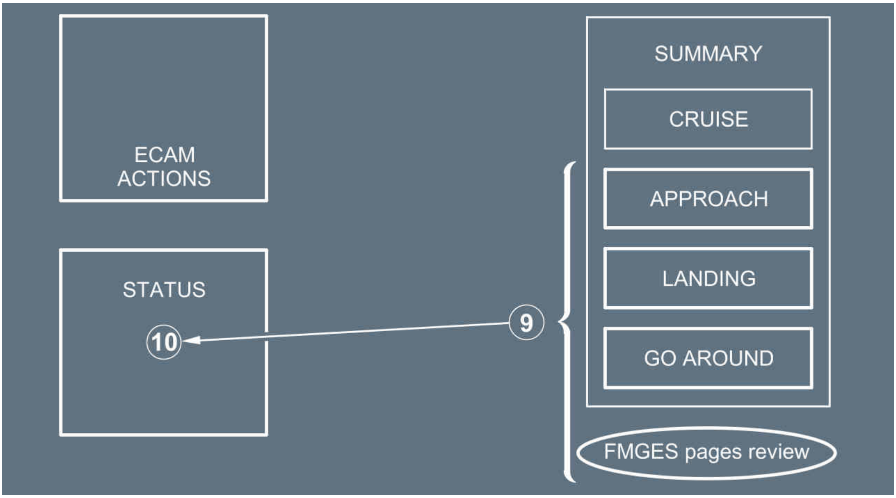


While the flight crew checks the STATUS page (**step 6**), they should use the APPROACH, LANDING, and GO-AROUND sections to support the approach preparation (**steps 7 and 8**).

When appropriate, the APPROACH, LANDING, and GO-AROUND sections include the LANDING WITH SLATS or FLAPS JAMMED procedure and the L/G GRAVITY EXTENSION procedure that the flight crew must apply during the approach, landing, and go-around phases.

APPROACH BRIEFING

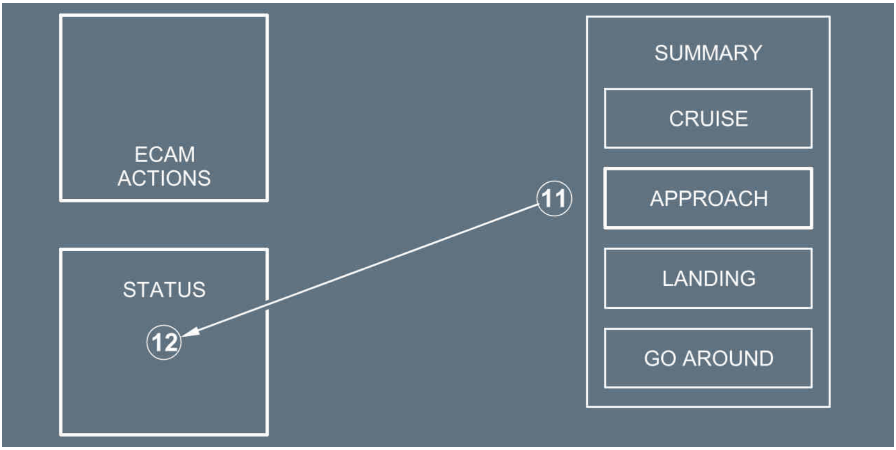
Approach Briefing with the QRH Summary



The flight crew should use the APPROACH, LANDING, and GO-AROUND sections of the QRH summary to perform the approach briefing, while they crosscheck the associated FMS pages and the STATUS page (**steps 9 and 10**).

APPROACH

Approach with the QRH Summary



To perform the approach, the flight crew should refer to the APPROACH section (**step 11**).
When the aircraft is in final configuration, the flight crew can rapidly review the LANDING and GO-AROUND sections, as a reminder (braking, NWS, reversers, and L/G retraction in the case of a go-around).
Finally, the PM should check the STATUS page (**step 12**) and check that all the APPR PROC actions are completed.

GOLDEN RULES FOR PILOTS

Ident.: AOP-40-00019328.0001001 / 19 APR 17
Applicable to: ALL

INTRODUCTION

The Airbus "Golden Rules for Pilots" are operational guidelines, based on all of the following:
- Basic flying principles
- The adaptation of these basic flying principles to modern-technology aircraft
- The provision of information about required crew coordination for the operation of Airbus aircraft.

The objective of these Golden Rules is to also take into account the principles of flight crew interaction with automated systems, and the principles of Crew Resource Management (CRM), in order to help prevent the causes of many accidents or incidents and to ensure flight efficiency.

GENERAL GOLDEN RULES

The following four Golden Rules for Pilots are applicable to all normal operations, and to all unexpected or abnormal/emergency situations:
1. ***Fly. Navigate. Communicate:*** *In this order and with appropriate tasksharing.*
   Fly! Navigate! Communicate! The flight crew must perform these three actions in sequence and must use appropriate tasksharing in normal and abnormal operations, in manual flight or in flight with the AP engaged.

The following explains each of the three actions, and the steps associated with the performance of these actions:

- ***Fly***

  "**Fly**" indicates that:
  - **The Pilot Flying** (**PF**) must concentrate on "**flying the aircraft**" to monitor and control the pitch attitude, bank angle, airspeed, thrust, sideslip, heading, etc., in order to achieve and maintain the desired targets, vertical flight path, and lateral flight path.
  - **The Pilot Monitoring** (**PM**) must assist the PF and must **actively monitor** flight parameters, and call out any excessive deviation. The PM's role of "actively monitoring" is very important.

  Therefore, both flight crewmembers must:
  - Focus and concentrate on their tasks to ensure appropriate tasksharing
  - Maintain situational awareness and immediately resolve any uncertainty as a crew.

- ***Navigate***

  "**Navigate**" refers to and includes the following four ***"Know where ..."*** statements, in order to ensure situational awareness:
  - Know **where you are…**
  - Know **where you should be…**
  - Know **where you should go…**
  - Know **where the weather, terrain, and obstacles are.**

- ***Communicate***

  "Communicate" involves effective and appropriate crew communication between the:
  - PF and the PM
  - Flight crew and Air Traffic Control (ATC)
  - Flight crew and the cabin crew
  - Flight crew and the ground crew.

  Communication enables the flight crew to safely and appropriately perform the flight, and enhance situational awareness. To ensure good communication, the flight crew should use **standard phraseology** and the **applicable callouts.**

  In abnormal and emergency situations, the PF must recover a steady flight path, and the flight crew must identify the flight situation. The PF must then inform ATC and the cabin crew of:
  - ■ The flight situation
  - ■ The flight crew's intentions.

The flight crew must therefore always keep in mind the key message:
Fly the Aircraft, Fly the Aircraft, Fly the Aircraft...

To safely and appropriately perform a flight, both flight crewmembers must have basic flying skills, and must be able to fly with appropriate tasksharing in all situations.

2. ***Use the appropriate level of automation at all times.***

   Aircraft are equipped with several levels of automation, used to perform specific tasks.

   The appropriate use of automated systems significantly helps the flight crew with, for example:
   - Workload management
   - Situation awareness (traffic, ATC communication, etc.).

   The flight crew must, at all times, perform both of the following:
   - **Determine and select** the appropriate level of automation that can include manual flight

     Note: *The decision to use manual flight must be agreed between both pilots and must be based on an individual assessment of the pilot. This assessment should include aircraft status (malfunctions), pilot fatigue, weather conditions, traffic situation, and if the PF is familiar with the area.*

   - **Understand** the operational effect of the selected level of automation.

3. ***Understand the FMA at all times.***

   The flight crew must confirm the operational effect of all actions on the FCU, or on the MCDU, via a crosscheck of the corresponding annunciation or data on the PFD and on the ND.

   At all times, the flight crew should be aware of the following:
   - Guidance modes (armed or engaged)
   - Guidance targets
   - Aircraft response in terms of attitude, speed, and trajectory
   - Transition or reversion modes.

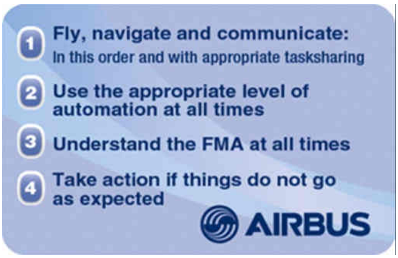
   Therefore, to ensure correct situational awareness, at all times, the flight crew must:
   - **Monitor the FMA**
   - **Announce the FMA**
   - **Confirm the FMA**
   - **Understand the FMA.**

4. ***Take action if things do not go as expected.***

If the aircraft does not follow the desired vertical or lateral flight path, or the selected targets, and if the flight crew does not have sufficient time to analyze and solve the situation, the flight **crew must immediately take appropriate or required actions**, as follows:

The PF should change the level of automation:
- From managed guidance to selected guidance, or
- From selected guidance to manual flying.

The PM should perform the following actions in sequence:
- Communicate with the PF
- Challenge the actions of the PF, when necessary
- Take over, when necessary.



AIRCRAFT SYSTEMS

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AS-WXR Weather Radar

SUMMARY OF HIGHLIGHTS

Localization Title	Toc Index	ID	Reason
AS-RUD Operational Recommendations	B	1	Documentation update: Addition of "Operational Recommendations" documentary unit
AS-RUD Operational Recommendations	B	2	Effectivity update: The information no longer applies to all ACN.

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INTRODUCTION

Ident.: AS-BIRD-00016414.0001001 / 04 SEP 18
Applicable to: ALL

Two flying references may be used on the PFD:
- The attitude
- The Flight Path Vector (FPV), called the "bird".

When HDG/VS is selected on the FCU, "bird" is off, and the attitude is the flight reference with HDG and VS as basic guidance parameters.
The attitude flight reference should be used for dynamic manoeuvres, for example, take-off or go-around. An action on the sidestick has an immediate effect on the aircraft attitude. The flight crew can monitor this flight reference directly and accurately during these manoeuvres.
When TRK/FPA is selected on the FCU, the "bird" is the flight reference with the TRK and FPA as basic guidance parameters.
In dynamic maneuvers, the "bird" is directly affected by the aircraft inertia and has a delayed reaction. As a result, the "bird" should not be used as a flight reference in dynamic maneuvers.
The "bird" is the flight reference that should be used when flying a stabilized segment of trajectory, e.g. a non-precision approach or visual circuit.

RELIABILITY

The bird is computed from IRS data and is affected by inertial errors. During the approach, the flight crew may detect a small track error, usually up to +/- 2 °.
The bird is also computed from static pressure information. Therefore, if the altitude information is not reliable, the flight crew must consider the bird as not reliable.

PRACTICAL USE OF THE BIRD

Applicable to: ALL

Ident.: AS-BIRD-BIRD-00019339.0001001 / 20 MAR 17

GENERAL RULE

When using the "bird", the flight crew should first change attitude, and then check the result with reference to the "bird".

Ident.: AS-BIRD-BIRD-00019340.0001001 / 20 MAR 17

APPROACH USING FPA GUIDANCE

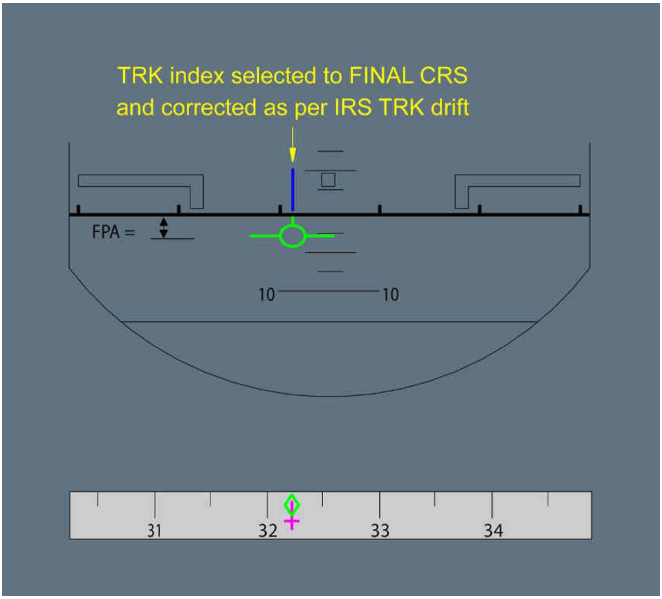
The FPV is particularly useful for this type of approach. The flight crew can select values for the inbound track and final descent path angle on the FCU. Once established inbound, only minor corrections should be required to maintain an accurate approach path. The flight crew can monitor the tracking and descent flight path, with reference to the track indicator and the "bird".

However, the flight crew 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.
The TRK-FPA Flight Director is particularly useful for guiding the aircraft during non-precision approaches, although it can also be used at other times. When using this mode of the FD, the pilot places the FPV symbol in the center of the flight path director (FPD) symbol. This is similar to using the FD in HDG-V/S, when the pilot puts the center of the fixed aircraft symbol at the center of the crossed bars of the FD. If the FCU is set on the correct track and flight path angle, and if the FPV and the FPD are aligned, they will guide the aircraft along a trajectory that is stabilized with respect to the ground, whereas when the pilot is using HDG-V/S the trajectory is stabilized with respect to the air. However, if the aircraft is disturbed from this ideal trajectory, merely following the FPD will result in its following a trajectory that is parallel to the intended trajectory. Thus, when the aircraft is disturbed from the original trajectory, the pilot must adjust either its track or its flight path angle or both in order to obtain guidance back to the original trajectory.

Ident.: AS-BIRD-BIRD-00019341.0001001 / 20 MAR 17

VISUAL CIRCUITS

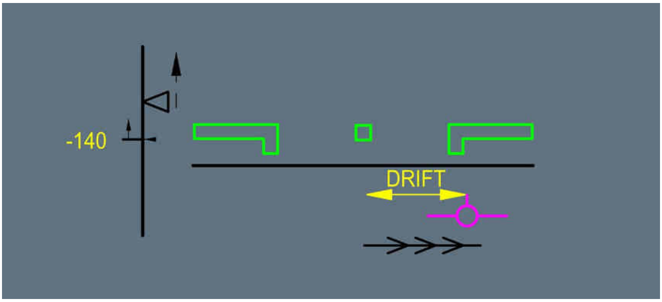
The FPV can be used as a cross-reference, when flying visual circuits. On the downwind leg, the flight crew should position the wings of the "bird" on the horizon, in order to maintain level flight. The downwind track should be set on the FCU. The flight crew should position the tail of the "bird" on the blue track index on the PFD , in order to maintain the desired track downwind.
On the final inbound 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.



Ident.: AS-BIRD-BIRD-00019342.0001001 / 20 MAR 17

FINAL APPROACH

The "bird" is a very useful flight reference, because it provides the trajectory parameters, and quickly warns the flight crew of downburst. In addition, together with the GS MINI protection, it is an excellent indicator of shears or wind variations. The position of the "bird" in relation to the fixed aircraft symbol provides an immediate indication of the wind direction. Therefore, when approaching the minimum, the flight crew knows in which direction to search for the runway.
If the target approach speed symbol moves upward, this indicates that there is headwind gust. If the "bird" drifts to the right, this indicates that there is wind from the left.



Ident.: AS-BIRD-BIRD-00019343.0002001 / 20 MAR 17

GO-AROUND

The pilot must take care when making a go-around with the FPV selected. There is inevitable some lag between the pilot's raising the nose to commence the go-around and the aircraft's responding by changing its trajectory.
For the go-around, the appropriate flight reference is the attitude, because go-around is a dynamic maneuver. Therefore, when performing a go-around, regardless of the previously-selected flight reference, upon selection of TOGA, the FD bars are automatically restored in SRS/GA TRK modes, and the "bird" is automatically removed.

GENERAL

Ident.: AS-CG-00019702.0001001 / 20 MAR 17
Applicable to: ALL

The Center of Gravity (CG) is the point at which weight is applied. The CG is expressed as a percentage of the Mean Aerodynamic Chord (MAC). It must remain within a range determined by the CG's impact on the aircraft:
- Performance
- Structure
- Handling characteristics (when in direct law).

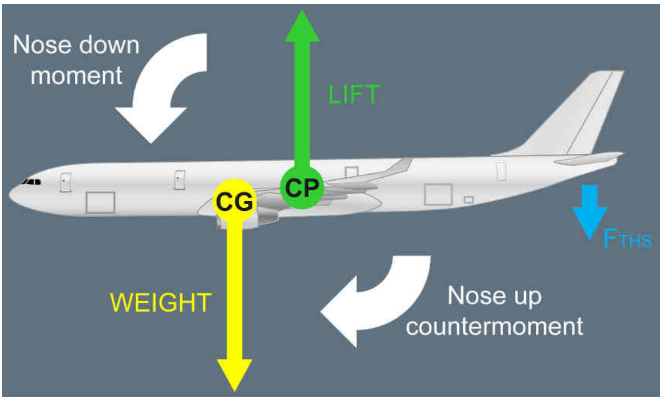
These factors define the range that the CG must remain within. This range is referred to as the CG envelope.

MECHANICAL ASSUMPTIONS

Ident.: AS-CG-00019703.0001001 / 20 MAR 17
Applicable to: ALL

For pitch control, there are three forces that must be considered when airborne:
- The weight applied on the CG
- The lift applied on the Center of Pressure (CP)
- The downward force created by the Trimmable Horizontal Stabilizer (THS).

Forces Applied On Flying Aircraft



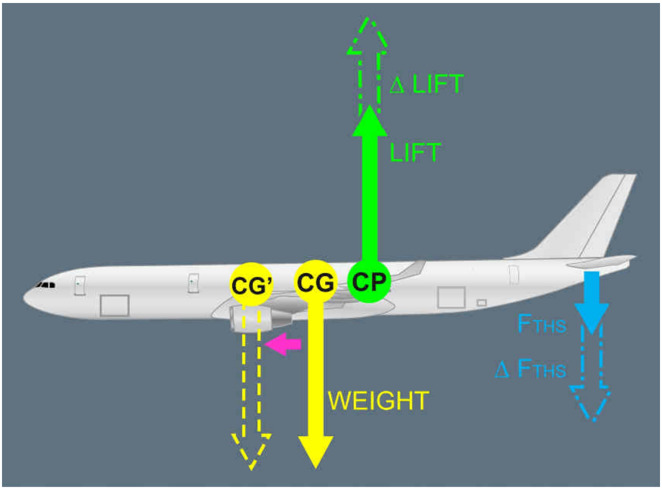
Because the first two forces are not applied at the same point, they create a pitching moment, that must be counteracted by the THS setting.

INFLUENCE OF THE CENTER OF GRAVITY ON THE AIRCRAFT PERFORMANCE

Ident.: AS-CG-00019704.0001001 / 25 JUL 17
Applicable to: ALL

The position of the CG has a significant impact on performance, because it determines the balance of the longitudinal forces.
When the CG moves forward, the nose down moment increases. The THS produces a greater downward force to counteract this moment. As a result, lift must increase, in order to balance both the weight and the THS downward force. Therefore, a forward CG will result in a greater stall speed value. On A330/A340, the stall speed increases by 1.5 kt, when the CG varies from 26 % to full forward CG.

Influence of the CG Position



IMPACT ON TAKEOFF PERFORMANCE

TAKEOFF SPEED AND ASSOCIATED DISTANCES

The aircraft operating speeds are referenced to the stall speed, e.g. V2 >1.13 VS1G.
If the CG moves forward ▸ VS1G increases ▸ V2 increases ▸ TOD increases (or the runway-limited TOW decreases).

ROTATION MANEUVER

An aft CG gives the aircraft a nose up attitude, that helps the rotation. A forward CG results in a nose heavy situation, and a difficult rotation. It is "heavier", therefore longer, at forward CG.

CLIMB GRADIENT

As mentioned above, a forward CG is counteracted by a greater THS downward force. This creates drag, that, in addition to the drag caused by the lift increase, degrades aircraft performance, for example, the climb gradient.
For example:

A340 Performance decrement with CG full forward, in comparison with CG 26 % CONF. 3, Packs On, ISA, ZP=0			
	CG 26 %	CG full forward	
TOD	3 165 m	3 241 m	76 m
5 % Climb gradient limiting weight	257.6 t	256.2 t	1.4 t

IMPACT ON IN-FLIGHT PERFORMANCE

A forward CG causes a nose up counter moment, that degrades fuel consumption, because of increased induced drag. For low fuel consumption, it is better to have the CG as far aft as possible.

Fuel increment 1 000 NM stage length CG location at 20 % (reference at 35 %)	
Aircraft type	Fuel increment (kg/lb)
A330	220/485
A340	380/838

The result summarizes the worst cases, i.e. it considers an heavy aircraft at a high flight level. Airbus has developed a trim tank transfer system, that controls the aircraft CG. When the airplane is in cruise, the system optimizes the CG to save fuel by reducing the drag on the airplane. The system either transfers fuel to the trim tank (aft transfer), or from the trim tank (forward transfer). This movement of fuel changes the CG. The flight crew can also manually select a forward fuel transfer. The Fuel Control and Management Computer (FCMC) calculates the CG of the aircraft, based on the ZFWCG and fuel distribution. It then compares the result to a target value. From this calculation, the FCMC determines the quantity of fuel to be moved aft or forward in flight (usually one aft fuel transfer is carried out during each flight).

IMPACT ON LANDING PERFORMANCES

For landing, the aircraft operating speeds are referenced to the stall speed, i.e. Vapp > 1.23 VS1G. If the CG moves forward ▸ VS increases ▸ Vapp increases ▸ Landing Distance increases (or the Maximum Landing Weight, limited by landing distance, decreases).

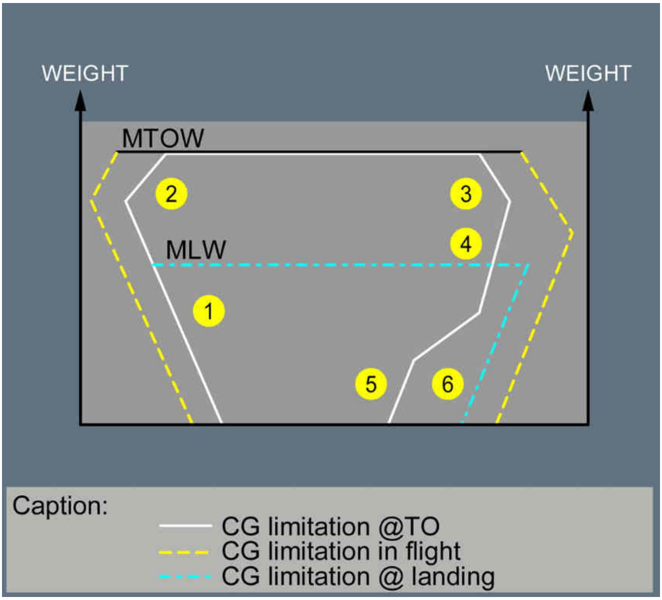
INFLUENCE OF THE CG ON THE STRUCTURE AND HANDLING CHARACTERISTICS

Ident.: AS-CG-00019705.0001001 / 20 MAR 17
Applicable to: ALL

TAKEOFF AND LANDING

During the flights phases, that are critical and constraining, the CG must stay within certified limits for structural and handling qualities considerations (when in direct law). The following CG-certified envelope has been designed, in accordance with these limits:

CG envelope



1 Performance/loading compromise at takeoff

- A too FWD CG may lead to difficult rotation
- The envelope must be as wide as possible but the forward limit must not be too aft, in order to facilitate the loading of the aircraft

2 Nose gear strength structural limit

The further forward the CG is, the more weight there is over the nose gear

FWD limit at takeoff

3

Main gear strength structural limit

The further aft the CG is, the more weight there is over the main gear

aft limit at takeoff

4

α floor limit

The further aft the CG is, the less effective is the THS to counteract the resulting nose up moment in go-around phase or α floor

aft limit in go-around

5

Nose gear adherence limit

The further aft the CG is, the lesser the adherence for ground control

aft limit at takeoff

6

α floor limit (landing)

Similar to TOGA limitations but less restricting, as the aircarft is less heavy than takeoff

aft limit at landing

The CG envelope must also allow passengers to move in the cabin. Therefore, when the takeoff CG and landing CG envelope have been determined, the in flight envelope is deducted from takeoff/landing CG envelope by adding a 2 % margin, provided that all the criteria for the handling characteristics are met.

Note: *In approach with flaps extended, there is a nose down moment. This is counteracted by THS nose up setting. The further forward the CG is, the more the THS nose up setting is required. This can result in a THS stall, particularly in cases of push over when the pilot pushes hard on the sidestick, in reaction to a significant speed decrease. This limits the forward CG during approach.*

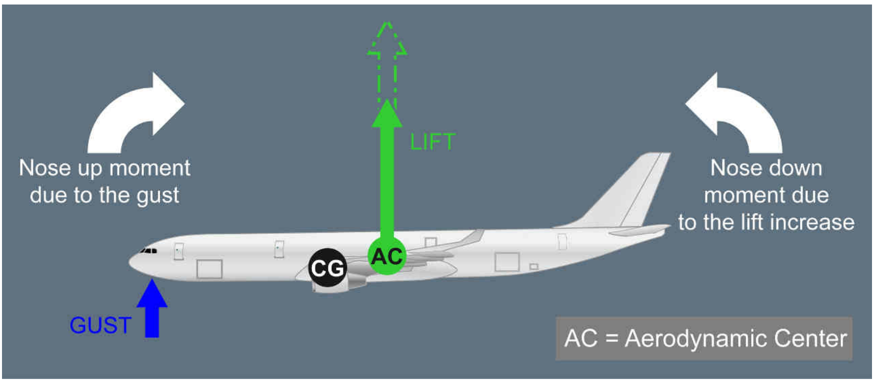
IN FLIGHT

On a fly-by-wire aircraft, in direct law, the handling characteristics are affected by the location of the CG, in the same way as in a mechanically controlled aircraft.

STABILITY ISSUE – THE AERODYNAMIC CENTER OR NEUTRAL POINT

In case of a perturbation or a gust, the aircraft is considered as stable, if it tends to revert toward its previous status. The aerodynamic center or neutral point is the point where there is an increase (or decrease) of lift, when the aircraft angle-of-attack changes.

Aircraft Longitudinal Stability

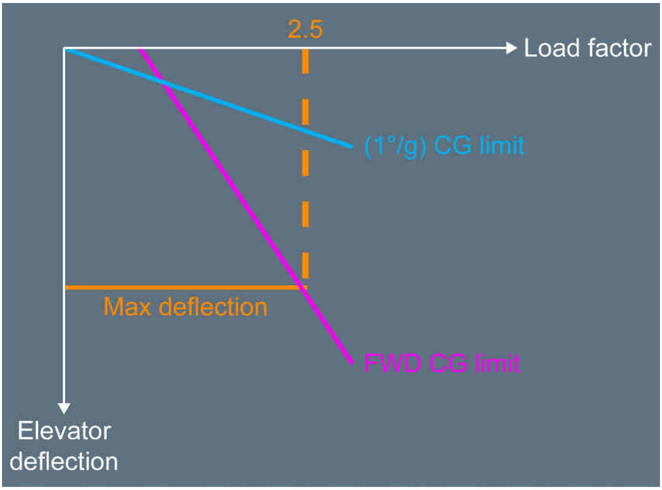


The gust illustrated here causes an increase in the angle-of-attack, therefore an additional lift. The nose down moment, due to the lift increase, causes a decrease in the angle-of-attack. The aircraft is stable.
If the CG is behind the aerodynamic center, the increase in lift creates a nose up moment, that adds to the initial nose up moment caused by the gust. The aircraft is unstable.
The CG must be forward of the aerodynamic center for stability.

MANEUVERING CRITERIA – MANEUVER POINT

Depending on where the CG is, a deflection of the elevator causes a sharper, or less aircraft maneuver. In other words, the CG has a direct influence on the maneuverability of the aircraft. If a very small deflection of the elevator causes "a lot of g", the efficiency of the elevator is very high. The aircraft is considered to be very sensitive to maneuver. The maneuver point is the CG, for which the elevator is infinitely effective. The CG must obviously be as far forward from the maneuver point as possible. This distance is defined by a maneuverability criteria, that determines that "at least 1 ° of elevator deflection is required to pull 1 g load factor". This condition defines the aft CG limit in terms of maneuverability.
But the CG must not be too far forward. The maximum elevator deflection must enable at least the maximum acceptable load factor (e.g. 2.5 g) to be pulled. This condition defines the forward CG limit in terms of maneuverability.

Maximum Elevator Deflexion and Extern Load Factor



THE CG AND TRIM POSITION

Ident.: AS-CG-00019706.0001001 / 20 MAR 17
Applicable to: ALL

IN FLIGHT

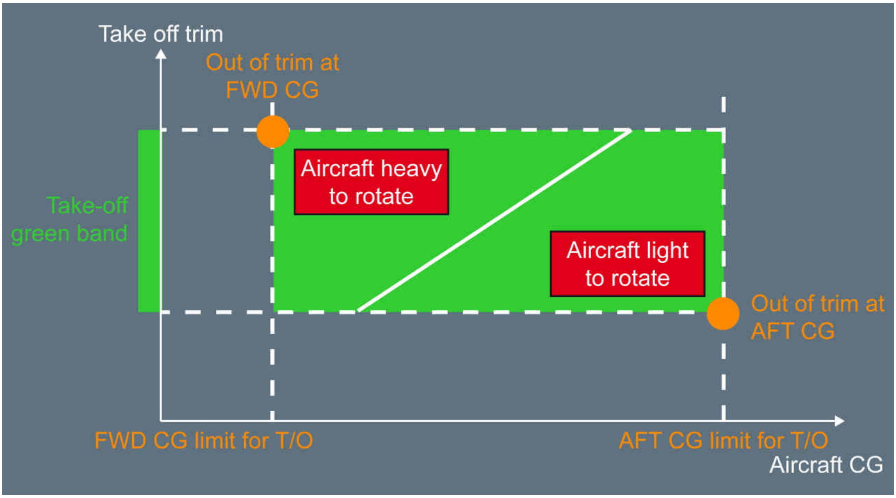
In flight, on all fly-by-wire aircraft, the position of the pitch trim surface automatically adjusts in order to maintain the flight path with no deflection of the elevators.

The position of the pitch trim surfaces that is required to maintain Flight Level depends obviously on the center of gravity of the aircraft. However, it also depends on several other parameters, such as altitude, speed, aircraft weight and aircraft configuration.

TAKEOFF

For takeoff, the pitch trim surface must be set to an appropriate position depending on the CG. This is done automatically on A340-500/600, A330/A340 Enhanced (with specific aircraft definition) and aircraft equipped with the automatic trim setting function . It is set manually on others models.
Setting the pitch trim on ground, before takeoff, provides consistent rotation characteristics and a trimmed aircraft at V2 +10 kt. The setting results from a compromise, because the rotation characteristics and the trim at V2 +10 kt do not only depend on the CG, but are also a function of the flap configuration, thrust and V2.
However, the takeoff trim setting must also be limited, in order to cover required abuse cases at takeoff. These limitations define the green band.

Take Off Trim vs Aircraft CG



The above graph indicates the recommended TO trim, according to the CG The TRIM/CG relationship is indicated on the pitch trim wheel scale. It applies only at takeoff.

OBJECTIVE

Ident.: AS-FG-10-1-00016419.0001001 / 20 MAR 17
Applicable to: ALL

The Flight Director (FD) and the Auto Pilot (AP) assist the flight crew to fly the aircraft within the normal flight.

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

MANAGED AND SELECTED MODES

Ident.: AS-FG-10-1-00016420.0001001 / 20 MAR 17
Applicable to: ALL

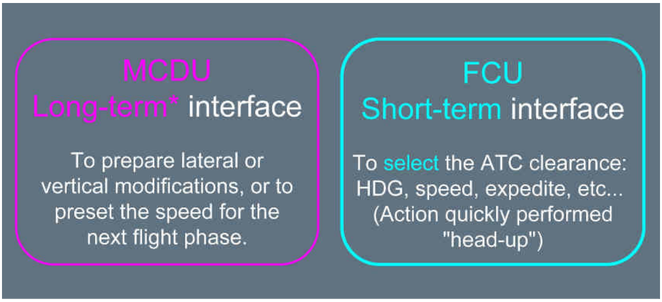
The choice of mode is a strategic decision that is taken by the PF.

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

Ident.: AS-FG-10-1-00016421.0001001 / 20 MAR 17
Applicable to: ALL



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

OPERATIONAL TECHNIQUES

With the FMS, anticipate flight plan updates by preparing:
- EN ROUTE DIVERSIONS
- DIVERSION TO ALTN
- CIRCLING
- LATE CHANGE OF RWY

This enables the MCDU to be used for short-term actions.

AP/FD MONITORING

Ident.: AS-FG-10-1-00016422.0001001 / 20 MAR 17
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 change. The flight crew uses the FCU or MCDU 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:
- If in managed mode, select the desired target
- Or, disengage the autopilot, and fly the aircraft manually.

RECOMMENDED PRACTICE FOR AUTOPILOT (AP) ENGAGEMENT

Ident.: AS-FG-10-1-00016423.0001001 / 20 MAR 17
Applicable to: ALL

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

Ident.: AS-FG-10-1-00016424.0001001 / 04 NOV 20
Applicable to: ALL

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

Therefore:
- Fly a centered FD or follow FPD orders,
- If not using FD or FPD orders, set the FDs to OFF. 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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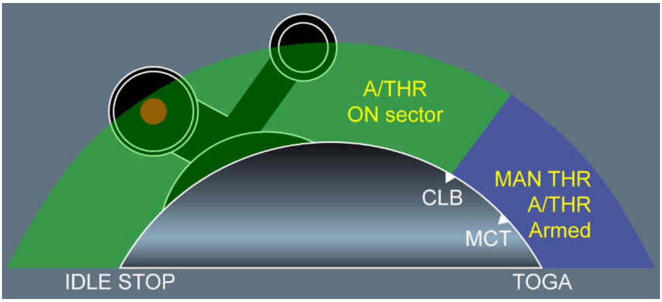
Ident.: AS-FG-10-2-00019308.0001001 / 03 NOV 21
Applicable to: ALL

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 Angle, 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).



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.

DURING APPROACH

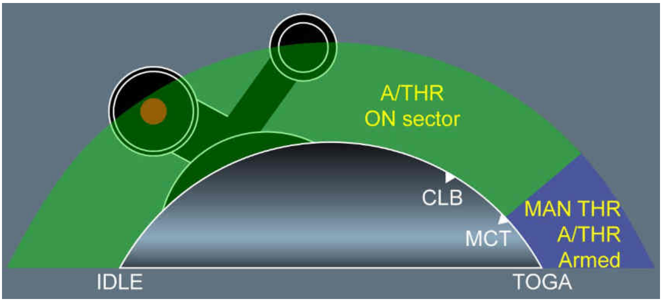
The flight crew should use autothrust for approaches. On final approach, it usually gives more accurate speed control, although in turbulent conditions the actual airspeed may vary from the target speed, by as much as 5 kt. Although the changeover between auto and manual thrust is easy to make with a little practice, the flight crew should, when using autothrust for the final approach, keep it engaged until the flight crew retards the thrust levers to idle for touchdown. If the flight crew is going to make the landing using manual thrust, the flight crew should disconnect the A/THR by the time the flight crew has reached 1 000 ft on the final approach.
If the flight crew makes a shallow flare, with A/THR engaged, it will increase thrust to maintain the approach speed until the flight crew pulls the thrust levers back to idle. Therefore, the flight crew

should avoid making a shallow flare, or should retard the thrust levers as soon as it is no longer necessary to carry thrust, and if necessary before the flight crew receives the “retard” reminder. Although use of the autothrust is recommended for the entire approach, this does not absolve the flight crew from their responsibility to monitor its performance, and to disconnect it if it fails to maintain speed at the selected value.

OPERATIONS WITH ONE ENGINE INOPERATIVE

Ident.: AS-FG-10-2-00019309.0001001 / 26 JUL 17
Applicable to: ALL

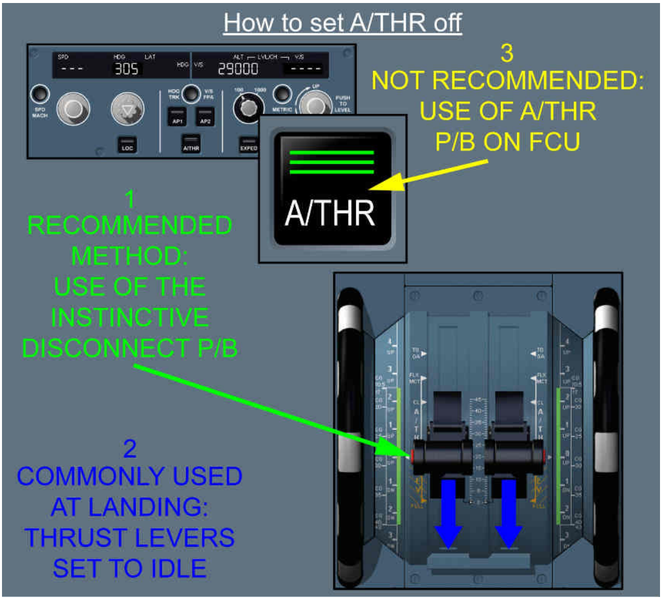
The flight crew can continue using A/THR after an engine failure. The A/THR can only be active, when the thrust levers are set between IDLE and MCT.



In the case of an engine failure, the thrust levers will be in MCT detent for the 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).
With AP OFF, pilots may feel that the directional control is more difficult because the A/THR changes the thrust setting. The choice between using, or not using A/THR after engine failure is a personal one. As far as speed control is concerned, the A/THR is usually more accurate than a pilot.

TO SET AUTOTHRUST TO OFF

Ident.: AS-FG-10-2-00019310.0001001 / 04 SEP 18
Applicable to: ALL

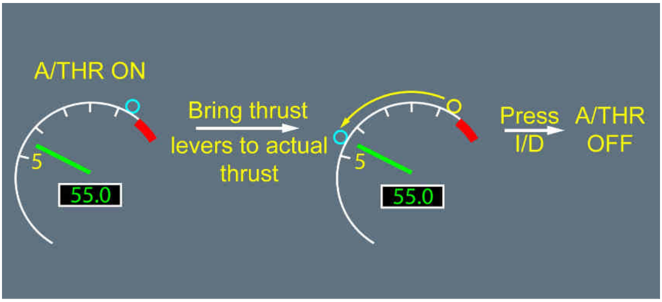


1) USE OF INSTINCTIVE DISCONNECT (I/D) PUSHBUTTON

If the I/D pb is pressed when the thrust levers are in CL detent, thrust will increase to MAX CL. This will cause an unwanted thrust increase and may destabilize 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 TLA symbol on the thrust gauge
- Press the I/D pb
- Check that “AUTO FLT A/THR OFF” is displayed on the ECAM, and that there is no annunciator in the first column of the FMA.
- Adjust the autothrust as required.

This technique minimizes thrust discontinuity, when setting A/THR to 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 rapidly 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 "AUTO FLT A/THR LIMITED" message.

3) USE OF THE A/THR PUSHBUTTON

Use of the A/THR 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 on the FMA
- The AUTO FLT A/THR OFF ECAM alert is triggered
- The ENG THRUST LOCKED ECAM alert is triggered, if the thrust levers are not moved within 5 s.

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 I/D pb are inoperative.

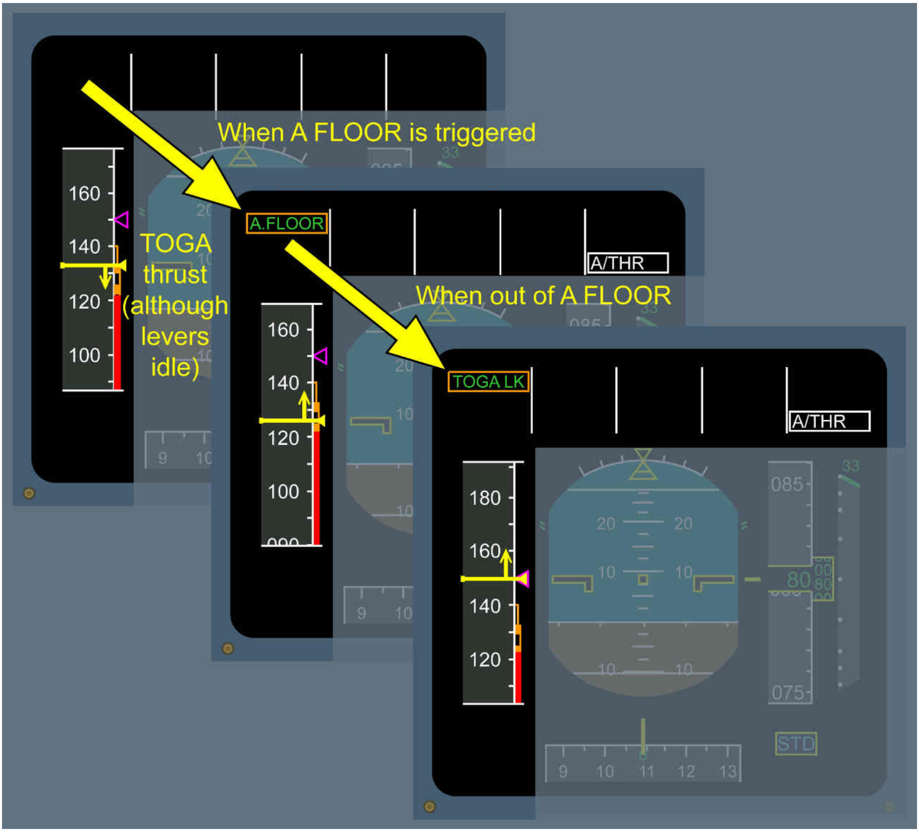
ALPHA FLOOR

Ident.: AS-FG-10-2-00019311.0001001 / 20 MAR 17
Applicable to: ALL

When the aircraft's angle-of-attack 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.



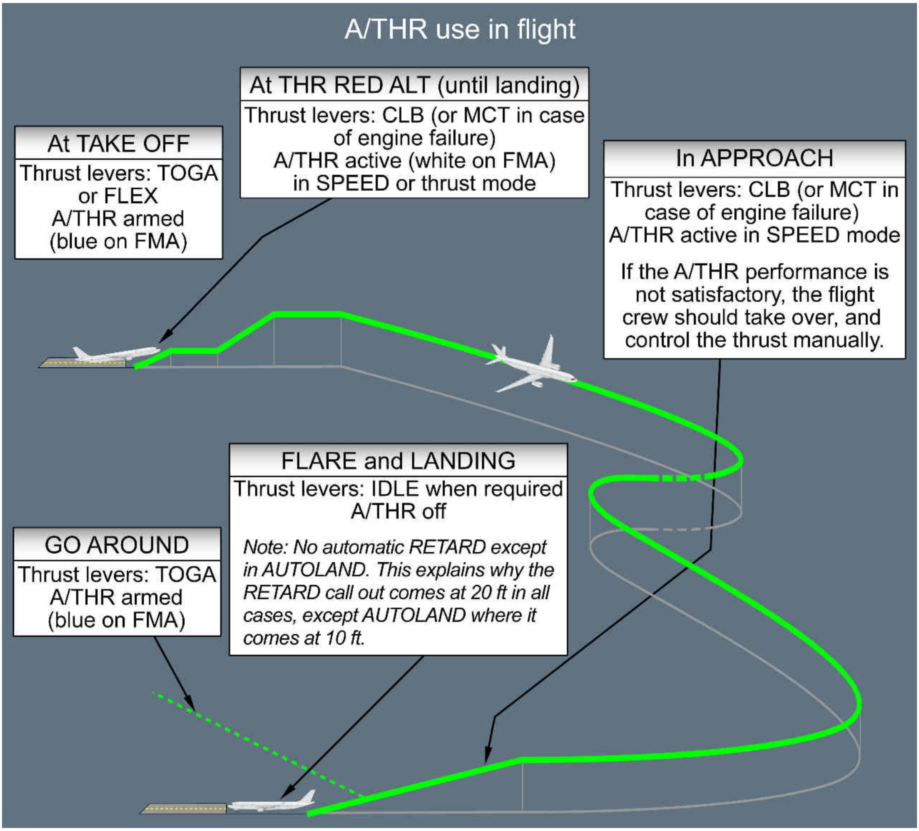
When the speed decreases, so that the angle-of-attack reaches the ALPHA FLOOR threshold, A/THR activates and orders TOGA thrust, despite the fact that the thrust levers are at IDLE.
When the aircraft accelerates again, the angle-of-attack drops below the ALPHA FLOOR threshold. TOGA thrust is maintained or locked. 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 lift off to 100 ft RA at landing. It is inhibited in some cases of engine failure.

A/THR USE SUMMARY

Ident.: AS-FG-10-2-00019313.0001001 / 20 MAR 17
Applicable to: ALL

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.

However, use of manual thrust is recommended when the autotrim function is lost. The aim of this recommendation is to avoid large thrust changes.



A/THR should be monitored via the:
- FMA – SPEED / SPEED TREND on the PFD
- N1/N1 command (EPR) on the ECAM E/WD.

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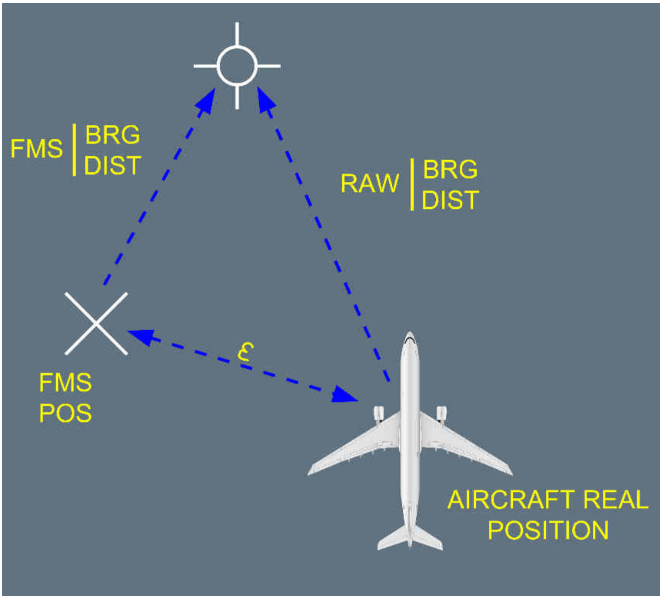
NAVIGATION ACCURACY

Ident.: AS-FM-10-00019691.0001001 / 20 MAR 17
Applicable to: ALL

NAVIGATION ACCURACY CROSSCHECK TECHNIQUE

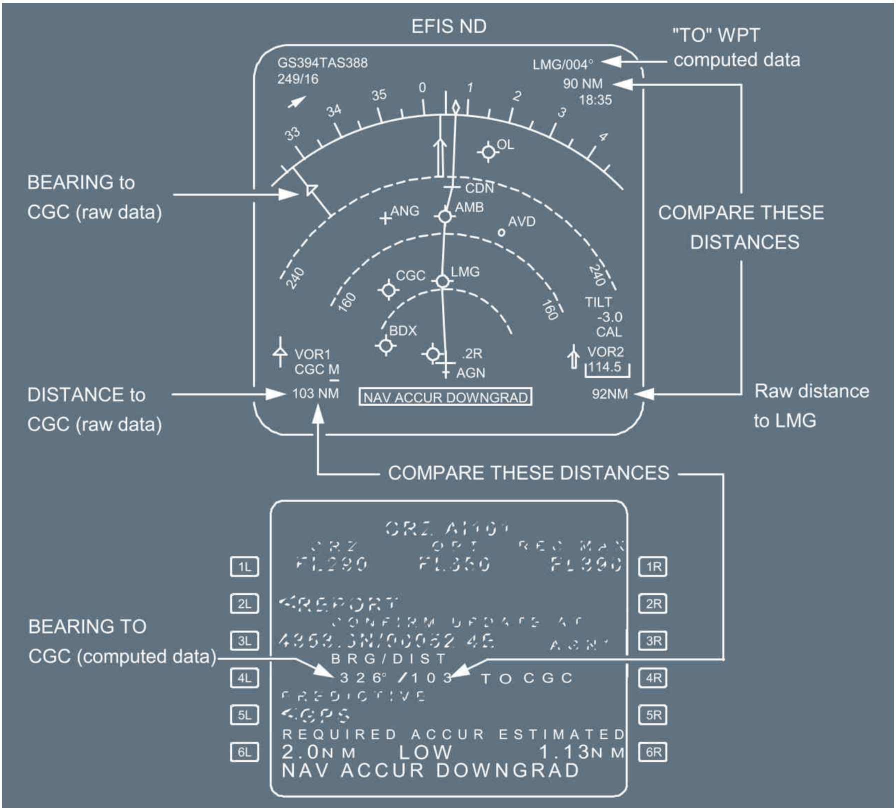
The principle consists in comparing the FMS position with the RADIO position (aircraft real position).

Navigation Accuracy Crosscheck



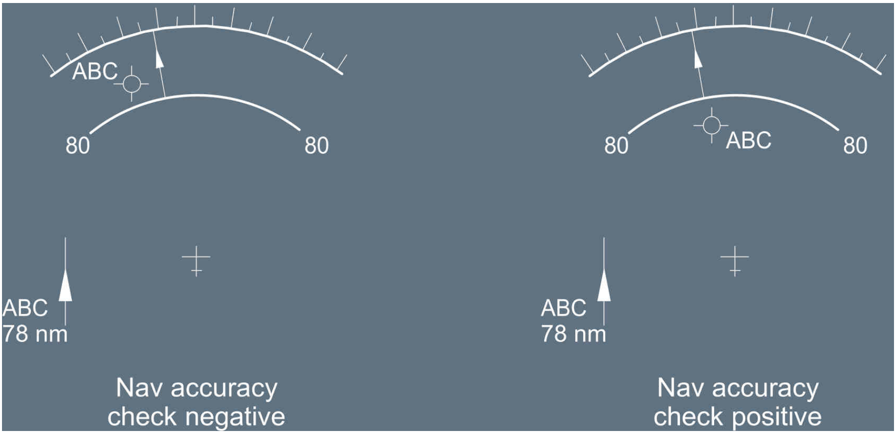
The flight crew inserts a radio ident in the MCDU PROG page that provides a bearing/distance in relation to the FMS position. They then compare these values with the raw data received from the navaid, that indicates the real position of the aircraft. This enables the flight crew to quantify the error ε.

Navigation Accuracy Crosscheck Technique



On the ND, the flight crew may compare 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).

Navigation Accuracy Crosscheck Technique on the ND



In area with high magnetic variation change, this comparison of bearings may not be adequate.

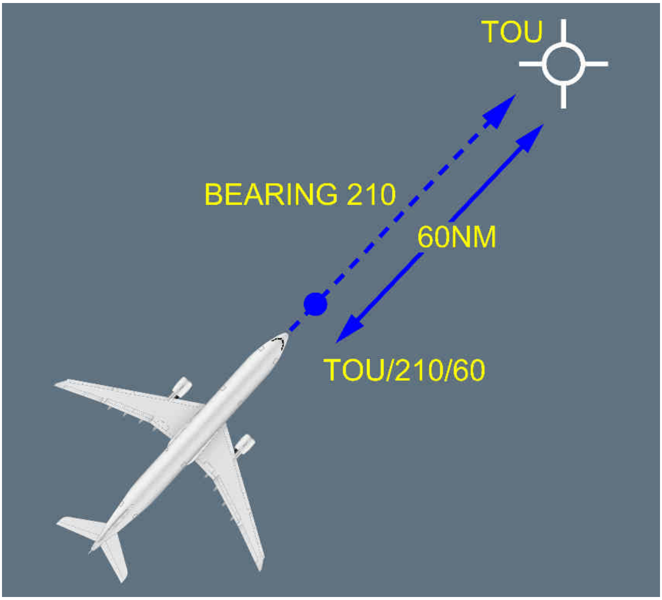
POSITION UPDATE

In the case of an obvious and major map shift, indicated by messages, such as "CHECK A/C POSITION, FM1/FM2 POS MISMATCH", the aircraft position may be updated on the MCDU PROG page. There are two possible techniques:

The recommended technique is to update the FMS over a beacon by pressing the 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 EPE is automatically set to a higher value and the navigation accuracy is low.

The second technique consists of updating the FM 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 ° error on bearing.

FM Position Update in Flight



ZFW - ZFWCG ENTRY ERRORS

Applicable to: ALL

Ident.: AS-FM-10-ZFW-00019692.0001001 / 20 MAR 17

GENERAL

Before engine start, the FMGC computes the aircraft's Gross Weight (GW) and Center of Gravity (CG). After engine start, both the Flight Envelope Computer (FE) and the Fuel Control and Monitoring Computer (FCMC) calculate the GW and CG.

These GW and CG values provide information for:
- Aircraft GW and CG displays
- FM predictions and speeds
- The AP/FD and flight control laws
- The calculation of the VS1G
- The calculation of the characteristic speeds (VLS, F, S, GD), for display on the PFD
- CG control

If a ZFW or ZFWCG is not correctly entered on the INIT B page of the MCDU, this results in calculation errors.

Ident.: AS-FM-10-ZFW-00019693.0001001 / 25 JUL 17

TECHNICAL BACKGROUND

To calculate the GW and CG:

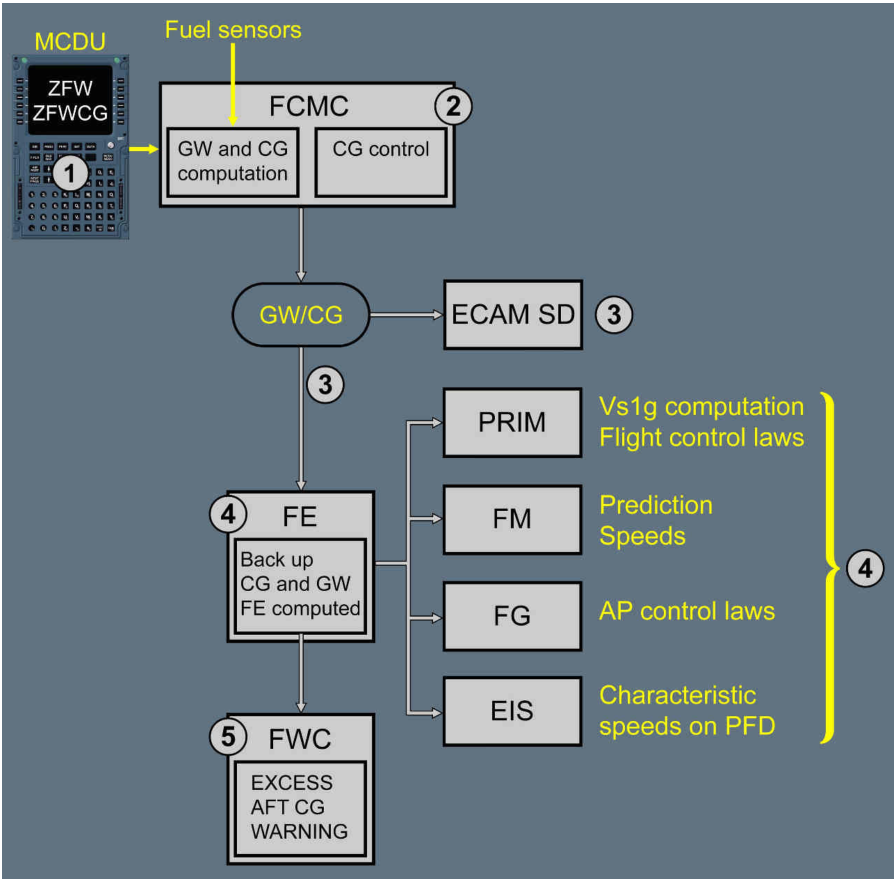
1. The pilot enters the ZFW and ZFWCG on the INIT B page of the MCDU.
2. The FCMC calculates the GW and CG by taking into account the ZFW and ZFWCG (entered on the INIT B page of the MCDU), and the quantity of fuel in each tank.

   The GW and CG, calculated by the FCMC, are:
   - Used by the FCMC to regulate the center of gravity
   - Transmitted to the ECAM SD for display
   - Transmitted to the FE.
3. The FE transmits the GW and CG to the:
   - FM, for predictions and speeds
   - PRIM, for the computation of the VS1G and for flight control laws
   - FG, for the AP/FD control laws
   - EIS, for the display of characteristic speeds

   Note:
   - *The FE computes a backup:*
     - *GW, with aerodynamic data or from Fuel Used (FU) data*
     - *CG, with aerodynamic data, and the THS position.*

     If FCMC data are available, the GW and CG FCMC computed are used.
     If FCMC data are not available, the GW and CG FE computed are used.
     However, if the FCMC-computed CG, and the FE-computed CG differs more than a specified threshold, the PRIM uses 30 % CG for flight control laws.
   - *The FE uses VS1G from the PRIM to compute characteristic speeds (VLS , F, S, GD). These speeds are displayed on PFD.*
   - *For the calculation of ValphaPROT, ValphaMAX, and VSW, the PRIM uses AOA data only.*
4. The FE-computed CG is used to trigger the Excess AFT CG warnings of the FWC. This works independently from the FCMC.

GW and CG Computation and Use



Ident.: AS-FM-10-ZFW-00019694.0001001 / 20 MAR 17

ZFW ENTRY ERROR AND OPERATIONAL CONSEQUENCES

The following summarizes the impact of erroneous ZFW or ZFWCG entries on the INIT B page of the MCDU:

ERRONEOUS ZFWCG ENTRY

If the ZFWCG entry is not correct, the FCMC-computed CG will not be correct, and:
- An erroneous CG appears on both the SD page of the ECAM, and on the FUEL PRED page of the MCDU.
- Affects CG regulation.
  However, the EXCESS AFT CG warning remains reliable.
- Slightly affects FM predictions.
- Impacts the VLS and VAPP speeds, that appear on the PERF APPR page of the MCDU (A340-500/600 only).
- The pitch trim setting may not be correct at takeoff.
- The PRIM operates with a CG of 30 % in flight.
  However, this will have a very small effect on aircraft handling.
- Slightly affects AP/FD control laws.
- Impacts the VLS that appears on the PFD (A340-500/600 only).

However, ValphaPROT, ValphaMAX, VSW are not affected, because they are calculated on the basis of aerodynamic data.

ERRONEOUS ZFW ENTRY

If the ZFW entry is not correct, the FCMC-computed GW and, to a lesser degree, the CG will not be correct, and:
- Erroneous GW and CG appear on both the ECAM and on the FUEL PRED page of the MCDU.
- Slightly affects CG regulation, because the aft CG target depends on the weight. However the EXCESS AFT CG warning remains reliable.
- May affect the SRS guidance mode (If VLS is greater than the V2 that is entered on the PERF TO page of the MCDU).
- Affects FM predictions and speeds.
- Slightly affects FG and the PRIM control laws
- Affects the characteristic speeds that appear on the PFD.

However, ValphaPROT, ValphaMAX, VSW are not affected, because they are calculated on the basis of aerodynamic data.

ERRONEOUS FUEL ON BOARD (FOB) ENTRY

If the FOB entry is not correct, the GW and CG will not be correct until the engines are started, and all of the above-mentioned consequences apply. When the engines are started, fuel figures are updated and applicable data is also updated accordingly.

Ident.: AS-FM-10-ZFW-00019695.0001001 / 20 MAR 17

OPERATIONAL RECOMMENDATIONS

It is possible to limit the number of ZFW or ZFWCG entry errors by applying the following recommendations:

- If the flight crew performs a manual refuelling, the flight crew should carefully check the CG calculation, because the load and trim sheet CG is calculated on the basis of the standard distribution of fuel
- Both flight crewmembers should crosscheck ZFW and ZFWCG entries
- The CG on the load and trim sheet should be compared with the CG on the ECAM.

If the flight crew detects a GW error in flight (e.g. a characteristic speeds error), then a GW update can be made via the FUEL PRED page of the MCDU.

GENERAL

Ident.: AS-RUD-00019316.0001001 / 20 MAR 17
Applicable to: ALL

In flight, the rudder controls the yaw, and the vertical stabilizer ensures directional stability. The rudder and the vertical stabilizer are designed to:
- Provide sufficient lateral/directional control of the aircraft during crosswind takeoffs and landings, within the certified crosswind limits
- Provide aircraft control in the case of an engine failure, and maximum asymmetric thrust at any speed above the minimum control speed on ground (VMCG).

Flight crew controls the rudder via a conventional mechanical rudder control. Primary (PRIM) and Secondary (SEC) computers provide :
- Yaw damping
- Rudder travel limitation

For more information about yaw control, *Refer to FCOM/DSC-27-10-20 Yaw Control - General*

OPERATIONAL RECOMMENDATIONS

1 Ident.: AS-RUD-00019317.0004001 / 03 SEP 19
Criteria: 27-4211, LR
Applicable to: HB-JMC, HB-JMD

In order to avoid excessive structural loads on the rudder and on the vertical stabilizer, the flight crew must apply the following operational recommendations.

THE RUDDER IS DESIGNED TO CONTROL THE AIRCRAFT, IN THE FOLLOWING SITUATIONS

A. IN NORMAL OPERATIONS, FOR LATERAL CONTROL

- During the take off roll, when on ground, especially in crosswind conditions,
- During landing flare with crosswind, for decrab purposes,
- During the landing roll, when on ground.

In these circumstances, large and even rapid rudder inputs may be necessary, in order to obtain the appropriate aircraft response.
The flight crew should always apply the rudder corrections as necessary, in order to obtain the appropriate aircraft response.
On Airbus aircraft, the rudder control system includes a turn coordination function to achieve acceptable turn coordination

B. TO COUNTERACT THRUST ASYMMETRY

Up to full rudder deflection can be used to compensate for the yawing moments that are due to asymmetric thrust.

Note: At high speed (i.e. slats retracted), thrust asymmetry (eg. due to an engine failure) does not have a significant effect on the yaw control of the aircraft. The rudder deflection required to counter an engine failure and center the sideslip is small.

C. IN SOME OTHER ABNORMAL SITUATIONS

The flight crew may also use the rudder pedals in some abnormal situations. For example :
- Loss of both yaw damper systems: The flight crew uses the rudder pedals as deemed necessary, for turn coordination to prevent excessive sideslip;
- Rudder trim runaway: The flight crew uses the rudder pedals in order to return the rudder to neutral
- Landing with abnormal landing gear position: The flight crew uses the rudder pedals for directional control on the ground.

In all of the normal or abnormal situations that are described above, correct rudder pedals use does not affect the structural integrity of the aircraft.

THE RUDDER SHOULD NOT BE USED

- To induce roll, or
- To counter roll, induced by any type of turbulence.

Regardless of the airborne flight condition, aggressive, full or nearly full, opposite rudder pedal inputs must not be applied. Such inputs can lead to loads higher than the limit, and can result in structural damage or failure. The rudder travel limiter function is not designed to prevent structural damage or failure in the event of such rudder system inputs.

Note: The Operator policy must never include rudder pedal reversions. This restriction also applies to the so-called "aircraft defensive maneuvers" in order to disable or incapacitate hijackers.

For dutch roll, the flight control laws combined with the natural aircraft damping are sufficient to correctly damp the dutch roll oscillations. Therefore, the flight crew should not use the rudder pedals in order to complement the flight control laws.

STOP RUDDER INPUT AURAL ALERT

The "STOP RUDDER INPUT" aural alert is triggered when inappropriate rudder inputs are detected. This alert warns the flight crew to avoid excessive rudder pedal command to prevent rudder overload.

CAUTION	Avoid large and rapid rudder inputs.

OPERATIONAL RECOMMENDATIONS

Ident.: AS-RUD-00019317.0001001 / 20 MAR 17
Criteria: LR
2 **Applicable to: HB-JME, HB-JMF, HB-JMG**

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- Rudder trim runaway: The flight crew uses the rudder pedals in order to return the rudder to neutral
- Landing with abnormal landing gear position: The flight crew uses the rudder pedals for directional control on the ground.

In all of the normal or abnormal situations that are described above, correct rudder pedals use does not affect the structural integrity of the aircraft.

Note: In the event of a rudder travel limit system failure, refer to the relevant RUDDER TRAVEL LIMIT FAULT procedure (Refer to FCOM/PRO-ABN-F_CTL F/CTL RUD TRV LIM FAULT).

THE RUDDER SHOULD NOT BE USED

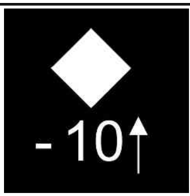
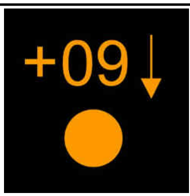
- To induce roll, or
- To counter roll, induced by any type of turbulence.

Regardless of the airborne flight condition, aggressive, full or nearly full, opposite rudder pedal inputs must not be applied. Such inputs can lead to loads higher than the limit, and can result in structural damage or failure. The rudder travel limiter system is not designed to prevent structural damage or failure in the event of such rudder system inputs.
For dutch roll, the flight control laws combined with the natural aircraft damping are sufficient to correctly damp the dutch roll oscillations. Therefore, the flight crew should not use the rudder pedals in order to complement the flight control laws.

Note: Even if both yaw damper systems are lost, the rudder should not be used to dampen the dutch roll. Refer to the YAW DAMPER FAULT procedure (Refer to FCOM/PRO-ABN-F_CTL F/CTL RUD TRV LIM FAULT).

INTRUDER CLASSIFICATION

Ident.: AS-TCAS-00016448.0001001 / 10 MAY 22
Applicable to: ALL

Intruder	**Display on ND**(1)	**Type of collision threat**	**Aural warning**	**Flight crew response**		
				Without AP/FD TCAS	**AP/FD TCAS without AP**	**AP/FD TCAS with AP**
No threat traffic or others		No threat	-	-	-	-
Proximate		Consider as No threat	-	-	-	-
Traffic Advisory (TA)		Potential threat	"TRAFFIC TRAFFIC"	No evasive maneuver	Monitor AP/FD TCAS mode arming. No evasive maneuver	

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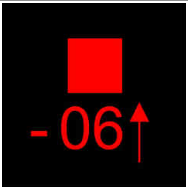
Continued from the previous page

Intruder	Display on ND(1)	Type of collision threat	Aural warning	Flight crew response		
				Without AP/FD 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 your flight path and keep V/S out of red sector	Follow the FDs. Monitor V/S remains out of red area. (2)	Monitor V/S remains out of red area. (2)
			Corrective, e.g. "CLIMB"	Smoothly and firmly (0.25 g) follow VSI green sector within 5 s	Smoothly and firmly follow the FDs. Monitor V/S gets out of red area, and remains in green area. (2)	Monitor V/S gets out of red area, and remains in green area. (2)
			Corrective, e.g. "CLIMB NOW" or "INCREASE CLIMB"	Smoothly and firmly (0.35 g) follow VSI green sector within 2.5 s	Smoothly and firmly follow the FDs. Monitor V/S gets out of red area, and remains in green area. (2)	Monitor V/S gets out of red area, and remains in green area. (2)

(1) *If the aircraft is equipped with ATSAW, the TCAS symbol is superimposed on aircraft symbol.*

(2) *In AP/FD TCAS mode, the load factor authority of the guidance law is increased.*

Note: *In some dynamic situation the TCAS may generate an RA without a previous TA. Such situation is linked to a rapid change in the Intruder Detection Category.*

OPERATING TECHNIQUES

Applicable to: ALL

Ident.: AS-TCAS-10-00019338.0001001 / 12 MAY 22

ALL is the default selection. The flight crew may select another mode depending on the situation. For more information, *Refer to FCOM/DSC-34-20-60-20 ATC/TCAS Panel*.

TA shall be selected in the case of:
- Engine failure
- Known nearby traffic, which is in visual contact

- Flight with landing gear down
- Operations at specific airports, and during specific procedures that an operator identifies as having a significant potential for not wanted and not appropriate RAs, e.g. closely spaced parallel runways, converging runways.

The flight crew should comply with the vertical speed limitations during the last 2 000 ft of a climb or descent. In particular, the flight crew should limit vertical speeds to 1 500 ft/min during the last 2 000 ft of a climb or descent, especially when they are aware of traffic that is converging in altitude and intending to level off 1 000 ft above or below the flight crew's assigned altitude.

If a TA is generated:
- The PF announces: "TCAS, I have control"
- No evasive maneuver should be initiated, only on the basis of a TA.

If a RA is generated:
- The flight crew must always follow the TCAS RA orders in the correct direction, even:
  - If the TCAS RA orders are in contradiction with the ATC instructions
  - At the maximum ceiling altitude with "CLIMB, CLIMB" or "INCREASE CLIMB, INCREASE CLIMB" TCAS RA orders
  - If it results in crossing the altitude of the intruder.

CAUTION	If the flight crew does not follow a RA, the flight crew should be aware that the intruder may be TCAS equipped and may be maneuvering toward the aircraft in response to a coordinated RA. This could compromize safe separation.

- The PF disconnects the AP, and smoothly and firmly follows the VSI green sector within 5 s, and requests that both FDs be disconnected

  Note: *Both FDs must be disconnected when APs are disconnected:*
  - *To ensure autothrust speed mode*
  - *To avoid possible confusion between FD bar orders and, TCAS aural, and VSI orders.*

- The PM disconnects both FDs, but will not try to see intruders
- The PF will avoid excessive maneuvers, and keep the V/S outside the red area of the VSI and within the green area. If necessary, the PF must use the full speed range between Valpha max and VMAX
- The PM must notify ATC
- The flight crew should never maneuver in the opposite direction of the RA, because TCAS maneuvers are coordinated.

If any CLIMB RA (For more information *Refer to FCOM/DSC-34-20-60-20 Aural Messages*) is generated when the aircraft is in approach in CONF 3 or FULL:
- The flight crew perform a go-around and follow the SRS orders
- The AP and FD can be kept engaged during the go-around
- During the go-around, the flight crew check that the vertical speed remains out of the red area of the vertical speed scale, and take over if necessary. For example, the flight crew should take over if the vertical speed gets back to the red area of the vertical speed scale when the aircraft intercepts the FCU selected altitude.

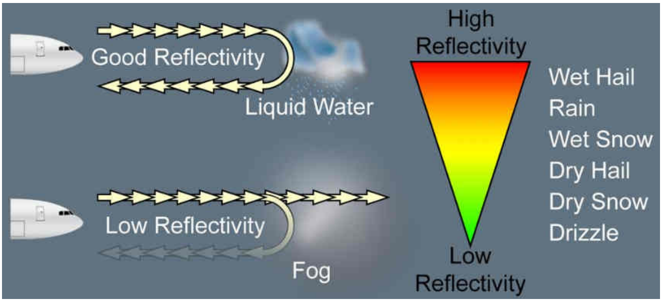
When clear of conflict:
- The flight crew must resume normal navigation, in accordance with ATC clearance, and using the AP/FD, as required.

GENERAL

Ident.: AS-WXR-00019333.0001001 / 20 MAR 17
Applicable to: ALL

This FCTM chapter provides basic knowledge on the use of onboard weather radars. To get all the information on the characteristics, limitations and operational recommendations of each radar, refer to the user guide of the radar manufacturer.
Weather detection is based on the reflectivity of water droplets. The weather echo appears on the ND with a color scale that goes from red (high reflectivity) to green (low reflectivity).
The intensity of the weather echo is associated with the droplet size, composition and quantity (e.g. the reflectivity of a water particle is five times more than an ice particle of the same size). The flight crew must be aware that 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).

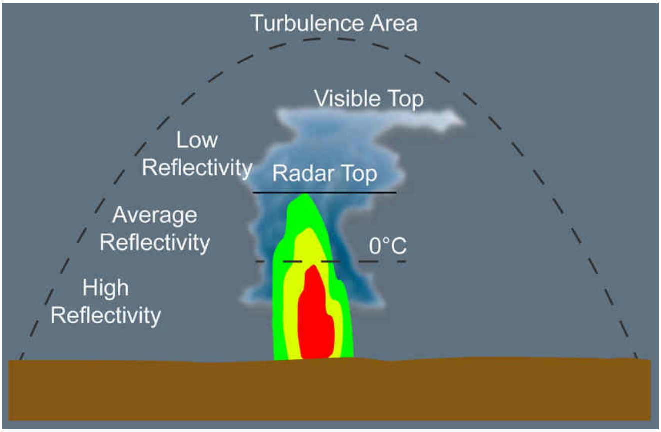
Weather Radar Principle



The purpose of the weather radar is to help the flight crew detect and avoid storm cells (e.g. cumulonimbus). Due to its large vertical expansion, a storm cell does not have the same reflectivity depending on the altitude. The quantity of liquid water in the atmosphere decreases with the altitude. Therefore the reflectivity of a storm cell decreases with the altitude.
The upper detection limit of the weather radar is called the radar top.
The flight crew must be aware of both of the following:

- The radar top is not the visible top of the storm cell
- The storm cell and associated turbulence extend significantly above the radar top.

Reflective Image of a Cumulonimbus



WEATHER DETECTION

Ident.: AS-WXR-00019334.0001001 / 03 NOV 22
Applicable to: ALL

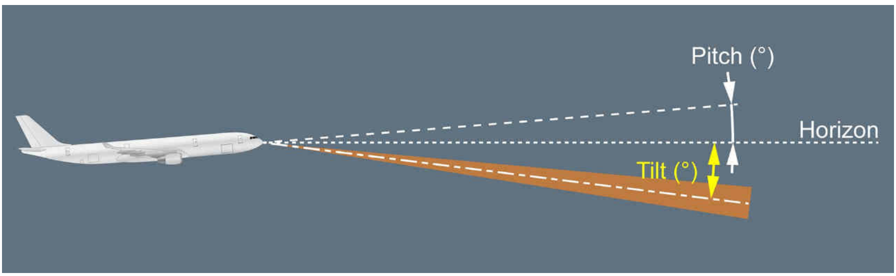
The flight crew uses the following controls and functions to operate the weather radar:

- TILT
- GAIN
- RANGE.

MANUAL TILT MANAGEMENT

The tilt refers to the angle between the antenna beam centerline and the horizon.
The radar uses data from the IRS to stabilize its antenna. Therefore, the antenna tilt is independent of the aircraft pitch and bank angle.

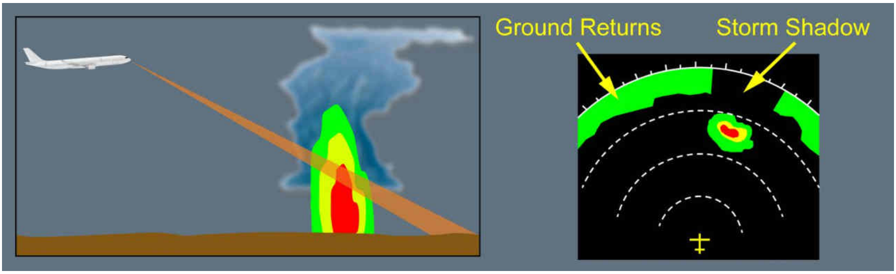
Tilt Angle Definition



The flight crew should regularly scan the area ahead of the aircraft, at several ND ranges. In order to identify the strongest weather returns, the flight crew should tilt the weather radar antenna up and down.
To obtain a correct display of a storm cell, the flight crew must use the tilt knob to point the weather radar beam to the most reflective part of the storm cell. A correct tilt setting prevents the overscanning of the storm cell.

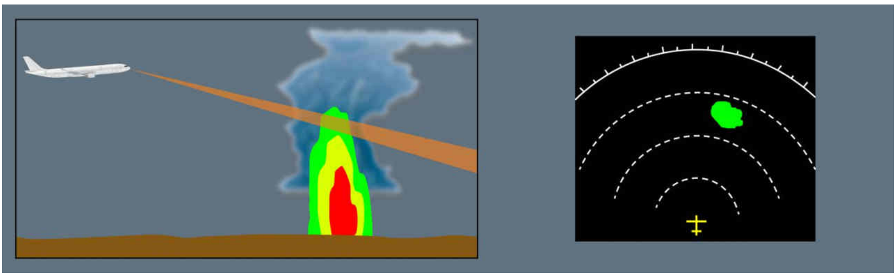
Note: *Common practice is to ensure that the ground return is at the top of the ND screen.*

Correct Storm Display



At high altitude, a storm cell may contain ice particles that have low reflectivity. If the tilt setting is not correct, the ND may display only the upper (less reflective) part of a storm cell (overscanning). As a result, the flight crew may underestimate or not detect a storm cell.

Overscanning



GAIN SETTING FOR WEATHER DETECTION

The flight crew should use the calibrated gain (CAL or AUTO) for weather detection as default mode for the weather radar. The use of the calibrated gain ensures a standard display of the colors on the ND. The flight crew can manually tune the gain to analyze storm cells. *Refer to AS-WXR Analysis of Weather Radar Data*.

RANGE MANAGEMENT

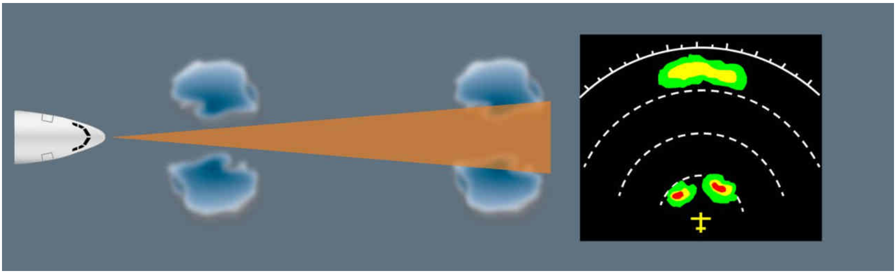
The flight crew should monitor both the long-distance and short-distance weather, in order to be able to efficiently plan appropriate course changes, and to avoid the “blind alley effect”. *Refer to AS-WXR Analysis of Weather Radar Data*.

At long distance ahead of the aircraft, the accuracy of the weather displayed is low, due to both of the following:

- The increase in the width of the weather radar beam
- Signal attenuation.

Therefore, the accuracy of the weather displayed is better for short-distance weather.

Accuracy of the Weather Display



USE OF THE WEATHER RADAR IN ACCORDANCE WITH THE FLIGHT PHASE

Manual Tilt

Manual Weather Radars (or Automatic Weather Radars in Manual Tilt Mode)		
Flight Phase	**Tilt Setting**	**Comments**
TAXI / TAKEOFF	Manually and gradually tilt up to scan weather (maximum 15 ° up). Then set tilt to 4 ° up.	Check the departure path.
CLIMB	Adjust the ND range as required and decrease the tilt angle as the aircraft climbs.	Compensation of the altitude increase to avoid overscanning.
LEVEL FLIGHT/CRUISE	1. Adjust ND range as required 2. Regularly modify the tilt to scan the weather ahead of the aircraft 3. When the weather scan is completed, adjust the tilt so that the ground returns appear on the top of the ND [(2)] [(3)].	In cruise, the combination of the following ND ranges provides good weather awareness[(1)]: - 160 NM on the PM ND - 80 NM on the PF ND. Use shorter ND ranges to track/avoid short-distance weather.

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Manual Weather Radars (or Automatic Weather Radars in Manual Tilt Mode)		
Flight Phase	**Tilt Setting**	**Comments**
DESCENT	During descent, adjust the tilt to maintain the ground returns on the top of the ND.	-
APPROACH	Set the tilt to 4 ° up.	This tilt setting (4 ° up) prevents the display of too many ground returns.

(1) For aircraft equipped with a manual weather radar that has only one tilt control knob, use an average tilt value to suit both ND ranges.

(2) It is difficult to identify the difference between weather returns and ground returns: A change in the tilt setting causes the shape and color of ground returns to rapidly change. These ground returns eventually disappear. This is not the case for weather returns.

(3) For flights above the water, there are no ground returns. Therefore, the flight crew can use any of the following tilt settings at cruise altitude as an initial value before adjustment:

- *Approximately -6 ° for an ND range of 40 NM, or*
- *Approximately -2 ° for an ND range of 80 NM, or*
- *Approximately -1 ° for an ND range of 160 NM, or*
- *Approximately -1 ° for an ND range of 320 NM.*

Automatic Tilt Control

Automatic Weather Radars		
Flight Phase	**Tilt Setting**	**Comments**
TAXI / TAKEOFF	Manually and gradually tilt up to scan weather (maximum 15 ° up). Then set tilt to AUTO.	Check the departure path.
IN FLIGHT	Adjust ND range as required. Set tilt to AUTO. Use manual tilt for storm cell analysis, then set tilt back to AUTO. Regularly perform manual scans to enhance weather awareness, then set tilt back to AUTO.	In cruise, the combination of the following ND ranges provides good weather awareness: - 160 NM on the PM ND - 80 NM on the PF ND. Use shorter ND ranges to track/avoid short-distance weather.

ANALYSIS OF WEATHER RADAR DATA

Applicable to: ALL

Ident.: AS-WXR-WXR-00019335.0001001 / 20 MAR 17

ASSESSMENT OF THE VERTICAL EXPANSION OF A STORM CELL

The assessment of the vertical expansion of a detected storm cell enables the flight crew to assess the convective energy of the storm cell and therefore to identify its potential threat.

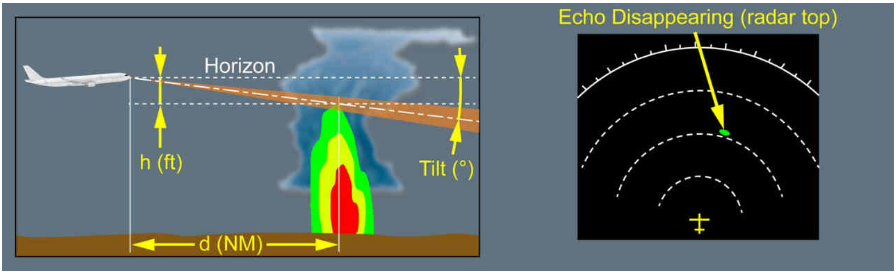
Note: *The flight crew can increase the gain in order to obtain a more visible display of the top of the storm cell (that contains less reflective ice particles).*

When flying towards a cell, the flight crew can estimate the vertical expansion of the cloud above/below the aircraft altitude with the following formula:

$$h(ft) \simeq d(NM) \times Tilt(°) \times 100$$

h(ft) is the difference between the radar top altitude and the aircraft altitude.
d(NM) is the distance between the aircraft and the storm cell.
Tilt(°) is the tilt setting for which the storm cell image disappears from the ND.
Example: a weather return that disappears from the ND at 40 NM with a tilt setting of 1 ° down, indicates that the top of the storm cell is 4 000 ft below the aircraft altitude.

Assessment of the Vertical Expansion of a Storm Cell



Ident.: AS-WXR-WXR-00019336.0001001 / 20 MAR 17

INTERPRETATION OF THE COLORS OF THE WEATHER DISPLAYED ON THE ND

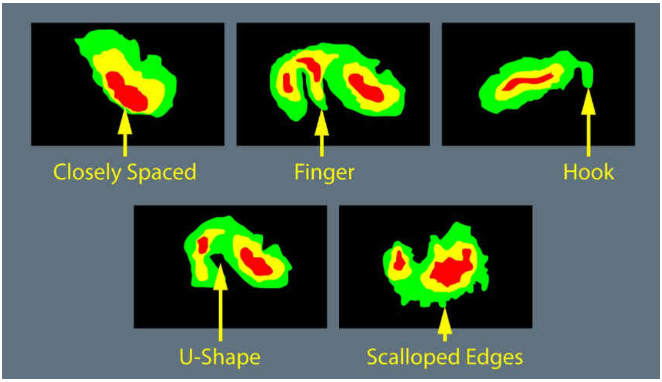
Particle reflectivity of a storm cell is independent of the potential weather hazard in the storm cell. There can be a high percentage of humidity in the atmosphere, when near the sea. In this case, thermal convection will produce clouds that are full of water. These clouds will have a high reflectivity, but may not necessarily be a high threat.
On the other hand, in equatorial overland regions where specific converging winds produce large-scale uplifts of dry air. As a result, these storm cells have lower reflectivity than mid-latitude

storm cells, and therefore can be difficult to detect. However turbulence in, or above these clouds may have a higher intensity than indicated by the image on the weather radar display.
The flight crew must not underestimate a storm cell with a high vertical expansion, even if the weather return is low.

SPECIFIC WEATHER SHAPES

The flight crew should carefully observe shapes, more than colors, in order to detect adverse weather conditions.
Areas of different colors that are near to one another usually indicate zones of severe turbulence.
Some shapes are good indicators of severe hail and signify strong vertical drafts. Shapes that change quickly, whatever form they take, also indicate high weather activity.

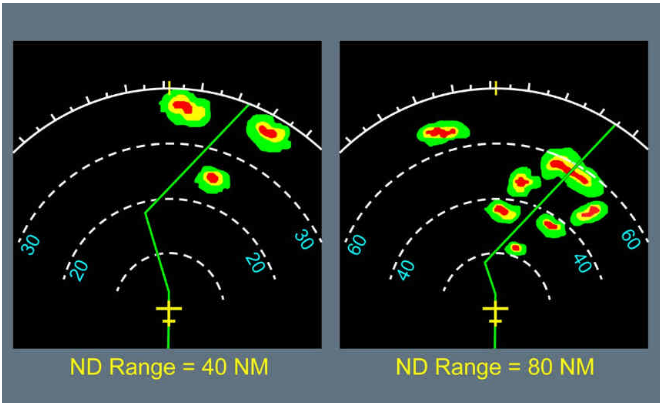
Specific Weather Shapes



BLIND ALLEY EFFECT

The flight crew should determine appropriate course changes to avoid adverse weather conditions, with the use of both high and short ND ranges. This technique avoids the “blind alley effect", defined by the following: a course change that may appear safe with a short ND range, may be blocked when observed with a higher ND range.

Blind Alley Effect



ATTENUATION EFFECT

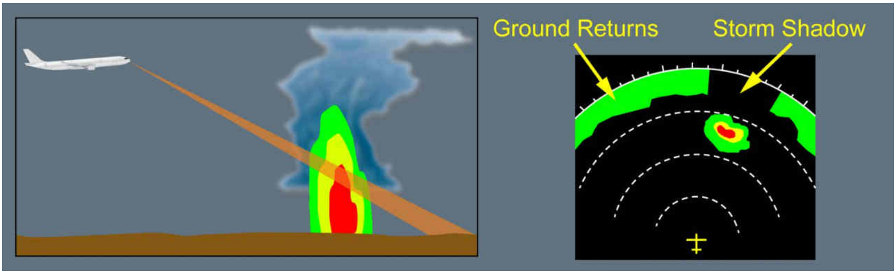
In areas of heavy precipitation, an important part of the weather radar signal is reflected by the frontal part of the precipitation due to its strong reflectivity. Therefore, the area behind the precipitation returns low signals, that appears as green or black areas (storm shadows). Attenuation of long-distance weather or attenuation of ground returns can help the flight crew to identify an area of heavy precipitation that may be a very active storm cell.

Some radars provide an indication on the ND to highlight areas that may be affected by attenuation:

- PAC alert on Collins radars *Refer to FCOM/DSC-34-20-30-30 Weather Radar indication on ND*
- REACT function on Honeywell radars *Refer to FCOM/DSC-34-20-30-30 Weather Hazard Prediction Function Indication on ND*.

Note: *On a weather radar display, the flight crew should always consider a black hole behind a red area as a potentially very active zone.*

Use of Attenuation Effect to Identify an Active Storm Cell

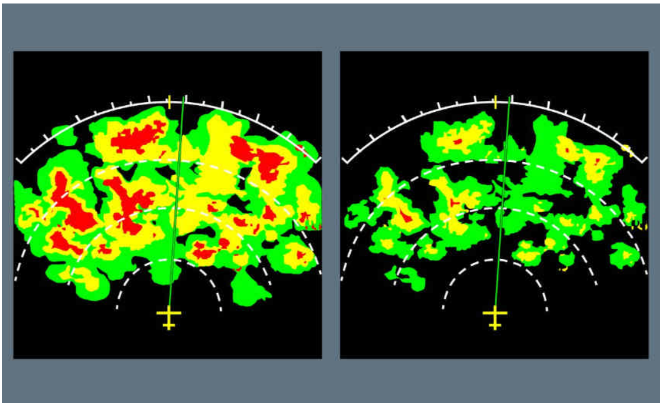


USE OF MANUAL GAIN FOR WEATHER ANALYSIS

To assess the general weather conditions, the flight crew can use manual gain.
Manual gain adjusts the color calibration of the radar. Therefore, the weather will appear either stronger (gain increased) or weaker (gain reduced).
When operating in heavy rain, the weather radar picture can be saturated. In this case, manually reduce the gain will help the flight crew to identify the areas of heaviest rainfall, that are usually associated with active storm cells.

Note: *After a storm cell analysis, the flight crew must set the GAIN knob back to AUTO/CAL.*

Use of Reduced Gain to Identify Heaviest Rainfall



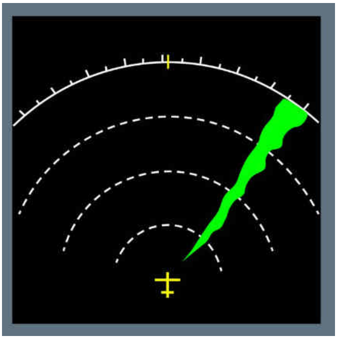
RADAR INTERFERENCE

High power external radio frequency sources that operate at a frequency next to the frequency of the weather radar may create interferences. These interferences may result in a not usual return

display on the ND. The radar return will appear as a single wedge that extends out along the ND toward the source of interference.
The width and color of the interference may differ on the ND, depending on the distance to the source and its strength.
This interference does not damage the radar system, and will disappear as soon as the source of interference is outside the limit of the radar scan zone.

Note: *Radar interference may also be known as 'spoking' or 'alien radar'.*

Radar Interference



OPERATIONS IN CONVECTIVE WEATHER

Ident.: AS-WXR-00019337.0001001 / 26 NOV 19
Applicable to: ALL

The flight crew should apply the following operational recommendations in convective weather conditions. These recommendations are applicable in addition to basic knowledge of meteorology and of operation in adverse weather conditions.

Weather detection:

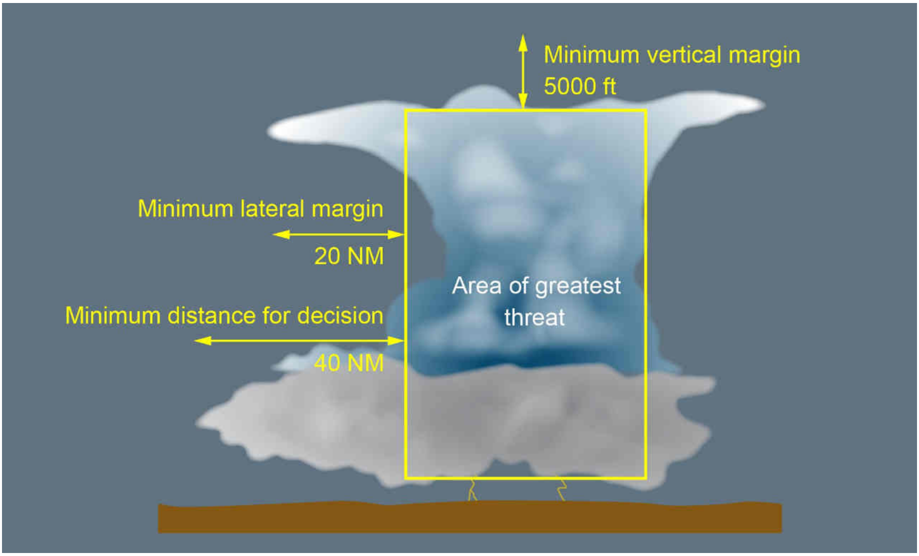
- Always consider that a convective cloud may be dangerous, even if the weather echo is weak. Remember that the weather radar detects only water droplets
- Frequent lightning may indicate an area with high probability of severe turbulence
- Remember that the TURB function detects areas of wet turbulence only

Avoidance decision:

- Establish an "area of greatest threat" based on the locations and shape of the strongest weather radar echoes, and on the meteorological knowledge of the flight crew. This "area of greatest threat" corresponds to the zone where the flight crew estimates that the weather conditions are too dangerous to fly in
- The weather hazard prediction function (if installed) indicates zones with a high probability of weather hazards (hail or lightning). Avoidance of the detected weather always has priority over avoidance of the weather hazards. As a priority, apply the recommendations to avoid storms, and avoid hazard areas as much as possible
- Initiate your avoidance maneuver as early as possible. As the aircraft gets nearer to the convective weather zone, the information from the weather radar often becomes partial. Consider a minimum distance of 40 NM from the convective cloud to make the decision for avoidance maneuver.

Avoidance technique:

- If possible, perform lateral avoidance instead of vertical avoidance. Vertical avoidance is in general not recommended, particularly at high altitude, due to the reduction of buffet and performance margins. In addition, some convective clouds may have a significant and unpredictable build-up speed.
- Lateral avoidance:
  - If possible, deviate upwind instead of downwind. Usually, there is less turbulence and hail upwind of a convective cloud
  - If possible, avoid the identified “area of greatest threat" by at least 20 NM
  - Apply an additional margin if the convective clouds are very dynamic
- Vertical avoidance:
  - Avoid flying below a convective cloud, even in visual conditions, due to possible severe turbulence, windshear, microbursts, lightning strikes and hail. If an aircraft must fly below a convective cloud, the flight crew should take into account all indications (visual judgement, weather radar, weather report, pilot’s report, etc.) before they take the final decision
  - For flight above a convective cloud, apply a vertical margin of 5 000 ft from the identified “area of greatest threat".



ICE CRYSTALS

Ident.: AS-WXR-00020895.0001001 / 06 JUL 17
Applicable to: ALL

GENERAL

Clouds are made of particles of water that can be either liquid or solid. Ice crystals are very small solid water particles. In some areas, there may be a very high concentration of ice crystals that may have adverse effect on the aircraft.
Areas of ice crystals are usually next to, or above the core of convective clouds that have high-intensity precipitation. However, areas of ice crystals may sometimes even be several nautical miles away from the core of the associated convective cloud.
When ice crystals get in contact with a hot surface, they melt. Depending on the type of surface, a water film may appear. On the windshield, this water film creates not-expected appearance of “rain" at temperatures too low for liquid water to exist.
If there is a specific airflow towards a zone of the aircraft where water can build up, accretion may occur and create a block of ice. This is why flight in areas of ice crystals may result in various effects, for example engine vibrations, engine power loss, engine damage, or icing of air data probes.

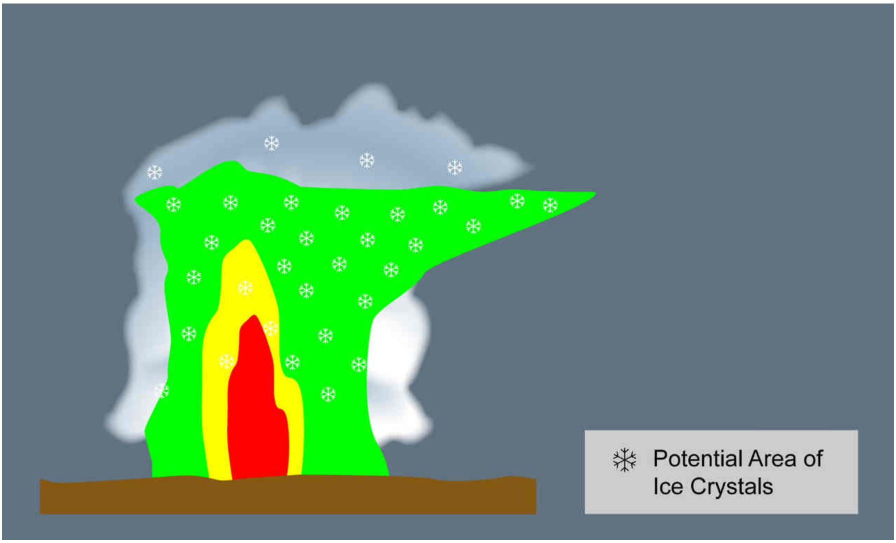
DETECTION OF ICE CRYSTALS

Ice crystals are difficult to detect with the weather radar, because their reflectivity is very low due to both their small size and solid state. In addition, in areas of ice crystals, the flight crew should not expect significant icing of the airframe. This is because ice crystals bounce off cold aircraft surfaces. This is why even the ice detection system does not detect ice crystals, because ice crystals do not build up on ice detectors and visual ice indicators.

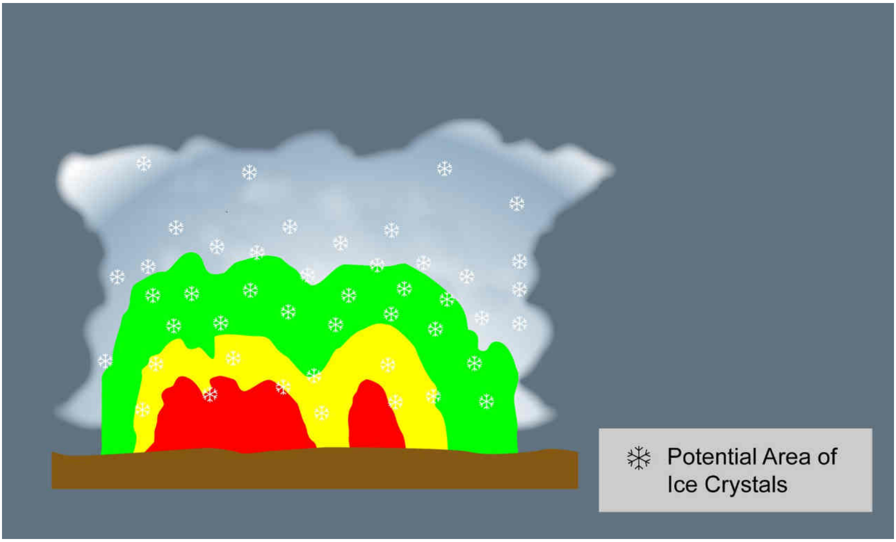
However, areas of ice crystals are usually associated with visible moisture. Ice crystals can be indicated by one or more of the following:

- Appearance of rain on the windshield at temperatures too low for rain to exist. This “rain" is usually associated with a “Shhhh" noise
- Small accumulation of ice particles on wipers
- Smell of ozone or Saint Elmo’s fire
- Aircraft TAT indication that remains near 0 °C (due to freezing of the TAT probe)
- Light to moderate turbulence in IMC at high altitude
- No significant radar echo at high aircraft altitude, combined with:
  - High-intensity precipitation that appears below the aircraft, or
  - Aircraft position downwind of a very active convective cloud.

Isolated Continental Thunderstorm



Mesoscale Convective Cloud



OPERATIONAL RECOMMENDATIONS FOR ICE CRYSTALS

If possible, the flight crew should avoid flight into areas that have a high concentration of ice crystals. The following recommendations apply:

- Use the weather radar:
  - Identify areas that have a strong echo, and perform a detailed analysis of the structure of the convective clouds
  - If necessary, use the weather radar manual modes for a more precise analysis
  - Pay particular attention to strong echoes below the aircraft and to downwind areas.
- To avoid convective clouds, comply with operational recommendations (*Refer to AS-WXR Operations in Convective Weather*), particularly:
  - Prefer lateral to vertical avoidance
  - Comply with the avoidance margins
  - Deviate upwind instead of downwind.

If the aircraft encounters ice crystals precipitation despite avoidance action, and if this results in engines or probes misbehaviors, the published procedures and recommendations apply, and in particular:

- ECAM alerts related to engine failure or engine stall
- ECAM alerts related to probe failure
- QRH procedures such as the ones linked to unreliable airspeed indication, engine vibrations, engine relight in flight…

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PROCEDURES

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PR-NP-GEN General

PR-NP-SOP Standard Operating Procedures

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PR-NP-SOP-110 Before Takeoff

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Localization Title	Toc Index	ID	Reason
PR-NP-GEN Communication	B	1	**Sterile cockpit altitude increased to 15000 ft iso 10000 ft according OM-A policy.**
PR-NP-SOP-120 Takeoff Roll	B	1	**Added comment to clarify feet position of CM1 and CM2 during takeoff roll.**
PR-NP-SOP-120 Takeoff Roll	B	2	Correction of a typo error.
PR-NP-SOP-120 Noise Abatement Departure Procedure	I	3	Documentation update: Deletion of information. Update of title in order to reflect the correct procedure name.
PR-NP-SOP-120 Noise Abatement Departure Procedure	I	4	Addition of a new section "INTRODUCTION" for the NADP.
PR-NP-SOP-120 Noise Abatement Departure Procedure	I	5	Addition of a note to highlight the conditions of application of the procedure.
PR-NP-SOP-190-GUI Circling Approach	E	1	Documentation update: Deletion of information. Documentation update: Information "F.00014179.0001001.008" moved from "F.00014179.0001001.007" to "F.00019758.0001001.057"
PR-NP-SOP-190-GUI Circling Approach	E	2	Update of the Circling Approach note in order to remove the maximum speed used to ensure the obstacle clearance during the circling approach
PR-NP-CL Before Start	C	1	**Speed names (e.g. "Vee One", "Vee R" do not need tobe called out. Hence callout example amended.**
PR-NP-CL Securing the Aircraft	L	2	**Removed "EFB.......OFF" since this item is not applicable to EDW (no fixed EFBs installed).** **Added item to check that chargers/cables are disconnected.**
PR-NP-SP-10-10-1 Taxi-Out	E	1	Correction of a typo error.
PR-AEP-BRK Loss of Braking	A	1	Documentation update: Deletion of information. Clarification of the conditions to apply the [MEM] LOSS OF BRAKING procedure.
PR-AEP-BRK Loss of Braking	A	2	Wording enhancement. No technical change.
PR-AEP-MISC Decision Making	C	1	Correction of a typo error.
PR-AEP-MISC Volcanic Ash Encounter	K	2	Correction of a typo error.
PR-AEP-MISC Recovery Techniques	L	3	Layout modification. No technical change. Correction of unit typo error.

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Localization Title	Toc Index	ID	Reason
			Removal of repetitive information to clarify when flight crew should recover the level flight.
			Addition information of takeover technique as per Airbus operational philosophy.
			Addition of information in order to specify the callout when the flight crew observes the divergence.
			Documentation update: Deletion of text.
PR-AEP-NAV Dual Radio Altimeter Failure	D	1	Correction of a typo error.
			Layout modification. No technical change.

GENERAL

Ident.: PR-NP-GEN-00019508.0001001 / 20 MAR 17
Applicable to: ALL

The Normal Procedures 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 Procedures chapter in conjunction with the FCOM, which provides the normal procedures and their associated tasksharing, callouts, and checklists.
All of these flying techniques are applicable to normal conditions.

COMMUNICATION

Ident.: PR-NP-GEN-00019509.0001001 / 01 SEP 23
Applicable to: ALL

1

CROSS-COCKPIT COMMUNICATION

The term "cross-cockpit communication" refers to communication between the PF and the PM. This communication is important 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:
- FMGS alterations
- Changes in speed or Mach
- Tuning 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 FCOM (*Refer to FCOM/PRO-NOR-SCO Communications and Standard Terms*).
In addition to the standard callout, the flight crew should communicate to enhance situation awareness. As per PM role and in accordance with the Airbus golden rules, the PM should monitor and announce any situation that requires PF reaction or should takeover, when necessary.
This is the case for any deviation from the intended flight path, or any case that requires a new assessment of the flight situation and of the flight crew's intention.

"STERILE" COCKPIT RULE

When the aircraft is below 15000 ft, any conversation that is not essential should be avoided: This includes conversations that take place in the cockpit, or between the flight and cabin crewmembers. It is important to adhere to this policy, in order to facilitate communication between both of the flight crew, and to ensure the effective communication of emergency or safety-related information, between flight and cabin crew members.

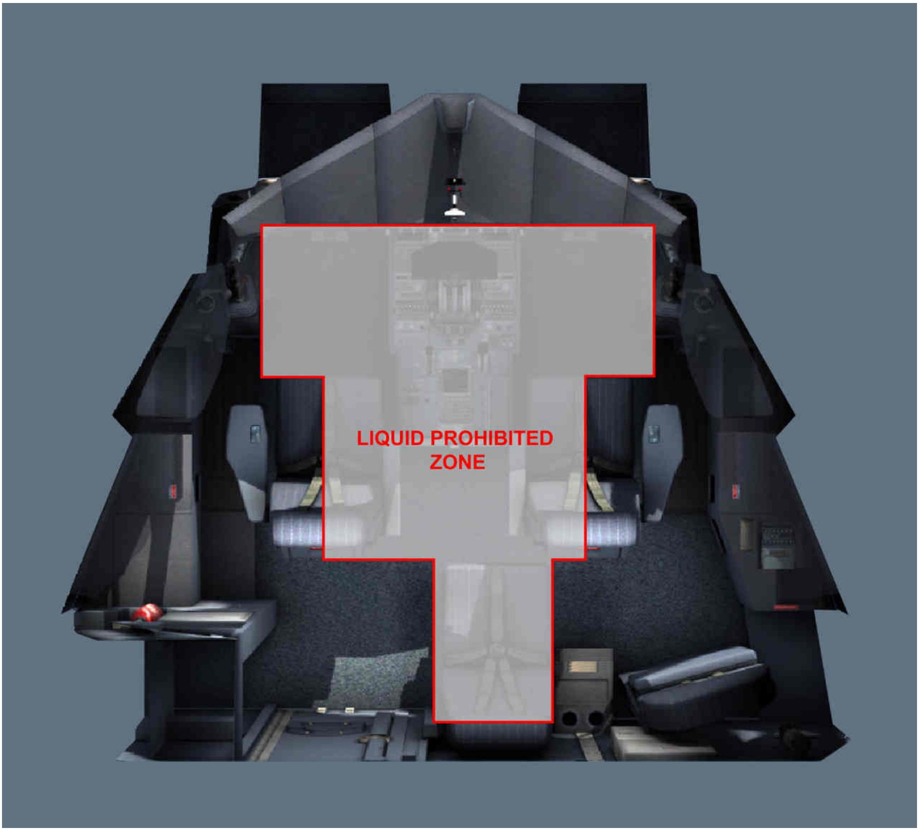
CLEAN COCKPIT

Ident.: PR-NP-GEN-00019510.0002001 / 04 NOV 20
Applicable to: ALL

Objects not stored in their dedicated area in the cockpit may fall and cause hazards such as damage to the equipment or inadvertent operations of the controls, or pushbuttons.

Airbus highly recommends that the flight crews put and store all objects in their dedicated area in the cockpit:
- Cups with lids in the cup holders
- Bottles with caps in the bottle holders
- Books and paper, if any, in the lateral stowage
- Trash in the waste bin in the lateral console
- Meal trays on the floor behind the flight crew. The flight attendants should collect the meal trays as soon as possible
- Personal equipment properly secured in the various stowage areas
- Portable electronic devices properly secured in the checklist stowage or in the flight document stowage (*Refer to FCOM/DSC-25-10-10 General Arrangement*).

CAUTION	The flight crew must carefully handle liquids in the cockpit area in accordance with the liquid prohibited zone in order to avoid any damage to equipment or inadvertent operation of controls. The flight crew must always ensure that the cups are equipped with lids and bottles equipped with caps.



SECURED AND TRANSIT STOP

Ident.: PR-NP-GEN-00019511.0001001 / 20 MAR 17
Applicable to: ALL

The aircraft is:

- in TRANSIT STOP when the last check list performed by the flight crew is the PARKING C/L
- in SECURED STOP when the last check list performed by the flight crew is the SECURING THE AIRCRAFT C/L

The flight crew performs only the items indicated by an asterisk (*) in the Standard Operating Procedures (SOP's) when there is no flight crew change and after a TRANSIT STOP.

Otherwise, the flight crew performs all the items of the SOP's.

OBJECTIVES

Ident.: PR-NP-SOP-40-00016458.0001001 / 05 DEC 17
Applicable to: ALL

The objectives of the preliminary cockpit preparation are:
- To ensure that all safety checks are performed:
  - The RCL pb is pressed for at least 3 s to display the cautions and warnings from the previous flight.
  - The technical logbook and the MEL are checked at this stage.
- To check the liquid levels i.e. oil, hydraulic and oxygen pressure:
  - The HYD pb is pressed, to check the hydraulic level
  - The ENG pb is pressed, to check engine oil level (*Refer to FCOM/PRO-NOR-SOP-04 Before Walkaround - ECAM*)
  - The DOOR pb is pressed, to check the oxygen pressure level
- To check the position of the surface control levers, for example, slats/flaps, and parking brake.

During the Preliminary Cockpit Preparation, the flight crew must also review all OEBs applicable to the aircraft. The flight crew must pay a particular attention to the red OEBs, and more particularly to the red OEBs that must be applied before the ECAM procedure.

OXYGEN

Ident.: PR-NP-SOP-40-00019513.0001001 / 20 MAR 17
Applicable to: ALL

The ECAM DOOR/OXY SD page displays the oxygen pressure. When the oxygen pressure is below a defined threshold, an amber half-box highlights the value. This advises the flight crew that the bottle should be refilled. The flight crew should refer to the minimum flight crew oxygen pressure (*Refer to FCOM/LIM-OXY Minimum Flight Crew Oxygen Pressure*). The prolonged dispatch of the aircraft in such condition is not recommended.

ADIRS OPERATIONS

Ident.: PR-NP-SOP-40-00024461.0002001 / 03 NOV 22
Applicable to: ALL

The flight crew performs the alignment or realignment of the IRS during the preliminary cockpit preparation. This action enables the IRS to operate in NAV mode and to provide continuously the aircraft position.

The flight crew can perform:
- An alignment or a realignment of the IRS with a complete IRS alignment procedure
- A realignment of the IRS with a fast IRS alignment procedure.

The IRS alignment or realignment includes the following two steps:
- Alignment:
  Gyro and accelerometers prepare for the NAV computation.
- Position Initialization:
  Navigation starting point is set.

ALIGNMENT STEP

COMPLETE IRS ALIGNMENT

During a complete alignment, IRS use gravity and the earth's rotation to determine the aircraft attitude and true heading, and IRS estimate the current aircraft latitude. The IR mode selectors must be OFF for more than 5 s. Then, the flight crew sets the IR mode selectors to the NAV mode.

Note: *The ON BAT light comes on during 5 s.*

FAST IRS ALIGNMENT

During a fast alignment, IRS reset the ground speed and some internal filters to 0, but IRS do not estimate the aircraft latitude.
The flight crew sets the IR mode selectors to OFF, then back to the NAV mode within 5 s.

POSITION INITIALIZATION STEP

Refer to PR-NP-SOP-60 FMGES Preparation.

CHECK OF ADIRS MODE

During the COCKPIT PREPARATION checklist, the flight crew checks that IRS are in NAV mode on the MCDU.

PRELIMINARY TAKEOFF PERFORMANCE COMPUTATION

Ident.: PR-NP-SOP-40-00021764.0001001 / 01 MAR 23
Applicable to: ALL

ROLE OF THE PRELIMINARY TAKEOFF PERFORMANCE COMPUTATION

Usually, during the preliminary cockpit preparation phase, the workload of the flight crew is less heavy than during future flight phases. The preliminary takeoff performance computation enables both flight crewmembers to share a common view of the plan of action for the takeoff. It also enables them to make the same assumptions for performance computations.

Both flight crewmembers enter the necessary data in their EFB TO PERF application. They must take into account any applicable MEL/CDL items and NOTAMs / AIP SUPs (possibly covered by a TMP RWY) and independently compute the preliminary takeoff performance data.
Then, both flight crewmembers crosscheck the results: they compare the EFB of the Captain with the EFB of the First Officer for the parameters listed below. This crosscheck ensures the validity of the computations.

CONTENT OF A PERFORMANCE DATA CROSSCHECK

When SOPs request a crosscheck of performance data, the flight crew must verify all of the following values:

- Runway ident
  This ensures that the runway used for the computation in the EFB and/or inserted in the FMS is the same
- Runway length
  The RWY length must be checked against the RWY length shown on the airport chart
- Takeoff shift
  This ensures that the flight crew took into account the right intersection
- V speeds (V1, VR, V2)
- Green dot speed
  This indirectly ensures that the GW values are consistent between EFB and FMS.
- Takeoff thrust (TOGA, FLEX, DERATED)
- FLAPS
- THS
- PACKS
- ANTI-ICE
- EO ACCEL ALT.

To prevent situations where the calculated performance cannot be reached, the following guideline must be applied:

- Wind: Consider conservative wind values. The EFB PERF application (taking into account 50% head- and 150% tailwind) only covers for wind changes during takeoff roll and not for wind conditions that may have changed between the time of calculation and the time of takeoff.
- OAT: Use the anticipated temperature at the expected takeoff time.
- QNH: A decrease by 1 hPA may cover for a pressure change.

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EXTERIOR WALKAROUND

Ident.: PR-NP-SOP-50-00019514.0001001 / 20 MAR 17
Applicable to: ALL

Standard Operating Procedures (SOP) outline the various elements that the flight crew must review in greater detail.

The objectives of the exterior inspection are:
- To obtain a global assessment of the aircraft status. Any missing parts, or panels will be checked against the Configuration Deviation List (CDL) for possible dispatch, and any potential operational consequences.
- To ensure that main control surfaces are in adequate position relative to surface control levers.
- To check that there are no leaks. For example, engine drain mast, hydraulic lines.
- To check the status of the essential visible sensors, i.e. AOA, pitot and static probes.
- To observe any possible abnormalities on the landing gear status:
    - Wheels and tires status (cut, wear, cracks)
    - Safety pins are removed
    - Brakes status (brake wear pin length with parking brake ON)
    - Length of oleo. Any difference between the two main landing gears must be reported. Typically, a 10 bar low pressure in oleo, leading to 60 mm oleo reduction, decreases the tail clearance by approximately 1 ft.
- To observe any possible abnormalities on the engines:
    - Fan blades, turbine exhaust, engine cowl and pylon status
    - Access door closed
    - Correct closure/latching condition of the fan cowl doors.

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FMGES PREPARATION

Ident.: PR-NP-SOP-60-00019516.0001001 / 03 NOV 22
Applicable to: ALL

FMGES PROGRAMMING

FMGES programming involves inserting navigation data, then performance data.

It is to be noted that:
- Boxed fields must be filled
- Blue fields inform the flight 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 font signifies that data is FMS computed
- Large font signifies manually entered data.

Navigation	Status INIT A F-PLN (SEC F-PLN) RAD NAV	
Performance	INIT B PERF	

This sequence of entry is the most practical. INIT B should not be filled immediately after INIT A, because the FMGES would begin to compute F-PLN predictions. These computations would slow down the entry procedure.

To obtain correct predictions, the fields of the various pages must be completed correctly, with available planned data for the flight:

- DATA
  The database validity, NAVAIDs and waypoints (possibly stored in previous flight), and PERF FACTOR must be checked on the STATUS page.
- INIT A
  The INIT A page provides access to the aircraft present position. The flight crew will check that it corresponds to the real aircraft position (*Refer to PR-NP-SOP-40 ADIRS Operations*).

  Manual Position Initialization of the IRS:

  The flight crew will check or modify the MCDU coordinates for the IRS position initialization.
  The most appropriate coordinates for the position initialization are gate coordinates.
  Then, the flight crew will press the ALIGN IRS prompt.

  Note: *When the flight crew enters or modifies the origin airport (FROM) or the CO RTE, the MCDU INIT coordinates are reset to the Airport Reference Point. The flight crew may manually modify these coordinates.*

  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 a next flight.
- F-PLN

  The F-PLN A page is to be completed thoroughly including:
  - The take-off runway
  - SID
  - Altitude and speed constraints
  - Correct transition to the cruise waypoint
  - Intended step climbs/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 (6th line of the F-PLN page), versus CFP distance.
- SEC F-PLN
  The SEC F-PLN should be used to consider an alternate runway for take-off, a return to departure airfield or a routing to a take-off alternate.
- RAD NAV
  The RAD NAV page is checked, and any required NAVAID should be manually entered using ident. If a NAVAID is reported on NOTAM as unreliable or unserviceable, it must be deselected on the MCDU DATA/POSITION MONITOR/SEL NAVAID page.

- INIT B

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

  The flight crew will update weight and CG on receipt of the load sheet.
  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 CFP. The trip wind facility is available if the wind profile has not already been entered.
  After engine start, the INIT B page is no longer available. The flight crew should use the FUEL PRED page for weight and fuel data insertion, if required.
  The INIT B page should not be completed immediately after INIT A, because the FMGES would begin to compute F-PLN predictions. This would slow down the entry procedure.
- PERF
  The thrust reduction altitude/acceleration altitude (THR RED/ACC) are set to default at 1 500 ft, or at a value defined by airline policy. The THR RED/ACC altitudes may be changed in the PERF TAKEOFF page, if required. The flight crew should consider the applicable noise abatement procedure.

  The engine-out acceleration altitude must:
  - Be at least 400 ft above airport altitude
  - Ensure that the net flight path is 35 ft above obstacles
  - Ensure that the maximum time for takeoff thrust is not exceeded.

  Therefore, there are generally a minimum and a maximum one-engine-out acceleration altitude values. The minimum value satisfies the first two criteria. The maximum value satisfies the last one. Any value between those two may be retained. The one-engine-out acceleration altitude is usually defaulted to 1 500 ft AGL, and may be updated as required.
  The flight crew uses the PERF CLB page to pre-select a speed. For example, "Green Dot" speed for a sharp turn after takeoff.

The flight crew may also check on the PROG page the CRZ FL, MAX REC FL and OPT FL.
When the FMGES has been programmed, the PM should then cross check the information before the take-off briefing. When the predictions are available, the flight crew may print the PREFLIGHT DATA. This print provides all the predictions that may be used during the initial part of the flight.

FMGES CROSSCHECK

When the PF finishes the FMGES preparation, the PM must check the PF's entries. The PM performs this check via a check of the different FMGES pages, in the same order as the FMGES preparation. By checking the setup, the PM should achieve the same mental image as the PF of the intended departure procedure, trajectory, and constraints. The PM should check with the PF if anything is not clear.

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TAKEOFF DATA

Ident.: PR-NP-SOP-70-00016460.0001001 / 01 MAR 23
Applicable to: ALL

The takeoff conditions may change before engine start due to one of the following reasons:
- The final loadsheet is different from the preliminary loadsheet (the resulting TOM on the INIT B page is higher than previously calculated or the TOMCG changed from BASIC to FWD)
- If operationally required (e.g. to improve small margins, to avoid TOGA takeoff or to depart from a more favorable runway)
- A change affects the performance computation (e.g. runway condition degradation, intersection or runway change, etc.)

In the above-mentioned cases, the flight crew must update the takeoff data, and they independently compute again the performance data. After this new double computation, the PF enters the revised takeoff data in the FMS ACTIVE/PERF page, then the PM crosschecks the takeoff performance data. To do so, the PM compares the FMS ACTIVE/PERF page with his/her EFB TAKEOFF application results page. For more information on the content of a performance crosscheck, *Refer to PR-NP-SOP-40 Preliminary Takeoff Performance Computation*.

CAUTION	The loadsheet ZFMCG may be wrong if the PAX are not seated according OA/OB/OC distribution of the loadsheet. Therefore, on all flights with free seating (e.g. middle leg of a triangle flight), it is mandatory to count the PAX per section. If outside LMC tolerances, request a new loadsheet with the correct distribution. Alternatively, use the FS+ Loadsheet module to generate a manual loadsheet.

For TOMCG, the station/ACARS loadsheet virtually "refuels" the aircraft only to takeoff fuel and not to block fuel. However, the aircraft is actually refueled up to ramp mass (TOM plus taxi fuel), which is accounted for by the CG displayed on the lower ECAM DU and the FS+ Loadsheet module. Above around 75t FOB, the trim tank will be filled further (above 2400kg). But taxi fuel is consumed from the center/inner tanks and not from the trim tank, which is the reason for the CG difference of 2% or more between the station/ACARS loadsheet and the CG of the lower ECAM DU/FS+ Loadsheet. Therefore, it is important to enter the THS value converted from the lower ECAM DU into the FMS TAKEOFF PERF page. Using the value from the loadhsheet may result in false ECAM F/CTL PITCH/TRIM/MCDU/CG DISAGREE warning at takeoff.

SEATING POSITION AND ADJUSTMENT OF RUDDER PEDALS

Ident.: PR-NP-SOP-70-00016461.0001001 / 20 MAR 17
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 increasing the cockpit cut-off angle, therefore 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 appropriate 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 flight crew must have their feet in a position so that full rudder deflection combined with full braking, even differential, can be applied instinctively and without delay.
The armrest and the rudder pedals have position indicators. These positions should be noted and set accordingly for each flight.

BRAKES

Applicable to: ALL

Ident.: PR-NP-SOP-100-X-00019518.0001001 / 20 MAR 17

BRAKE CHECK

When the aircraft starts to move, the PF should check the efficiency of the normal braking system by gently pressing the brake pedals, to ensure that the aircraft slows down. The PM 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 (green pressure has taken over blue pressure). Although green hydraulic power supplies the braking system, each time pedals are quickly pressed, a brief brake pressure indication may appear on the BRAKE PRESS indicator. No maintenance action is required if the pressure peak is less than 2 000 PSI. If a “spongy” pedal is felt during taxi, this indicates a degraded performance of the alternate braking system. Spongy pedals can change the feeling of braking.

Ident.: PR-NP-SOP-100-X-00019519.0001001 / 20 MAR 17

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.

Ident.: PR-NP-SOP-100-X-00019520.0001001 / 20 MAR 17

TAXI SPEED AND BRAKING

On long, straight taxiways, and with no ATC or other ground traffic constraints, the PF should allow the aircraft to accelerate to 30 kt, and should then use one smooth brake application to decelerate to 10 kt. The PF should avoid continuous brake applications. The GS indication on the ND should be used to assess taxi speed.

Ident.: PR-NP-SOP-100-X-00019521.0001001 / 20 MAR 17

BRAKE TEMPERATURE

The maximum brake temperature limitation for takeoff ensures that in the case of a hydraulic leak, any hydraulic fluid that touches the brake units does not ignite in the wheel well after the landing gear retraction.

Ident.: PR-NP-SOP-100-X-00019522.0001001 / 25 JUL 17

BRAKING ANOMALIES

If the ACCU PRESS drops below 1 500 PSI, 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 set the A/SKID & N/W STRG sw to OFF. They should not apply pressure to the pedals while setting the A/SKID & N/W STRG sw to OFF. Then, the PF should refer to the triple brake indicator and modulate the pressure as necessary.

Ident.: PR-NP-SOP-100-X-00019523.0001001 / 20 MAR 17

BRAKE FANS (IF INSTALLED)

Brake fans cool the brakes, and the brake temperature sensor. Therefore, when the brake fans are running, the indicated brake temperature will be significantly lower than the indicated brake temperature when the brake fans are off.
Therefore, as soon as the brake fans are switched on, the indicated brake temperature decreases almost instantaneously. On the other hand, when the brake fans are switched off, it will take several minutes for the indicated brake temperature to increase and match the real brake temperature.
When the fans are running, the difference between the indicated and the actual brake temperature can range from 50 °C (when the actual brake temperature is 100 °C) to 150 °C (when the actual brake temperature is 300 °C). Therefore, before takeoff, if the fans are running, the flight crew should refer to the indicated brake temperature. When the indicated brake temperature is above 150 °C, takeoff must be delayed.
Brake fans should not be used during takeoff, in order to avoid Foreign Object Damage to fans and brakes.

FLIGHT CONTROLS

Ident.: PR-NP-SOP-100-00019524.0001001 / 03 NOV 21
Applicable to: ALL

At a convenient stage, before or during taxi, and before arming the autobrake, the PF silently applies full longitudinal and lateral sidestick deflection. On the F/CTL page, the PM checks and calls out full travel of elevators and ailerons, and correct deflection and retraction of spoilers.

As each full travel/neutral position is reached, the PM calls out:
- "Full up, full down, neutral"
- "Full left, full right, neutral"

The PF silently checks that the PM calls are in accordance with the sidestick order. The PF then presses the PEDAL DISC pb on the nose wheel tiller, and silently applies full left and full right rudder, and then returns the rudder to neutral.

The PM follows on the rudder pedals and, when each full travel/neutral position is reached, calls out:
- "Full left, full right, neutral"

Full control input must be held for sufficient time for full travel to be reached and indicated on the F/CTL page.
The PM then applies full longitudinal and lateral sidestick deflection, and on the F/CTL page, silently checks full travel and correct sense of all elevators and ailerons, and correct deflection and retraction of all spoilers.
If this check is carried out during taxi, it is essential that the PF remains head-up throughout the procedure.

TAXI ROLL AND STEERING

Ident.: PR-NP-SOP-100-00019525.0001001 / 25 JUL 17
Applicable to: ALL

Before taxi, check that the amber "NWS DISC" ECAM message is off, to ensure that steering is fully available.

THRUST USE

The flight crew will need a little power above idle thrust to move the aircraft.
Excessive thrust application can result in exhaust-blast damage or Foreign Object Damage (FOD).
Thrust should normally be used symmetrically.

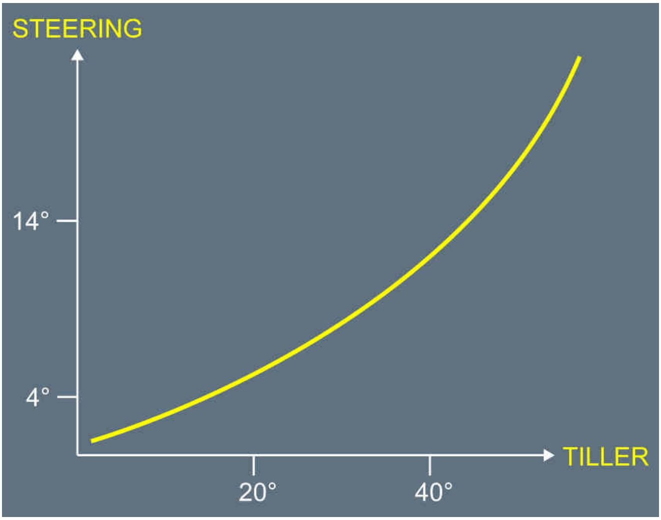
TILLER AND RUDDER PEDALS USE

Pedals control nosewheel steering at low speed (± 6 ° 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

The Nosewheel steering is "by-wire" with no mechanical connection between tiller and the nosewheel. The relationship between tiller deflection and nosewheel angle is not linear and the tiller forces are light.

Tiller Deflection vs Nosewheel Steering Angle

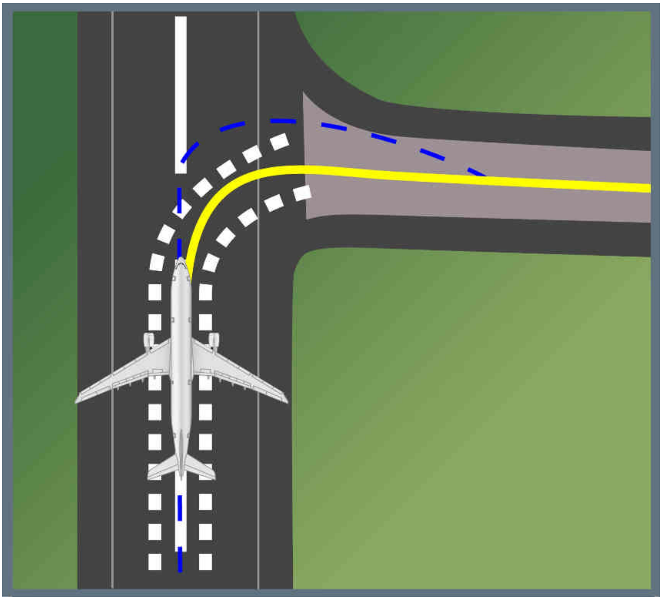


Therefore, the PF should move the tiller smoothly and maintain the tiller's position. Any correction should be small and smooth, and maintained for enough time to enable the pilot to assess the outcome. Being over-active on the tiller will cause uncomfortable oscillations.
On straight taxiways, the aircraft is correctly aligned on the centerline, when the centerline is lined-up between the PFD and ND.

Correctly Following the Centerline

When the seating position is correct, the cut-off angle is 20 °, and the visual ground geometry provides an obscured segment of 53 ft (16.15 m). During taxi, a turn must be initiated before an obstacle approaches the obscured segment. This provides both wing and tail clearance, with symmetric thrust and no differential braking.
Asymmetric thrust can be used to initiate a tight turn and to keep the aircraft moving during the turn. If nosewheel lateral skidding occurs while turning, reduce taxi speed or increase turn radius.
Avoid stopping the aircraft in a turn, because excessive thrust will be required to start the aircraft moving again.
The flight crew should be aware that the main gear on the inside of a turn will always cut the corner and track inside of the nosewheel track. For this reason, over-steer must be used.

Oversteering Technique



When exiting a tight turn, the PF should anticipate the steer out. Additionally, the PF should allow the aircraft to roll forward for a short distance to minimize the stress on the main gears.
In the event that one or more tires is/are deflated on the main landing gear, the maximum permitted steering angle will be limited by the aircraft speed. Therefore, with one tire deflated, the aircraft speed is limited to 7 kt and nosewheel steering can be used. With two tires deflated, the aircraft speed is limited to 3 kt and nosewheel steering angle should be limited to 30 °.
For turns of 90 ° or more, the aircraft speed should be less than 10 kt.

180 DEGREES TURN ON RUNWAY

Ident.: PR-NP-SOP-100-00021545.0001001 / 28 MAY 20
Applicable to: ALL

For more information on the minimum runway width that is necessary to perform a 180 ° turn with the following technique, *Refer to FCOM/DSC-20-30 180 degrees Turn on Runway*.

Note:
- *In order to avoid stress and fatigue in the main landing gear, the flight crew must not use differential braking to fully stop one main landing gear (braked pivot turn technique is not allowed)*
- *If the runway is wet or contaminated, the aircraft may skid, particularly on painted parts of the runway. The flight crew should consider additional margin when the runway is wet or contaminated.*

IF THE PF IS THE CREWMEMBER IN THE LEFT HAND SEAT (CM1)

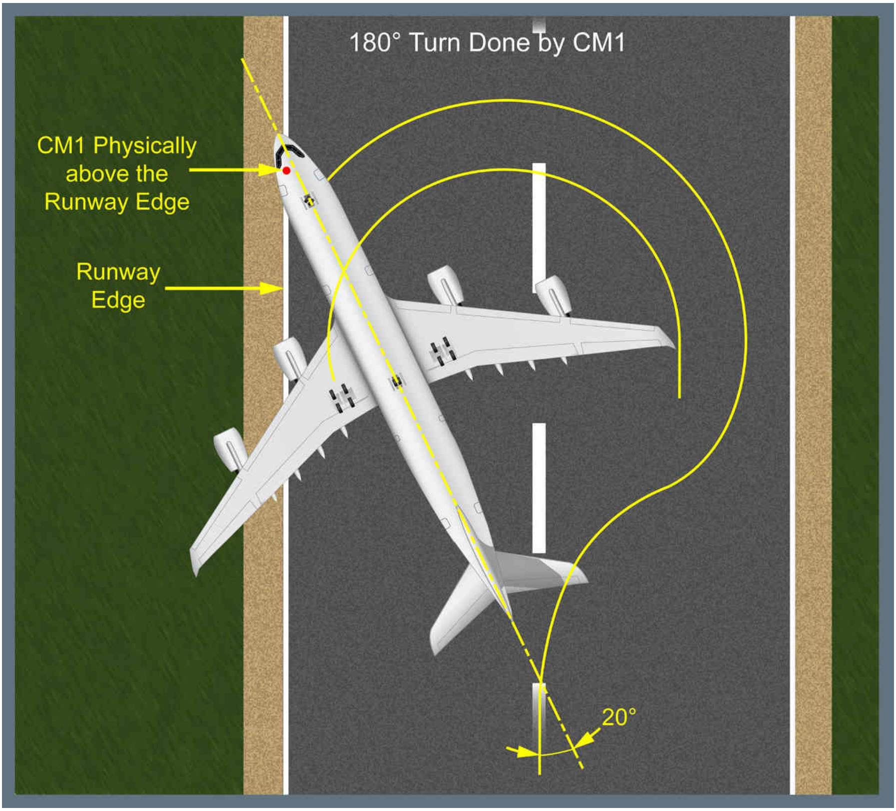
Taxi on the right hand side of the runway.
Maintain a ground speed between 5 kt and 10 kt during the entire maneuver.

Note: On wet or contaminated runway, it is recommended to maintain a speed of 5 kt during the entire maneuver.

Turn left, maintaining a 20 ° divergence from the runway axis.
Monitor the approaching runway edge.

When the CM1 is physically over the runway edge:
- Turn right, up to full tiller deflection
- If necessary, use asymmetric thrust (IDLE on ENG 3+4) and/or differential braking (more brake pressure on the right side) to maintain a constant speed.

When the 180 ° turn is complete, align with runway centerline and release the tiller to neutral position before stopping.



IF THE PF IS THE CREWMEMBER IN THE RIGHT HAND SEAT (CM2)

<u>Note:</u> *The technique is symmetrical.*

Taxi on the left hand side of the runway.
Maintain a ground speed between 5 kt and 10 kt during the entire maneuver.

<u>Note:</u> *On wet or contaminated runway, it is recommended to maintain a speed of 5 kt during the entire maneuver.*

Turn right, maintaining a 20 ° divergence from the runway axis.
Monitor the approaching runway edge.

When the CM2 is physically over the runway edge:
- Turn left, up to full tiller deflection
- If necessary, use asymmetric thrust (IDLE on ENG 1+2) and/or differential braking (more brake pressure on the left side) to maintain a constant speed.

When the 180 ° turn is complete, align with runway centerline and release the tiller to neutral position before stopping.

LAST DATA CHANGES BEFORE TAKEOFF

Ident.: PR-NP-SOP-100-00021765.0001001 / 05 DEC 17
Applicable to: ALL

If the takeoff conditions change during the taxi phase, and if the previous performance computation is no longer appropriate, the flight crew must update the takeoff data. This is the case for example in the following conditions:
- The runway in use changes, or
- The runway condition deteriorates, or
- The use of a new intersection shortens the runway length, or
- The wind or the temperature changes.

In order to ensure that the performance data used for the takeoff is accurate, the technique to perform this update is the same as for the BEFORE PUSHBACK OR START phase (*Refer to PR-NP-SOP BEFORE PUSHBACK OR START*). However, the tasksharing is different. Both of the following apply:
- The PF delegates the FMS updates to the PM, in order to limit disruption during taxi
- As a result, the PF must crosscheck the data that the PM modified in the FMS.

In order to compute and crosscheck the performance data, the PF should perform one of the following:
- Stop the aircraft, or
- Transfer the control to the PM.

DEPARTURE BRIEFING CONFIRMATION

Ident.: PR-NP-SOP-100-00019526.0001001 / 18 NOV 21
Applicable to: ALL

The departure briefing confirmation should only review any changes that may have occurred since the full departure briefing done at the parking bay (e.g. change of SID, change in runway conditions etc.).

ADIRS ALIGNMENT

Ident.: PR-NP-SOP-100-00020270.0001001 / 20 MAR 17
Applicable to: ALL

During taxi, it is recommended to check a global consistency of FMGEC entries (position and flight plan). Therefore, set the ND in ARC or NAV mode with range 10 NM and check the runway and the SID on the ND in comparison to the aircraft symbol, that indicates the current aircraft position.

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PACKS

Ident.: PR-NP-SOP-110-00016463.0001001 / 20 MAR 17
Applicable to: ALL

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 N1/EPR.
If the takeoff is performed with one pack unserviceable, the procedure states to set the failed pack to OFF. The takeoff may be performed with the other pack ON (if performances permit) with TOGA or FLEX thrust, the pack being supplied by the onside bleed. In this asymmetric bleed configuration, the N1 takeoff value is limited to the value corresponding to the bleed ON configuration and takeoff performance must be computed accordingly.

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THRUST SETTING

Ident.: PR-NP-SOP-120-00019527.0003001 / 16 JAN 18
Applicable to: ALL

The Thrust Setting 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, an alert triggers on the ECAM.
At any time during FLEX takeoff, the flight crew may set the thrust levers to TOGA.

TAKEOFF ROLL

Ident.: PR-NP-SOP-120-00019528.0001001 / 01 SEP 23
Applicable to: ALL

1

2 Once the thrust is set, the PF announces the indications on the FMA. The PM must check that the thrust is set by 80 kt and must announce "Thrust Set".
The Captain must keep their hand on the thrust levers when the thrust levers are set to TOGA/FLX notch and until V1.
The feet of the CM1 shall be up on the pedals to ensure manual braking capability in case of a rejected takeoff. The feet of the CM2 shall follow the pedals with the heels on the ground to avoid inadvertant brake application.
During the take-off roll, the PM monitors the PFD and ENG indications to ensure early detection and appropriate decision making in the case of malfunction. By scanning the airspeed indications, the PM will detect any inconsistent airspeed indications between instruments or absence of airspeed indications.
On a normal takeoff, to counteract the pitch up moment during thrust application, the PF should apply half forward or full forward sidestick (depending on the wind conditions) at the start of the takeoff roll until reaching 80 kt. At this point, the input should be gradually reduced to be zero by 100 kt.
The PF should use pedals to keep the aircraft straight. The nosewheel steering will be effective until reaching 100 kt but its authority decreases at a pre-determined rate as the groundspeed increases and the rudder becomes more effective. The use of the tiller is not recommended during takeoff roll, because of its high efficiency, which might lead to aircraft overreaction.
The hand of the PM rests on the bottom of the sidestick to be ready for immediate takeover if necessary.
For crosswind takeoffs, routine use of into wind aileron is not necessary. In strong crosswind conditions, small lateral stick input may be used to maintain wings level, 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 (due to high weight on wheels on the spoiler

extended side), reduces lift and increases drag. Spoiler deflection becomes significant with more than half sidestick deflection.

In the event of unexpected lateral disturbance during takeoff roll, the flight crew should use the rudder as for counteracting any lateral disturbance. Indeed, excessive rudder input may increase the magnitude of the lateral disturbance. The flight crew may be surprised during takeoff roll by unexpected lateral disturbance in conditions such as:
- The presence of thermals or thermal vortices that often develop in hot and dry countries. Sometimes, these thermal streams get stronger, and create small whirlwinds referred to as "dust devils", or
- The jet blast of another aircraft close to the active runway, or
- The wind that accelerates between two buildings by "venturi" effect.

As the aircraft lifts off, any lateral stick input applied will result in a roll rate demand, making aircraft lateral control more difficult. Wings must be level.
In case of low visibility takeoff, 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

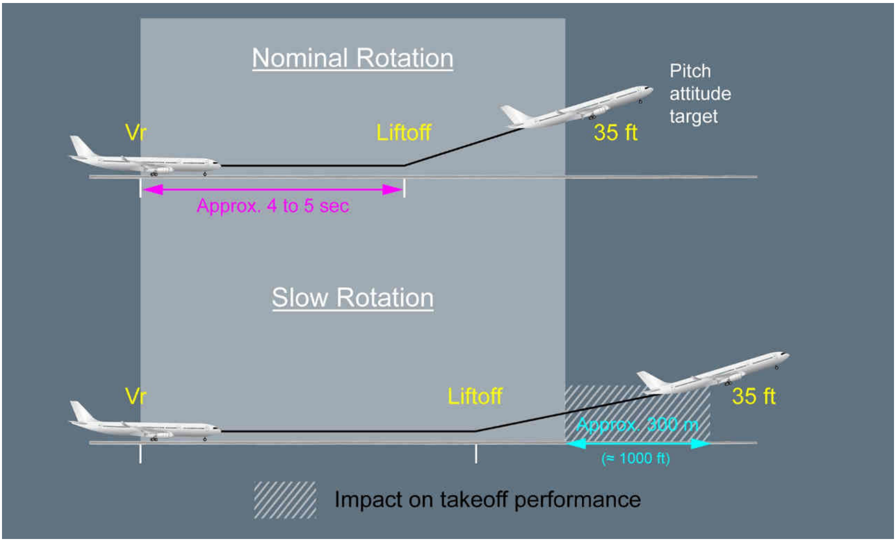
Ident.: PR-NP-SOP-120-00019529.0001001 / 27 FEB 18
Applicable to: ALL

ROTATION TECHNIQUE

The rotation technique is similar on all fly-by-wire aircraft.
To initiate the rotation, the flight crew performs a positive backward stick input. When the rotation is initiated, the flight crew achieves a rotation rate of approximately 3 °/s resulting in a continuous pitch increase.
During the rotation, the aircraft liftoff occurs at approximately 10 ° of pitch, typically around 4 to 5 s after the initiation of the rotation. After the liftoff, the PF targets the required pitch attitude.
To monitor the rotation, the PF uses the outside visual references. Once airborne, the PF controls the pitch attitude target on the PFD.

A slow rotation rate or an under rotation (below takeoff pitch target) has an impact on takeoff performance (refer to below graphic):
- The takeoff run and the takeoff distance increase,
- The obstacle clearance after takeoff decreases.

Performance impacts for a rotation rate of approximately 2 °/s



TAIL STRIKE AVOIDANCE

Ident.: PR-NP-SOP-120-00019531.0001001 / 01 MAR 23
Applicable to: ALL

INTRODUCTION

Tail strikes can cause extensive structural damage, which can jeopardize the flight and result in heavy maintenance action. They most often occur in such adverse conditions as crosswind, turbulence, windshear, etc.
The minimum tail clearance occurs before liftoff (due to rotating bogies).
With low VS2/VS1g ratios (between 1.13 and 1.20) it is not recommended to use F1 for takeoff unless operationally necessary.

MAIN FACTORS

EARLY ROTATION

Early rotation occurs when the flight crew initiates the rotation below the appropriate VR. The possible reasons for this are:
- The computed VR is incorrect for the aircraft weight or flap configuration
- The PF commands the rotation below VR because of gusts, windshear or an obstacle on the runway
- The following factors or a combination of these factors may also lead to an aircraft auto rotation before VR:
  - A bumpy runway
  - A sudden release of forward sidestick input
  - The use of TOGA thrust
  - An aircraft not correctly trimmed.

  In this case the pilot will have to counteract this auto rotation until VR is reached and should be cautious not to overreact.

Whatever the cause of the early rotation, the result is an increased pitch attitude at liftoff, and therefore, a reduced tail clearance.

ROTATION TECHNIQUE

For more information on the rotation technique recommendations, *Refer to PR-NP-SOP-120 Rotation*.
An abrupt increase of rotation rate close to liftoff might result in a tail strike.
If the established pitch rate is not satisfactory, the PF must correct it as soon as detected.

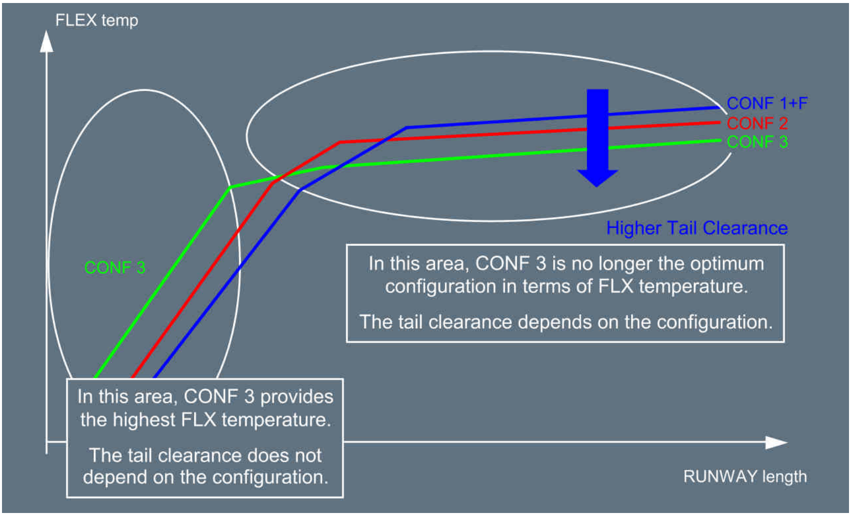
CONFIGURATION

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 extend the engine life.

On A340-500/600:

For any runway length, CONF 3 usually provides the highest FLEX temperature, and the tail clearance at lift off does not depends on the configuration. So, the flight crew should select CONF 3.

On A330 and A340-300:



The configuration that provides the maximum FLEX temperature varies with the runway length.
On short runways, CONF 3 usually provides the highest FLEX temperature, and the tail clearance at liftoff does not depend on the configuration. So, the flight crew should select CONF 3.
On medium or long runways, the second segment limitation becomes the limiting factor, and CONF 2 or CONF 1+F becomes the optimum configuration, in term of FLEX temperature.
In these cases, the tail clearance at liftoff depends on the configuration. The highest flap configuration provides the highest tail strike margin.
There is a difference between twin and quadri, regarding this concern: The A330 has more tail clearance than the A340, that has quite often, takeoff speeds closer to VMU limitation. This is true with one engine inoperative. Since twin aircraft have more thrust margin for takeoff, this is even more the case with all engines operative.
On A340-300, selecting CONF 3 instead of 1+F increases the tail clearance by 1.5 to 2 ft, at the expense of a loss in FLEX temperature generally less than 3 °C.

Note: *Detailed effect:*

- *From CONF 1+F to CONF 2: Tail clearance increased by 0.5 to 1 ft, loss in FLEX temperature generally less than 1 °C*
- *From CONF 2 to CONF 3: Tail clearance increased by 1 ft, loss in FLEX temperature generally less than 2 °C.*

The first degrees of flexible thrust have an impact on maintenance costs about 5 times higher than the last one.

Summary:

On A340-200/300, taking the above into consideration, the crew may decide to select CONF 2 or CONF 3:
- When the FLEX temperature is close to TREF, it is advisable to select one more step of flaps (compared to the optimum one)
- When the FLEX temperature is more than 15 °C above TREF, it is advisable to select CONF 3.

TAKEOFF PITCH TRIM SETTING

The main purpose of the pitch trim setting for takeoff is to provide consistent rotation characteristics. Takeoff pitch trim setting is automatic on ground on the A340-500/600, A330/A340 Enhanced (with specific aircraft definition) and aircraft equipped with automatic trim setting function . It is set manually via the pitch trim wheel on other A330/340 models.
The aircraft performs a safe takeoff, provided that the pitch trim setting is within the green band on the pitch trim wheel.

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

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

CROSSWIND TAKEOFF

In the TAKEOFF ROLL paragraph the PF should avoid using large deflection, which results in excessive spoiler extension.
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 tail strike.

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.

AIRCRAFT SYSTEM FOR TAIL STRIKE PREVENTION

A tail strike pitch limit indicator appears on the PFD to indicate the maximum pitch attitude to avoid a tail strike.
This design is installed as standard on A340-500/600 and as an option on all A330 and A340-200/300.

ACTION IN CASE OF TAIL STRIKE

If a tail strike occurs at takeoff, flight at altitude requiring a pressurized cabin must be avoided and a return to the departure airport should be performed for damage assessment.

ACCELERATION ALTITUDE

Ident.: PR-NP-SOP-120-00019669.0001001 / 20 MAR 17
Applicable to: ALL

At the acceleration altitude, the FD pitch mode changes from SRS to CLB or OP CLB mode.

The speed target 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).

If green dot speed is higher than the managed target speed (eg: 250 kt speed limit) displayed by a magenta triangle on the PFD speed scale, the AP/FD will guide the aircraft to green dot (as per the general managed speed guidance rule). If required by ATC, the crew will select the adequate target speed (below green dot) on the FCU.

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.

If the engine start selector had been selected to IGN START for take-off, the PM should confirm with the PF when it may be deselected.

SLATS/FLAPS RETRACTION AT HEAVY WEIGHT

Ident.: PR-NP-SOP-120-00016464.0001001 / 20 MAR 17
Applicable to: ALL

If takeoff 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, three protections may intervene:
- The Flap Load Relief System (FLRS)
- The Automatic Retraction System (ARS)
- The alpha Lock function

THE FLAP LOAD RELIEF SYSTEM

When IAS reaches VFE, the FLRS is activated. It retracts automatically the flaps to the next further retracted lever position. Typically, this may occur in CONF 2, when F speed is close to VFE CONF2. In this case, VFE is unchanged on PFD speed scale. (Displayed VFE remains VFE CONF 2 in accordance with the flap lever position). "RELIEF" is displayed on the E/WD Flap/Slat indication. As the aircraft accelerates above F speed, the flap lever can be selected to 1. If IAS decreases below VFE, the flaps will re-extend.

THE AUTOMATIC RETRACTION SYSTEM

While in Conf 1+F and IAS reaches 200 kt (215 kt for the A340-500 or -600), the ARS is activated. The ARS automatically retracts flaps to 0°. The VFE displayed on the PFD change 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 200 kt (215 kt for the A340-500 or -600), the flaps will not extend back to 1+F.

THE ALPHA LOCK FUNCTION

The slats alpha/speed lock function will prevent slat retraction at high AOA or low speed at the moment the flap lever is moved from Flaps 1 to Flaps 0. "A. LOCK" pulses above the E/WD Slat indication. The inhibition is removed and the slats retract when both alpha and speed fall within normal values. This is a normal situation at high gross weight. If alpha lock function is triggered, the crew will continue the scheduled acceleration, allowing further slats retraction.

OVERSPEED WARNING DURING SLATS/FLAPS TRANSITION

Ident.: PR-NP-SOP-120-00019532.0001001 / 25 JUL 17
Applicable to: ALL

During the Slats/Flaps transition the flight crew must respect the VMAX displayed on the PFD. The VMAX value displayed on the PFD speed scale is based on the Slats/Flaps control lever position. The OVERSPEED WARNING is based on the actual Slats/Flaps surface position. Therefore, during Slats/Flaps transition, the dynamic acceleration of the airplane may lead to a temporary OVERSPEED WARNING even if the current speed is out of the red and black strip displayed on the PFD. In this situation, there are no operational consequences.

LOW ALTITUDE LEVEL OFF

Ident.: PR-NP-SOP-120-00019533.0001001 / 20 MAR 17
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 ABATEMENT DEPARTURE PROCEDURE

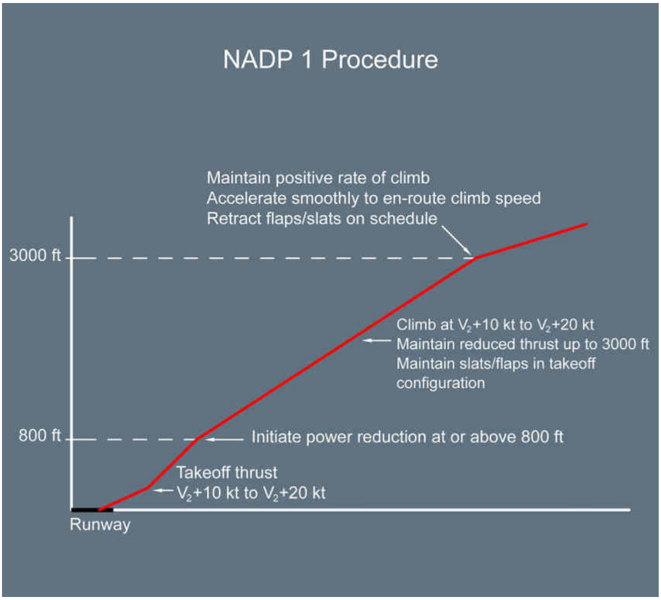
Ident.: PR-NP-SOP-120-00019534.0001001 / 03 MAY 23
Applicable to: ALL

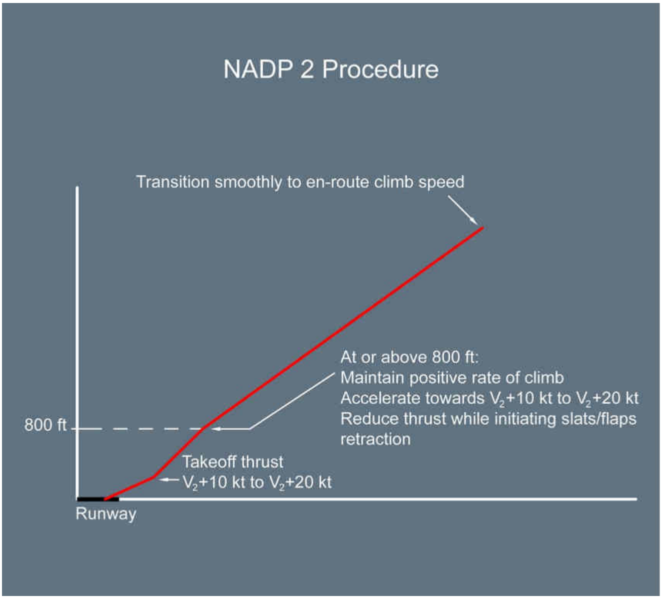
3

4 **INTRODUCTION**

The NADP is an operational procedure for the climb phase to provide noise levels reduction to areas close to the airport or distant from the airport. The procedure can be performed by two different methods:
- NADP 1: Intends to reduce noise levels close to the airport
- NADP 2: Intends to reduce noise levels in areas distant from the airport.

5 **HOW TO APPLY THIS PROCEDURE?**





Note: *For both methods, the flight crew must not initiate the thrust reduction before the required minimum altitude.*
The flight crew should not apply NADP during significant turbulence or windshear. In addition, the operators can develop alternate operator-specific procedures.
The operators must comply with the local noise procedures.

CLIMB MODES

Ident.: PR-NP-SOP-140-00016465.0001001 / 20 MAR 17
Applicable to: ALL

The AP/FD climb modes may be either:
- Managed, or
- 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.
In areas of high traffic density, low values of vertical speed will reduce the possibility of nuisance TCAS warnings.
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 ATHR 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 (if triple click option is available)
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 in the MCDU 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.

CLIMB THRUST

Ident.: PR-NP-SOP-140-00019535.0001001 / 25 JUL 17
Applicable to: ALL

During the climb, the thrust levers are in the CL detent, the A/THR is active in thrust mode and the FADECs manage the thrust to a maximum value depending upon ambient conditions.

Engine life may be extended by operating the engines at less than maximum climb rated thrust. Two levels of derated climb thrust can be selected on the PERF CLB page:
- D1, which reduces the maximum climb thrust by 10 %
- D2, which reduces the maximum climb thrust by 15 %.

If a derated climb has been entered prior to departure, then "THR DCLB 1(2)" will be displayed on the FMA as the thrust levers are set to CL detent at the thrust reduction altitude. The crew may toggle the level of derate between D2 and D1 as operations permit or cancel it to recover the MCL nominal thrust at any stage through the MCDU PERF CLB page. During the latter stage of a climb to higher levels, the derate is progressively reduced to zero by the FADECs.
Climb performance will be reduced when using derated climb thrust but the ceiling will not be affected.
Should an engine failure occur during a derated climb, derated climb thrust is deselected by selecting MCT.
The derated climb slightly increases fuel consumption. The flight crew should take it into account for the fuel quantity computation.

SMALL ALTITUDE CHANGES

Ident.: PR-NP-SOP-140-00016466.0001001 / 20 MAR 17
Applicable to: ALL

The use of low values of V/S, e.g less than 1 000 ft/min may be appropriate for small altitude changes as it makes the guidance smoother and needs less thrust variation.

SPEED CONSIDERATIONS

Ident.: PR-NP-SOP-140-00019538.0001001 / 20 MAR 17
Applicable to: ALL

The climb speed may be either:
- Managed, or
- Selected.

MANAGED

The managed climb speed, computed by the FMGS, 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 MCDU PERF CLIMB page or selected on the FCU as required.

On ground, prior take-off, speed target at acceleration altitude can be pre-selected on the MCDU PERF CLIMB 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 FCU to achieve the maximum rate of climb or the maximum gradient of climb.
The speed to achieve the maximum rate of climb, i.e. to reach a given altitude in the shortest time, lies between ECON climb speed and green dot. As there is no indication of this speed on the PFD, a good rule of thumb is to use turbulence speed to achieve maximum rate.
The speed to achieve the maximum gradient of climb, i.e. to reach a given altitude in a shortest distance, is green dot. The MCDU PERF CLB page displays the time and distance required to achieve the selected altitude by climbing at green dot speed. 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

Ident.: PR-NP-SOP-140-00019540.0001001 / 20 MAR 17
Applicable to: ALL

The MCDU PROG page provides the crew with the MAX REC ALT and with the OPT ALT information (See cruise section). This information is to be used to rapidly answer to ATC: "CAN YOU CLIMB TO FL XXX?"
The MCDU PERF CLB page provides predictions to a given FL in terms of time and distance assuming CLB mode. This FL is defaulted to the FCU target altitude or it may be manually inserted.
The **symbol** level arrow on the ND assumes the current AP engaged mode. This information is to be used to rapidly answer to ATC: "CAN YOU MAKE FL XXX by ZZZ waypoint?". The crew will use a PD (Place/Distance), i.e. ZZZ,-10 waypoint if the question is "CAN YOU MAKE FL XXX , 10 N.m before ZZZ point?"

LATERAL NAVIGATION

Ident.: PR-NP-SOP-140-00019541.0001001 / 20 MAR 17
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 MCDU FPLN page will not be observed unless they are selected on the FCU.

UNDUE ACTIVATION OF GO-AROUND PHASE

Ident.: PR-NP-SOP-140-00024086.0001001 / 28 MAY 20
Applicable to: ALL

In some specific cases, the FMS Go-Around phase may be unduly activated. This situation may be encountered after takeoff if the aircraft is above the ACC ALT and the flight crew sets the thrust levers to TOGA detent with at least CONF 1.

In such situation, the flight crew should do either of the following in order to activate the CLIMB phase:
- Insert a NEW DEST (different from the current DEST), or
- Select the ALTN destination.

Once the FMS CLIMB phase is activated again, the flight crew should modify the DEST in order to insert the DEST of the intended flight.

FMS USE

Applicable to: ALL

Ident.: PR-NP-SOP-150-10-00020931.0001001 / 20 MAR 17

CRUISE FL

If the aircraft is cleared to a lower cruise flight level than the pre-planned cruise flight level displayed on MCDU PROG page, "ALT CRZ" will not be displayed on the FMA and cruise Mach number will not be targeted. The crew will update the MCDU PROG 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 ± 3 kt) before a readjustment of thrust occurs. This optimizes the fuel consumption in cruise.

Ident.: PR-NP-SOP-150-10-00020932.0001001 / 20 MAR 17

WIND AND TEMPERATURE

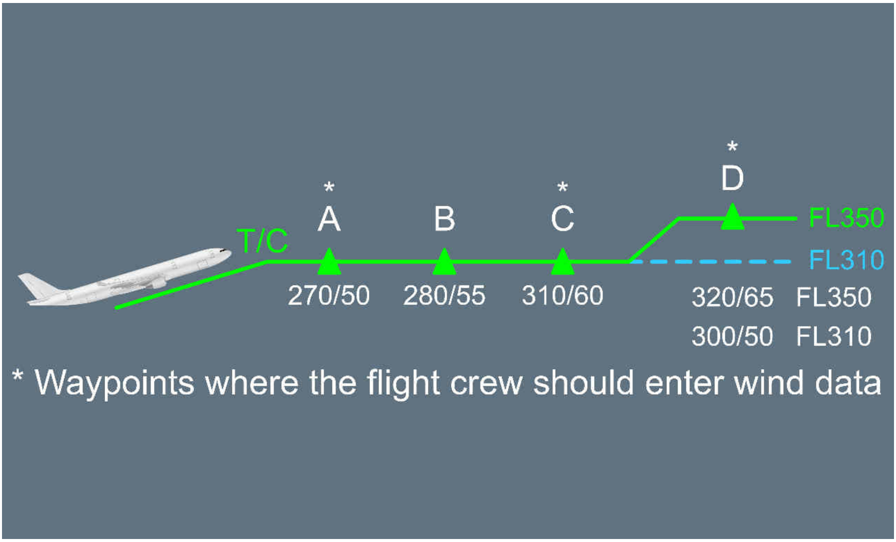
When reaching cruise FL, the crew will ensure that the wind and temperatures are correctly entered and the lateral and vertical F-PLN reflect the CFP. Wind entries should be made at waypoints when there is a difference of either 30 ° or 30 kt for the wind data and 5 °C for temperature deviation. These 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.

Ident.: PR-NP-SOP-150-10-00020933.0001001 / 20 MAR 17

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.

Step Climb and Wind Propagation Rule



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.

Ident.: PR-NP-SOP-150-10-00019542.0001001 / 20 MAR 17

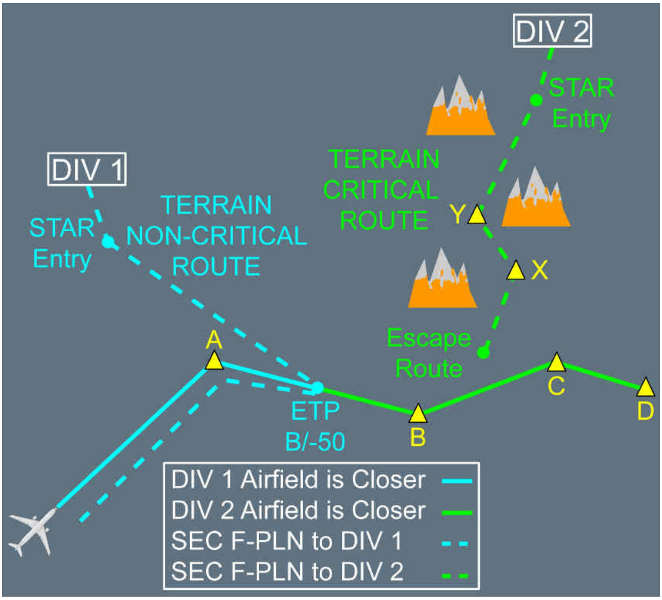
ETP

The ETP function should be used to assist the crew in making a decision should an en-route diversion be required. Suitable airport pairs should be entered on the ETP page and the FMS will then calculate the ETP. Each time an ETP is sequenced, the crew should insert the next suitable diversion airfield.
The SEC F-PLN is a useful tool and should be used practically. The ETP should be inserted in the SEC F-PLN as a PD (Place/Distance) 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 the ETP page
- Insert the next applicable diversion airfield with associated wind
- Read new ETP
- Insert new ETP as a PD

- Copy active on the SEC F-PLN
- Insert the new diversion as New Dest in the SEC F-PLN from new ETP

Example of SEC F-PLN Use During Cruise



The DATA/Stored Routes function in the MCDU can be used to store up to five possible diversion routes. These routes can be entered into the SEC F-PLN using the SEC INIT prompt. This prompt will only be available if the SEC F-PLN is deleted. *Refer to FCOM/DSC-22_20-60-50 Secondary Flight Plan* for further information

For diversion purpose, the crew can also use the CLOSEST AIRPORT page which provides valuable fuel/time estimates to the four closest airports from the aircraft position, 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.

Ident.: PR-NP-SOP-150-10-00020936.0001001 / 20 MAR 17

MISCELLANEOUS

If ATC requires a position report, the crew will use the REPORT page which can be accessed from PROG 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 the FIX INFO page which can be accessed from a lateral revision on F-PLN page at PPOS.
If ATC requires a report at a given time, the crew will insert a time marker pseudo waypoint.
If there is weather, the crew will use the OFFSET function which can be accessed from a lateral revision at PPOS. 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

Ident.: PR-NP-SOP-150-00019543.0001001 / 20 MAR 17
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

Ident.: PR-NP-SOP-150-00019544.0002001 / 20 MAR 17
Applicable to: ALL

The cruise speed may be either:
- Managed, or
- 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, e.g. +50 kt head wind equates to M +0.01.
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 M 0.84, to achieve this constraint. If the constraint can be met, i.e. within ± 2 min, a magenta asterix will be displayed on the MCDU; 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 option enables to fly cruise segment at constant Mach. This guidance is performed under managed speed control and is taken in to account for cruise predictions. This facility is also available in the SEC F-PLN.

SELECTED

Should ATC require a specific cruise speed or turbulence penetration is required, the pilot must select the cruise speed on the FCU. FMS predictions are updated accordingly until reaching either the next step climb or top of descent, where the programmed speeds apply again. The FMS predictions are therefore realistic.
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.

SPEED DECAY DURING CRUISE

Ident.: PR-NP-SOP-150-00019545.0001001 / 05 MAY 22
Applicable to: ALL

FACTORS THAT CAUSE A SPEED DECAY DURING CRUISE

On an aircraft with no failure, and the A/THR engaged or the MAX CLB thrust applied in manual mode, a continuous speed decay during the cruise phase may be due to:

- A large and continuous increase in tailwind or decrease in headwind, in addition to an increase in the OAT, that results in a decrease of the REC MAX FL (*Refer to PR-NP-SOP-150 Altitude Considerations*), or
- A large downdraft, when the flight crew flies (parallel and) downwind in a mountainous area, due to orographic waves. The downdraft may have a negative vertical speed of more than 500 ft/min. Therefore, if the aircraft is in a downdraft, the flight crew must climb in order to maintain altitude, and the pitch angle and the thrust value increase. Without sufficient thrust margin, the flight crew may notice that aircraft speed decays, but the REC MAX FL is not modified.

THRUST MARGIN AND EXTERNAL PARAMETERS

The flight crew must be aware that at high altitude, the thrust margin (difference between the thrust in use and the maximum available thrust) is limited. The maximum available thrust decreases when there is an increase in altitude and/or outside temperature. In some conditions, MCT may be the maximum available thrust. In such a situation, it is useless to put the thrust levers in the TOGA detent to try to increase the thrust.
The REC MAX FL indicated in the PROG page of the MCDU decreases when the OAT increases. The nearer the aircraft is to the REC MAX FL, the smaller the thrust margin.

GREEN DOT SPEED AS A REFERENCE

The optimum lift/drag speed is the GD speed. The GD speed uses the lowest quantity of thrust necessary to maintain the required/desired altitude. When the aircraft speed is below GD speed, any decrease in speed requires an increase in thrust in order to maintain the required/desired altitude. Therefore, if aircraft speed is below GD speed and continues to decrease, even with the maximum available thrust in use, if the flight crew maintains the current altitude, the angle of attack will further increase.

OPERATIONAL RECOMMENDATION

The nearer the aircraft is to the REC MAX FL, the smaller is the thrust margin that the flight crew has to manage a speed decay during cruise.
If the aircraft speed goes below GD speed, with the maximum available thrust in use, the only way for the flight crew to avoid an increase in the angle of attack is to descend.

Note: *With the A/THR on, the selection of the OP DES mode reduces the thrust to idle, and therefore increases the time to recover the energy.*

As a result, the flight crew can recover normal aircraft speed and the normal thrust margin.

ALTITUDE CONSIDERATIONS

Ident.: PR-NP-SOP-150-00019546.0001001 / 20 MAR 17
Applicable to: ALL

The MCDU PROG 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 0.3 g buffet margin. If the crew inserts a FL higher than REC MAX into the MCDU, it will be accepted only if it provides a buffet margin greater than 0.2 g. Otherwise, it will be rejected and the message "CRZ ABOVE MAX FL" will appear on the MCDU scratchpad. This message may also be triggered in case of temperature increase leading the aircraft to fly above the REC MAX FL. 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 MCDU 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 PROG page is meaningful only if the wind and temperature profile has been accurately entered. The Flight crew should be aware that flying at a FL different from the OPT FL can have an adverse effect on the trip cost.
For each Mach number, there will be a different OPT FL. Should an FMGES failure occur, the crew should refer to the FCOM or QRH to determine the OPT FL. FCOM and QRH charts are only provided for four different Mach numbers.

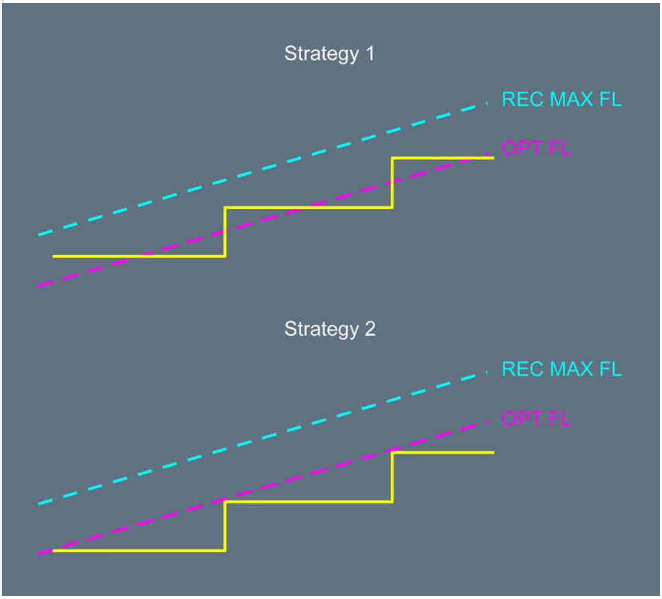
STEP CLIMB

Ident.: PR-NP-SOP-150-00019547.0001001 / 15 NOV 21
Applicable to: ALL

From a cost point of view, it is better to climb to a higher cruise altitude when aircraft weight permits, because the optimum altitude increases when fuel is consumed during the flight. This technique is referred to as a Step Climb.
The flight crew can plan the step climbs at waypoints, or the FMS can compute the optimum step points. In order to determine the optimum location of the next FL change, the flight crew uses the OPTIMUM STEP POINT function on the MCDU STEP ALTS page which is either accessed from the MCDU F-PLN/VERT REV page or the MCDU PERF CRZ page. If predictions are satisfactory in terms of time and fuel saving, the flight crew inserts the optimum step point in the temporary flight

plan provided it is compatible with the ATC. The inserted step climb is set as a geographic waypoint. The flight crew can update the step point by pressing the UPDATE* button on the STEP ALTS page.
The OPT STEP computation is accurate if the flight crew accurately entered the vertical wind profile. For more information, *Refer to FMS Use*.
It can be advantageous to request an initial cruise altitude above the OPT FL, if altitude changes are difficult to obtain on specific routes. This minimizes the possibility of being held at a low altitude and in high fuel consumption condition for long periods of time. The flight crew should compare the requested/cleared cruise altitude to the REC MAX FL. Before the flight crew accepts an altitude above the OPT FL, they should determine if this FL will remain acceptable considering the projected flight conditions such as turbulence, standing waves or temperature changes.
The following graph indicates the two step climb strategies with respect to the OPT FL and the REC MAX FL. Strategy 1 provides the best trip cost.

OPT FL Follow Up



FUEL TEMPERATURE

Ident.: PR-NP-SOP-150-00019548.0001001 / 22 MAR 17
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. The rate of cooling of fuel can be expected to be in the order of 3 °C per hour with a maximum of 12 °C per hour in the most extreme conditions.

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 4 000 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 M 0.01 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.

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LANDING PERFORMANCE

Ident.: PR-NP-SOP-160-00023088.0001001 / 01 MAR 23
Applicable to: ALL

GENERAL

DISPATCH POLICY

Airbus recommends to crosscheck at dispatch, in addition to the regulatory performance requirements, that in the forecast conditions, the FLD for the planned mass is less than the available runway length (LDA). This check should be made for both the destination and the destination alternates.

LANDING PERFORMANCE AT TIME OF ARRIVAL

Both flight crew members enter the necessary data in their FS+ Landing application. They must take into account any applicable MEL/CDL/ECAM items and NOTAMs/AIP SUPs (possibly covered by a TMP RMY) and indpendently compute the landing performance data. As part of their approach preparation, the flight crew should always make an in-flight performance calculation, each time conditions have changed from the assumptions made at dispatch and always in case of wet/contaminated runway or for a dry runway in case of any uncertainty regarding the LDTA (e.g. in case of small stop margin due to runway length):

- **Runway change**
  If the runway, planned to be used at time of dispatch, is not known, consider that it was based on the longest runway and no wind. If the runway to be used is shorter, a specific computation is recommended
- **Diversion**
- The intended use of **autobrake** or **autoland** (as the RLD only considers manual braking)
- **Degradation** of the runway conditions since dispatch
- **In-flight failure** affecting the landing performance.

In the case of degradation of the runway conditions since dispatch, the flight crew should use all available information that is reported to them, to make an appropriate assessment of the Runway Surface Conditions. This includes an assessment of how these conditions may degrade before it is no longer possible to stop the aircraft within the declared distances. If the flight crew is not sure, they should request to change the runway for a more favorable one, or decide that a diversion may be a better option.

In order to assess the landing performance, the flight crew should follow the two main steps described below:

1. Identify the Braking Performance Level with the RCAM for RWY COND selection in the LDG PERF application
2. Calculate the Landing Performance with the LDG PERF application. Consider a margin of 15 % (Factored In-Flight Landing Distance), except under abnormal operations.

USE OF REVERSE THRUST

Operational Landing Distances should be calculated in accordance with the planned operation. For example, if the flight crew expects to use idle reverse thrust only, they should establish the FLD without reverse thrust.
When the runway is wet or contaminated, Airbus recommends the use of maximum reverse thrust.
The flight crew may use idle reverse in wet conditions, when it is ensured that a safe stop with spoilers and wheel braking alone can be made on a runway contaminated with standing water. The LDA should therefore exceed the unfactored LD without reverse for the braking action corresponding to standing water (RWYCC 2, Braking Action Medium to Poor).

USE OF AUTOBRAKE

To avoid landing with unduly high autobrake settings, the FLD with autobrake may exceed the LDA as long as all of the following conditions are satisfied:
- The RWYCC is 5 or 6
- The LD with autobrake is less than the LDA
- The FLD with maximum manual braking is less than the LDA.

USE OF THE RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)

RUNWAY CONDITION REPORTING

When information in accordance with the GRF SNOWTAM format is available, the flight crew may use it for the performance assessment.
When information is provided in the non-GRF SNOWTAM format, or any other local format, the flight crew should use the RCAM to determine the appropriate input parameters for the performance computation. The non-GRF SNOWTAM format can be detected by its use of field codes as, for example, F), G).

RCAM LOCATION

Refer to FCOM/EFB-LDG-30 Runway Condition Assessment Matrix for Landing.

INFORMATION PROVIDED BY THE RCAM

The purpose of the RCAM is to provide the flight crew with an identification method of an appropriate Braking Performance Level, if it is not provided by the airport.

The RCAM provides 6 Braking Performance Levels:
- 6 - Dry
- 5 - Good
- 4 - Good to Medium
- 3 - Medium
- 2 - Medium to Poor
- 1 - Poor

USE OF THE RCAM

The flight crew gathers all available information (e.g. ATIS, METAR, SNOWTAM, TAF, AIREP, NOTAM, Airport Documentation) related to Runway Surface Conditions.
The flight crew makes a **primary** assessment based on Runway Condition information (i.e. runway state, contaminant type, depth, temperature). This results in a **primary** Braking Performance Level.

Then, the flight crew **downgrades** this primary Braking Performance Level, if:
- A Special AIREP is available and this AIREP corresponds to a lower Braking Performance Level
- A SNOWTAM includes a lower RWYCC, or the ESF corresponds to a lower Braking Performance Level
  For loose contaminants (Dry Snow, Wet Snow or Slush), the flight crew should not consider an ESF based on friction measurements
- Complementary information is available and is related to a possible degradation of the Runway Condition or braking action.

In any case, the flight crew must not use an AIREP, ESF or any other complementary information to upgrade a primary Braking Performance Level that was based on Runway Condition information. The flight crew may accept an upgraded RWYCC reported by the airport.

In the following example, the reported Runway Condition is wet, and the AIREP is "Good to Medium":
1. The primary assessment based on Runway Condition information results in "5 - Good"
2. The downgrade based on Reported Braking Action results in "4 - Good to Medium".

Runway Condition: Wet

Reported Braking Action: Good to Medium

Runway Surface Conditions		Observations on Deceleration and Directional Control	Related Landing Performance		Maximum Crosswind for Landing (Gust included)
Runway State or / and Runway Contaminant	AIREP*		RWYCC**	Level	
Dry	-	-	6	DRY	40kt
Damp **Wet** Up to 3 mm (1/8 in) of water **Slush** Up to 3 mm (1/8 in) **Dry snow** Up to 3 mm (1/8 in) **Wet snow** Up to 3 mm (1/8 in) **Frost**	Good	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	5	GOOD	40kt
Compacted snow OAT at or below −15°C	Good to Medium	Braking deceleration and controllability is between Good and Medium	4	GOOD TO MEDIUM	27kt
Dry snow More than 3 mm (1/8 in), up to 100 mm (4 in) **Wet snow** More than 3 mm (1/8 in), up to 30 mm (6/5 in) **Compacted Snow** OAT above −15°C **Dry snow over compacted snow** **Wet snow over compacted snow** **Slippery wet**	Medium	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be reduced.	3	MEDIUM	20kt
Standing Water More than 3 mm (1/8 in), up to 13 mm (1/2 in) **Slush** More than 3 mm (1/8 in), up to 13 mm (1/2 in)	Medium to Poor	Braking deceleration and controllability is between Medium and Poor. Potential for Hydroplaning exists.	2	MEDIUM TO POOR	20kt
Ice (cold & dry)	Poor	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	1	POOR	15kt
Wet ice **Water on top of Compacted Snow** **Dry Snow or Wet Snow over ice**	Less than Poor	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	0	-	-

**AIREP: Special Air Report of Braking Action* ***RWYCC: Runway Condition Code*

The following example illustrates the downgrade based on complementary information related to a possible degradation of the Runway Condition or braking action:
- Runway state reported as wet
- NOTAM “SLIPPERY WHEN WET".

In this example, the flight crew should perform the landing performance assessment with the Braking Performance Level “3 - Medium”.

In normal operations, the flight crew should perform the landing performance assessment with the Braking Performance Level “3 - Medium” if:
- There is rain on the runway
- A NOTAM "SLIPPERY WHEN WET" or the equivalent information (e.g. airport documentation) warns that the runway braking action is less than when the runway is “WET”.

Note: *Based on current knowledge, hail on the runway cannot be categorized in terms of its effect on braking performance. Operations on hail covered surfaces are not recommended due to the risk of engine ingestion and airframe damage.*

CROSSWIND

If the flight crew downgrades the braking performance assessment after they consider additional information, they should also downgrade the maximum crosswind value.
For Maximum Crosswinds, *Refer to FCOM/LIM-AG-OPS Crosswind Takeoff and Landing*.
The LDG PERF application automatically takes into account the crosswind limitations according to the Operator policy.
In the case of strong or gusty crosswind above 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.

RISK OF DEGRADED RUNWAY CONDITIONS

If meteorological conditions may change, or under active precipitation, the flight crew should consider a backup assessment of the in-flight landing performance. This assessment should take into account the worst probable Braking Performance Level.
The flight crew may become aware of these conditions late in approach (e.g. following an AIREP transmission that contains "Medium to Poor", or following the visual assessment of the runway).
In addition to the usual assessment with the Braking Performance Level "5 - Good", it is safe practice to perform a second assessment with "2 - Medium to Poor". If the result of the second assessment shows that the runway is too short, it enables the flight crew to anticipate, in the event of degraded runway conditions (e.g. heavy rain), an appropriate decision to continue or not the approach.

SPECIALLY PREPARED WINTER RUNWAY

An airport may be authorized by its national authorities to report a Specially Prepared Winter Runway combined with a RWYCC of up to 4. This approval depends on a statistical demonstration based on aircraft data recorded and analyzed for observed braking action. When this type of report is applicable, the flight crew may consider a RWYCC of 4, if permitted by the operator policy.

REPORTED FRICTION

Estimated surface friction should not be reported as it is not possible to establish a correlation between the values provided by the ground equipment and the aircraft performance. However, some countries continue to report measured friction. The flight crew should disregard this information, when available.

DOWNGRADED OR UPGRADED RWYCC

An airport may report a RWYCC that is less than the one associated with the reported contamination condition according to the RCAM. The runway inspector must consider all the information available to make the most appropriate report of runway conditions. The information may include, for example, friction measurements, vehicle control during inspection or local knowledge. The airport can downgrade any RWYCC to any lower RWYCC. It should not report any RWYCC 0, as in that case, the runway must be closed.

In some situations, the airport may report a better RWYCC than the primary one obtained from the RCAM. Upgrades are permitted only when:
- The runway condition results in an RWYCC of 1 or 0 according to the RCAM
- All observations indicate that the braking action is of the order of Good, including friction measurements.

The maximum upgraded RWYCC is 3.
The flight crew should never upgrade an RWYCC on their own initiative.

DIFFERENT RWYCC ON DIFFERENT THIRDS

The airport may report a different RWYCC for different subsections of the runway that correspond to a third of the runway length. The flight crew should use the worst RWYCC for the landing performance assessment, unless a specific operator policy applies.
The flight crew should use the lowest RWYCC to determine the maximum acceptable crosswind, as even short sections of very slippery conditions can induce a loss of control.

LAYERED CONTAMINATION

The RCAM includes some cases of layered contamination.
The performance section of the SNOWTAM can contain only these cases, for which the effect on aircraft braking performance is known in terms of RWYCC.
The free text section of the SNOWTAM may report different cases. Most combinations not listed in the RCAM result in conditions that are too slippery for safe operations.
Depths reported for layered contaminants apply to the top layer only. The flight crew may ignore loose snow of less than 3 mm (1/8 in) on top of compacted snow.
Any depth of water, snow or slush on top of ice will cause a very slippery condition.

AIREP OF BRAKING ACTION

Local regulation may require that the flight crew makes AIREPs of observed braking action if they consider it to be less than previously reported. The RCAM provides the terminology to be used for these reports (from Good, Good to Medium to Poor or Less Than Poor). It also provides the associated description of the observation in terms of deceleration capability and directional control.

Flight crew may find braking action difficult to evaluate, as it is supposed to quantify only the wheel braking component of the deceleration. Aerodynamic braking and reverse thrust can, at high speed, permit to achieve the expected deceleration and hide a low wheel braking efficiency.

The BACF, if installed, may assist the flight crew to make reports (*Refer to FCOM/ 00023494 **Not found***).

ATC may communicate AIREPs from previous aircraft. Flight crew should take into account the type of aircraft (weight, approach speed, wheel track) that made the report when they evaluate the impact on their own landing performance calculations.

EXAMPLES OF LANDING PERFORMANCE CODE - LEVEL ASSESSMENT

RUNWAY CONTAMINATED BY COMPACTED SNOW, OAT -10 °C

Compacted Snow at or below -15 °C is in the category of Good to Medium.

Compacted Snow above -15 °C is in the category of Medium.

This information indicates that the computation should be done with the Landing Performance level 3 - Medium and the corresponding maximum crosswind must be taken into account.

RUNWAY COVERED BY LESS THAN 3 MM (1/8 IN) OF WATER BUT HEAVY RAIN WITH STORM CELLS IN THE VICINITY ARE REPORTED

According to the matrix, the expected landing performance on a runway covered by less than 3 mm (1/8 in) of water (runway is wet) is 5 - Good.

However, heavy rain can saturate the draining capabilities of the runway and result in standing water. Standing water (more than 3 mm – 1/8 in of water) is in the category of 2 - Medium to Poor.

This information indicates that it may be appropriate to consider 2 - Medium to Poor Landing Performance and the corresponding maximum crosswind must be taken into account.

The flight crew should not apply the benefit of runway grooving or PFC in conditions of heavy rain or storm cells in the vicinity.

RUNWAY COVERED BY TREATED ICE (COLD AND DRY) WITH AN ESTIMATED SURFACE FRICTION GOOD OR RUNWAY CONDITION CODE 3

Icy runways are in the category of 1 - Poor or 0 - Less than Poor.

The RCAM does not permit unconditional benefit of runway treatment as, for example, sand, gravel or chemicals. The success of the surface treatment must be validated by friction measurements and supported by all other observations of trained airport personnel. The airport will report an RWYCC 3.
The upgrade of the landing performance may only be performed by the airport. If on treated cold and dry ice, a surface friction Good or better is measured on all three thirds of the runway, the airport may upgrade the RWYCC to the category of 3 - Medium.

CONTENT OF A LANDING PERFORMANCE DATA CROSSCHECK

Ident.: PR-NP-SOP-160-00024762.0001001 / 01 MAR 23
Applicable to: ALL

When SOPs request a crosscheck of landing performance data, both the PF and the PM must verify all the following values:
- RWY Ident
  This ensures that the runway used for the computation in the EFB and/or inserted in the FMS is the same
- RWY Length
  This ensures that the flight crew took into account any NOTAM that affects the runway length. The RWY length must be checked against the RWY length shown on the airport chart
- Airport Weather Information (Wind, QNH, Temperature, Runway condition)
- Landing Weight
- FLAPS
- FLD
- VAPP.
- the calculated VLS versus the VLS displayed on the FMS

BRAKES OXIDATION

Ident.: PR-NP-SOP-160-00020598.0001001 / 20 MAR 17
Applicable to: ALL

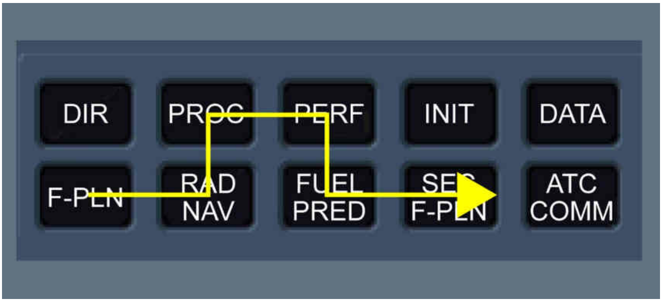
Two different factors affect the life of carbon brakes:
- The wear of the disks,
- The oxidation of the disks.

The oxidation may degrade rapidly the carbon brakes and may cause the rupture of a brake disk.
The main cause of oxidation is the repetitive high temperature of the brakes (particularly above 400 °C).
Therefore, the flight crew should preferably use autobrake LO when performance permits.

APPROACH PREPARATION

Ident.: PR-NP-SOP-160-00019551.0001001 / 10 MAY 21
Applicable to: ALL

The flight crew should obtain the latest information for landing (weather, runway state, braking action, etc.) at the latest 15 min prior to descent. The flight crew should check the landing performance (VAPP and landing distance) and the PF should program the FMGES for the descent and arrival.
The fuel predictions are accurate if the F-PLN is correctly entered in terms of arrival, go-around and alternate routing.
The PF should program the FMGES applying the following sequence:



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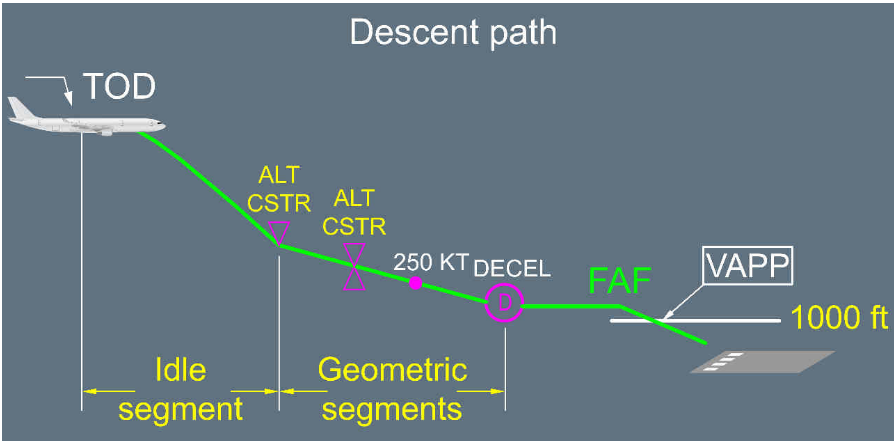
COMPUTATION PRINCIPLES

Ident.: PR-NP-SOP-170-00016467.0001001 / 04 JUN 19
Applicable to: ALL

TOD AND PROFILE COMPUTATION

The FMGS calculates the TOD backwards from a position 1 000 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.
With DPO option, the idle segment assumes a given managed speed flown at idle thrust. This gives less flexibility to keep the aircraft on the descent path if engine anti-ice is used or if winds vary. In the case of use of engine anti-ice or increased tailwind, the use of speed brakes may be required to go back on the descent path.
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 PERF DES page, before entering DESCENT phase), or
- The speed constraint or limit when applicable.

GUIDANCE AND MONITORING

Ident.: PR-NP-SOP-170-00019553.0001001 / 25 JUL 17
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 PROG page, as well as the level arrow on the ND.
The **selected OP DES 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 OP DES 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 on the ND. When the aircraft is not far away from the lateral F-PLN (small XTK), 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 MCDU 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 in the MCDU or non-sequencing of F-PLN waypoints, giving a false distance to touchdown.

DESCENT INITIATION

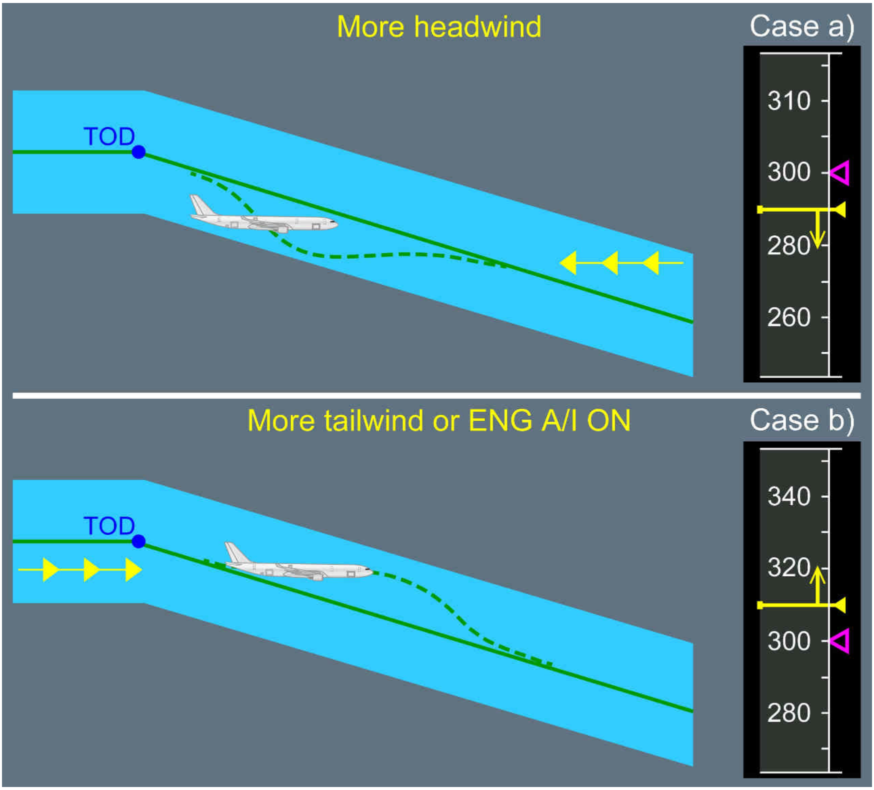
To initiate a managed descent, the pilot will set the ATC cleared altitude on the FCU and push the ALT selector. DES mode engages and is annunciated on the FMA. If an early descent were required by ATC, DES mode would give 1 000 ft/min rate of descent, until regaining the computed profile.

To avoid overshooting the computed descent path, it is preferable to push the FCU ALT selector a few miles prior to the calculated TOD. This method will ensure a controlled entry into the descent and is particularly useful in situations of high cruise Mach number or strong tail winds. If the descent is delayed, the PFD and the MCDU display "DECELERATE" or "T/D REACHED". This message is displayed in white on the PFD and in amber on the MCDU. 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 kt speed range around the managed target speed to maintain the descent path.

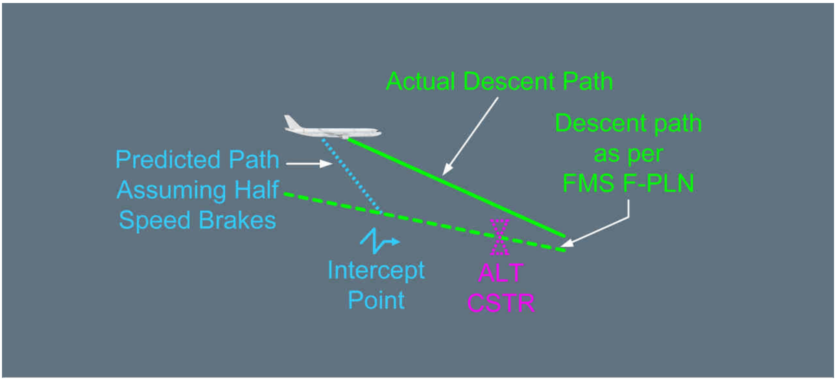
Managed Descent: Speed Target Range Principle



- **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 SPEEDBRAKES" will be displayed on the PFD and MCDU.

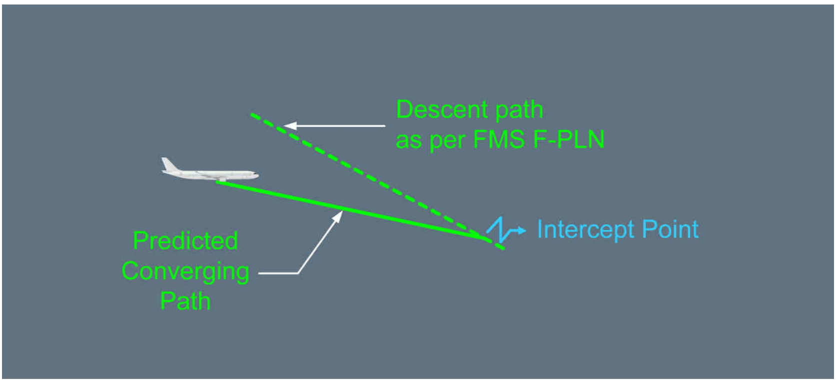
This technique allows an altitude constraint to be matched with minimum use of speedbrakes.
When regaining the descent profile, the speedbrakes should be retracted to prevent the A/THR applying thrust against speedbrakes. If the speedbrakes are not retracted, the "SPD BRK" message on the ECAM memo becomes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

A/C Above Descent Path



- **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.

A/C Below Descent Path



- **If selected speed is used:**
  The 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 kt with a pre-computed descent profile assuming managed speed 300 kt, 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 FCU 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 MCDU descent altitude constraints and will fly an unrestricted descent down to the FCU selected altitude.
If the crew wishes to increase the rate of descent, 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.

HOLDING SPEED AND CONFIGURATION

Ident.: PR-NP-SOP-180-00019554.0001001 / 20 MAR 17
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 min hold. 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 holding pattern can be modified by the crew.
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 the hold speed when entering the holding pattern.

The default hold speed is the lowest of the following:
- Maximum Endurance speed
- ICAO limit holding speed
- Speed constraint (if any).

When no specific speed limit applies, the default hold speed is the Maximum Endurance speed, which is approximatively equal to Green Dot (it can be between Green Dot and Green Dot +10 kt, depending on aircraft weight and flight conditions) and provides the lowest hourly fuel consumption.
If the Maximum Endurance 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 Maximum Endurance speed.

IN THE HOLDING PATTERN

Ident.: PR-NP-SOP-180-00019555.0001001 / 25 JUL 17
Applicable to: ALL

The holding pattern can be performed in clean configuration or CONF 1 configuration. The holding pattern is not included in the descent path computation since the FMGS does not know how many patterns will be flown. When the holding fix is sequenced, the FMGS 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 MCDU HOLD page. These predictions are based upon the fuel policy requirements specified on the MCDU FUEL PRED 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 310 performed at maximum range speed
- 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 MCDU ALTN airport page which can be accessed by a lateral revision at destination.

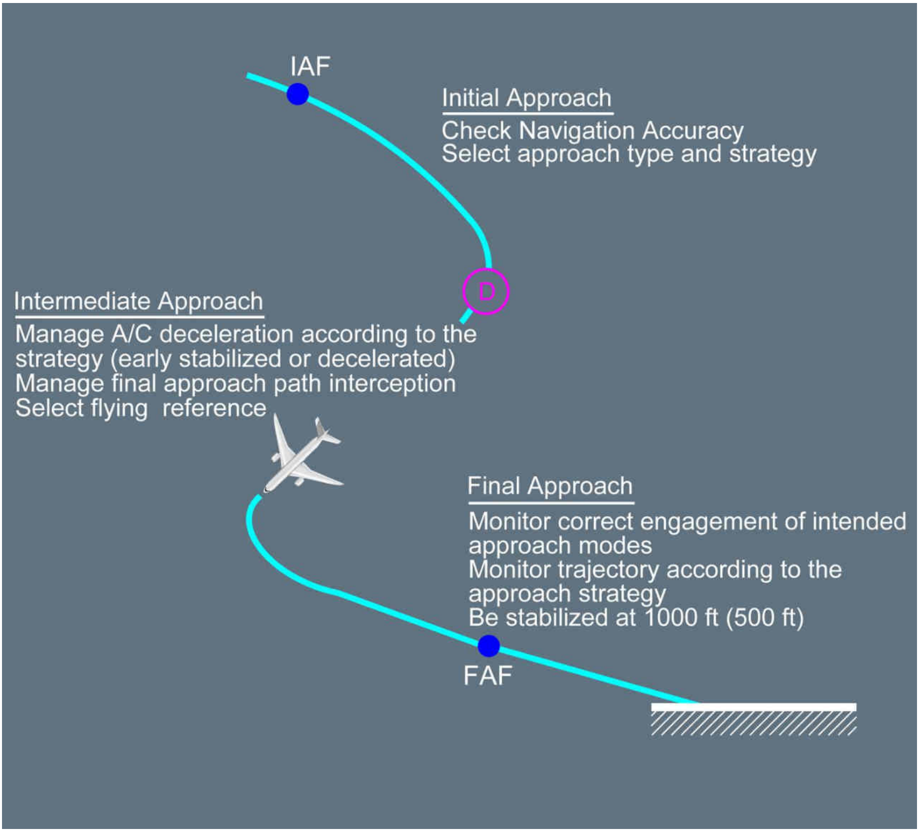
To exit the holding pattern, the crew should select either:
- IMM EXIT (The aircraft will return immediately to the hold fix, exit the holding pattern and resume its navigation), or
- HDG if radar vectors, or
- DIR TO if cleared to a waypoint.

General

INTRODUCTION

Ident.: PR-NP-SOP-190-GEN-00016586.0001001 / 20 MAR 17
Applicable to: ALL

All approaches are divided into three parts (i.e initial, intermediate and final) where the flight crew should perform associated configuration management and guidance management.
Techniques, which apply to specific approach types are covered in the appropriate chapters.



DISCONTINUED APPROACH

Ident.: PR-NP-SOP-190-GEN-00016590.0001001 / 20 MAR 17
Applicable to: ALL

The discontinued approach is an alternative technique to the GO AROUND procedure to interrupt an approach when the aircraft is at or above the selected FCU altitude.
Contrary to the GO AROUND procedure, the discontinued approach technique does not require the flight crew to set the thrust levers to TOGA detent.
The flight crew should initiate the discontinued approach technique with the callout: “CANCEL APPROACH".
The first action of the flight crew is to disengage and disarm any AP/FD approach mode, by pressing on the APPR pb or LOC pb.

Configuration Management

INITIAL APPROACH

Applicable to: ALL

Ident.: PR-NP-SOP-190-CONF-A-00016591.0001001 / 05 MAR 19

F-PLN SEQUENCING

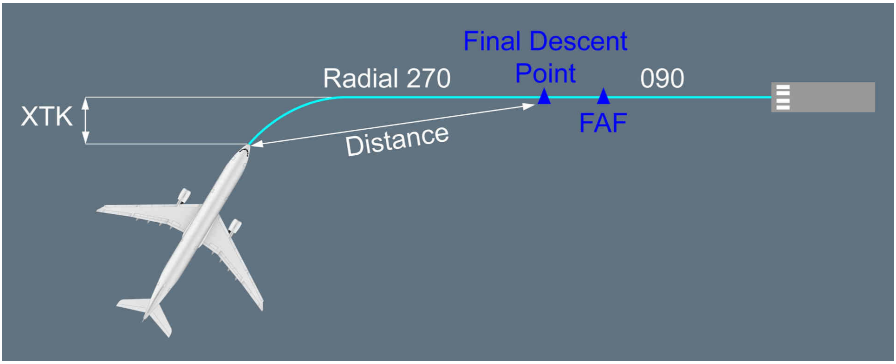
When in NAV mode, the F-PLN will sequence automatically. In HDG/TRK mode, the F-PLN waypoints will sequence automatically only if the aircraft flies close to the planned route. Correct F-PLN sequencing is important to ensure that the planned missed approach route is available in case of go-around and to ensure correct predictions. A good cue to monitor the proper F-PLN sequencing is the TO waypoint on the upper right side of the ND, which should remain meaningful. If ATC provides radar vectors and automatic waypoint sequencing does not occur, the flight crew should use the DIR TO RADIAL IN function or delete the FROM waypoint on the F-PLN page until the next likely waypoint to be over flown is displayed as the TO waypoint on the ND. 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

For more information about the waypoint sequencing, *Refer to FCOM/DSC-22_20-30-10-05 General*.

However, considerations should be given to the following:
- A radial is to be inserted in the MCDU. In the following example, the final approach course is 090 ° corresponding to radial 270 °
- Using DIR TO or DIR TO RADIAL IN function arms the NAV mode. If NAV mode is not appropriate, pull the HDG knob to disarm it.
- DIR TO RADIAL IN must not be used beyond the Final Descent Point, in order to ensure that the vertical profile in final is unchanged.
- Deceleration will not occur automatically as long as lateral mode is HDG

The flight crew should sequence the F-PLN first, and then press the APPR pb. When the LOC mode (or F-LOC mode for aircraft fitted with FLS) is armed or engaged, the flight crew should not perform a DIR TO, in order to sequence the F-PLN, as this will result in the FMGES to revert to the NAV mode. In this case, the LOC mode (or F-LOC mode for aircraft fitted with FLS) will have to be re-armed and re-engaged, increasing workload unduly.



Ident.: PR-NP-SOP-190-CONF-A-00019557.0001001 / 20 MAR 17

APPROACH PHASE ACTIVATION

Activation of the approach phase will initiate a deceleration towards VAPP or the speed constraint inserted at the Final Descent Point (FDP).
When in NAV mode with managed speed, the approach phase activates automatically when sequencing the deceleration pseudo-waypoint. If an early deceleration is required, the approach phase can be manually activated on the MCDU PERF APPR page. When the approach phase is activated, the magenta target speed becomes VAPP.
When in HDG mode, e.g. for radar vectoring, the flight crew will activate the approach phase manually.

APPROACH SPEED TECHNIQUE

There are two approach techniques:
- Decelerated approach
- Early stabilized approach.

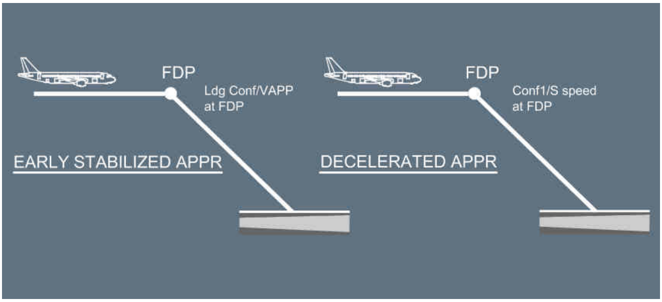
DECELERATED APPROACH

This technique refers to an approach where the aircraft reaches 1 000 ft in the landing configuration at VAPP. In most cases, this equates to the aircraft being in CONF 1 and at S speed at the FDP. This is the preferred technique for an approach using vertical managed guidance. The deceleration pseudo waypoint, D, assumes a decelerated approach technique.

EARLY STABILIZED APPROACH

This technique refers to an approach where the aircraft reaches the FDP in the landing configuration at VAPP. This technique is recommended for non-precision approaches flown with selected vertical guidance (LOC FPA, NAV FPA and TRK FPA). To get a valuable deceleration pseudo waypoint and to ensure a timely deceleration, the pilot should enter VAPP as a speed constraint at the FDP.

Early Stabilized Versus Decelerated Approach



INTERMEDIATE APPROACH

Applicable to: ALL

Ident.: PR-NP-SOP-190-CONF-B-00016592.0001001 / 20 MAR 17

GENERAL

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

Ident.: PR-NP-SOP-190-CONF-B-00019563.0001001 / 01 MAR 23

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 maneuvering speed of the current configuration, when higher than VAPP, e.g. green dot for CONF 0, S speed for CONF 1 etc.
To achieve a constant deceleration and to minimize thrust variation, the flight crew should extend the next configuration when reaching the current configuration maneuvering speed +10 kt (IAS must be lower than VFE next), e.g. when the speed reaches green dot +10 kt, the flight crew should select CONF 1. Using this technique, the mean deceleration rate will be approximately 10 kt/NM in level flight. This deceleration rate will be twice, i.e. 20 kt/NM, with the use of the speedbrakes.
If selected speed is to be used to comply with ATC, the requested speed should be selected 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 flight crew should push the FCU speed selector to resume managed speed.

When flying the intermediate approach in selected speed, the flight 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.
In certain circumstances, e.g. tail wind or high weight, the deceleration rate may be insufficient. In this case, the landing gear may be lowered, preferably below 220 kt (to avoid gear doors overstress), and before selection of Flap 2.

Speedbrakes can also be used to increase the deceleration rate but the flight crew should be aware of:
- The increase in VLS with the use of speedbrakes
- The limited effect at low speeds

If possible, the descent below FL100 should follow approximately a 3° angle. Under normal wind situations, the following speed schedule will in most cases lead to a smooth and comfortable configuration phase:

	A340
green dot	15 NM Final
200 kts	12 NM Final
180 kts	10 NM Final
160 kts	6 NM Final

green dot speed	**S-speed**	**F-speed**
min speed CLEAN	min speed Flaps 1	min speed Flaps 2 & 3

FINAL APPROACH

Applicable to: ALL

Ident.: PR-NP-SOP-190-CONF-C-00019567.0001001 / 03 NOV 21

USE OF A/THR

The flight crew should use the A/THR for approaches as it provides accurate speed control. The PF should keep the hand on the thrust levers so as to be prepared to react if needed.
During final approach, the managed target speed moves along the speed scale as a function of wind variation. If ATC gives a new wind for landing, the flight crew will update it on MCDU PERF APPR page.
The flight crew 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 PF should disconnect it and control the thrust manually.
If the PF uses manual thrust for landing, the PF should disconnect the A/THR at 1 000 ft AAL at the latest.

Ident.: PR-NP-SOP-190-CONF-C-00019568.0001001 / 20 MAR 17

TRAJECTORY STABILIZATION

The first prerequisite for safe final approach and landing is to stabilize the aircraft as per criteria given in the FCOM (*Refer to FCOM/PRO-NOR-SOP-18-A Stabilization Criteria*).
If, for any reason, one flight parameter deviates from stabilized conditions, the PM will make a callout.

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

Ident.: PR-NP-SOP-190-CONF-C-00019743.0001001 / 20 MAR 17

AP DISCONNECTION

During the final approach with the AP engaged, the aircraft will be stabilized. Therefore, when disconnecting the AP for a manual landing, the flight crew should avoid the temptation to make large inputs on the sidestick.
The flight crew should disconnect the autopilot early enough to resume manual control of the aircraft and to evaluate the drift before flare. During crosswind conditions, the flight crew should avoid any tendency to drift downwind.

Some common errors include:
- Descending below the final path
- Reducing the drift too early

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Guidance Management

APPROACH USING LOC G/S GUIDANCE

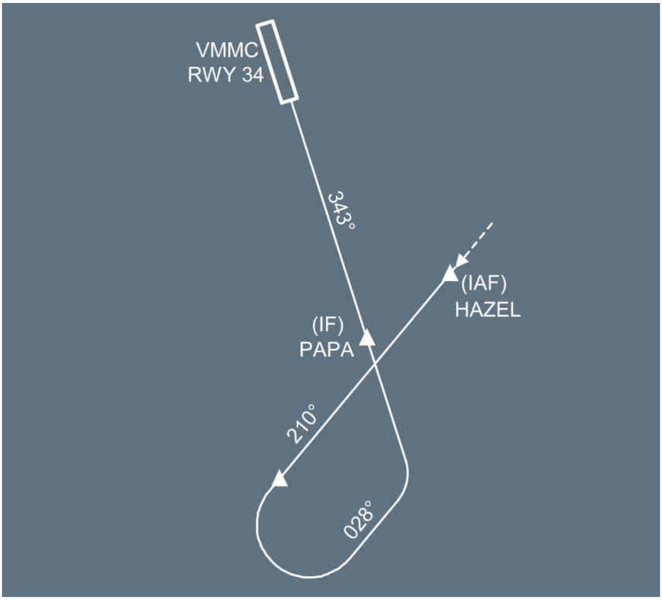
Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-A-00016594.0001001 / 20 MAR 17

INTERCEPTION OF THE FINAL APPROACH COURSE

When cleared for the ILS and when on the intercept trajectory for the LOC, the flight crew should press the APPR pb. 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.
In the example below, if the ATC clears the aircraft for the procedure at HAZEL, the flight crew must delay the push on the APPR pb, as the aircraft is not on the intercept trajectory for the LOC.

VMMC ILS RWY34 via HAZEL



If the ATC clears for a LOC capture only, the crew will press LOC pb-sw on the FCU.
If the ATC clears for approach at a significant distance, e.g. 30 NM, the flight 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.

Ident.: PR-NP-SOP-190-GUI-A-00019569.0001001 / 04 NOV 20

GLIDE SLOPE INTERCEPTION FROM ABOVE

The following procedure must 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 flight crew must react without delay to meet the stabilization criteria.
In order to get the best rate of descent when cleared by ATC and below the limiting speeds, the flight crew should lower the landing gear and select flaps as required (at least CONF 2 should be selected to ensure that the aircraft speed will not increase). Speedbrakes may also be used, noting the considerations detailed in the subsection "Deceleration and configuration change" earlier in this chapter.

When cleared to intercept the glide slope, the flight crew should:

- Press the APPR pb on FCU and confirm G/S is armed and LOC engaged, monitor the vertical interception
- Select the FCU altitude above aircraft altitude to avoid unwanted ALT* engagement
- Select V/S 1 500 ft/min initially. V/S in excess of 2 000 ft/min will result in the speed increasing towards VFE.

The use of V/S mode ensures that the A/THR is in SPEED mode.
The flight crew should carefully monitor the rate of descent to avoid exceeding VFE. When approaching the G/S path, G/S* will engage. The flight crew should monitor the G/S capture with raw data (pitch and G/S deviation). The go-around altitude should be set on the FCU at G/S*.

APPROACH USING LOC G/S GUIDANCE FOR CATII / CATIII

Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-B-00016621.0001001 / 20 MAR 17

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 and 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 CAT II 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

Ident.: PR-NP-SOP-190-GUI-B-00019744.0001001 / 20 MAR 17

DEFINITION

DECISION HEIGHT

The Decision Height (DH) is the wheel height above the runway elevation by which a go around must be initiated unless appropriate 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 safely. 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 parts 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 A330 and A340, the AH = 200 ft.

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.

Ident.: PR-NP-SOP-190-GUI-B-00016622.0001001 / 20 MAR 17

FLIGHT PREPARATION

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 CATII or CATIII requirements
- Check aircraft required equipment for CAT 2 or CAT 3 in QRH
- Check that crew qualification is current

- Consider extra fuel for possible approach delay
- Consider weather at alternate

Ident.: PR-NP-SOP-190-GUI-B-00016623.0001001 / 20 MAR 17

APPROACH PREPARATION

LIMITATIONS

- The crew will check that tower wind remains within the limit for CAT II or CAT III approaches (*Refer to FCOM/LIM-AFS-20 Maximum Wind Conditions for ILS CAT II or CAT III and for GLS (If Installed) CAT I*)
- The autoland maximum altitude must be observed.

AIRCRAFT CAPABILITY

The failures that may affect the aircraft's CAT 2 or CAT 3 capability are listed in the QRH. Most of these failures are monitored by the FMGS 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 FMGS and, consequently, not reflected on the FMA. It is very important, therefore, that the crew refer to the QRH 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. As a rule of thumb, an incorrect seating position which reduces the cut-off angle by 1° reduces the visual segment by approximately 10 m (30 ft).

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

Regardless 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	Manual flying or AP/FD, A/THR	AP/FD, A/THR down to DH	AP/FD/ATHR and Autoland	
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.

APPROACH 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

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.

PF Tasks

The PF supervises the approach (trajectory, attitude, speed) and takes appropriate decision at DH or in case of failure.

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.

PM Tasks

The PM is head down throughout the approach and landing. The PM monitors:
- The FMA and calls all mode changes below 350 ft as required (i.e. after PF calls "LAND")
- The Auto call out
- The aircraft trajectory or attitude exceedance
- Any failures.

The PM should be go-around minded.

SOME SYSTEM PARTICULARS

- Below 700 ft RA, data coming from the FMS is frozen e.g. ILS tune inhibit.
- Below 400 ft RA, the FCU is frozen.
- At 350 ft, LAND must be displayed on FMA. This ensures correct final approach guidance.
- Below 200 ft, the AUTOLAND red light illuminates if
  - Both APs trip off
  - Excessive beam deviation is sensed
  - Localizer or glide slope transmitter or receiver fails
  - A RA misbehavior is sensed.
- Flare comes at or below 40 ft

- THR IDLE comes at or below 30 ft
- RETARD auto call out comes at 10 ft for autoland as an order (Instead of 20 ft for manual landing as a reminder).

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 appropriate 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.
  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.
- 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 inappropriate 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 look outside to assess that the autoland is properly carried out, considering the appropriate visual references.

For CATII approaches, autoland is recommended. If manual landing is preferred, the PF will take-over at 80 ft at 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 should make the standard callouts and advise ATC when the landing roll is completed

Ident.: PR-NP-SOP-190-GUI-B-00016626.0001001 / 20 MAR 17

AUTOLAND IN CAT I OR BETTER WEATHER CONDITIONS

The flight 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 flight 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.

APPROACH USING FINAL APP GUIDANCE

Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-D-00021694.0001001 / 13 DEC 17

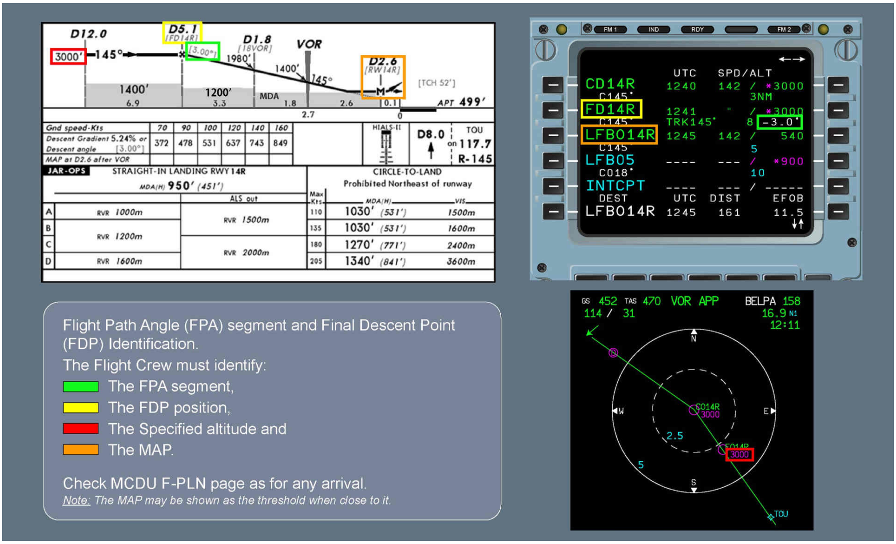
IDENTIFICATION OF FINAL DESCENT POINT

It is recommended to arm FINAL APP mode when the TO waypoint is the FDP.

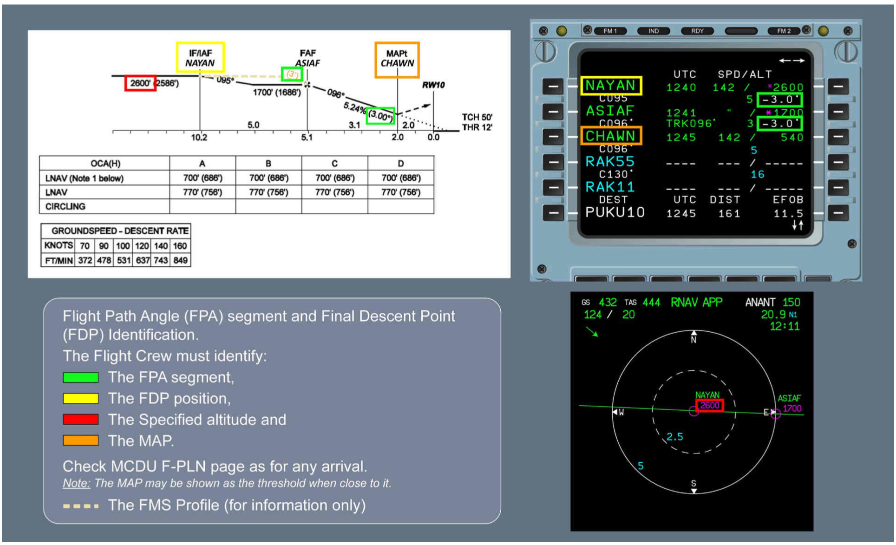
The Final Descent Point is the waypoint from which starts the FMS segment with coded FPA. From this Final Descent Point, lateral and vertical profiles must be checked by crosschecking the following elements on approach chart, MCDU and ND: (see figure below)
- Identification of FPA segment,
- Final Descent Point / VIP position,
- Constraint altitude,
- Map.

There can be some differences between charts and FMGEC. The schemas below propose some examples to provide support in identification of the Final Descent Point. These examples do not aim at being exhaustive and other approach configuration can be flown.

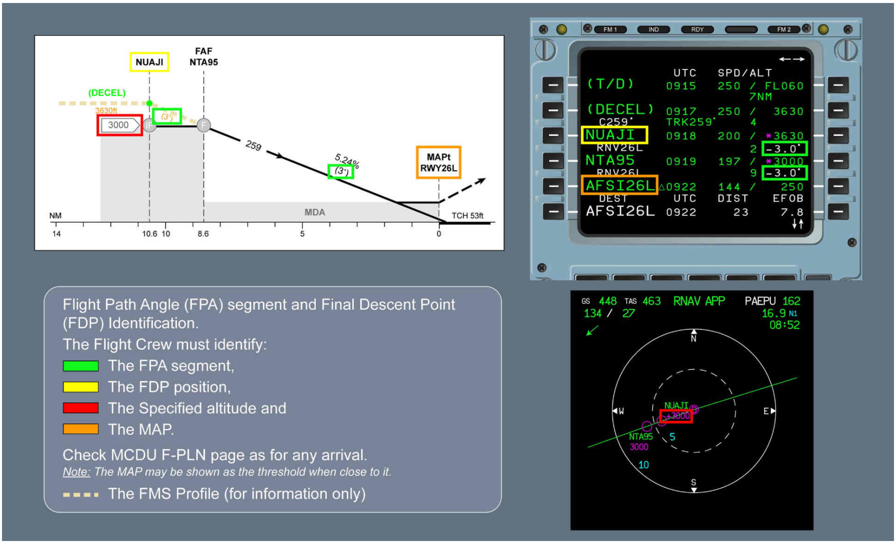
Identification of the FDP with FDP at FAF



Identification of the FDP when different from the descent point



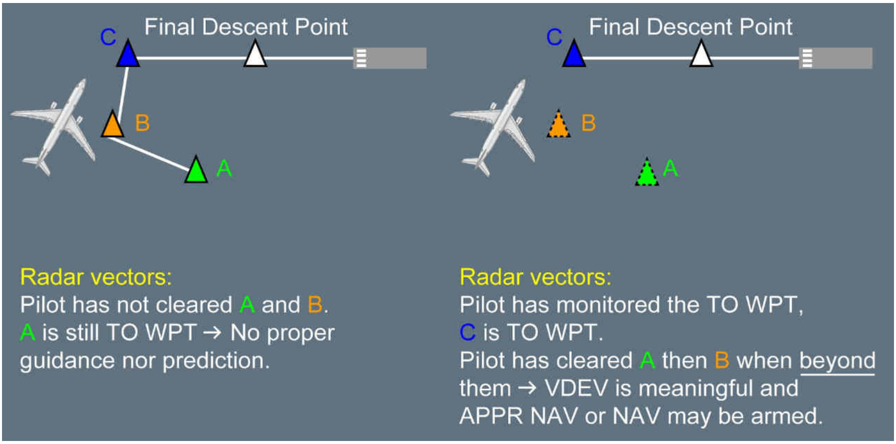
Identification of the FDP when before the FAF



Ident.: PR-NP-SOP-190-GUI-D-00019754.0001001 / 05 JUN 18

INTERCEPTION OF THE FINAL APPROACH COURSE

It is essential to have a correct F-PLN in order to ensure proper final approach guidance. Indeed the NAV and APPR NAV modes are always guiding the aircraft along the F-PLN active leg and the managed vertical mode ensures VDEV =0, VDEV, being computed along the remaining F-PLN to destination. Hence, the crew will monitor the proper sequencing of the F-PLN, more specifically if HDG mode is selected, by checking that the TO WPT, on upper right hand corner of ND, is the most probable one and meaningful.



When cleared for final approach course interception, the pilot should press the APPR p/b on FCU. On the FMA, APP NAV mode becomes armed or engaged and FINAL mode becomes armed. The VDEV or "brick" scale becomes active and represents the vertical deviation, which may include a level segment. The VDEV/brick scale will only be displayed if LS pb is not pressed. If the LS pb is pressed by mistake, the V/DEV will flash in amber on thePFD.
The final approach course interception will be monitored through applicable raw data.

Ident.: PR-NP-SOP-190-GUI-D-00019751.0001001 / 20 MAR 17

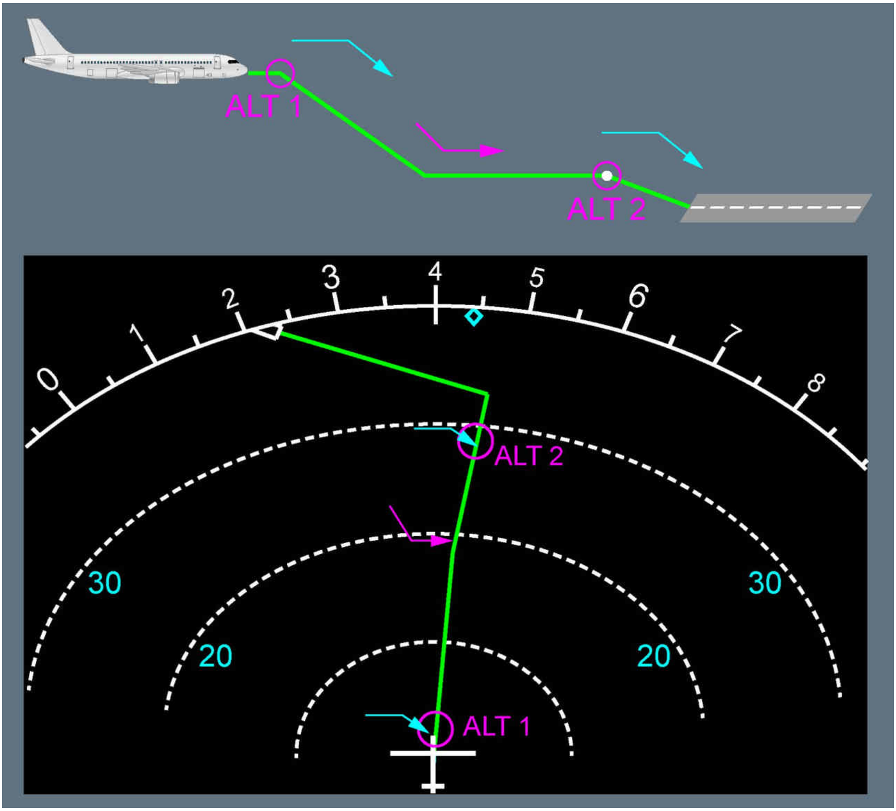
INTERCEPTION OF THE FINAL VERTICAL LEG

It is essential that the crew does not modify the final approach in the MCDU FPLN page.
FINAL APP becomes active and the FMS manages both lateral and vertical guidance.

The crew will monitor the final approach using:
- Start of descent blue symbol on ND
- FMA on PFD
- VDEV, XTK, F-PLN on ND with GPS PRIMARY
- VDEV, XTK, F-PLN confirmed by needles, distance/altitude

If FINAL APP does not engage at the beginning of the final descent, the flight crew should consider to interrupt the instrument approach procedure unless they can maintain visual references throughout the approach.
In some NPAs, the final approach flies an "idle descent" segment from one altitude constraint to another, followed by a level segment. This is materialized by a magenta level off symbol on ND followed by a blue start of descent.

Final Approach Trajectory with Idle Descent Segment



Ident.: PR-NP-SOP-190-GUI-D-00020668.0001001 / 20 MAR 17

REACHING MINIMA

When approaching minima, the pilot flying should expand the instrument scan to include outside visual cues.
If the required visual conditions are not met at minima, or are lost below minima, a missed approach must be initiated.

Ident.: PR-NP-SOP-190-GUI-D-00019752.0001001 / 20 MAR 17

COLD WEATHER OPERATIONS

For all Non Precision Approaches, there is a minimum OAT. Below this temperature, the error on the barometric altitude is no longer acceptable, and altitude should be corrected in temperature. As it is not authorized to make these altitude corrections to the final approach segment of the FM Flight Plan (F-PLN) through the MCDU, it is not possible to use FINAL APP when OAT is below this minimum OAT. The flight crew must then use selected vertical guidance. This minimum OAT is indicated on the approach chart or must be defined by the operator based on the terrain profile (plus adequate margin).

APPROACH USING FPA GUIDANCE

Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-E-00019753.0001001 / 20 MAR 17

GENERAL

This section deals with flying an approach with the FPA guidance.
The lateral guidance may be either managed or selected and the vertical guidance is FPA.
The use of AP is recommended for all approaches using FPA guidance as it reduces crew workload and facilitates monitoring the procedure and flight path.
The following sections list some particularities of these approaches.

Ident.: PR-NP-SOP-190-GUI-E-00019750.0001001 / 20 MAR 17

INTERCEPTION OF THE FINAL APPROACH COURSE

When cleared for final approach course interception:

- **If NAV ACCURACY HIGH:**
  NAV mode can be used. Under radar vectoring, the crew should use the DIR TO FDP with RADIAL INBD facility.
- **If NAV ACCURACY LOW:**
  Select appropriate TRK on FCU, in order to establish final course tracking with reference to NAVAID raw data. When established on the final course, the selected track compensates for drift.

The final approach course interception should be monitored through applicable raw data (ADF, VOR, LOC).

Ident.: PR-NP-SOP-190-GUI-E-00019755.0001001 / 04 SEP 18

INTERCEPTION OF THE FINAL VERTICAL LEG

The Final Path Angle (FPA) should be preset on the FCU 1 NM prior to the FDP at the latest. A smooth interception of the final approach path can be achieved by pulling the FPA selector 0.3 NM prior to the FDP.
The vertical trajectory should be monitored with altitude/distance raw data.

Ident.: PR-NP-SOP-190-GUI-E-00020669.0001001 / 20 MAR 17

REACHING MINIMA

When approaching minima, the pilot flying should expand the instrument scan to include outside visual cues.
If the required visual conditions are not met at minima, or are lost below minima, a missed approach must be initiated.

Ident.: PR-NP-SOP-190-GUI-E-00019756.0001001 / 20 MAR 17

LOC ONLY, ILS G/S OUT APPROACH

LOC ONLY approaches may be flown using the LOC signal for lateral navigation and FPA for vertical guidance.

DESCENT (CROSSING FL100)

The flight crew presses the LS pb on the EFIS control panel.

INITIAL/INTERMEDIATE APPROACH

The flight crew will press LOC pb-sw on the FCU when cleared for approach, and on the intercept trajectory for the final approach course. The flight crew will monitor the LOC armed mode and then LOC capture.

FINAL APPROACH

Approaching the point where the final descent starts, the flight crew will initiate the descent as for approach using vertical selected guidance.

Ident.: PR-NP-SOP-190-GUI-E-00019757.0001001 / 25 JUL 17

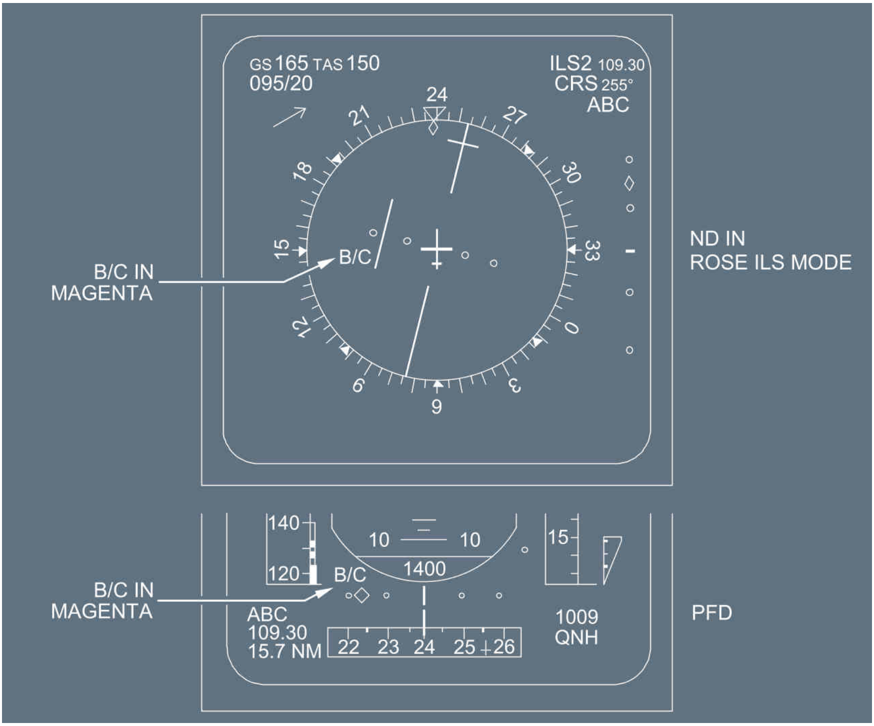
BACK COURSE LOCALIZER APPROACH

Back course localizer (LOC B/C) approach consists in using the LOC signal of the opposite runway for lateral approach management.
LOC B/C may be flown using the LOC B/C mode for lateral guidance and the FPA mode for the vertical guidance.
The prefered technique is an early stabilized approach technique, using the AP/FD and A/THR.

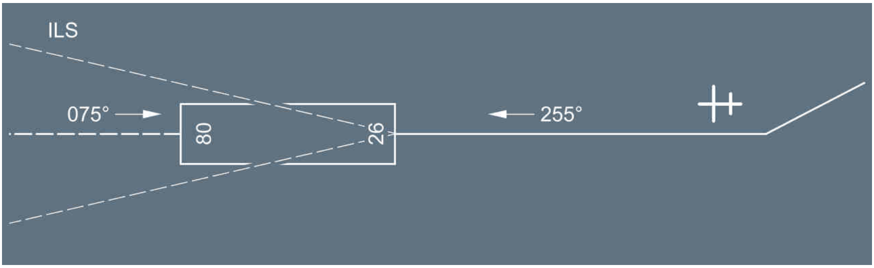
APPROACH PREPARATION

- **If the LOC B/C approach is stored in the FMS database:**
  The flight crew should insert the LOC B/C approach into the F-PLN. The ILS frequency and associated back course are automatically tuned and displayed on the MCDU RAD NAV page. The CRS digit will be preceded by a "B" ("B" means Back Course).
- **If the LOC B/C approach is not stored in the FMS database:**
  The flight crew should enter the ILS frequency and the final approach CRS the aircraft will actually fly preceded by a "B" in MCDU RAD NAV page ("B" means Back Course).

B/C in magenta will be displayed both on PFD and ND. This provides a proper directional deviation on PFD and a proper directional guidance from the FG.



EXAMPLE



In this example:
- Standard ILS APPR procedure on RWY 08 (CRS = 075 °)
- B/C LOC APP procedure on RWY26 (CRS = 255 °)

INSERT CRS = B255

Note: No title is displayed on the ND.

DESCENT (CROSSING FL100)

The flight crew should press the LS pb on the FCU and deselect the LS pb on ISIS (ISIS displays the LOC reverse deviations).

INITIAL/INTERMEDIATE APPROACH

The flight crew should select the ND in ROSE ILS mode on the EFIS control panel.
When cleared for the approach and on the intercept trajectory for the final approach course, the flight crew should press the LOC pb on the FCU. The LOC B/C mode arms.

CAUTION	The flight crew must not arm the APPR mode.

The flight crew should select the TRK/FPA flying reference (bird).

FINAL APPROACH

Approaching the Final Descent Point, the flight crew will select the FPA corresponding to the final approach path.

CIRCLING APPROACH

Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-F-00019758.0001001 / 03 MAY 23

The circling approach is the visual phase of an instrument approach to bring an aircraft into position for landing on a runway which is not suitably located for a straight-in approach (e.g. due to wind conditions).

1 APPROACH PREPARATION

The flight crew performs the approach preparation before starting the descent, including tuning of the reference navaids. They should include the following additional items in the FMS programming:

F-PLN

Lateral: Enter STAR, instrument approach procedure, including the missed approach procedure for instrument approach.
Vertical: Insert F speed as constraint at FAF since the circling approach will be flown in CONF 3, landing gear down and F speed. Check altitude constraints.

SEC F-PLN

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 COPY ACTIVE
- Lateral revision on destination and insert landing runway
- Keep the F-PLN discontinuity.

ARRIVAL BRIEFING

The flight crew should perform the arrival briefing with additional items specific to the circling procedure:
- Circling minima as published on the Approach chart or as per Company Operations Manual
- Direction of circling, if restricted according to the Approach chart, e.g. due to terrain. It is preferable that PF should be on the same side as the direction of circling, e.g. for circling to the left, PF should be CM1
- Significant obstacles in airport vicinity
- Technique to be used (e.g. AP and A/THR, FPV) and configuration
- Action in the case of loss of visual references.

FINAL INSTRUMENT APPROACH

The flight crew flies an early stabilized approach at F speed, CONF 3 and landing gear down.

The flight crew can perform the LANDING C/L except the FLAPS for landing. They will check the configuration for landing during the final turn.

2 **CIRCLING APPROACH**

CAUTION	The flight crew must conduct the flight within the circling area, while maintaining required visual references at all times.

The following can be used to assist the flight crew in the circling approach pattern:
- Selected modes with AP are recommended. Waypoints can be entered before the approach to assist the flight crew in the circling approach pattern. However, they must not fly this pattern with AP engaged in NAV mode
- The ND in ROSE mode with a low range can be used for situational awareness
- In support to the timing technique, the flight crew should initiate the base turn when the aircraft is approximately on the 45 ° angle of the runway threshold.

Note: *The flight crew should maintain F speed during the circling procedure to ensure that the aircraft remains within the safe circling area (defined in ICAO PANS-OPS). In regions where FAA TERPS criteria apply, the circling areas and limit speeds are more restrictive. Therefore, in these regions, refer to the Company SOPs.*

At the Circling MDA(MDH) at the latest:
- Perform a level off

At MAP, if the flight crew finds no visual reference:
- Initiate a go-around

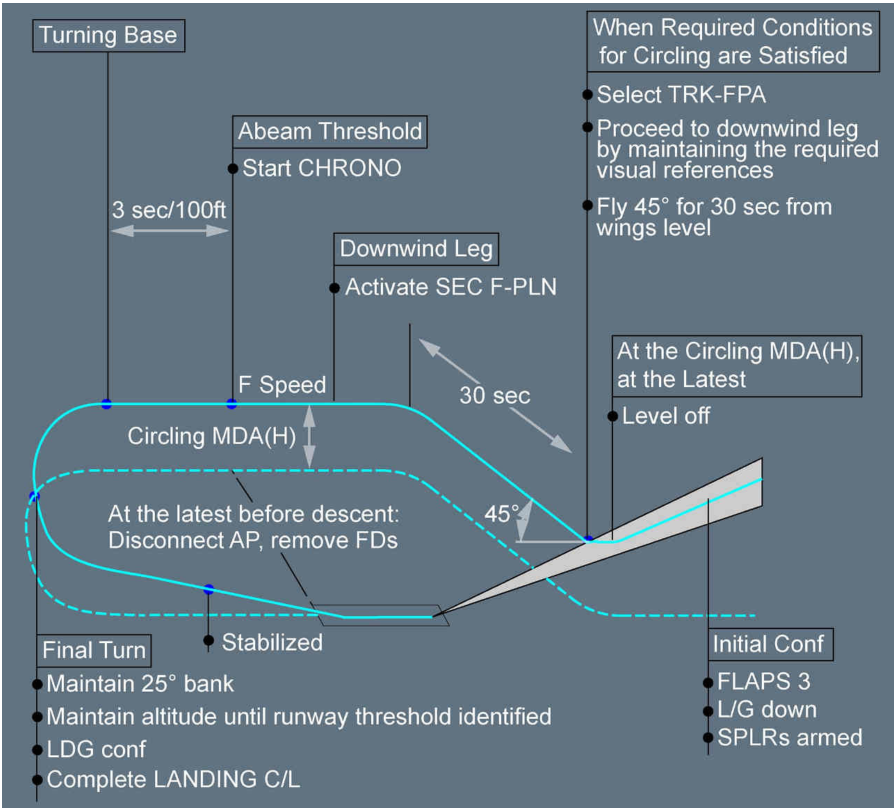
When required conditions for circling are satisfied:
- Select TRK-FPA
- Preselect a track of 45 ° away from the final approach course (or as required by the published procedure)
- When wings level, start the CHRONO
- After approximately 30 s select the downwind track parallel to the landing runway
- At any time in the downwind leg, activate the SEC F-PLN to display the landing runway and to take credit of the Ground Speed Mini function in final approach when managed speed is used. However, the flight crew should avoid a too early activation of the SEC F-PLN in order to keep the missed approach procedure of the instrument approach within the FMS if a go-around is necessary.
- When the aircraft is abeam the runway threshold, start the CHRONO. The time from abeam threshold to the beginning of the base turn depends on the height above touchdown: Approximately 3 s /100 ft.
- Disconnect the AP and remove the FDs at the latest before starting the descent toward the runway. Keep the A/THR active

- To perform the final turn, initially maintain 25 ° bank angle and maintain the altitude until the visual references for the intended runway are distinctly visible and identifiable
- Set the landing configuration when appropriate, but ensure early stabilization in final
- When the aircraft is fully configured for landing, complete LANDING C/L.

If, at any time during the circling procedure, the required visual references are lost, the main objective is to climb and to leave the circling area into the missed approach of the initial instrument approach, while remaining within the obstacle-free area, unless otherwise specified.
When the SEC F-PLN is activated, the go-around procedure in the FMS is associated with the landing runway, and not with the instrument approach. Therefore, if visual references are lost during the circling approach, the flight crew should fly the go-around using selected guidance, following the pre-briefed missed approach procedure, unless otherwise specified.
For circling approach with one engine inoperative (A330 aircraft), *Refer to PR-AEP-ENG One Engine Inoperative - Circling*.

Ident.: PR-NP-SOP-190-GUI-F-00019759.0001001 / 20 MAR 17

CIRCLING APPROACH PATTERN



VISUAL APPROACH

Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-G-00019760.0001001 / 20 MAR 17

INITIAL APPROACH

The flight crew must keep in mind that the pattern is flown visually. However, the cross track error on ND is a good cue of the aircraft lateral position versus the runway centerline. This indication can be obtained when performing a DIR TO radial inbound on the last available waypoint, positioned on the extended runway centerline.

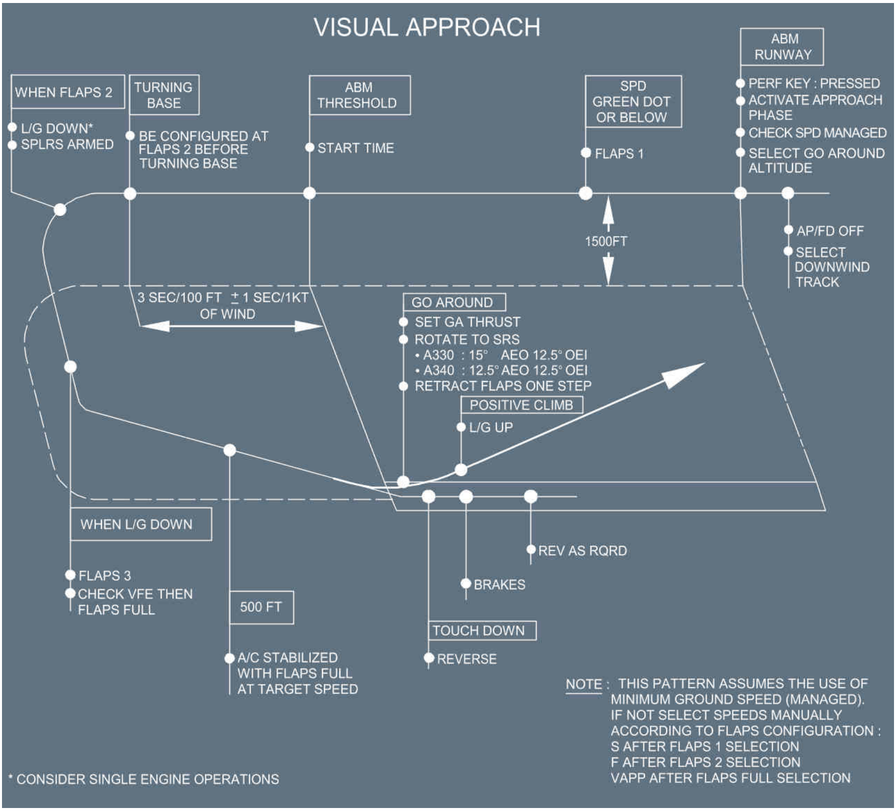
The flight crew will aim to get the following configuration on beginning of the downwind leg:
- Both AP and FDs will be selected off
- BIRD ON
- A/THR confirmed active in speed mode, i.e. SPEED on the FMA
- Managed speed will be used to enable the "GS mini" function
- The downwind track will be selected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

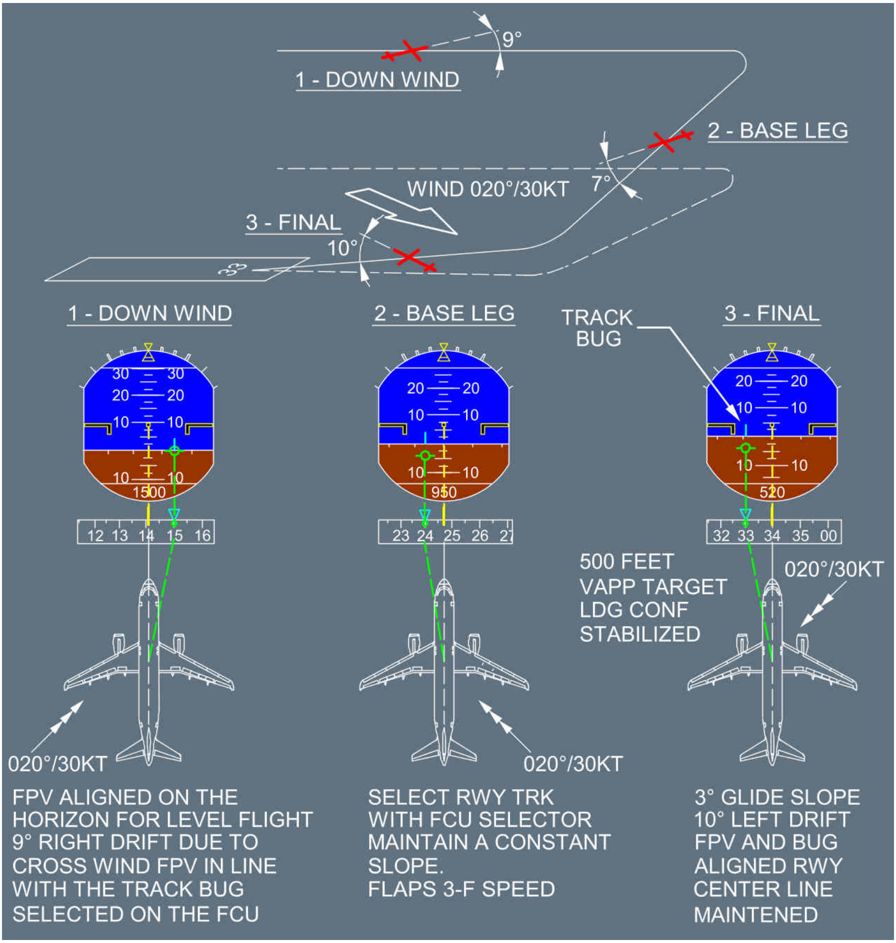
Ident.: PR-NP-SOP-190-GUI-G-00019761.0001001 / 04 SEP 18

INTERMEDIATE / FINAL APPROACH

Assuming a 1 500 ft AAL circuit, the base turn should be commenced 45 s after passing abeam the downwind threshold (3sec/100ft +/- 1 sec/1kt of headwind / tailwind). The final turn onto the runway centreline will be commenced with 20 ° angle of bank. Initially the rate of descent should be 400 fpm, increasing to 700 fpm when 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





9°
1 - DOWN WIND
2 - BASE LEG
7°
WIND 020°/30KT
3 - FINAL
10°
1 - DOWN WIND
2 - BASE LEG
TRACK BUG
3 - FINAL
500 FEET
VAPP TARGET
LDG CONF
STABILIZED
020°/30KT
020°/30KT
020°/30KT
FPV ALIGNED ON THE HORIZON FOR LEVEL FLIGHT 9° RIGHT DRIFT DUE TO CROSS WIND FPV IN LINE WITH THE TRACK BUG SELECTED ON THE FCU
SELECT RWY TRK WITH FCU SELECTOR MAINTAIN A CONSTANT SLOPE. FLAPS 3-F SPEED
3° GLIDE SLOPE 10° LEFT DRIFT FPV AND BUG ALIGNED RWY CENTER LINE MAINTENED

ILS RAW DATA

Applicable to: ALL

Ident.: PR-NP-SOP-190-GUI-H-00019762.0001001 / 20 MAR 17

INITIAL APPROACH

FLYING REFERENCE

The "bird" is to be used as the flying reference.

APPROACH PHASE ACTIVATION

The approach technique is the early stabilized approach.

Ident.: PR-NP-SOP-190-GUI-H-00019763.0001001 / 20 MAR 17

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 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, check unwanted residual bank angle. Also a slight IRS drift should be suspected as the bird is computed out of IRS data. The ILS course pointer and the TRK diamond are also displayed on PFD compass.

Ident.: PR-NP-SOP-190-GUI-H-00019764.0001001 / 20 MAR 17

FINAL APPROACH

When 1/2 dot below the G/S, the pilot should initiate the interception of the G/S by smoothly flying the FPV down to the glide 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.

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APPROACH AND LANDING TECHNIQUES

Ident.: PR-NP-SOP-250-00016468.0001001 / 20 MAR 17
Applicable to: ALL

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 FPV are effective aids to the pilot.
VAPP should be determined with the wind corrections by using the FMGS 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 the right touchdown attitude and airspeed.
During the flare, the pilot should not concentrate on the airspeed, but only on the attitude with external cues.
Specific PM call outs have been reinforced for excessive pitch attitude at landing.

HAND POSITION ON SIDESTICK

Ident.: PR-NP-SOP-250-18702867.9001001 / 01 MAR 23
Applicable to: ALL

HAND POSITION ON SIDESTICK

Below 1000ft AAL:
While the PF firmly holds the sidestick to make the appropriate inputs, the PM hand touches, but does not hold, the sidestick ready for immediate takeover if necessary.
Landing roll:
While the PF firmly holds the sidestick to make the appropriate inputs, the hand of the PM rests on the bottom of the sidestick to be ready for immediate takeover if necessary.

TRANSITION TO VISUAL REFERENCES

Ident.: PR-NP-SOP-250-00016469.0001001 / 04 JUL 17
Applicable to: ALL

When the aircraft transitions from IMC to VMC, the flight crew should:
- Continue to include the PFD in the scan
- Initially maintain pitch and heading
- Not eliminate the drift in the case of crosswind

- Not duck under
- Maintain a stabilized flight path down to the flare. At 50 ft, one dot below the glide slope is 7 ft below the glide slope.

If the flight crew uses the Bird, they can monitor the Bird vs. the aircraft attitude symbol in the center of the PFD.
This provides a good assessment of the drift, and therefore, indicates in which direction to look for the runway.

FLARE AND TOUCHDOWN

Ident.: PR-NP-SOP-250-00016470.0001001 / 10 MAY 22
Applicable to: ALL

PITCH CONTROL

When reaching 100 ft RA, auto-trim ceases and the pitch law is modified to be a full authority pitch direct law as described in the OPERATIONAL PHILOSOPHY Chapter. Indeed, the normal pitch law, which provides trajectory stability, would not be well adapted to the flare manoeuvre.
At 50 ft a slight pitch down elevator order is applied. Consequently, the pilot will have to move the stick rearwards, so as to reproduce conventional aircraft aerodynamic characteristics. The flare technique is thus very conventional.
Prior to flare, avoid destabilization of the approach and steepening the slope at low heights in attempts to target a shorter touchdown. If a normal touchdown point cannot be achieved or if destabilization occurs just prior to flare, a go-around (or rejected landing) should be performed.
The PM monitors the rate of descent and should call "*SINK RATE*" if the vertical speed is excessive prior to the flare.
From stabilized conditions, the flare height is about 40 ft.
This height varies due to the range of typical operational conditions that can directly influence the rate of descent.

Compared to typical sea level flare heights for flat and adequate runway lengths, pilot need to be aware of factors that will require an earlier flare, in particular:
- High airport elevation.
  Increased altitude will result in higher ground speeds during approach with associated increase in descent rates to maintain the approach slope.
- Steeper approach slope (compared to nominal 3 °).

- Tailwind.
  Increased tailwind will result in higher ground speed during approach with associated increase in descent rates to maintain the approach slope.
- Increasing runway slope.
  Increasing runway slope and/or rising terrain in front of the runway will affect the radio height callouts down to over flying the threshold used by the flight crew to assess the height for the start of flare possibly causing flare inputs to be late. The visual misperception of being high is also likely.

Note that the cumulative effect of any of the above factors combined for one approach will require even more anticipation to perform an earlier flare.
If the flare is initiated too late (below 25 ft) then the pitch changes will not have sufficient time to allow the necessary change to aircraft trajectory. Late, weak or released flare inputs increase the risk of a hard landing.

Avoid under flaring
- The rate of descent must be controlled prior to the initiation of the flare (i.e. nominal 3 ° slope and rate not increasing)
- Start the flare with positive (or "prompt") backpressure on the sidestick and holding as necessary
- Avoid significant forward stick movement once Flare initiated (releasing backpressure is acceptable).

At 20 ft, the "RETARD" auto call-out reminds the pilot to retard thrust levers. It is a reminder rather than an order. When best adapted, the pilot will rapidly retard all thrust levers : depending on the conditions, the pilot will retard earlier or later. However, the pilot must ensure that all thrust levers are at IDLE detent at the latest at touchdown, to ensure ground spoilers extension at touchdown.
In order to assess the rate of descent in the flare, and the aircraft position relative to the ground, look well ahead of the aircraft. The typical pitch increment in the flare is approximately 2.3 ° (2.6 ° for A340-500/600 aircraft), which leads to -1 ° flight path angle associated with a 10 kt speed decay in the manoeuvre. Do not allow the aircraft to float or do not attempt to extend the flare by increasing pitch attitude in an attempt to achieve a perfectly smooth touchdown. A prolonged float will increase both the landing distance and the risk of tail strike.
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.
It is not recommended to keep the nose high in order to increase aircraft drag during the initial part of the roll-out, as this technique is inefficient and increases the risk of tail strike. Furthermore, if auto brake MED is used (mode 4 or HI on A340-500/600), it may lead to a hard nose gear touch down.

During the derotation phase, it is normal to feel 3 successive "shocks" or "contacts with the ground"; the first from aft wheels of the MLG boogie, the second from the front wheels of the MLG boogie, the third from the NLG.

LATERAL AND DIRECTIONAL CONTROL

FINAL APPROACH

In crosswind conditions, a crabbed-approach wings-level should be flown with the aircraft (cockpit) positioned on the extended runway centerline until the flare.

FLARE

The objectives of the lateral and directional control of the aircraft during the flare are:
- To land on the centerline, and
- to minimize the lateral loads on the main landing gear.

The recommended de-crab technique is to use all of the following:
- The rudder to align the aircraft with the runway heading during the flare.
- The roll control, if needed, to maintain the aircraft on the runway centerline. Any tendency to drift downwind should be counteracted by an appropriate lateral (roll) input on the sidestick.

In the case of strong crosswind, in the de-crab phase, the PF should be prepared to add small bank angle into the wind in order to maintain the aircraft on the runway centerline. The aircraft may be landed with a partial de-crab (residual crab angle up to about 5 °) to prevent excessive bank. This technique prevents wingtip (or engine nacelle) strike caused by an excessive bank angle.
As a consequence, this may result in touching down with some bank angle into the wind (hence with the upwind landing gear first).

ROLLOUT

Ident.: PR-NP-SOP-250-00019592.0001001 / 20 MAR 17
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.
For more information about rudder pedals recommendations, *Refer to PR-NP-SOP-70 Seating Position and Adjustment of Rudder Pedals*

DECELERATION

Ident.: PR-NP-SOP-250-00019593.0002001 / 20 MAR 17
Applicable to: ALL

Once on the ground, the importance of the timely use of all means of stopping the aircraft cannot be overemphasized.

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 autobrake activation.

REVERSE THRUST EFFICIENCY

Thrust reversers are more efficient at high speeds. The flight crew must select reverse thrust immediately after main landing gear touchdown.
Below 70 kt, thrust reversers efficiency rapidly decreases. Below 60 kt with REV MAX selected, engine stall may occur. Therefore, it is recommended to reduce the reverse thrust to REV IDLE at

70 kt, and keep REV IDLE until taxi speed. However in an emergency case, the flight crew must keep REV MAX until full-stop of the aircraft.
At taxi speed, and not above, stow the thrust reversers before leaving the runway, in order to avoid foreign object ingestion.

REVERSE THRUST SELECTION

The selection of REV MAX is the standard practice for landing.

LANDING ON DRY RUNWAYS

On DRY runways, the flight crew may select REV IDLE.

LANDING ON WET RUNWAYS

On WET runways, the flight crew may select REV IDLE, if all the conditions described in the SOP DESCENT PREPARATION (*Refer to FCOM/PRO-NOR-SOP-16 Descent Preparation - General*) are satisfied.

LANDING ON CONTAMINATED RUNWAYS

On contaminated runways, the flight crew must select REV MAX.

REMINDER ON LANDING DISTANCE COMPUTATION AT DISPATCH FOR DRY AND WET RUNWAYS

DEFINITIONS

ALD	:	The Actual Landing Distance is the distance used on a dry runway from the crossing of the runway threshold at 50 ft until full-stop of the aircraft, using maximum manual braking. No reverse thrust is considered for the calculation of the ALD. The ALD is demonstrated during flight test campaign for certification purpose.
RLD dry	:	The Required Landing Distance on a dry runway is a factored ALD. The factor is 1.67. (RLD dry = ALD x 1.67)
RLD wet	:	The Required Landing Distance on a wet runway is a factored ALD. The factor is 1.92 (RLD wet = RLD dry x 1.15)

DISPATCH CONDITIONS

For landing distance computation at dispatch, the airline uses the RLD.
Landing distances computed at dispatch for wet runways provide only reduced margins in comparison with landing distances achievable in operations with the use of REV IDLE. Sufficient margins are restored when the flight crew uses REV MAX.
The runway slope is not considered for the landing distance computation at dispatch. On a destination airport with multiple runways, the landing distance computation at dispatch may be performed on the longest landing runway with no wind.

The expected landing runway may be used for the landing distance computation at dispatch with forecast wind at landing. If the wind condition changes at landing, the flight crew must perform a new landing distance computation.

LANDING WITH REV IDLE ON WET RUNWAYS

The landing distance computation at dispatch (RLD) does not consider REV IDLE operation. Therefore, it is necessary to perform a computation to consider REV IDLE operation, as described in the SOP DESCENT PREPARATION (*Refer to FCOM/PRO-NOR-SOP-16 Descent Preparation - General*). This may be done before the flight.
At descent preparation, if the flight crew considers the use of REV IDLE on a wet runway, they should be able to confirm a MEDIUM TO POOR landing distance computation with no reverse credit on the predicted landing runway.
A MEDIUM TO POOR computation enables the flight crew to consider extreme situations where a runway reported wet is worse than wet. If a runway reported wet is water contaminated, the braking action is a function of the water depth. During active precipitation or shortly afterwards, the water depth is variable, and therefore difficult to evaluate and to report accurately.
Therefore on runways reported wet, the real friction coefficient may be significantly less than expected and/or aquaplaning may occur. When REV IDLE is used, the maximum possible deceleration of the aircraft mainly depends on the runway friction coefficient.

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. Full pedal braking with anti-skid provides a deceleration rate of 10 kts/sec.

BRAKES

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

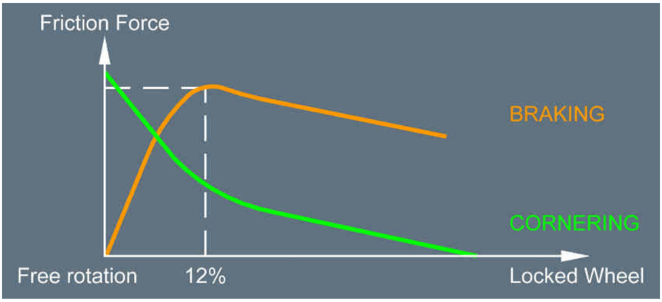
- The use of autobrake is usually preferable because it minimizes the number of brake applications and thus reduces brake wear. Additionally, the autobrake provides a symmetrical brake pressure application which ensures an equal braking effect on both main landing gear wheels on wet or evenly contaminated runway. More particularly, the autobrake 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 MED autobrake should be preferred for short or contaminated runways. The use of MAX autobrake is not recommended.
- On very short runways, the use of pedal braking is to be envisaged since the pilot may apply full pedal braking with no delay after touch down.
- 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 green DECEL light comes on when the actual deceleration is 80 % of the selected rate. For example the DECEL light might not appear when the autobrake is selected on a contaminated runway, because the deceleration rate is not reached with the autobrake properly functioning. Whereas the DECEL light might appear with mode LO selected on a dry runway while only the reversers achieve the selected deceleration rate without autobrake being actually activated. In other words, the DECEL light is not an indicator of the autobrake operation as such, but that the deceleration rate is reached.
Since the autobrake 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.

CROSS WIND CONDITIONS

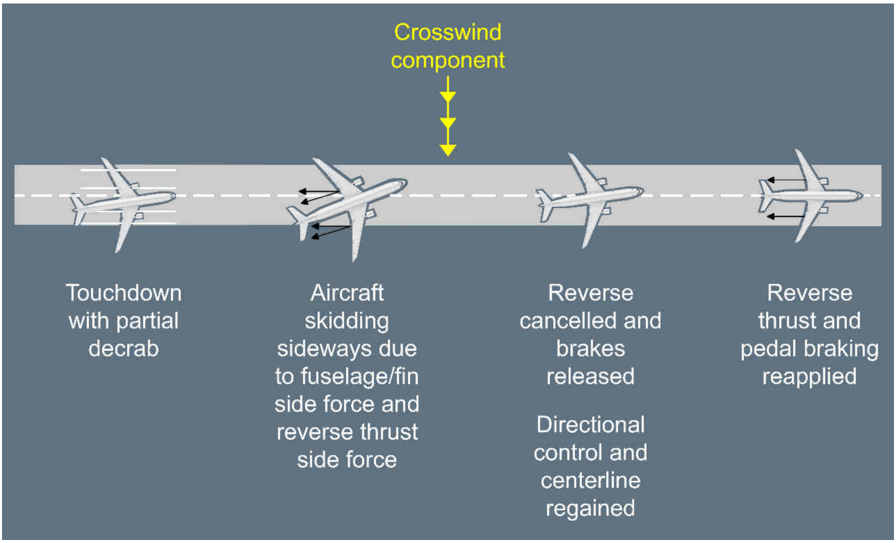
The reverse thrust side force and crosswind component can combine to cause the aircraft to drift to the downwind side of the runway if the aircraft is allowed to weathercock into wind after landing. Additionally, as the anti-skid system will be operating at maximum braking effectiveness, the main gear tire cornering forces available to counteract this drift will be reduced.

Braking Force and Cornering Force Vs Skid Ratio



To correct back to the centerline, the pilot must reduce reverse thrust to reverse idle and release the brakes. This will minimise the reverse thrust side force component, without the requirement to go through a full reverser actuating cycle, and provide the total tire cornering forces for realignment with the runway centerline. Rudder and differential braking should be used, as required, to correct back to the runway centerline. When re-established on the runway centerline, the pilot should re-apply braking and reverse thrust as required.
For more information about rudder pedals recommendations, *Refer to PR-NP-SOP-70 Seating Position and Adjustment of Rudder Pedals*

Directional Control during Crosswind Landing



TAIL STRIKE AVOIDANCE

Ident.: PR-NP-SOP-250-00019594.0001001 / 20 MAR 17
Applicable to: ALL

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

AIRCRAFT SYSTEM FOR TAIL STRIKE PREVENTION

The following aircraft systems help to prevent tail strike occurrence:
- A "PITCH-PITCH" synthetic voice sounds when the pitch attitude becomes excessive,
- A tail strike pitch limit indicator appears on the PFD to indicate the maximum pitch attitude to avoid a tail strike.

This design is installed as standard on A340-500/600 and as an option on all A330 and A340-200/300.

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.

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GENERAL

Ident.: PR-NP-SOP-260-00019602.0001001 / 20 MAR 17
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.

CONSIDERATION ABOUT GO-AROUND

Applicable to: ALL

Ident.: PR-NP-SOP-260-A-00019603.0001001 / 28 NOV 17

DECISION MAKING

The flight crew must consider to perform a go-around if:
- There is a loss or a doubt about situation awareness, or
- There is a malfunction which jeopardizes the safe completion of the approach e.g. major navigation problem, or
- ATC changes the final approach clearance resulting in rushed action from the crew or potentially unstable approach, or
- The approach is unstable in speed, altitude, or flight path in such a way that stability is not obtained by 1 000 ft AAL in IMC or (500 ft AAL in VMC), or is not maintained until landing, or
- Any of the following alerts occur:
  - GPWS, or
  - TCAS, or
  - Windshear, or
  - ROW ⧏ alerts for the relevant runway condition. Refer to AS-ROWROP Operating Techniques.
- Adequate visual references are not obtained at minima or lost below minima.

Ident.: PR-NP-SOP-260-A-00019604.0001001 / 05 MAR 19

GO-AROUND NEAR THE GROUND

The PF must not initiate a go-around after the selection of the thrust reversers. If the PF initiates a go-around, the flight crew must complete the go-around maneuver.

If the flight crew performs a go-around near the ground, they should take into account the following:
- The PF should avoid excessive rotation rate, in order to prevent a tailstrike. For more information *Refer to PR-NP-SOP-250 Tail Strike Avoidance*
- A temporary landing gear contact with the runway is acceptable.

Only when the aircraft is safely established in the go-around, the flight crew retracts flaps one step and the landing gear.

Note: *If the aircraft is on the runway when the PF applies TOGA thrust, CONFIG ECAM red warning(s) may transiently trigger. The flight crew should disregard these alerts.*

AP/FD GO-AROUND PHASE ACTIVATION

Ident.: PR-NP-SOP-260-00019605.0002001 / 03 NOV 21
Applicable to: ALL

When the thrust levers are set to the TOGA detent, with the FLAPS lever not in 0, all of the following occur:
- The SRS GA and the GA TRK modes engage
- The GA phase activates on the FMS:
  - The missed approach becomes the active F-PLN
  - At the end of the missed approach procedure, the FMS strings the previous flown approach in the active F-PLN.
- For the go-around, the appropriate flight reference is the attitude, because go-around is a dynamic maneuver
- If extended, the speed brakes automatically retract.

If TOGA thrust is not desired during go-around for any reason (e.g. an early go-around ordered by ATC), it is essential that the thrust levers are set momentarily but without delay, to the TOGA detent (i.e. the full forward thrust levers position), in order to ensure proper activation of the SRS GA and the go-around phase (i.e. guidance modes and FMS flight phase). Then, the flight crew should set the thrust lever to CL detent to take advantage of the A/THR (the A/THR follows a speed target).

If the thrust levers are not correctly set to the TOGA detent, the following occur:
- The AP/FD remain engaged in approach or landing mode (e.g. G/S, LOC, LAND, FLARE on FMA)
- The FMS does not engage the GA phase, and remains in APPR phase
- LVR CLB flashes on FMA.

If the thrust levers are set to the TOGA detent with the FLAPS lever at 0, the following occur:
- The AP/FD remain engaged in approach or landing mode (e.g. G/S, LOC, LAND, FLARE on FMA)
- The FMS does not engage the GA phase, and remains in APPR phase
- LVR CLB flashes on FMA.

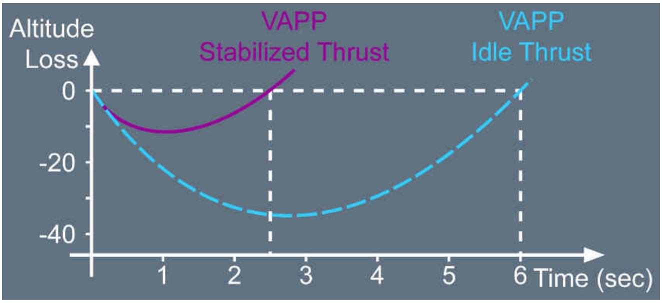
Consequently, as the thrust levers are set to the TOGA detent, the aircraft energy will rapidly increase but the aircraft will remain on its approach path.
In this case, the flight crew must take appropriate actions without delay.

GO-AROUND PHASE

Ident.: PR-NP-SOP-260-00019606.0001001 / 19 SEP 17
Applicable to: ALL

The SRS mode guides the aircraft with the highest speed of VLS, 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 green dot.
The GA TRK mode guides the aircraft on the track memorised at the time of TOGA selection.
The missed approach route becomes the ACTIVE F-PLN provided the waypoints have been correctly sequenced on the approach. Depending on the aircraft configuration, NAV mode engages automatically or manually in order to follow the missed approach F-PLN.
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 lose some altitude. This altitude loss will be greater if initial thrust is close to idle and/or the aircraft speed is lower than VAPP.

Altitude Loss Following a Go Around



Above the go-around acceleration altitude, or when the flight crew engages another vertical mode (CLB, OP CLB), the target speed is green dot.

LEAVING THE GO-AROUND PHASE

Applicable to: ALL

Ident.: PR-NP-SOP-260-B-00019601.0001001 / 20 MAR 17

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.

Ident.: PR-NP-SOP-260-B-00016471.0001001 / 20 MAR 17

SECOND APPROACH

If a second approach is to be flown, the crew will activate the approach phase in the MCDU PERF GO-AROUND page. The FMS switches to Approach phase and the target speed moves according to the flaps lever setting, e.g. green dot for Flaps 0.
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.

Ident.: PR-NP-SOP-260-B-00016472.0001001 / 25 JUL 17

DIVERSION

Once the aircraft path is established and clearance has been obtained, the crew will modify the FMGS to allow the FMGS switching from go-around phase to climb phase:
- If the crew has prepared the ALTN F-PLN in the active F-PLN, a lateral revision at the TO WPT is required to access the ENABLE ALTN prompt. On selecting the ENABLE ALTN prompt, 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 F-PLN in the SEC F-PLN, the SEC F-PLN will be activated, and a DIR TO performed as required. AP/FD must be in HDG mode for the ACTIVATE SEC F-PLN prompt to be displayed.
- If the crew has not prepared the ALTN FPLN, a selected climb will be initiated. Once established in climb and clear of terrain, the crew will make a lateral revision at any waypoint to insert a NEW DEST. The route and a CRZ FL (on PROG page) can be updated as required.

The crew will check the defaulted CRZ FL on PROG page and CI, (consistent with diversion strategy), on PERF page.

USE OF BRAKE FANS

Ident.: PR-NP-SOP-270-00016589.0001001 / 20 MAR 17
Applicable to: ALL

Delaying brake fans selection limits the oxidation of any possible transient hot spots of the brake disk surface. The selection of the brake fans, before the aircraft reaches the gate, prevents to blow carbon brake dust on the ground personnel. The brake fans blow dust during the first seconds of operation only.

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GENERAL

Ident.: PR-NP-CL-00019512.0001001 / 01 MAR 23
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).

CHECKLIST START

The Pilot Flying (PF) requests the normal checklist.

CHECKLISTS ACTIONS

The checklist actions are referred to as "challenge/response" type actions. The PM reads the left part of the line, and the PF "responds" to the "challenge" only after checking the current status of the aircraft.
The LANDING and AFTER LANDING checklist may be performed by-heart, as long as the PM ensures that the item and wording correspond to the original checklist.
If the current status of the aircraft does not correspond to the checklist response, the PF takes corrective action before “responding” to the “challenge”. If corrective action is not possible, then the PF modifies the response to reflect the real situation (with a specific answer). When necessary, the other flight crewmember crosschecks the validity of the response.
The challenger (PM) waits for a response corresponding to the checklist, before validating the item.

CHECKLIST COMPLETE

When the checklist is completed, the PM announces, for example: “LANDING CHECKLIST COMPLETE”.

SECURING THE AIRCRAFT CHECKLIST

The above guidelines apply but CM1(CM2) is used instead of PF(PM), in order to be consistent with the associated SOP.

COCKPIT PREPARATION

Ident.: PR-NP-CL-00024935.0001001 / 05 MAY 22
Applicable to: ALL

Checklist trigger: Departure briefing completed.

GEAR PINS & COVERS..REMOVED

The PF confirms that the gear pins and all covers were checked removed during the walkaround. The PF announces “REMOVED”.

FUEL QUANTITY .... ____ KG

The PF checks the FOB and fuel distribution on the FUEL SD page, and compares with the computerized flight plan.
The PF announces e.g. “Fifteen thousand three hundred thirty kilograms balanced”.

SEAT BELTS ....ON

The PF checks the memo.
The PF announces "ON".

ADIRS ....NAV

The PF checks on the MCDU that the ADIRS are on NAV.
The PF announces "NAV".

BARO REF .... _____ (BOTH)

The PF and PM check and read the QNH BARO setting (or QFE BARO setting).
The PF then PM announce e.g. “QNH One Zero One Three”.

BEFORE START

Ident.: PR-NP-CL-00024936.0001001 / 01 SEP 23
Applicable to: ALL

1

Checklist trigger:
- Pushback clearance or start clearance received
- Before Start flow pattern completed.

PARKING BRAKE .... ____

The PF checks the PARK BRK memo.
The PF announces e.g. “SET”.

T.O SPEEDS & THRUST .... _____ (BOTH)

The PF reads aloud V1, VR, V2 and thrust setting on the FMS PERF page while PM checks V1 and V2 on the PFD .
The PF announces e.g. “One Two Five, One Two Five, One Two Nine, Flex Fifty Two”.
The PM reads aloud V1, VR, V2 and thrust setting on the FMS PERF page while PF checks V1 and V2 on the PFD.
The PM announces e.g. “One Two Five, One Two Five, One Two Nine, Flex Fifty Two”.

BEACON .... ON

The PF checks the BEACON sw on the overhead panel.
The PF announces "ON".

AFTER START

Ident.: PR-NP-CL-00024937.0001001 / 09 NOV 21
Applicable to: ALL

Checklist trigger: On hand signal from the ground personnel.

ANTI ICE.. ____

The PF checks the WING ANTI ICE pb and ENG 1(2) ANTI ICE pb on the ANTI ICE overhead panel.
The PF announces "OFF" or "Engines ON" or "Engines ON Wings ON".

ECAM STATUS..CHECKED

The PF checks on ECAM that the STATUS REMINDER is not displayed.

PITCH TRIM.. ____%

The PF checks the pitch trim wheel is at the expected takeoff CG value.
The PF announces e.g. "thirty two point four percent".

RUDDER TRIM...NEUTRAL

The PF checks the rudder trim is within the tolerance ±0.6 °.
The PF announces e.g. "NEUTRAL".

TAXI

Ident.: PR-NP-CL-00024938.0005001 / 01 MAR 23
Applicable to: ALL

Checklist trigger: T.O CONFIG pb pressed and cabin report received.

FLIGHT CONTROLS .... CHECKED (BOTH)

The PF confirms that the flight controls check was performed.
The PF then PM announces "CHECKED".

FLAPS SETTING .... CONF ____ (BOTH)

The PF and the PM check and compare the flaps setting on the EWD and FMS PERF page.
The PF and the PM announces the configuration displayed on EWD e.g. "CONF 1+F".

RADAR & PRED W/S .... ON & AUTO

The PF checks on the ND that the weather radar is ON.
The PF checks on the pedestal that the predictive windshear is AUTO.
The PF announces "ON AND AUTO".

ENG START SEL .... _____

The PF checks the IGNITION is displayed or not on the memo.
The PF announces "IGNITION" or "NORM".

ECAM MEMO .... T.O NO BLUE

- *AUTO BRK MAX*
- *SEAT BELTS ON*
- *CABIN READY*
- *SPLRS ARM*
- *FLAPS T.O*
- *T.O CONFIG NORM*

The PF checks no blue items on the ECAM memo.
The PF announces "TAKEOFF NO BLUE".

LINE-UP

Ident.: PR-NP-CL-00024939.0001001 / 05 MAY 22
Applicable to: ALL

Checklist trigger:
- Line-up clearance received
- Before Takeoff flow pattern completed.

T.O RWY.. ____ (BOTH)

The PF and PM confirm that the line-up is performed on the intended runway and intersection.
The PF then PM announce the runway and intersection (e.g. Runway one four Left Bravo four).

TCAS.. ____

The PF checks the TCAS mode selector.
The PF announces "TA ONLY" or "TA/RA".

PACKS 1 & 2.. ____

The PF checks the PACK 1 pb-sw, PACK 2 pb-sw and APU BLEED pb-sw on the AIR overhead panel.
The PF announces “ON” or “ON supplied by APU” or “OFF”.

DEPARTURE CHANGE

Ident.: PR-NP-CL-00024940.0001001 / 09 NOV 21
Applicable to: ALL

Checklist trigger: Revised departure briefing completed.

RWY & SID.. ____

The PF checks the runway, the shift and the SID on the FMS.
The PF announces e.g. “Runway One four Right”, “Shift five hundred meters” and “SID NEEDLE ONE”.

FLAPS SETTING...CONF ____ (BOTH)

The PF checks and compares the flaps setting on the PFD and FMS PERF page.
The PF announces the configuration displayed on PFD e.g. "CONF 1+F".

T.O SPEEDS & THRUST.. _____ (BOTH)

The PF reads aloud V1, VR, V2 and thrust setting on the FMS PERF page while PM checks V1 and V2 on the PFD.
The PF announces e.g. "V1 One Two Five, VR One Two Five, V2 One Two Nine, Flex Fifty Two".
The PM reads aloud V1, VR, V2 and thrust setting on the FMS PERF page while PF checks V1 and V2 on the PFD.
The PM announces e.g. "V1 One Two Five, VR One Two Five, V2 One Two Nine, Flex Fifty Two".

FCU ALT.. _____

The PF checks the altitude on the glareshield.
The PF announces e.g. "Five thousand feet".

APPROACH

Ident.: PR-NP-CL-00024941.0001001 / 09 NOV 21
Applicable to: ALL

Checklist trigger: Below 10 000 ft AAL and barometric reference set.

BARO REF.. _____ (BOTH)

The PF and PM check and read the QNH BARO setting (or QFE BARO setting).
The PF then PM announce e.g. "QNH One Zero One Three".

SEAT BELTS...ON

The PF checks the memo.
The PF announces "ON".

MINIMUM.. _____

The PF checks the baro or radio minimum on the FMA.
The PF announces e.g. "BARO Four hundred fifty feet" or "RADIO One hundred sixty feet".

AUTO BRAKE.. _____

The PF checks the autobrake mode on the autobrake panel.
The PF announces the autobrake mode e.g. "LOW" or "MED".

ENG START SEL.. _____

The PF checks that IGNITION is displayed or not on the memo.
The PF announces "IGNITION" or "NORM".

LANDING

Ident.: PR-NP-CL-00024942.0002001 / 01 MAR 23
Applicable to: ALL

Checklist trigger: LDG CONF set and cabin report received.

ECAM MEMO .... LDG NO BLUE

- *LDG GEAR DN*
- *SEAT BELTS ON*
- *CABIN READY*
- *SPLRS ARM*
- *FLAPS LDG*

The PF checks no blue items on the ECAM memo.
The PF announces "LANDING NO BLUE".

AFTER LANDING

Ident.: PR-NP-CL-00024943.0002001 / 09 NOV 21
Applicable to: ALL

Checklist trigger: After Landing Flow pattern completed.

RADAR & PRED W/S.. OFF

The PF checks on the pedestal that the weather radar and predictive windshear are OFF.
The PF announces "OFF".

PARKING

Ident.: PR-NP-CL-00024944.0001001 / 06 MAY 22
Applicable to: ALL

Checklist trigger: SEAT BELTS sw OFF.

PARKING BRAKE OR CHOCKS.. _____ SET

The PF checks the PARK BRK memo or confirms that the ground personnel set the chocks.
The PF announces “PARKING BRAKE SET” or “CHOCKS SET”.

ENGINES.. OFF

The PF checks the master levers and engine parameters on EWD.
The PF announces "OFF".

WING LIGHTS.. OFF

The PF checks the WING LIGHTS pb-sw on the EXT LT overhead panel.
The PF announces “OFF”.

FUEL PUMPs .... OFF

The PF checks the FUEL pb-sw on the overhead panel.
The PF announces "OFF".

SECURING THE AIRCRAFT

Ident.: PR-NP-CL-00024945.0001001 / 01 SEP 23
Applicable to: ALL

2

Checklist trigger: After the last passenger left the aircraft (if securing the aircraft is intended).

OXYGEN .... OFF

The CM2 checks the CREW SUPPLY pb-sw on the OXYGEN overhead panel.
The CM2 announces "OFF".

EMER EXIT LIGHT .... OFF

The CM2 checks the EMER EXIT LT sw on the SIGNS overhead panel.
The CM2 announces "OFF".

CHARGERS/CABLES .... DISCONNECTED

The CM1 and CM2 check that CHARGERS/CABLES are disconnected from the power plugs.
*The CM2 announces *DISCONNECTED".*

BATTERIES .... OFF

The CM1 checks the BAT pb-sw on the ELEC overhead panel.
The CM1 announces "OFF".

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Cold Weather Operations and Icing Conditions

GENERAL

Ident.: PR-NP-SP-10-10-1-00016473.0001001 / 05 JUN 18
Applicable to: ALL

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, after the aircraft has been refueled with cold fuel, or after it has been exposed to low overnight air temperatures. In such cases, humidity or rain will cause ice accretion on the upper wing, and light frost under the wing (only 3 mm of frost on the under side of the wing tank area is acceptable).
Ice accretion on the lower part of the nose fuselage may also affect the Static, Pitot and AOA probes. If ice ridges build up on the skin of the aircraft, it may impact the aerodynamic flow in front of the Static, Pitot and AOA probes. As a result, the flight crew may observe unreliable air data during the takeoff and climb phases.

EXTERIOR INSPECTION

Ident.: PR-NP-SP-10-10-1-00016482.0001001 / 20 MAR 17
Applicable to: ALL

When icing conditions on ground are encountered, and/or when ice accretion is suspected, the Captain should determine, on the basis of the exterior inspection, if 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.

COCKPIT PREPARATION

Ident.: PR-NP-SP-10-10-1-00019670.0001001 / 20 MAR 17
Applicable to: ALL

The following systems may be affected in very cold weather:
- EFIS/ECAM (when the cockpit temperature is very low)
- IRS alignment (may take longer than usual, up to 15 min).

The probe and window heating may be used on ground.

AIRCRAFT DEICING/ANTI-ICING ON GROUND

Ident.: PR-NP-SP-10-10-1-00016483.0001001 / 05 MAR 19
Applicable to: ALL

DEICING/ANTI-ICING FLUID

Deicing/anti-icing fluids must be able to remove ice and to prevent its accumulation on aircraft surfaces until the beginning of the takeoff. In addition, the fluids must flow off the surfaces of the aircraft during takeoff, in order not to degrade 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	Longer 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, and depends on the type of fluid, and on the nature and severity of precipitation. The flight crew should refer to applicable tables as guidelines. These tables must be used in conjunction with the pre-takeoff check.

Depending upon the severity of the weather, the deicing/anti-icing procedure must be applied either:
- In one step, via the single application of heated and diluted deicing/anti-icing fluid: This procedure provides a short holdover time, and should be used in low moisture conditions only. 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: These two sprays must be applied consecutively. The holdover time starts from the beginning of the application of the second fluid.

PROCEDURES

Refer to FCOM/PRO-NOR-SUP-ADVWXR Before Fluid Spraying

TAXI-OUT

Ident.: PR-NP-SP-10-10-1-00016485.0001001 / 12 MAY 23
Applicable to: ALL

1 On contaminated taxiways, the taxi speed should be limited to 10 kt, and any action that could distract the flight crew during taxiing should be delayed until the aircraft is stopped.

The following factors should be taken into account:
- At speeds below 10 kt, the antiskid is deactivated .
- Engine anti-ice will increase ground idle thrust.
- To minimize the risk of skidding during turns: Avoid large tiller inputs.

- On slippery taxiways: It may be more effective to use differential braking and/or thrust, instead of nosewheel steering.
- On slush-covered, or snow-covered, taxiways: Flap selection should be delayed until reaching the holding point, in order to avoid contaminating the flap/slat actuation mechanism.
- When reaching the holding point: The "Taxi" checklist must be performed.
- The flight crew must maintain the aircraft at an appropriate distance from the aircraft in front.
- In icing conditions: When holding on ground for extended periods of time, or if engine vibration occurs, thrust should be increased periodically, and immediately before takeoff, to shed any ice from the fan blades.

For more details about this procedure*Refer to FCOM/PRO-NOR-SOP-09 After Start - ENG Anti-Ice*

TAKEOFF

Ident.: PR-NP-SP-10-10-1-00016486.0001001 / 20 MAR 17
Applicable to: ALL

TAKEOFF PERFORMANCE

The use of FLEX thrust for takeoff on contaminated runways is prohibited. 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, or deep snow reduces the 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

Before the aircraft lines up on the runway for takeoff, the flight crew must ensure that the airframe has no ice or snow.
Then, before applying thrust, the Captain should ensure that the nosewheel is straight. If there is a tendency to deviate from the runway centerline, this tendency must be neutralized immediately, via rudder pedal steering, not via the tiller.
On contaminated runways, the flight crew should ensure that engine thrust advances symmetrically to help minimize potential problems with directional control.
The flight crew should keep in mind that RTO is a potentially hazardous manoeuvre on contaminated runways.
If a RTO must be performed, the flight crew should maintain directional control with the rudder and small inputs to the nose wheel. If necessary, the flight crew should use differential braking to realign with the runway centerline when stopping distance permits.

IN FLIGHT

Ident.: PR-NP-SP-10-10-1-00016487.0001001 / 05 MAY 22
Applicable to: ALL

CLIMB/DESCENT

Whenever icing conditions are encountered or expected, the engine anti-ice should be turned on. Although the TAT before entering clouds may not require engine anti-ice, flight crews should be aware that the TAT often decreases significantly, when entering clouds.
If the recommended anti-ice procedures are not performed, engine stall, over-temperature, or engine damage may occur.
Wing anti-ice should be turned on, if either 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 clean configuration. This is because prolonged flight in icing conditions with the slats extended should be avoided.

APPROACH

ICE ACCRETION

If significant ice accretion develops on parts of the wing, the aircraft speed must be increased (*Refer to FCOM/PRO-NOR-SUP-ADVWXR Minimum Speed with Ice Accretion*).

BAROMETER INDICATIONS

In cold weather, the atmosphere differs from the ISA conditions. The parameters that the ADIRS computes are barometric and ISA-referenced. When the atmosphere differs from the ISA conditions, the altitude and FPA computed by the ADIRS, and the associated indications on PFD (altitude, VDEV, etc.) are not accurate.

Note: *The ADIRS computes the FPA from inertial data and barometric altitude.*

When the temperature is lower than ISA:
- The true altitude of the aircraft is lower than the altitude that the ADIRS computes
- The FPA that the aircraft actually flies, is less steep than the FPA that the ADIRS computes.

If appropriate, the flight crew should therefore apply corrections on the altitudes and on the FPA (in vertical selected FPA mode), and they should be vigilant on the parameters that are displayed.

Altitude Correction

The flight crew should consider to correct the target altitudes, by adding the values that are indicated in the table below:

Corrections to be Added (ft)			
	Airport Temperature (°C)		
Height (ft)	**-10**	**-20**	**-30**
500	50	70	100
1 000	100	140	190
2 000	200	280	380
3 000	290	420	570
4 000	390	570	760
5 000	490	710	950

These values are calculated for an aerodrome at sea level, and are therefore conservative when applied at a higher altitude aerodrome. For aerodromes at sea level, these corrections corresponds approximately to 4 x Delta ISA x Height (ft)/1000.
The correction depends on the airport temperature, and on the height above the airport. This correction has to be added to the indicated altitude.
Along the Approach and Missed Approach, the flight crew should consider to apply the altitude corrections on the relevant minimum altitudes (all including FAF, Step-down altitudes, minima), and on the altitude for the altitude/distance check.
For Non Precision Approach in vertical managed mode, refer to the Approach guidance management section.

FPA Correction

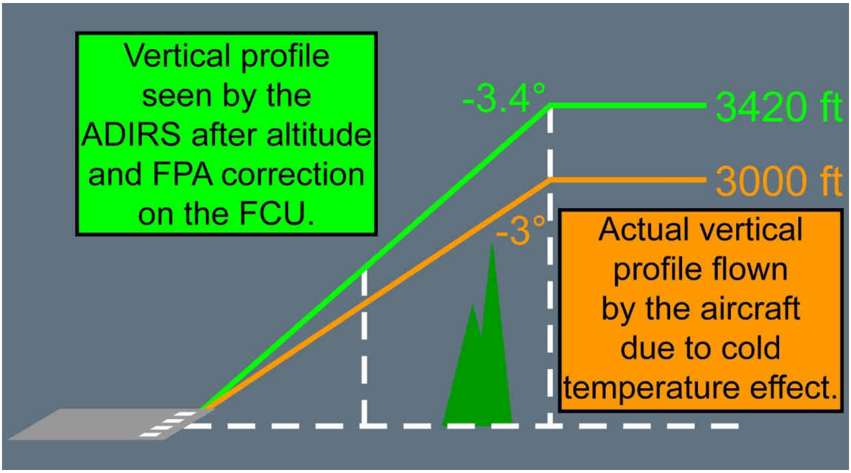
When the temperature is lower than ISA, the FPA that the aircraft actually flies is less steep than the FPA that the ADIRS (ISA referenced) computes.
In vertical selected mode FPA, to correct the FPA for this ISA deviation effect, the flight crew should select on the FCU a FPA slightly different from the FPA that the aircraft needs to fly.
In any case, the check "altitude (corrected in temperature) versus distance" remains the reference.

Impact on the indications

The barometric indications on PFD, namely the altitude and the VDEV are not corrected in temperature and are therefore not accurate.

Example

EXAMPLE	Airport outside temperature -20 °C ; Delta ISA = -35 °C. Approach: FAF at 3 000 ft ; Final descent slope 3 °.



LANDING

Ident.: PR-NP-SP-10-10-1-00016488.0001001 / 20 MAR 17
Applicable to: ALL

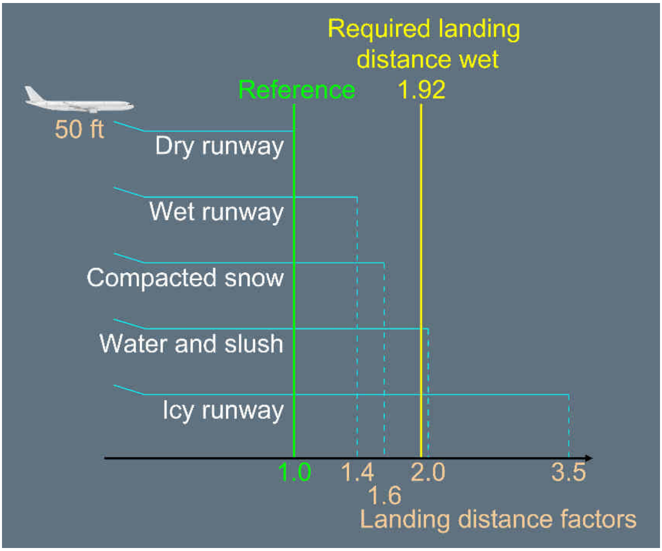
The flight crew should avoid landing on slippery runways, particularly if the antiskid is inoperative. However, if it is not possible to avoid such landings, the following factors (linked to operations on contaminated runways) should be considered:
- Braking action
- Directional control.

BRAKING ACTION

The presence of 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 landing distances provide a good assessment of the real landing distances for specific levels of contamination.
After a brief flare a firm touchdown should be made, and REV MAX should be selected, as soon as the main landing gear is on ground. Using reversers on a runway that is contaminated with dry snow may reduce visibility, particularly at low speeds. In such cases, reverse thrust should be reduced to idle, if necessary.
If necessary, REV MAX can be used until the aircraft is fully stopped.
The use of MED (4 for A340-500/600) autobrake mode is recommended, when landing on an evenly contaminated runway. It is possible that the DECEL light on the AUTO BRK panel will not

come on, as the predetermined deceleration may not be achieved. This does not mean that the autobrake is not working.
In the case of uneven contamination on a wet or contaminated runway, the autobrake may laterally destabilize the aircraft. If this occurs, consider deselecting the autobrake.

Typical Landing Distance Factors vs. Runway Conditions



DIRECTIONAL CONTROL

During rollout, the sidestick must be centered. This prevents asymmetric wheel loading, that results in asymmetric braking and increases the weathercock tendency of the aircraft.
The flight crew should maintain directional control with the rudder as long as possible.
When required, differential braking must be applied by completely releasing the pedal on the side that is opposite to the expected direction of the turn. This is because, on a slippery runway, the same braking effect may be produced by a full or half-deflection of the pedal.

Landing on a contaminated runway in crosswind requires careful consideration. In such a case, directional control problems are caused by two different factors:
- If the aircraft touches down with some crab, and reverse thrust is selected, the side-force component of reverse 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. This adds to any problems there may be with directional control.

If there is a problem with directional control:

- Reverse thrust should be set to idle, in order to reduce the reverse thrust side-force component.
- The brakes should be released, in order to increase the cornering force.
- The pilot should return to the runway centerline, reselect reverse thrust, and resume braking (*Refer to PR-NP-SOP-250 Rollout*).

TAXI-IN

Ident.: PR-NP-SP-10-10-1-00016489.0001001 / 20 MAR 17
Applicable to: ALL

During taxi-in, after landing, the flaps/slats should not be retracted. This is because retraction could cause damage, by crushing any ice that is in the slots of the slats. When the aircraft arrives at the gate, and the engines are stopped, a visual inspection should be performed to check that the slats/flaps areas are free of contamination. They may then be retracted, with the electric pumps.
At the end of the flight, in extreme cold conditions, cold soak protection is requested when a longer stopover is expected.

Windshear

GENERAL

Ident.: PR-NP-SP-10-10-2-00019671.0001001 / 03 MAR 21
Applicable to: ALL

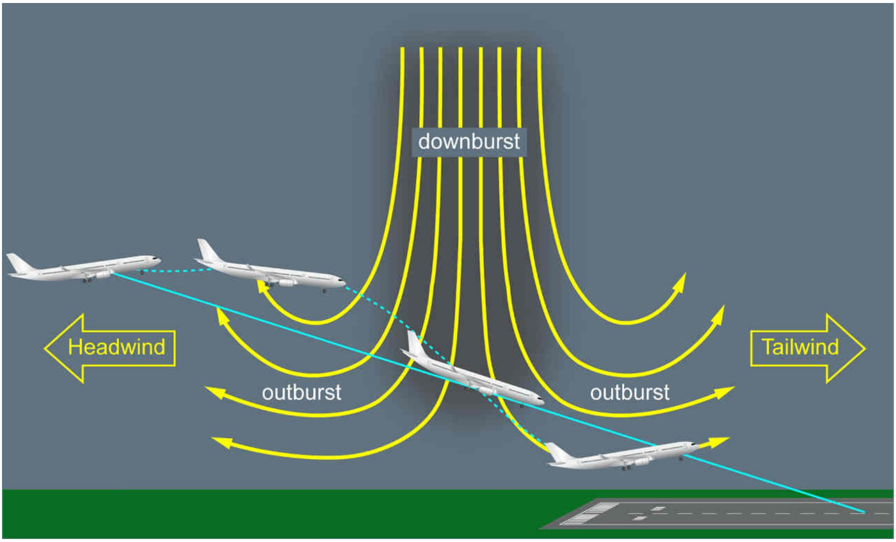
WINDSHEAR PHENOMENON

Windshear is a sudden change in either wind speed or direction, or both, over a relatively short distance. Windshear occurs either horizontally or vertically at all altitudes.

Windshear can result from a microburst. Microbursts occur close to the ground and are a possible hazard to the safe flight of the aircraft for the following two reasons:
- The downburst of a microburst can result in strong downward winds (40 kt can be reached)
- The outburst of a microburst can result in both a large horizontal windshear and a wind component shift from headwind to tailwind (horizontal winds can reach up to 40 kt).

An aircraft that approaches a microburst will first encounter a strong headwind. This can result in an increase in the indicated airspeed. This may cause the aircraft to fly above the intended flight path and/or accelerate. With a fixed speed on approach, the flight crew's reaction may be to reduce power. This will cause the aircraft to fly with reduced energy through the downburst. The wind will then become a tailwind. The indicated airspeed and lift will drop and the downburst may be sufficiently strong to force the aircraft to lose a significant amount of altitude. The degraded performance, combined with a tailwind encounter, may cause the aircraft to stall.

Windshear Phenomenon



AWARENESS AND AVOIDANCE

Awareness of the weather conditions that cause windshear will reduce the risk of an encounter. Studying meteorological reports and listening to tower reports will help the flight crew to assess the weather conditions that are to be expected during takeoff or landing.
If a windshear encounter is likely, the takeoff or landing should be delayed until the conditions improve, e.g. until a thunderstorm has moved away from the airport.

RECOGNITION

Timely recognition of a windshear condition is vital for the successful implementation of the windshear recovery/escape procedure.

The flight crew should pay attention to the following deviations that may indicate a possible windshear condition:
- Indicated airspeed variations in excess of 15 kt
- Ground speed variations
- Wind indication variations on the ND or HUD : directions and velocity
- Vertical speed excursions of 500 ft/min
- Pitch attitude excursions of 5 °
- Glide slope deviation of 1 dot

- Heading variations of 10 °
- Unusual A/THR activity.

STRATEGY FOR COPING WITH WINDSHEAR

Windshear and microburst are hazardous phenomena for an aircraft at takeoff or landing. The strategy to cope with windshear is:

- **Increasing Flight Crew Awareness** through the PWS
- **Informing the Flight Crew** of unexpected air mass variations through FPV and approach speed variations
- **Warning the flight crew** of significant loss of energy through "SPEED, SPEED, SPEED" and "WINDSHEAR" aural warnings
- **Providing effective tools** to escape the shear through ALPHA FLOOR protection, SRS pitch order, high AOA protection and GS mini protection.

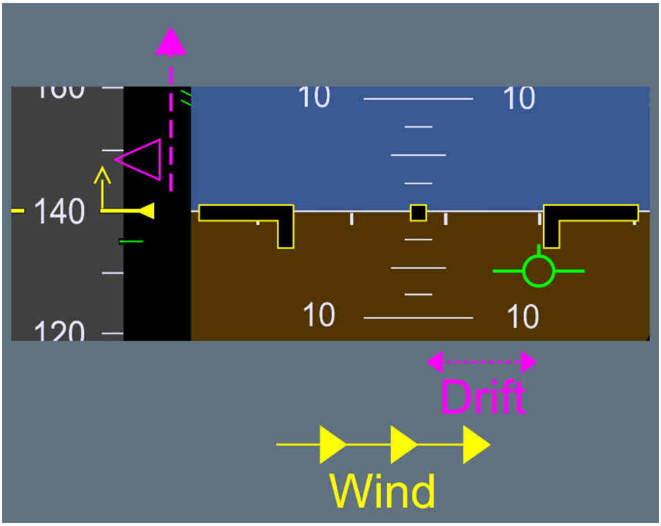
INCREASING FLIGHT CREW AWARENESS

When the airshaft of a microburst reaches the ground, it mushrooms outward, carrying with it a large number of falling rain droplets. The radar can measure the speed variations of the droplets, and as a result, assess wind variations. This predictive capability to assess wind variations is performed by the PWS. The PWS automatically operates below a given altitude (*Refer to FCOM/DSC-34-20-30-20 General*), if the radar is ON or OFF, provided that the PWS sw is in the AUTO position.

INFORMING THE FLIGHT CREW

The FPV associated with the approach speed variations (GS mini protection) is an effective means for informing the flight crew of unexpected air mass variations:
Approach speed variations and lateral FPV displacement reflect horizontal wind gradient.
Vertical FPV displacement reflects the vertical air mass movement.

Bird and Target Speed - Wind Interpretation



WARNING THE FLIGHT CREW

The "SPEED, SPEED, SPEED" low energy warning is based on the aircraft speed, acceleration and flight path angle. This warning attracts the PF’s eyes to the speed scale, and requests rapid thrust adjustment. In windshear conditions, it is the first warning to appear, before the activation of the alpha floor protection. The following table provides some typical values of the speed at which the warning could occur in two different circumstances.

Deceleration Rate	Flight Path Angle	Warning
-1 kt/second	-3 °	VLS -7 kt
-1 kt/second	-4 °	VLS -1 kt

In addition, the aircraft has a reactive windshear warning system. This system triggers if the aircraft encounters windshear. In such a case, there is a "WINDSHEAR WINDSHEAR WINDSHEAR" aural warning.

PROVIDING EFFECTIVE TOOLS

There are three effective tools to assist the flight crew to escape:
- The alpha floor protection
- The SRS AP/FD pitch law
- The high AOA protection.

When the alpha floor protection is triggered, the A/THR triggers TOGA on all engines. The FMA displays A.FLOOR, that changes to TOGA LK, when the aircraft AOA has decreased. TOGA/LK can only be deselected by turning the A/THR off.
The SRS pitch mode ensures the best aircraft climb performance. Therefore, the procedure requests following the SRS pitch bar and possibly full aft stick, in order to follow the SRS orders and minimize the loss of height.
The high AOA protection enables the PF to safely pull full aft stick, 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

Ident.: PR-NP-SP-10-10-2-00016475.0001001 / 04 NOV 20
Applicable to: ALL

GENERAL GUIDELINES

- Predictive windshear warning (“WINDSHEAR AHEAD" and "GO AROUND WINDSHEAR AHEAD" aural alerts, associated with W/S AHEAD that appears on the PFDs), reactive windshear warning ("WINDSHEAR WINDSHEAR WINDSHEAR" aural alert, associated with WINDSHEAR that appears on PFDs) and windshear detected by the flight crew, request immediate actions.

  The following recommendations apply for takeoff after V1 and when airborne (including approach and go around phases):
  - The flight crew must set TOGA thrust and should follow SRS orders (if necessary pull the sidestick fully back).
    If the FD bars are not displayed, the flight crew should move toward the following initial pitch attitude:
    - 17.5 ° for A330 aircraft, or
    - 12.5 ° for A340 aircraft.

    Then, if necessary, to prevent a loss in altitude, increase the pitch attitude.
  - If the AP is engaged, the flight crew should keep it engaged. The AP disengages if the angle of attack value goes above αPROT
  - The flight crew should monitor the flight path, the speed and the speed trend.
- Suspected windshear (upon ATC or traffic notification or flight crew observation) and predictive windshear caution (“MONITOR RADAR DISPLAY" aural alert, associated with W/S AHEAD that appears on the PFDs) request anticipation of the flight crew to be prepared for a possible windshear.

Note: When a predictive windshear aural alert ("WINDSHEAR AHEAD" or "GO AROUND WINDSHEAR AHEAD") is triggered, the flight crew must carefully check that there is no hazard. If this is the case, the flight crew can disregard the alert, as long as both the following apply:
- *There are no other signs of possible windshear conditions*
- *The reactive windshear system is operational.*

Known cases of spurious predictive windshear alerts were reported at some airports either during takeoff or landing, due to the specific obstacle environment.
However, the flight crew must rely on all reactive windshear (i.e. WINDSHEAR) alerts.

TAKEOFF

SUSPECTED WINDSHEAR OR PREDICTIVE WINDSHEAR

The Predictive Windshear Function detected a windshear.
Predictive windshear alerts are inhibited when the aircraft speed is above 100 kt and up to 50 ft.
If a predictive windshear alert is triggered on the runway before takeoff, or in case of suspected windshear, the flight crew must delay takeoff until conditions are better. In order to evaluate takeoff conditions, the flight crew should apply both of the following:

- Use their observations and experience
- Check the weather conditions.

In order to select the preferred runway, the flight crew should take into consideration the location of expected windshear.
If a predictive windshear warning is triggered during the takeoff roll, the Captain must reject takeoff.
If a predictive windshear caution is triggered during the takeoff roll, it is the decision of the Captain according to the Captain's situation assessment to either:

- Continue with takeoff considering TOGA, or
- Reject takeoff.

If a predictive windshear 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 OR WINDSHEAR DETECTED BY FLIGHT CREW OBSERVATION

The Reactive Windshear Function detected a windshear.
During the takeoff roll, "WINDSHEAR WINDSHEAR WINDSHEAR" alert is inhibited.
Windshear recognition is based on the flight crew observation.

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 PM should call out the wind variations from the ND and V/S and, when clear of the windshear, report the encounter to the ATC.

APPROACH

SUSPECTED WINDSHEAR OR PREDICTIVE WINDSHEAR

The Predictive Windshear Function detected a windshear.
If "MONITOR RADAR DISPLAY" or the visual alert appears, or in case of suspected windshear, 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
- The flight crew may increase VAPP displayed on MCDU PERF APP page up to a maximum VLS +15 kt, in case of strong or gusty crosswind greater than 20 kt, use the LDG PERF application of EFB for VAPP determination.
- In very difficult weather conditions, the A/THR response time may not be sufficient to manage the instantaneous loss of airspeed. *Refer to PR-NP-SOP-190-CONF Use of A/THR* for the applicable technique description.

In the case of "GO AROUND, WINDSHEAR AHEAD" aural alert 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 OR WINDSHEAR DETECTED BY FLIGHT CREW OBSERVATION

The Reactive Windshear Function detected a windshear.
In the case of a windshear, the PF must set TOGA for a go-around.
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 PM should call out the wind variations from the ND and V/S and, when clear of the windshear, report the encounter to the ATC.

Weather Turbulence

INTRODUCTION

Ident.: PR-NP-SP-10-10-3-00016476.0001001 / 20 MAR 17
Applicable to: ALL

Severe turbulence is defined as turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in airspeed.
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 set the SEAT BELTS sw to ON, in order to prepare passengers and prevent injuries
- All loose equipment must be secured in the cockpit and in the cabin.

If severe turbulence occurs during a flight, the flight crew must make a logbook entry in order to initiate maintenance action.

TAKEOFF

Ident.: PR-NP-SP-10-10-3-00016490.0001001 / 20 MAR 17
Applicable to: ALL

For takeoff in high turbulence, the flight crew must wait for the target speed +20 kt (limited to VFE-5) before retracting the slats/flaps (e.g. the flight crew must wait for F+20 kt before setting Flaps 1).

IN FLIGHT

Ident.: PR-NP-SP-10-10-3-00016491.0001001 / 18 MAY 22
Applicable to: ALL

USE OF THE RADAR

Areas of known turbulence, associated with CBs, must be avoided. Good management of the radar tilt is essential, in order to accurately assess and evaluate the vertical development of CBs. 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 NM upwind.

USE OF THE AP AND A/THR

- In cruise
  - If moderate turbulence is encountered, the flight crew should set the AP and A/THR to ON.
  - If severe turbulence is encountered : *Refer to QRH/severe turbulence.*

- In approach
  The flight crew should use AP and A/THR for approaches as it reduces the workload. If the A/THR performance is unsatisfactory, the PF should disconnect it and control the thrust manually.
  Use of managed speed is recommanded in order to benefit form GS mini function : *Refer to FCOM/DSC-22_30-60-20 Ground Speed Mini Function*

Note: *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.*

Note: *In some cases (e.g. A340 aircraft), and/or with heavy weights, turbulence speed may be less than the green dot speed. The turbulence speed must be flown for structural reasons. Green dot speed is not a limitation, but merely a maneuver speed and the flight crew may fly below this speed.*

THRUST AND AIRSPEED

Set the thrust to give the recommended speed. This thrust aims to obtain, in stabilized conditions, the speed for turbulence penetration.
Change thrust only in case of an extreme variation in airspeed, and do not chase your Mach or airspeed.
A transient increase is preferable to a loss of speed that decreases buffet margins and is difficult to recover.

ALTITUDE

If the flight crew flies the aircraft manually:
- The flight crew may expect large variations in altitude, but should not chase altitude
- The flight crew should consider descending to or below the OPT FL, in order to increase the margin to buffet.

CONSIDERATIONS ON CLEAR AIR TURBULENCE (CAT)

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

- The flight crew must set the harness to on, check that the seat belts signs are on and use all white lights in thunderstorms.
- Turbulence speeds are indicated in the QRH.
- 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.

LANDING

Ident.: PR-NP-SP-10-10-3-00023630.0001001 / 26 NOV 19
Applicable to: ALL

Configuration FULL or 3 can be used.
CONF FULL provides better handling capability in turbulent conditions. However, CONF 3 provides more energy and less drag.

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Wake Turbulence

WAKE TURBULENCE

Ident.: PR-NP-SP-10-10-4-00022019.0001001 / 27 FEB 18
Applicable to: ALL

GENERAL:

Every aircraft that flies generates wake vortices, also known as wake turbulence. Wake turbulence rolls-up into a pair of coherent, counter-rotating vortices that can persist for some minutes behind the aircraft's flight path. This wake turbulence usually moves downward and laterally with the wind. The intensity of the trailing vortex and the dissipation time depends upon factors such as the weight, size, speed of the aircraft, and the prevailing atmospheric conditions (calm weather creates the most critical situation).
Wake turbulence may cause possible danger to the safe flight of another aircraft that crosses or operates below the trajectory of the aircraft that generates these vortices. An aircraft can encounter wake turbulence during any flight phase.

WAKE TURBULENCE PREVENTION:

To reduce the encounter of a wake turbulence, the flight crew must comply with the aircraft separation minima.
If the flight crew suspects that the aircraft may encounter wake turbulence, an upwind lateral offset can be used to avoid the wake turbulence. However, the application of a lateral offset does not guarantee that the vortex will be avoided (except if the vortices are clearly visible by condensation trails).
During final approach, the flight crew should remain on the standard approach slope because a deviation does not guarantee avoidance of wake turbulence.

WAKE TURBULENCE RECOVERY:

If the aircraft encounters wake turbulence, pilot input can amplify the effect of the vortices. All of the following is therefore recommended:

- Do not use the rudder: Use of the rudder does not reduce the severity of the encounter, nor does it enhance the ease of recovery.
- Keep the AP ON: The AP is able to correctly manage roll and pitch movements that are generated by wake turbulence. However, if the aircraft encounters severe wake turbulence, the AP may disconnect.
- If the AP was set to OFF by the flight crew or automatically disconnected, release the controls and wait for a reasonable stabilization of the aircraft.

  When the aircraft is stabilized perform both of the following:
  - Roll wings level
  - Establish again the trajectory.

GENERAL

Ident.: PR-NP-SP-20-00019675.0001001 / 01 MAR 23
Applicable to: ALL

This section describes the available cost-reduction guidelines for the different flight phases. Operators can use these procedures in order to define their own cost-reduction policy.

Each Operator is responsible for the decision of what costs/parameters to reduce, for example (non-exhaustive list):
- Maintenance costs
- Fuel consumption
- Operating costs
- Passenger comfort.

For example, the purpose of both CI and Flexible Takeoff is to reduce general costs, not the fuel consumption.
The information in this chapter is not applicable to all Operators to the same extent, and depends on their specific operations (e.g. geographical location, airport conditions, local regulations, etc.).
The flight crew should decide which procedures to apply, in accordance with the Operator's guidelines and the flight conditions of the day, including the aircraft status.
Whenever reasonable, EDW crews operate according Green Operating Procedures.

DISPATCH

Ident.: PR-NP-SP-20-00019676.0001001 / 20 MAR 17
Applicable to: ALL

FUEL QUANTITY

The flight crew must determine and monitor the necessary fuel quantity at departure, from accurate and consistent data (i.e. weather, performance factor, optimum flight level, average wind speed, etc.).
The weight of any extra fuel will increase fuel consumption.

TAKEOFF CONFIGURATION

Fuel reduction is not a factor for the selection of a takeoff configuration.
The takeoff performance and best takeoff configuration depend on several operational and environmental factors. The flight crew should select the takeoff configuration that:

- Optimizes takeoff performance (takeoff weight, etc.)
- If possible, increases flexible temperature
- Reduces takeoff speed (higher configuration for a dedicated flexible temperature).

A higher slats and flaps configuration (i.e. slats and flaps more extended) slightly increases fuel consumption. But, with a higher flexible temperature, such a higher configuration results in a cost reduction.

TAKEOFF THRUST

When performance permits, use the highest flexible temperature for takeoff.
Takeoff with flexible thrust increases fuel consumption compared with takeoff with TOGA thrust, due to the longer takeoff phase. But the use of flexible thrust reduces engine wear and reduces general costs.

PRELIMINARY COCKPIT PREPARATION

Ident.: PR-NP-SP-20-00020409.0001001 / 20 MAR 17
Applicable to: ALL

APU

The flight crew may delay, for as long as possible, the APU start, and use the ground electrical unit and ground pneumatic unit when available.

EXTERNAL WALKAROUND

Ident.: PR-NP-SP-20-00019677.0001001 / 20 MAR 17
Applicable to: ALL

During the external inspection, the flight crew should pay attention to defects that may increase aerodynamic drag, for example:

- Mismatch of aircraft fuselage panels
- Flight control surfaces that are not correctly aligned
- Worn seals on the airframe
- Peeling paint
- Dirt on the aircraft.

COCKPIT PREPARATION

Ident.: PR-NP-SP-20-00019678.0001001 / 01 MAR 23
Applicable to: ALL

FMGS INITIALIZATION

INIT PAGE

The flight crew should respectively check that:
- The Cost Index (CI) is consistent with the Computerized Flight Plan (CFP). The CI is the ratio of time costs versus fuel costs. The purpose of the CI is to reduce fuel consumption
- The tropopause value is correct, in order to ensure the accuracy of FMS predictions.
- Use the CI published on the EDW OFP.

TAKEOFF PERF PAGE

If conditions and regulations permit, the flight crew should reduce the altitude for both the thrust reduction altitude (THR RED ALT) and the acceleration altitude (ACCEL ALT).
Depending on the regulations, the lowest authorized altitude may be 400 ft.
Select a derate climb for short haul flights. Insert D2 in the perf climb page.

TAKEOFF RUNWAY OPTIMIZATION

The takeoff performance is the first factor to consider in the selection of the takeoff runway.
When possible, the flight crew should request takeoff on the runway that minimizes the taxi time and optimizes the departure trajectory, in order to minimize the flight time.

BEFORE PUSHBACK OR START

Ident.: PR-NP-SP-20-00019679.0001001 / 20 MAR 17
Applicable to: ALL

PUSHBACK/START CLEARANCE

When conditions and ATC permit, the flight crew should delay the engine start for as long as possible. This is to reduce time spent with the engines running before takeoff.
Before takeoff, the flight crew must ensure engine warm-up, in order to prevent engine wear, and to maintain engine performance.

AFTER START

Ident.: PR-NP-SP-20-00019680.0001001 / 20 MAR 17
Applicable to: ALL

APU

- If the APU is not necessary during or after taxi, the flight crew should set the APU bleed to off and shut down the APU. Fuel consumption is reduced when the APU is not running, even if bleed air is supplied by the engines.
- If the APU is necessary during or after taxi (e.g. when takeoff performance requires APU bleed), the flight crew may set the APU bleed to ON, in order to reduce fuel consumption. This opens the crossbleed valve and automatically closes the engine bleed . As the bleed air is not supplied by the engines, the fuel consumption is reduced.
  However, the use of APU bleed can lead to exhaust gases ingestion into the air conditioning system.

Fuel Consumption	lower than	Fuel Consumption	lower than	Fuel Consumption
BLEED from ENG APU OFF		BLEED from APU APU ON		BLEED from ENG APU ON

AIR CONDITIONING

Consider LO (ECON) mode. *Refer to FCOM/PRO-NOR-SOP-06 Overhead Panel - Air COND*

TAXI

Ident.: PR-NP-SP-20-00019681.0003001 / 20 MAR 17
Applicable to: ALL

THRUST MANAGEMENT

Idle thrust is sufficient to move a light aircraft during taxi. If necessary, the flight crew should apply a small thrust increase.
Excessive thrust burns more fuel, requires more brake application, and results in an increase in brake wear.

TWO ENGINES TAXI

Refer to FCOM/Refer to FCOM/PRO-SUP-70-20 Two Engines Taxi - Departure

BEFORE TAKEOFF

Ident.: PR-NP-SP-20-00019682.0001001 / 01 MAR 23
Applicable to: ALL

AIR CONDITIONING

Before takeoff, the flight crew can set both packs to OFF. *Refer to FCOM/PRO-NOR-SOP-11 Before Takeoff - Packs*.
It is EDW policy to takeoff with packs OFF:

CLIMB

Ident.: PR-NP-SP-20-00020410.0001001 / 20 MAR 17
Applicable to: ALL

ECON SPEED

Unless restricted by the ATC, the flight crew should use managed speed during climb, in order to fly at the optimum ECON speed.

ACCELERATION BELOW 10 000 FT

By default, the FMS flight plan takes into account the 250 kt speed limitation below 10 000 ft. If the ATC permits, the flight crew can remove this limitation, in order to accelerate and save fuel.

CRUISE

Ident.: PR-NP-SP-20-00020411.0001001 / 20 MAR 17
Applicable to: ALL

OPTIMUM FLIGHT LEVEL (OPT FL)

During cruise, the OPT FL increases while the aircraft weight decreases.
The flight crew should monitor the OPT FL, and fly at the most appropriate flight level for optimum aircraft performance and fuel consumption.
For additional information, *Refer to PR-NP-SOP-150 Step Climb*.

WIND UPDATE

The flight crew should insert accurate and up-to-date wind information in the FMS, in order to optimize respectively:
- Fuel predictions
- Determination of OPT FL.

The flight crew should update wind information when the change is more than:
- 30 ° in direction, or
- 30 kt in speed.

For additional information, *Refer to PR-NP-SOP-150 ETP*.

MANAGED SPEED

The flight crew should use managed speed mode, in order to:
- Fly at ECON speed
- Optimize speed in accordance with the CI and flight conditions of the day.
  The flight crew should not modify the CI in flight.

For additional information, *Refer to PR-NP-SOP-150 Cost Index*.

DESCENT PREPARATION

Ident.: PR-NP-SP-20-00019683.0001001 / 01 MAR 23
Applicable to: ALL

LANDING RUNWAY OPTIMIZATION

When landing performance permits, the flight crew should ask the ATC to land on the runway that minimizes approach and/or taxi time.

LANDING PREPARATION

When landing performance permits, the best combination to reduce fuel costs and brakes oxidation is: CONF 3 + REV IDLE + Autobrake LO.

If the flight crew needs to reduce the landing distance, they should consider to use the deceleration devices in the following order:
1. FLAPS FULL
2. REV MAX
3. Autobrake MED.

The flight crew should avoid the use of Autobrake MED in combination with CONF 3 and REV IDLE. This is because this configuration highly increases brake temperature and, as a result, brakes oxidation, which may be severe.

L2 For more information about brakes oxidation, *Refer to PR-NP-SOP-160 Brakes Oxidation*.

L1 When the flight crew rides the brakes (and overrides the Autobrake) at landing, brakes oxidation may occur.

Select idle reverse as a standard on dry and wet runways, if performance permits.

DESCENT

Ident.: PR-NP-SP-20-00020412.0001001 / 20 MAR 17
Applicable to: ALL

MANAGED SPEED

The flight crew should use managed speed mode, in order to:
- Fly at ECON speed
- Optimize speed in accordance with the CI and flight conditions of the day.

HOLDING

Ident.: PR-NP-SP-20-00020413.0001001 / 20 MAR 17
Applicable to: ALL

FLAPS CONFIGURATION

Clean configuration is the optimum configuration for a holding circuit.
When required (holding pattern or speed limitation), the flight crew may consider the selection of CONF 1.

OPTIMUM SPEED

In clean configuration, the flight crew should fly at Green Dot speed, in order to optimize the Lift-to-Drag ratio.

APPROACH

Ident.: PR-NP-SP-20-00020414.0001001 / 20 MAR 17
Applicable to: ALL

DECELERATION

When conditions and ATC permit, a decelerated approach reduces fuel consumption.
When the approach type does not enable to fly a decelerated approach, the flight crew should fly an early-stabilized approach.

FLAPS CONFIGURATION

When landing performance permits, the selection of CONF 3 reduces both the approach time and fuel consumption.

AFTER LANDING

Ident.: PR-NP-SP-20-00019684.0008001 / 20 MAR 17
Applicable to: ALL

APU

After landing, the flight crew should delay, for as long as possible, the start of the APU.
If only the ground pneumatic unit is available at the gate, the flight crew may keep the APU bleed off during transit.

TWO ENGINE TAXI

Refer to FCOM/Refer to FCOM/PRO-SUP-70-20 Two Engines Taxi - Arrival

GENERAL

Ident.: PR-NP-SP-30-00019696.0001001 / 20 MAR 17
Applicable to: ALL

GENERAL

An RF leg is an arc of circle with a fixed radius coded in the navigation database. The rounded value of the radius is displayed on MCDU FLIGHT PLAN page and is called ARC value.

USE OF AP/FD

Ident.: PR-NP-SP-30-00019697.0001001 / 20 MAR 17
Applicable to: ALL

USE OF AP/FD

Depending on the RNP operations, use of the FDs or the AP/FD may be mandatory.

SPEED MANAGEMENT ALONG RF LEGS

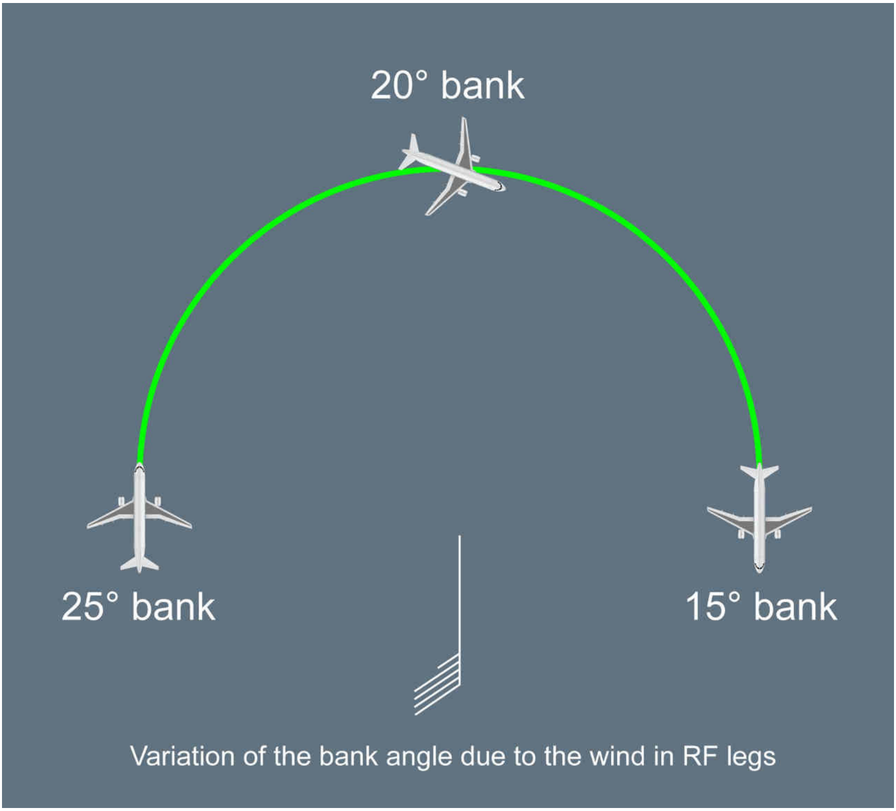
Ident.: PR-NP-SP-30-00019698.0001001 / 20 MAR 17
Applicable to: ALL

SPEED MANAGEMENT ALONG RF LEGS

When flying an RF leg, the FMS adapts the bank angle to fly the arc. The bank angle is a function of the ground speed.
If the ground speed is excessive, the requested bank angle to follow the trajectory can be higher than the maximum bank angle permitted by the Flight Guidance (FG) system (30 ° in normal conditions). In this case the aircraft will overshoot the trajectory.

Therefore, to fly RF legs, the flight crew should be aware of the following operational recommendations:
- Respect speed constraints on RF legs. Use managed speed.
- Pay attention to strong winds, particularly to high tailwinds that increase the ground speed
- Monitor the bank angle, particularly when near 30 ° (i.e. the maximum bank angle with the AP/FD engaged).

Variation of the Bank Angle Due to the Wind in RF Legs



GO-AROUND DURING RF LEG

Ident.: PR-NP-SP-30-00019699.0001001 / 20 MAR 17
Applicable to: ALL

GO-AROUND DURING RF LEG

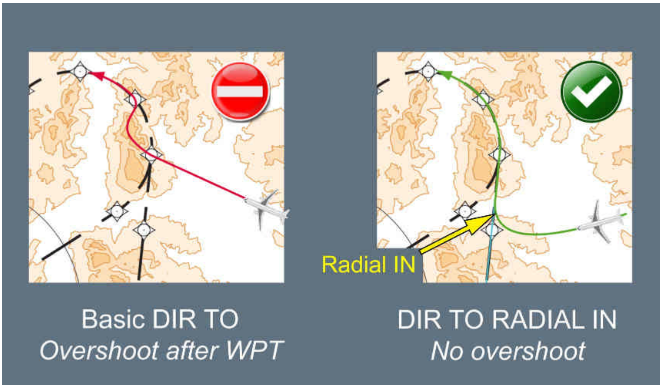
When the flight crew selects TOGA thrust, particularly in a turn, they must check that the NAV mode immediately engages in order to stay on the desired track.
If the NAV mode does not automatically engage, the flight crew must engage it manually.

USE OF THE DIR TO FUNCTION

Ident.: PR-NP-SP-30-00019700.0001001 / 30 AUG 18
Applicable to: ALL

USE OF THE DIR TO FUNCTION

The use of the DIR TO function below MSA is not recommended. This is because the flight plan leg that results is not part of the approach procedure.
The flight crew must use the RADIAL IN function when performing a DIR TO towards a waypoint followed by a RF leg. This enables the alignment of aircraft with the RF leg track, and to avoid an overshoot of the subsequent RNP F-PLN track after the waypoint.
The flight crew must not descend below the MSA until the aircraft is established on the F-PLN leg.

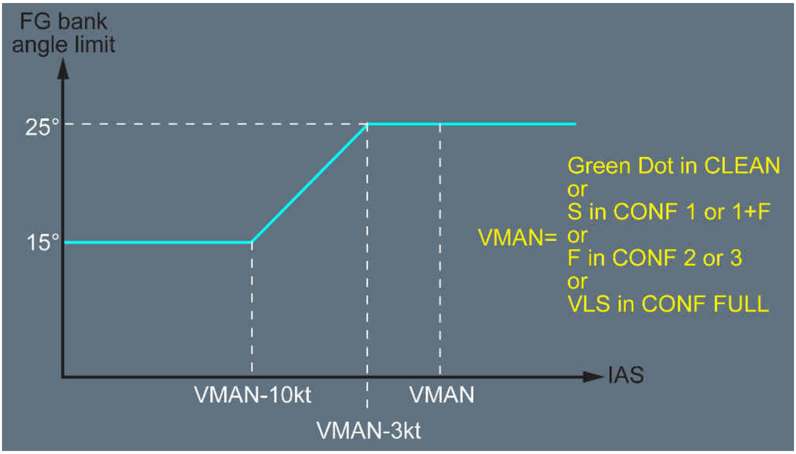


ENGINE-OUT CONSIDERATIONS

Ident.: PR-NP-SP-30-00019701.0001001 / 03 NOV 21
Applicable to: ALL

ENGINE-OUT CONSIDERATIONS

The bank angle limit of the FG with one engine inoperative is 25 ° when the NAV, APP NAV, or FINAL APP mode is engaged.
With one engine inoperative, the bank angle limit of the FG may be lower than 25 ° when the IAS is lower than maneuvering speeds (VMAN). The VMAN is the F speed, S speed, or Green Dot speed, depending on the flap configuration. The bank angle limit of the FG depends on the IAS as illustrated on the following graph:



During go-around or departure with one engine inoperative, the IAS may be lower than the current maneuvering speed, which will limit the bank angle.
The flight crew must be aware that during acceleration, flaps retraction at the usual speeds (F speed, then S speed) may affect the turn radius and a compatibility with turn requirements for a procedure being flown.

TOUCH AND GO

Applicable to: ALL

Ident.: PR-NP-SP-40-A-00020879.0001001 / 09 NOV 21

GENERAL

The primary objective of a touch and go is to practice approach and landing. Touch and go are not intended for neither landing roll nor takeoff procedure training.
Except for the items detailed hereafter, the flight crew must apply the SOPs and standard tasksharing when they perform a touch and go. On repetitive patterns without significant change, the instructor can decide to adapt the Acceleration Flow Pattern and Approach checklist.

The flight crew should pay attention to the following remarks when they perform a touch and go:
- The decision speed (V1) does not apply to touch and go. The PFD does not display V1 during the roll phase of a touch and go. Therefore, the flight crew should be go-minded.
- If the instructor wants to abandon the touch and go, the instructor calls “STOP – I HAVE CONTROL". Simultaneously the instructor takes control and stops the aircraft, with the use of maximum braking and reverse. When the aircraft stops, the instructor calls for any applicable ECAM actions. The decision to discontinue a touch and go after the application of TOGA must only be taken if the instructor is sure that the aircraft cannot safely fly.
- If the trainee selects reverse thrust, the flight crew must perform a full-stop landing.

If any failure occurs during the touch and go training, the flight crew must first perform the ECAM/QRH/OEB actions. Then, during the decision process, the instructor should consider MEL for assessment of the training continuation. For the determination of the MEL repair interval, consider each “touch and go” or “stop and go” as one flight.

Ident.: PR-NP-SP-40-A-00020880.0001001 / 20 MAR 17

DURING FINAL APPROACH

Before each touch and go, the instructor confirms with the trainee that both of the following apply:
- Reverse thrust will not be selected
- Brakes (auto or manual) will not be used.

Ident.: PR-NP-SP-40-A-00020881.0001001 / 28 MAY 20

DURING TOUCH AND GO

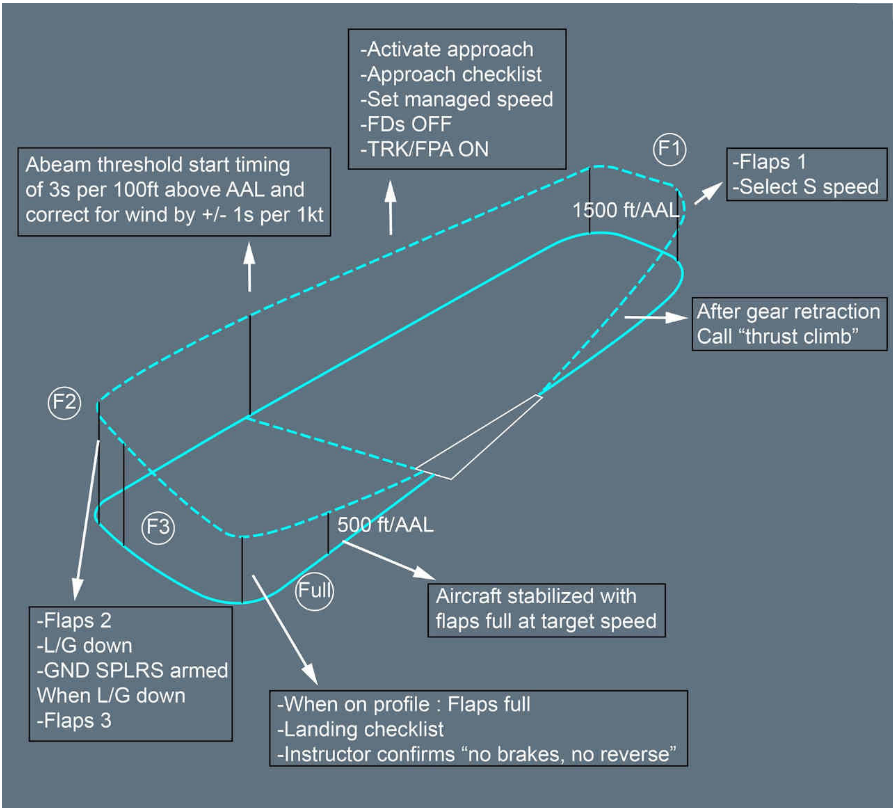
Trainee	Instructor
- Perform usual flare and landing technique - Maintain the runway centerline.	
	- Disarm the ground spoilers (1) - Order "STAND UP".
Move forward the thrust levers approximately 5 cm (2 in), in order to prevent the reduction of engines to ground idle.	
	- Set flaps configuration for takeoff (2) - If necessary, reset the rudder trim - Monitor the pitch trim movement towards the green band - Place one hand behind the thrust levers to ensure that they are advanced to approximately 5 cm (2 in) - Order "GO" when the aircraft is in the correct configuration (pitch trim, rudder trim and flaps).
Set TOGA thrust.	
Remove the hand from the thrust levers.	- Check engine parameters and announce "THRUST SET" - Order "ROTATE" at VAPP - Maintain the hand behind the thrust levers to ensure that the trainee does not perform an inadvertent reduction of thrust or unwanted stop.
Rotate the aircraft and target takeoff pitch attitude, then follow SRS.	

(1) *At nosewheel touchdown, the instructor pushes on the SPEED BRAKE lever to disarm the ground spoilers. The objective is to initiate the immediate retraction of the ground spoilers, and not to wait for their automatic retraction while the thrust levers are advanced.*
Carefully disarm the ground spoilers, so that the SPEED BRAKE lever is in the RET position. If the SPEED BRAKE lever is not in the fully-retracted position, the SPEED BRAKE lever will possibly command speed brakes extension. When thrust levers are set above CLB detent, the CONFIG SPEED BRAKES NOT RETRACTED alert triggers and the ground spoilers automatically retract.

(2) *Flap settings are as follows:*
- *Landing configuration: CONF FULL*
- *Takeoff configuration: CONF 2.*

Ident.: PR-NP-SP-40-A-00020882.0001001 / 05 MAY 22

VISUAL PATTERN



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STOP AND GO

Applicable to: ALL

Ident.: PR-NP-SP-50-B-00020883.0001001 / 20 MAR 17

GENERAL

The primary objective of a stop and go is to practice:
- Approach and landing
- Roll out and runway vacation
- Taxi and takeoff.

Except for the items detailed hereafter, the flight crew must apply the SOPs and standard tasksharing when they perform a stop and go.
The flight crew should taxi the aircraft to the runway threshold for the next takeoff.

Ident.: PR-NP-SP-50-B-00020884.0001001 / 20 MAR 17

WHEN THE RUNWAY IS VACATED

PF	PM
Disarm ground spoilers.	Set the FLAPS lever to 0.

Ident.: PR-NP-SP-50-B-00020885.0001001 / 09 NOV 21

BEFORE NEXT TAKEOFF

Before the next takeoff, the flight crew should perform all of the following actions:
- Consider MEL (if applicable). For the determination of the MEL repair interval, consider each “touch and go” or “stop and go” as one flight.
- Set FMS:
  - Set INIT data
  - Set ZFW & ZFW CG data
  - Set F-PLN data
  - Set TAKEOFF data.
- Set FCU and reset FDs
- Set Takeoff configuration:
  - Arm Ground Spoilers
  - Set Flaps
  - Set / check Rudder and Pitch Trims
  - Arm RTO Autobrake mode.
- Perform T.O CONFIG test
- Perform After Start checklist
- Request ATC clearance

- Perform Takeoff briefing
- Perform Taxi checklist.

Ident.: PR-NP-SP-50-B-00020886.0001001 / 20 MAR 17

BEFORE LINE UP

PF	PM
Check brake temperature.	Check brake temperature (1).

(1) *In order to limit the brake temperature, the flight crew should select the appropriate exit after landing. If performance permits, the instructor can decide to keep the landing gear down after takeoff for brake cooling.*

INTRODUCTION

Ident.: PR-AEP-GEN-00016493.0001001 / 20 MAR 17
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/QRH should be handled as described in FCTM (*Refer to AOP-30-30 General*).

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FMGEC FAILURE

Ident.: PR-AEP-AUTOFLT-00020224.0001001 / 04 NOV 20
Applicable to: ALL

SINGLE FMGEC FAILURE

Should a single FMGEC failure occur, the AP, if engaged on the affected side, will disconnect. The flight crew can recover the AP by selecting the other AP. The A/THR remains operative. Furthermore, flight plan information on the affected ND may be recovered by using the same range as the opposite ND. The flight crew should consider a FMGEC reset as detailed in QRH.

DUAL FMGEC FAILURE

Should a dual FMGEC failure occur, the AP/FD and A/THR will disconnect. The flight crew should try to recover both APs and A/THR by selecting them back ON (The AP and A/THR can be recovered if the FG parts of the FMGES are still available).
If both APs and A/THR cannot be recovered, the thrust levers will have to be moved to recover manual thrust. The flight crew should switch off the FDs and select TRK-FPA to allow the blue track index and the bird to be displayed. The RMPs can be used to tune the NAVAIDs.
The flight crew should refer to the QRH for system reset considerations and then *Refer to FCOM/DSC-22_20-90-10 Automatic FMGEC Reset and Resynchronization - FM Reset* to reload both FMGEC as required.
If both FMGEC cannot be recovered, the MCDU features a NAV B/UP function which provides simplified IRS based navigation (Refer to FCOM/DSC-22_20-60-150 General). The F-PLN is still available as the MCDU continuously memorizes the active flight plan in its internal memory. It should be noted that the FM source selector must be at NORM to allow the NAV B/UP prompt to be displayed on the MCDU MENU page.

Note: *In case of dual FMS failure with the FG part of the FMGEC still available, the AP remains engaged and reverts to HDG-V/S or TRK-FPA.*

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LOSS OF BRAKING

Ident.: PR-AEP-BRK-00019613.0001001 / 03 MAY 23
Applicable to: ALL

1 GENERAL

The [MEM] LOSS OF BRAKING enables the flight crew to manually activate the alternate braking mode without the antiskid function in the case of:
- A failure of the normal braking mode, and
- A failure of the automatic switching from normal braking mode to the alternate braking mode.

Ultimately, if the alternate braking mode without antiskid fails, the [MEM] LOSS OF BRAKING requests the use of the parking brake to stop the aircraft.
The [MEM] LOSS OF BRAKING must be applied only if the flight crew does not perceive any effect on the deceleration when applying manual braking. The [MEM] LOSS OF BRAKING can be applied after the PF took over the autobrake (if used) during a RTO or the landing roll, or during the taxi.
On wet/contaminated runways, the flight crew must keep in mind that the felt deceleration may be lower than on a dry runway. On wet/contaminated runways, the pilot may feel the antiskid cycling with a small deceleration rate. As per design, the antiskid cycling leads from time to time to short periods of brakes release to avoid wheel locking. In addition, when the reverse thrust is reduced from REV MAX to REV IDLE, the flight crew should be prepared to perceive a change in the felt deceleration. In these conditions, the undue application of the [MEM] LOSS OF BRAKING can affect the landing performance.

The procedure associated with the [MEM] LOSS OF BRAKING memory item results in:
- The loss of the nosewheel steering: Aircraft directional control can only be ensured by means of the rudder at high speed (since rudder efficiency decreases with the aircraft speed) and differential braking (if recovered)
- The loss of the antiskid function.

2 PROCEDURE

USE OF REVERSE THRUST

- If needed, full reverse thrust may be used until coming to a complete stop. Below 70 kt, when the flight crew considers that the aircraft can stop on the runway, the flight crew should set idle reverse thrust.
- Unless required due to an emergency, it is recommended to avoid the use of high level of reverse thrust at low speed in order to avoid engine stall and excessive EGT.

A/SKID & N/W STRG OFF

In order to successfully revert to alternate braking, it is important to sequence the actions in three steps. The PF should:

1. Release the brake pedals
2. Request the PM to set the A/SKID & N/W STRG sw to OFF
3. Press the brake pedals, only after the PM has set the A/SKID & N/W STRG sw to OFF. Modulate brake pedal pressure to maximum 1 000 PSI.

PARKING BRAKE

- If still no braking, use short successive parking brake applications to stop the aircraft
- Brake onset asymmetry may be felt at each parking brake application
- If possible, delay the use of parking brake until low speed, to reduce the risk of tire burst and lateral control difficulties.

INTRODUCTION TO EMERGENCY ELECTRICAL CONFIGURATION

Ident.: PR-AEP-ELEC-00019595.0001001 / 20 MAR 17
Applicable to: ALL

The procedure discussed in this section is the EMERGENCY ELECTRICAL CONFIGURATION.

Whilst it is very unlikely that this failure will be encountered, it is useful:
- To refresh on the technical background
- To recall the general guidelines that must be followed in such a case
- To outline the main available systems according to the electrical power source.

TECHNICAL BACKGROUND

Ident.: PR-AEP-ELEC-00019596.0001001 / 20 MAR 17
Applicable to: ALL

The electrical emergency configuration is due essentially to the loss of all main AC BUS which causes the engagement of the emergency generator.
In most cases, this is due to an anomaly on the electrical network, e.g. a short circuit. All engine generators trip and the emergency generator is driven by the EDP. In this scenario, the probability to restore electrical power using the APU generator is low.
Another cause for electrical emergency configuration could be a combination of electrical failures and engine failures. In this scenario, the flight crew may restore electrical power using the APU generator.
Depending on which engine(s) is (are) failed, and on the availability of the green hydraulic EDPs, the emergency generator may be driven by the RAT. In this case, it generates approximately half the electrical power of the previous scenario. If the speed is higher than 260 kt IAS, the emergency generator electrical power is increased as it takes credit from the engine windmill effect.
However, it must be highlighted that the probability of this last scenario is low. Therefore, the summary available in the QRH does not take this scenario into account.

GENERAL GUIDELINES

Ident.: PR-AEP-ELEC-00019597.0001001 / 20 MAR 17
Applicable to: ALL

The following guidelines apply whatever the power source is (EDP or RAT).
As only PFD 1 is available, the left hand seat pilot becomes PF. Once a safe flight path is established, and the aircraft is under control, ECAM actions will be carried out.
This is a serious emergency and ATC should be notified using appropriate phraseology ("MAYDAY").
Although the ECAM displays **LAND ASAP**, it would not be wise to attempt an approach at a poorly equipped airfield in marginal weather.
The power source for the emergency generator will assist the flight crew's decision making in this context: the aircraft is in a much better configuration when the EDP powers the emergency

generator, rather than the RAT. However, in either case, prolonged flight in this configuration is not recommended.
Flight crews should be aware of the sudden great increase of the workload.
As only the E/WD is available, a disciplined use of the ECAM Control Panel (ECP) is essential.
Consideration should be given to starting the APU, as indicated by the ECAM, taking into account the possibility to restore electrical power using the APU generator as mentioned above.
A clear reading of STATUS is essential to assess the aircraft status and properly sequence the actions during the approach.
This failure is a "complex procedure". A summary for handling the procedure is included in the QRH, which will be referred to upon completion of the ECAM procedure.
The ELEC EMER CONFIG SYS REMAINING list is available in QRH.
The LAND RECOVERY pb should be pressed prior to commencing the approach. This action will not be delayed since this will allow the recovery of a number of systems required for landing, e.g. ILS 1 (if MMR is not installed), SFCC 1, whilst shedding a number of systems that are no longer required, e.g. the operative fuel pump(s).
The landing gear must be extended by gravity and NWS is lost in all cases. When the emergency generator is powered by EDP, this avoids strong fluctuation of the green hydraulic pressure which may cause a spurious disconnection of the emergency generator.

REMAINING SYSTEMS

Ident.: PR-AEP-ELEC-00019599.0004001 / 20 MAR 17
Applicable to: ALL

The electrical distribution has been designed to fly, navigate, communicate and ensure passenger comfort.

However, depending on the power source (i.e. EDP or RAT), some differences should be outlined:

- EMER GEN powered by the EDP

Significant remaining systems in ELEC EMER CONFIG	
FLY	PFD 1, pitch trim, rudder trim, alternate law
NAVIGATE	MCDU 1 (B/U NAV), RMP 1, VOR 1, DME 1, (ILS 1, GPS 1 if MMR installed)
COMMUNICATE	VHF 1

Note: *The AP is not available. The rudder trim position indicator on centre pedestal is lost. The aircraft will be out of trim in roll due to right outboard aileron upfloat and it is necessary to pay close attention to bank angle and heading.*

Approach specificities:

When LAND RECOVERY is set ON:
- ILS 1 (if MMR not installed) and SFCC slat flap channel are recovered
- Direct law when landing gear extended
- Landing is performed with pedal braking without anti-skid

- EMER GEN powered by the RAT

Significant remaining systems in ELEC EMER CONFIG	
FLY	PFD 1, alternate law
NAVIGATE	RMP 1, VOR 1, DME 1, (ILS 1, GPS 1 if MMR installed)
COMMUNICATE	VHF 1

Note: *The AP, pitch trim and rudder trim are not available. The aircraft will be out of trim in roll due to right outboard aileron upfloat and it is necessary to pay close attention to bank angle and heading.*

Approach specificities:

When LAND RECOVERY is set ON:
- ILS 1 (if MMR not installed) and SFCC slat channel are recovered
- At slats extension, the emergency generator disconnects (in order to dedicate the RAT for flight controls) and landing is performed on batteries with the same loads
- Direct law when landing gear extended
- Landing is performed with pedal braking without anti-skid.

RESTORATION FROM ELEC EMER CONFIG

Ident.: PR-AEP-ELEC-00019600.0001001 / 20 MAR 17
Applicable to: ALL

When ELEC EMER CONFIG occurs, the LAND RECOVERY AC and DC BUS bars are initially shed and will remain shed until the LAND RECOVERY pb is set to ON. This remains true if normal electrical configuration is restored. This is the reason why the flight crew will also set the LAND RECOVERY pb to ON for approach following a restoration from an ELEC EMER CONFIG.

ENGINE ABNORMAL RESPONSE

Ident.: PR-AEP-ENG-00018634.0001001 / 12 JUL 18
Applicable to: ALL

Most engine malfunctions are taken into account by one or several ECAM alerts that warn the flight crew and provide the flight crew with the actions to perform. However, some engine malfunctions may not trigger an ECAM alert. These engine malfunctions may require some knowledge and the analysis of the flight crew, so that the flight crew can recognize, understand, and manage them.
When the flight crew identifies an abnormal parameter, the flight crew should use all the information available to analyze the engine malfunction. The flight crew should not consider only this abnormal parameter to perform their analysis.
If possible, the flight crew should keep the engine running in flight. Except if a procedure requires an engine shutdown, it is usually preferable to keep the engine running. Even at idle, the engine powers the hydraulic, electric, and bleed systems.
In addition, if the flight crew is not sure which engine has a malfunction, the flight crew should keep the engines running. If really damaged, the affected engine will eventually fail.
Before approach, if the engine response remains abnormal, the flight crew decides to keep the engine running or to shut it down taking into account the aircraft controllability and the flight conditions.

ALL ENGINES FAILURE

Applicable to: ALL

Ident.: PR-AEP-ENG-A-00019574.0005001 / 20 MAR 17

INTRODUCTION

The all engines failure is the situation where the aircraft entirely or partially loses engine thrust, and is no longer able to maintain level flight.

The all engines failure can be identified by the Flight Warning Computer (FWC) or by the flight crew:
1. In most cases, the FWC detects an all engines failure condition and displays the ENG ALL ENGINES FAILURE ECAM alert
2. In some cases, the FWC does not detect the all engines failure condition. In the case of partial loss of thrust (no engine flame out) on one or more engines, the residual N2 (or N3) may remain slightly above the ENG 1(2)(3)(4) FAIL ECAM alert threshold.

Ident.: PR-AEP-ENG-A-00019575.0001001 / 20 MAR 17

TECHNICAL BACKGROUND

An all engines failure situation mainly results in an emergency electrical configuration (*Refer to PR-AEP-ELEC Introduction to Emergency Electrical Configuration*), and in the loss of the blue and yellow hydraulic systems.

ELECTRICAL CONFIGURATION

In the case of an all engines failure:
- All the AC busbars are lost
- The RAT automatically deploys to supply the emergency generator (EMER GEN or CSM/G). The EMER GEN supplies both the AC ESS and the DC ESS bus bars.

As a result, the AC ESS SHED, DC ESS SHED, AC LAND RECOVERY and DC LAND RECOVERY bus bars are shed. Only systems required for the approach and landing are connected to the AC LAND RECOVERY and DC LAND RECOVERY bus bars. The AC LAND RECOVERY and DC LAND RECOVERY bus bars are recovered for the approach and landing upon selection of the LAND RECOVERY pb during the approach.
The emergency generator can supply all the electrical loads that are necessary for the remainder of the flight. The EMER GEN, that is connected to the network, remains connected even if all the main generators are recovered (following engines relight), or if the APU generator is connected.
Below FL 250, if the flight crew can start the APU, the normal electrical configuration partly recovers.

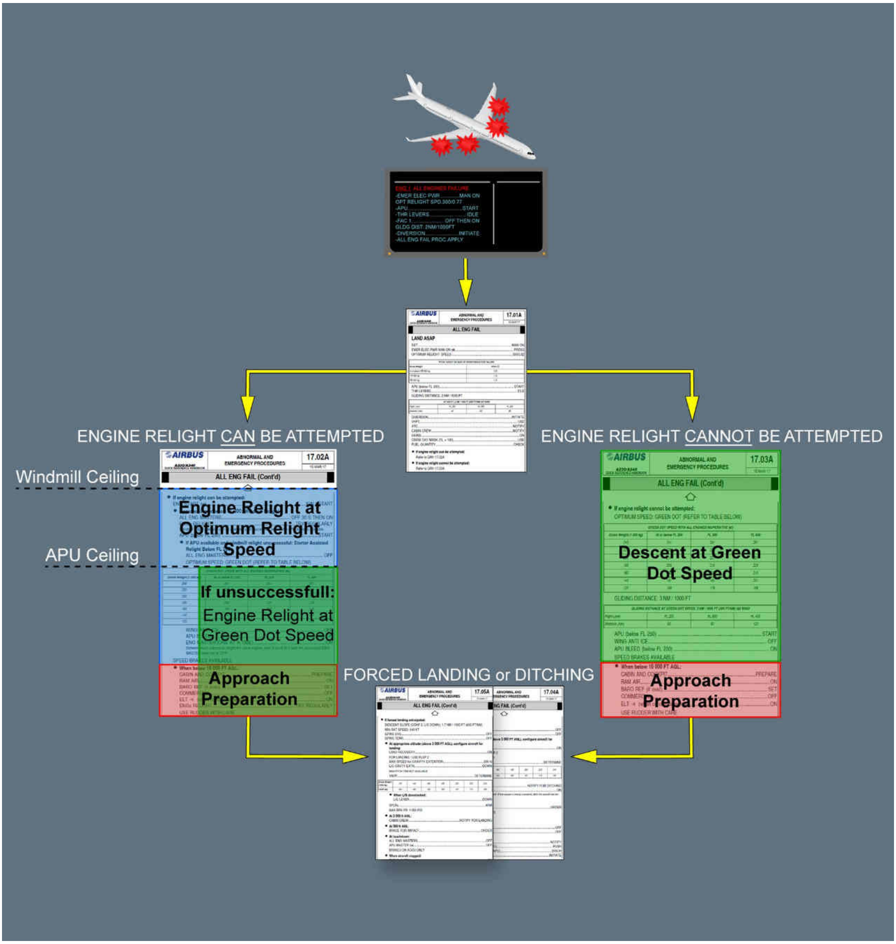
HYDRAULIC GENERATION

The blue and yellow hydraulic circuits are lost. The RAT automatically deploys to pressurize the green hydraulic system.
As hydraulic power is only available from the RAT, the PF should avoid large and rapid rudder deflections.
If engine windmilling is sufficient, additional hydraulic power may be recovered.

Ident.: PR-AEP-ENG-A-00019576.0003001 / 12 JUL 18

GENERAL PHILOSOPHY

GENERAL PHILOSOPHY



Following an all engines failure, the cockpit indications change significantly, because the generators disconnect from the AC and DC bus bars:
- AP, FD, and A/THR are lost
- Aircraft operates in alternate law
- F/O PFD and F/O ND are lost.

When the flight crew detects an all engines failure condition, they must apply the golden rule #1 (*Fly, Navigate, Communicate : In this order and with the appropriate tasksharing*). CM1 (left-hand seat pilot) is PF since only PFD1 is available. CM1 must immediately take over control of the aircraft, and must establish a safe flight path.
After the PF establishes a safe flight path, the PM should perform the ECAM actions. The EWD remains available. The PM (F/O side) can display the SD pages on EWD by pressing and holding the associated system page pushbutton on the ECP.
The ENG ALL ENGINES FAILUREalert provides the first key steps of the procedure and then directs the flight crew to the ALL ENG FAIL QRH procedure.
Due to the advantages of the Windmill relight (available for a large altitude range, simultaneous relight attempts on all engines, relight attempts not dependent on the technical condition of the aircraft systems) compared to the starter-assisted relight (using the APU bleed), the ALL ENG FAIL QRH procedure promotes the Windmill relight for all altitudes of the certified relight envelope. As a result, the optimum speed for Windmill engine relight is displayed on the ECAM when the ENG ALL ENGINES FAILURE alert triggers. This optimum relight speed depends on the engine type and enables an immediate Windmill relight without an excessive aircraft descent rate within the whole Windmill relight envelope. The optimum relight speed is greater than 260 kt in order to ensure that at least one fuel pump is electrically supplied by the CSM/G.
Depending on the circumstances, in order to reach the optimum relight speed, the flight crew may increase the speed during descent. However, the flight crew should keep in mind that, in alternate law, the overspeed protection is lost and that the aircraft speed and Mach upper limits are reduced.
If the all engines failure is subsequent to a flight through volcanic ashes, the situation may be associated to unreliable speed indications. Therefore, the QRH procedure includes complementary information compared to the ECAM and provides the pitch attitude that the PF must maintain to target the optimum relight speed.
The flight crew must set the thrust levers to the Idle detent in order to avoid any thrust power surge when the engine relights.
The gliding distance displayed on the ECAM enables to roughly estimate the aircraft range as a function of the aircraft altitude at the optimum relight speed without wind. As a result, the flight crew should be able to rapidly assess the situation and determine their landing strategy if the engines do not relight. However, this gliding distance figure is an envelope value. As a result, depending on actual parameters, the actual gliding distance may differ. After their range

assessment, the PF should then initiate the diversion to an accessible runway, or determine the most appropriate area for a forced landing or ditching.
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, etc…).
Different causes may lead to a thrust loss so that altitude cannot be maintained. However, fuel starvation is one of the most probable cause. As a result, the ALL ENG FAIL QRH procedure requests the flight crew to check the on-board fuel quantity in order to ensure that the aircraft is not experiencing a fuel starvation issue that will prevent engines relight. Then, depending on the flight crew assessment of the situation, they must determine whether engines relights can be attempted, or not. The ALL ENG FAIL QRH procedure addresses all situations and provides all necessary procedure steps until the touchdown if the engines do not relight. As a consequence, the QRH procedure includes the ditching or the forced landing procedures adapted to the all engines failure situation.

IF ENGINE RELIGHT CAN BE ATTEMPTED

If the flight crew can attempt engines relights, ALL ENG FAIL QRH procedure provides all necessary information and conditions (e.g. Windmill ceiling) to perform successful engines relights. As already indicated, the ALL ENG FAIL QRH procedure promotes windmill relight. If the first relight attempt is not successful, the flight crew should repeat windmill relight attempts on all engines until successful.
However, if none of the engines relights after several attempts using windmill, below FL 200, the flight crew can take advantage of the APU bleed air, if available, to attempt starter-assisted engine relights. If the APU bleed is used, the flight crew must fly at a speed below the optimum windmill speed to enable the FADEC to perform a starter-assisted engine relight. The flight crew can reduce speed to the green dot speed to minimize the aircraft descent rate. As green dot for all engines inoperative is not displayed on the left PFD, the ALL ENG FAIL QRH procedure includes a table of green dot speed with all engines inoperative as a function of the aircraft weight and altitude.
If the APU bleed is used, the flight crew can attempt a relight on only one engine at a time.
Regardless of the relight procedure (Windmill, or using the APU bleed), engine master levers must be set to OFF for 30 s in order to ventilate the combustion chamber of the engine between two relight attempts.
Depending on the engine state and environmental conditions, the engine relight may take time. As long as the engine parameters continuously increase and reach idle values without exceeding limits, the flight crew should not abort the relight attempt.

IF ENGINE RELIGHT CANNOT BE ATTEMPTED

If the flight crew considers that they cannot attempt engines relights (e.g. engine damage, fuel starvation), they should apply directly the applicable section of the ALL ENG FAIL QRH procedure. This section requires flying at green dot speed, that is the best lift-to-drag ratio speed in order to maximize the remaining time for cabin preparation and distance flown. This section of the ALL ENG FAIL QRH procedure provides a table of green dot speed with all engines inoperative as a function of the aircraft weight and altitude. If fuel remains, the flight crew should start the APU below FL 250 to improve electrical power supply and recover CM2 display units. The flight crew should also use APU bleed below FL 200 to recover the cabin pressurization.

APPROACH AND LANDING

When conditions permit, the flight crew should continue engine relights attempts using the APU bleed.
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. Ditching and forced landing procedures are very similar, except for the landing gear that must be up for a ditching.
The flight crew should pay attention to the time to manage the QRH procedure. An efficient procedure application is important to fully configure the aircraft for the ditching or the forced landing. Some items at the end of the procedure are time consuming (e.g. slats extension).
The flight crew must notify the cabin crew of a forced landing or ditching, in order to prepare the cabin. Before the approach, the flight crew must press the LAND RECOVERY pb in order to recover SFCC1 and enable the slats/flaps extension. If the APU supplies the electrical network, slats and flaps are available. If only the CSM/G supplies the electrical network, only the slats are available.

FORCED LANDING

If the flight crew expects a forced landing, they must extend the landing gear to absorb some energy at touchdown, even if the landing is planned out of a runway. The landing gear must be extended by gravity.
Since the trajectory is significantly modified when the aircraft is configured for landing (due to slat/flap and landing gear extension), the descent slope is provided at the beginning of the “Forced landing" section of the procedure to help flight crew anticipate this modification.
For the PF, during the initial and final approach, the main concern is the aircraft energy management.
The PF can consider an early landing gear extension in order to take new visual references of gliding distance and adjust the landing strategy accordingly.
The PF should maintain aircraft path higher than in a normal approach because there is no engine to manage energy.
If the aircraft is too high to reach the landing area, PF may use the remaining speed brakes to generate drag and increase the descent rate, if needed.
When the flight crew selects a runway, they may perform a visual approach, if possible.

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. As the A-SKID is not available, the brake pressure should be limited to 1 000 PSI. As the nose wheel steering is lost, the PF must use the rudder at high speed in order to maintain the runway axis, if applicable. At lower speeds, the PF may use differential braking to maintain the selected axis but avoid brake release for accumulator endurance purpose.

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 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 ENGINES FAILURE alert disappears and the ENG 1(2)(3)(4) FAIL alert is triggered on the E/WD for the remaining engines.
The ENG 1(2)(3)(4) FAIL procedure requests to consider the application of the abnormal ENG RELIGHT In Flight QRH procedure.
The ENG RELIGHT In Flight QRH procedure enables to attempt either a windmilling start, or a starter assisted engine relight with the bleed of the other engine.
The flight crew can decide at any time to stop the ENG RELIGHT In Flight QRH procedure, if the situation requires (e.g. remaining time and distance to fly), and to continue with other ECAM alerts or QRH procedures, if any.
Even if at least one engine is recovered, the AC & DC LAND RCVRY bus bars are still shed and systems supplied by these bus bars are still inoperative. Therefore, the flight crew must press the LAND RECOVERY pb before the approach in order to recover systems required for the approach and landing.
If engine 1 or 4 is recovered, the green hydraulic system is restored. Since the green Engine Driven Pump (EDP) has a higher power than the RAT, the green EDP takes the lead over the RAT to pressurize the green hydraulic system. As a result, the flight crew can extend the landing gear normally.

ENGINE FAILURE - GENERAL

Ident.: PR-AEP-ENG-00016499.0001001 / 20 MAR 17
Applicable to: ALL

An engine flameout can be due to many reasons, for example:
- Fuel starvation
- Encounter with volcanic ash, sand or dust clouds

- Heavy rain, hail, or icing
- Bird strike
- Engine stall
- Engine control system malfunction.

The engine flameout may trigger an ECAM alert.
The flight crew can detect an engine flameout without damage by a rapid decrease of EPR/N1, N2, N3, EGT and FF.

The flight crew can suspect engine damage, if the flight crew observes two or more of the following symptoms:
- Rapid increase of the EGT above the red line
- Important mismatch of the rotor speeds, or absence of rotation
- Significant increase of aircraft vibrations, or buffeting, or both vibrations and buffeting
- Hydraulic system loss
- Repeated, or not controllable engine stalls.

ENGINE FAILURE AT LOW SPEED

Ident.: PR-AEP-ENG-00019577.0001001 / 20 MAR 17
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.

To regain or maintain directional control on the runway, it is necessary:
- To immediately reduce all thrust levers to IDLE, which will reduce the thrust asymmetry caused by the failed engine
- To select all reversers irrespective of which engine has failed
- To use rudder pedal for directional control, supplemented by symmetrical or differential braking if needed.

The steering hand-wheels may be used when taxi speed is reached.

Note: *1. If rudder pedal input and differential braking are needed, apply both on the same side*
2. Below 72 kts, the ground spoilers will not deploy and the auto brake will not activate.

ENGINE FAILURE AFTER V1

Ident.: PR-AEP-ENG-00019578.0001001 / 03 NOV 21
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 flight path before the beginning of the ECAM procedure.

ON THE GROUND:

The flight crew should use the rudder conventionally to maintain the aircraft on the runway centerline. Depending on the rudder pedal input, ailerons and spoiler may be deflected on the wing opposite to the failed engine to increase yaw efficiency (*Refer to FCOM/DSC-27-20-10-30 Lateral Normal Law*).
At VR, the flight crew should rotate the aircraft using a continuous pitch rate of approximately 3 °/s towards an initial pitch attitude of 12.5 °. The combination of high FLEX temperatures and low VR speeds requires precise handling during the rotation and liftoff. The 12.5 ° pitch target will ensure the aircraft becomes airborne.

WHEN SAFELY AIRBORNE:

The flight crew should then follow the SRS orders that may request a lower pitch attitude in order to obtain the target speed. If an engine failure occurs after liftoff, the SRS targets the speed at which the failure occurred (limited between V2 and V2+15 kt).
In the case of an engine failure at takeoff, the blue beta target appears instead of the usual sideslip indication on the PFD (*Refer to FCOM/DSC-27-20-10-30 Sideslip Target*). The lateral normal law will react to a detected thrust asymmetry and command some rudder surface deflection to minimize the sideslip (there is no feedback of this command to the pedals).
Therefore, laterally, the aircraft is a stable platform and no rush is required to use the rudder pedals. However, since the lateral normal law does not order the entire rudder surface deflection, the flight crew must adjust the rudder pedals as usual to center the beta target in order to optimize the climb performance.
The flight crew should control the heading as usual with the bank angle. The flight crew should accelerate if it is not possible to center the beta target by applying full rudder. The flight crew should use the rudder trim to gradually relieve the pressure from the rudder pedals while keeping the beta target centered. When the aircraft is properly trimmed, the PF should engage the AP.

When the AP is engaged the rudder trim is managed via the AP, therefore:
- Manual rudder trim command is inhibited
- The flight crew should release any pressure on the rudder pedals.

Note: *If a rudder pedal deflection is maintained or applied after AP engagement, the AP may disengage.*

PERFORMANCE CONSIDERATIONS

If the climb and/or acceleration performance of the aircraft is less than expected, the flight crew should confirm that the landing gear has been selected up and 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 of the reduced thrust takeoff certification. The application of TOGA very rapidly supplies a large thrust increase 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.

WARNING	If the takeoff is performed at derated takeoff thrust, selecting TOGA at a speed below F can lead to loss of control of the aircraft.

Note: *In CONF 1+F, F speed is not displayed on the PFD. F speed is displayed on the FMS PERF TAKEOFF page.*

- Takeoff thrust is limited to 10 min.

DURING AIRCRAFT TURN

For bank angle limitations of the flight guidance in case of one engine out *Refer to FCOM/DSC-22_20-60-40 Flight Guidance Part*.

PROCEDURE

INITIATION OF THE PROCEDURE

For handling of ECAM/QRH/OEB procedures *Refer to AOP-30-30 General*.
The flight crew should control and monitor the aircraft trajectory as a priority. They should delay the acceleration phase only for the purpose to secure the engine. "Secure the engine" means that the flight crew should continue the ECAM procedure until:

- "ENG MASTER OFF" in the case of an engine failure without damage, or
- "AGENT 1 DISCH" in the case of an engine failure with damage, or
- Fire extinguished or "AGENT 2 DISCH" in the case of an engine fire.

ACCELERATION SEGMENT

At the engine-out (EO) acceleration altitude, the flight crew should press the ALT pb or push the V/S knob to level off and to 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. When the flap lever is at zero, the beta target reverts to the normal sideslip indication.

Note: *If the decision has been taken to delay the acceleration, the flight crew must not exceed the engine out maximum acceleration altitude. The engine out maximum acceleration altitude corresponds to the maximum altitude that can be achieved with one engine out and the other engine(s) operating at takeoff thrust for a maximum of 10 min.*

FINAL TAKE-OFF SEGMENT

When the speed trend arrow 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 THR MCT. If the thrust levers are already in the FLX/MCT detent, move the thrust levers to CL and then back to MCT.

FMA MAN TOGA

FMA MAN FLEX

FMA THR 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 page appears.

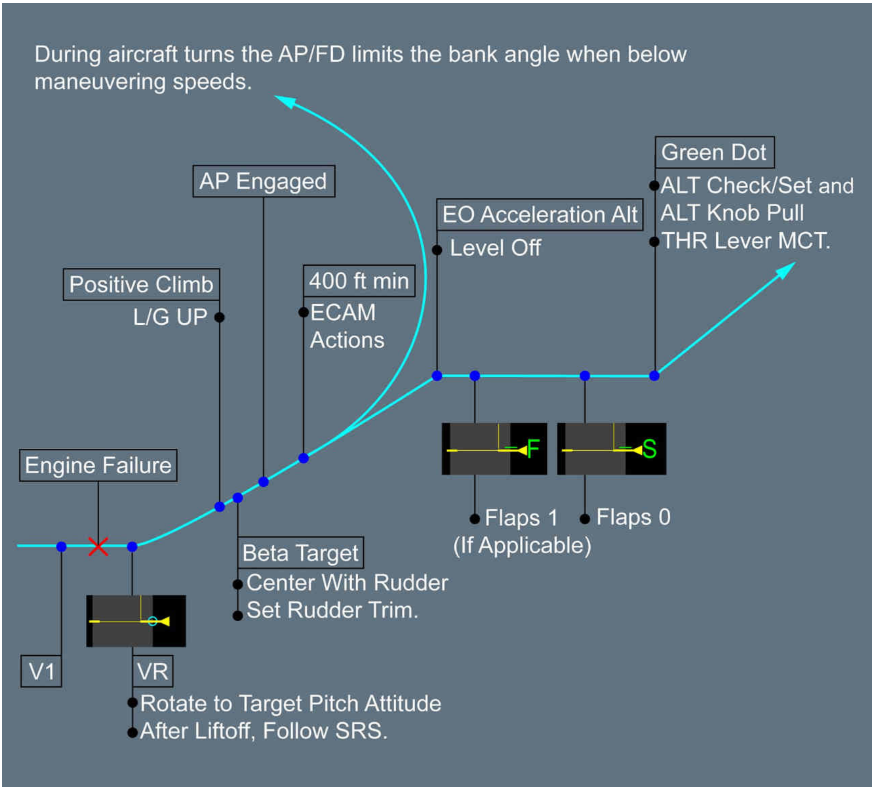
At this point, the flight crew should:
- Ensure that the Acceleration flow pattern is performed
- Consider to relight the engine (if no damage).

Then, the flight crew should review the STATUS page.

ONE ENGINE OUT FLIGHT PATH

The flight crew flies the one engine-out flight path in accordance with the departure briefing performed at the gate:
- The EOSID, or
- The SID, or
- Radar vector, etc.

Takeoff Pattern



ENGINE FAILURE DURING INITIAL CLIMB

Ident.: PR-AEP-ENG-00019585.0001001 / 20 MAR 17
Applicable to: ALL

This procedure is similar to the "Engine Failure after V1" procedure. If the failure occurs above V2 however, maintain the SRS commanded attitude. In any case, the minimum speed must be V2.
When an engine failure is detected, the FMGS produces predictions based on the engine-out configuration and any pre-selected speeds entered in the MCDU are deleted.

ENGINE FAILURE DURING CRUISE

Ident.: PR-AEP-ENG-00019579.0001001 / 05 MAY 22
Applicable to: ALL

GENERAL

When an engine failure occurs during cruise, three possible strategies apply:
- The standard strategy
- The obstacle strategy
- The fixed speed strategy.

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

Note: *Pressing the EO CLR key on the MCDU restores the all engine operative predictions and performance. Reverting to one engine-out performance again is not possible.*

PROCEDURE

As soon as the engine failure is recognized, the PF simultaneously:
- Sets all thrust levers to MCT
- Disconnects A/THR.

In cruise, the PF:
- Sets a HDG as appropriate and pulls
- Determines the engine out recovery altitude.

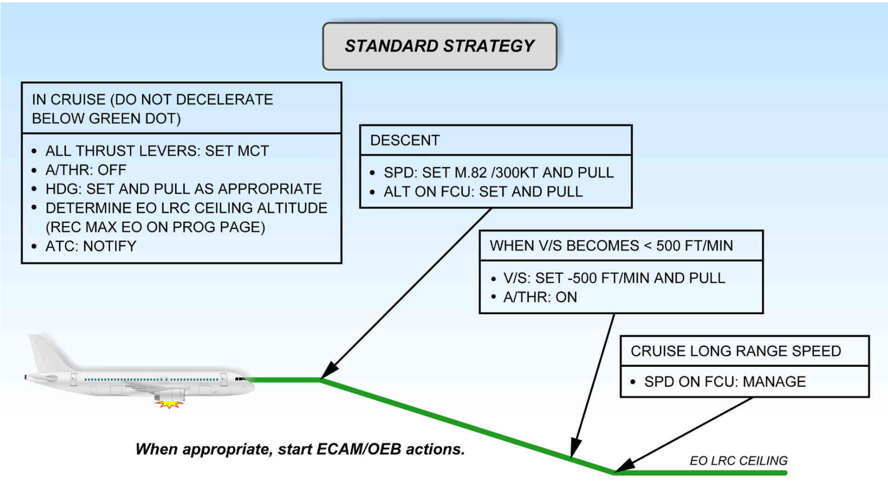
When ready for descent, the PF:
- Sets the SPEED and pulls
- Sets the engine out recovery altitude and pulls to engage for OPEN DES.

When appropriate, the PF requires the ECAM/OEB actions.
At high flight levels, close to the weight limits, the aircraft speed quickly reduces. Thus, the flight crew should not delay to descent. The crew must not decelerate below Green Dot.

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.

STANDARD STRATEGY

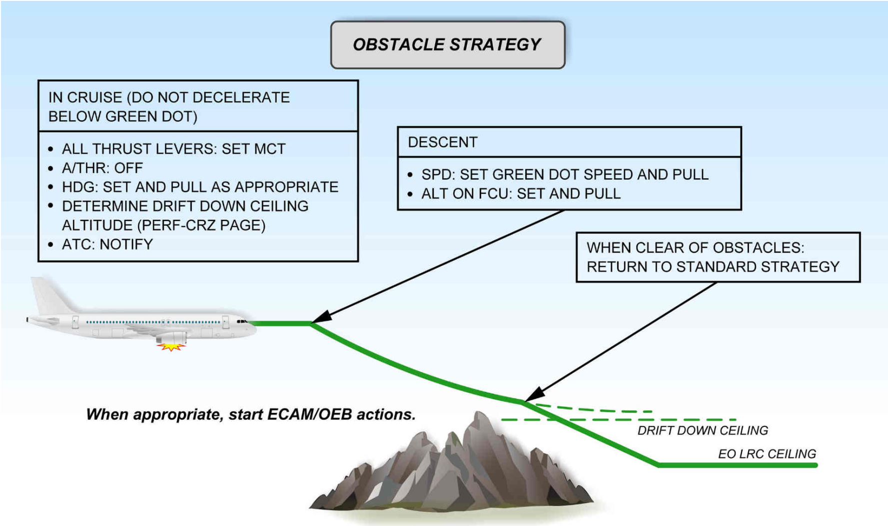
Set speed target M 0.82/300 kt. The speed of M 0.82/300 kt is chosen to ensure the aircraft is within the stabilized windmill engine relight in-flight envelope.
The REC MAX EO Cruise altitude, which equates to LRC Engine-Out maximum FL with anti-icing off, is displayed on the MCDU PROG page (one engine out gross ceiling at long-range speed is also available in the performance application of the EFB in the case of double FM failure).
When the V/S becomes less than 500 ft/min, select V/S -500 ft/min and A/THR on. Once established at level off altitude, long-range cruise performance with one engine out may be computed in the performance application of the EFB.



OBSTACLE STRATEGY

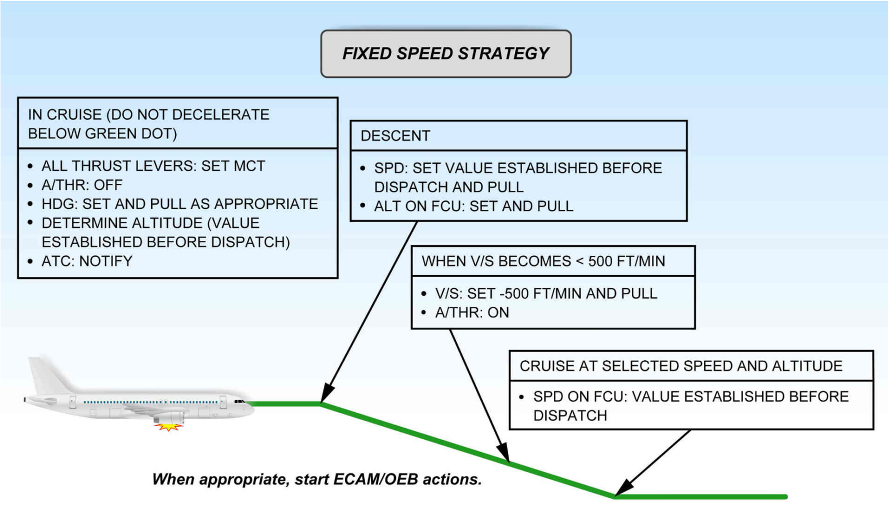
To maintain the highest possible level due to terrain, the drift down procedure must be adopted. The speed target in this case is Green Dot. The procedure is similar to the standard strategy, but as the speed target is now Green Dot, the rate and angle of descent are reduced.
The MCDU PERF CRZ page in EO condition displays the drift down ceiling (one engine out gross ceiling at Green Dot speed is also available in the performance application of the EFB).

When clear of obstacles, revert to Standard Strategy.



FIXED SPEED STRATEGY

This section provides the fixed speed strategy recommended for ETOPS operation. *Refer to FCOM/PRO-SPO-40A Diversion Decision Making*.



ENGINE STALL

Ident.: PR-AEP-ENG-00018635.0001001 / 28 MAY 20
Applicable to: ALL

An engine stall is the disruption of the airflow in a turbine engine. When the blades of the engine compressors stall, they are no longer able to compress the air from the front to the rear of the engine. In some cases, there may be a breakdown of the airflow, with the high pressure air at the end of the compressor reversing flow, and exiting from the front of the engine. If this occurs, it may result in an immediate and significant loss of thrust.
From the flight crew perspective, the engine stall is one of the most startling events at takeoff or during flight. The engine stall should not take the flight crew away from their primary task that is to fly the aircraft.

An engine stall can be due to any of the following reasons:
- An engine degradation (e.g. compressor blade rupture, or high wear)
- Ingestions of foreign objects (e.g. birds), or ice
- A malfunction of the bleed system
- A malfunction of the engine controls (e.g. fuel scheduling, or stall protection devices)
- A significant disturbance of the airflow (e.g. due to wake turbulence, non-appropriate use of the thrust reverser after landing, or lightning strike).

During takeoff, and at high power settings, the symptoms of an engine stall are the following:
- One or more very loud bangs, usually compared to a shotgun being fired a few meters away
- An instant loss of thrust, or even a reverse thrust, that causes a yaw movement
- Fluctuations of the engine parameters (EPR/N1, N2, or N3). The engine may give the impression to pump
- An increase of the EGT
- Engine vibrations
- Flames may be visible from both ends of the engine (inlet / tail pipe)
- Acrid smell in the cockpit.

During cruise, and at low power settings (e.g. at thrust reduction at the T/D), the symptoms of an engine stall are the following:
- One or more muffled bangs
- Slow or no thrust lever response
- Fluctuations of the engine parameters (EPR/N1, N2, or N3). The engine may give the impression to pump
- An increase of the EGT
- Engine vibrations
- Acrid smell in the cockpit.

Most of the FADECs have functions that:
- Regulate the airflow through the compressor, to prevent engine stalls
- Are able to detect engine stalls
- Try to recover from an engine stall, without flight crew action, by modifying the airflow.

When the FADEC detects an engine stall, the FADEC requests that the ENG 1(2) STALL ECAM alert is triggered. The FADEC is not able to detect an engine stall in all cases. Therefore, if the flight crew detects one or a combination of the engine stall symptoms, the flight crew should suspect an engine stall, and apply the QRH Engine Stall procedure.

The Engine Stall procedure is not a memory item. Therefore, if a stall occurs during cruise phase, the flight crew shall take the time to assess the situation before applying the procedure, as most of the times the FADEC will self-recover from the stall before any flight crew action. The Engine Stall procedure (ECAM or QRH) is as follows:
- When the flight crew has stabilized the aircraft trajectory, the flight crew first reduces thrust to idle on the affected engine.
  This action reduces the differential pressure across the compressor. This helps the engine airflow to become more stable.
- When at idle thrust, the flight crew checks the stability of the engine parameters on the EWD, and particularly the EPR/N1, EGT, N2, and N3 . The flight crew should also check the engine vibrations on the ENG SD page.

- The flight crew shuts down the engine if:
  - The fluctuations of the engine parameters, or the high EGT, or the engine vibrations persist, or
  - The symptoms of the engine stall persist at idle thrust.
- If the engine parameters are normal:
  - The flight crew selects the anti-ice on, in order to increase the bleed demand.
    This reduces the pressure at the exit of the compressor, and helps the airflow to circulate in the engine turbine from front to rear.
  - Then, the flight crew slowly advances the thrust levers, as long as the engine stall does not occur again. The engine response may be slow at high altitude.
    - If the engine stall reoccurs, the flight crew keeps the engine thrust below the stall threshold. The flight crew should not shut down the engine if the engine stall can be avoided. The flight crew should manually control the thrust on the affected engine between idle and the identified stall threshold for the remainder of the flight.
    - If the engine stall does not reoccur, the flight crew can resume normal operation of the engine.

The flight crew must report any engine stall for maintenance action.

ENGINE TAILPIPE FIRE

Ident.: PR-AEP-ENG-00016503.0001001 / 20 MAR 17
Applicable to: ALL

An engine tailpipe fire can only occur at engine start or at engine shutdown. It is the result of an excess of fuel in the combustion chamber, in the turbine or in the exhaust nozzle, that ignites. A tailpipe fire is an internal fire in the engine, compared with an engine fire that occurs outside the engine core and gas path. No critical areas are affected in the engine in the case of a tailpipe fire. However, it can have an effect on the aircraft (e.g. damage the flaps). The correct method to manage an engine tailpipe fire is to stop the fuel flow, and to ventilate the engine.
In the case of a tailpipe fire, there is no cockpit alert. The only indication can be an increasing EGT due to the fire in the turbine. Therefore, most of the time, the ground crew, cabin crew, or ATC visually detect the tailpipe fire.

In the case of a tailpipe fire, the flight crew must apply the QRH ENG TAILPIPE FIRE procedure, which requires the flight crew to:
- Shut down the engine, in order to stop the fuel flow
- Dry crank the engine, to remove the remaining fuel.

The flight crew should not use the ENG FIRE pb. This cuts off the electrical supply of the FADEC, and stops the dry crank sequence performed by the FADEC.
The flight crew should not use the fire extinguisher, as it does not extinguish an internal engine fire. As a first priority, the fuel flow must be stopped, and the engine must be ventilated.

If the tailpipe fire procedure does not stop the fire, or if bleed air is not easily available, the ground crew can use a ground fire extinguisher as a last option. Ground fire extinguishing agent can cause serious corrosive damage to the engine and requires a maintenance action on the engine.

ENGINE VIBRATIONS

Ident.: PR-AEP-ENG-00018636.0001001 / 20 MAR 17
Applicable to: ALL

Engine vibrations are usually caused by an imbalance of the engine that can be due to many reasons such as:
- A deformation of one or several blades due to Foreign Object Damage (FOD), or a bird strike
- A rupture or a loss of one or several blades
- An internal engine failure (e.g. engine stall)
- A fan icing

High engine vibration alone does not require an engine in-flight shutdown. If the engine needs to be shutdown, others symptoms and certainly an ECAM alert will warn the flight crew, and request them to shut down the engine.
A high N1 vibration level may be accompanied by perceivable airframe vibrations.
When the vibration level exceeds a certain threshold, the ECAM advisory function automatically highlights the affected parameter. When the flight crew identifies high engine vibrations, the flight crew must refer to the ECAM ADVISORY CONDITIONS section of the QRH.This section guides the flight crew to the QRH HIGH ENGINE VIBRATION procedure.
In the case of high engine vibrations, the flight crew first checks the engine parameters, and crosschecks them with the other engine. The flight crew identifies if there are engine vibrations only, or if there is another problem on the engine for which the flight crew may expect an ECAM alert.
Then the flight crew determines if icing is suspected or not. The flight crew should suspect icing if N1 vibrations occur without variation on other engine parameters. If the flight crew notices unexpected behavior on other engine parameters, the flight crew should consider that icing is not suspected.
These checks take into account the cases of engine problems in icing conditions, and also the cases of vibrations due to icing, out of standard icing conditions.

If the flight crew suspects icing, and if flight conditions permit, the flight crew should shed the ice with the following procedure:
- The flight crew disconnects the A/THR
- The flight crew performs several large thrust variations from idle to a thrust compatible with the flight phase
  It may be necessary to perform several engine run-ups (decrease and then increase of thrust) to fully shed the ice.

If the flight crew does not suspect icing, and if flight conditions permit, the flight crew reduces thrust to make the vibration decrease, and stay below the advisory threshold.

If the vibrations do not decrease, there may be another problem with the engine. The flight crew should expect an ECAM alert that will provide guidance on the actions to perform.
Finally, during the taxi-in phase, the flight crew may consider to shut down the engine if the flight crew experienced vibrations in flight, or if the flight crew experiences vibrations during taxi. On ground, the flight crew should consider engine shutdown in order to avoid increased damage to the engine.

ONE ENGINE INOPERATIVE - GO-AROUND

Ident.: PR-AEP-ENG-00019583.0001001 / 20 MAR 17
Applicable to: ALL

A one engine inoperative go-around is similar to a go-around flown with all engines.
On the application of TOGA, the flight crew must apply rudder promptly to compensate for the increase in thrust and consequently to keep the beta target centred.
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 (or NAV if option installed) and this must be considered with respect to terrain clearance.
At the engine-out acceleration altitude, apply the same technique as described earlier.*Refer to PR-AEP-ENG Engine Failure after V1*

TWO ENGINES INOPERATIVE - GO-AROUND

Ident.: PR-AEP-ENG-00019332.0001001 / 20 MAR 17
Applicable to: ALL

In the case of a two-engine failure during go-around, the aircraft speed will most probably be below VMCL-2. In this case, even with full rudder pedal, the PF will not be able to center the Beta Target, because the rudder is less efficient at such a low speed. This is a good indication that the PF should accelerate. Furthermore, this indication is enhanced by a VLS increase on the PFD, and by a pitch down order of the FD bars in SRS mode.

ONE ENGINE INOPERATIVE - LANDING

Ident.: PR-AEP-ENG-00019581.0001001 / 19 APR 17
Applicable to: ALL

Autoland is available with one engine inoperative, and maximum use of the AP should be made to minimise crew workload. If required, a manual approach and landing with one engine inoperative is conventional. The flight crew should trim to keep the slip indication centred. It remains yellow as long as the thrust on the remaining engine(s) is below a certain value. With flap selected and above this threshold value, the indicator becomes the blue beta target. This is a visual cue that the aircraft is approaching its maximum thrust capability.

The flight crew should not select the gear down too early, as large amounts of power will be required to maintain level flight at high weights and/or high altitude airports.
The flight crew can reset the rudder trim in the later phase of the approach, before engine thrust reduction. On pressing the rudder trim reset button, the trim is removed and the flight crew should anticipate the increased rudder force required. With rudder trim at zero, the neutral rudder pedal position corresponds to zero rudder and zero nose wheel deflection.

TWO ENGINES INOPERATIVE - LANDING

Ident.: PR-AEP-ENG-00019584.0001001 / 26 NOV 19
Applicable to: ALL

The two-engine inoperative landing is in the scope of the aircraft certification process.

PROCEDURE

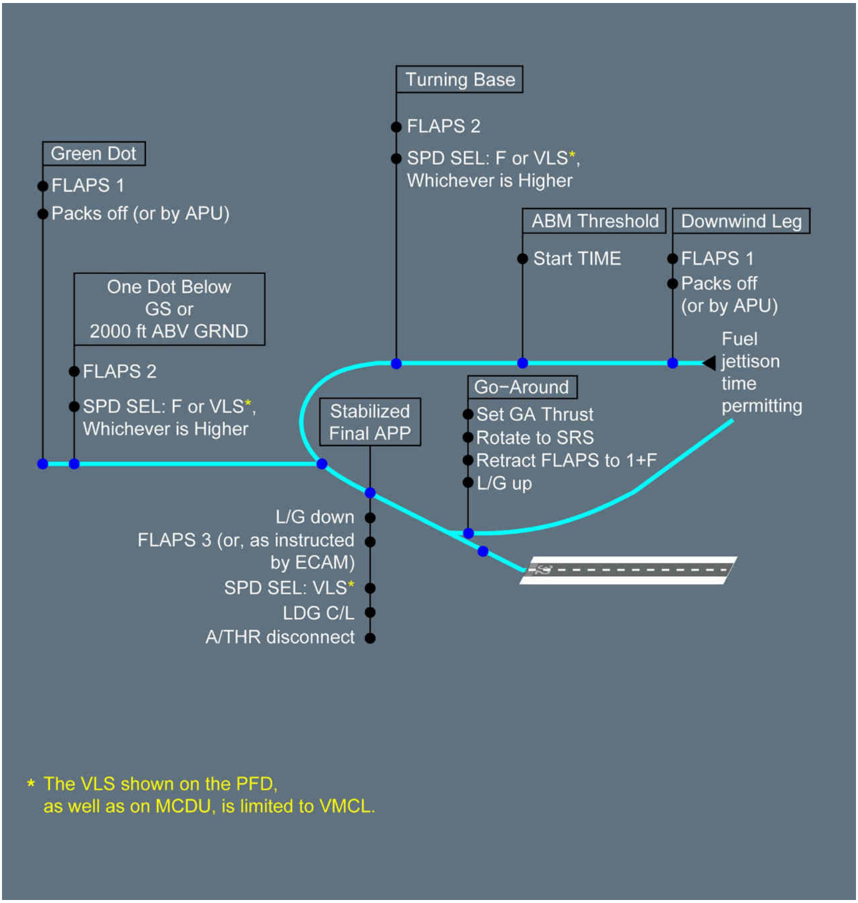
Should a two-engine inoperative landing be performed:
- Fuel jettison should be considered, if time permits
- A longer than normal straight in approach or a wide visual pattern is preferred
- During the approach, the packs should be selected off or supplied by the APU to maximize engine thrust
- In case of two engines inoperative on the same wing, large thrust variation should be minimized, as it will exacerbate the handling of asymmetric flight
- Similarly, Flaps 2 should be selected one dot below GS to minimize thrust variation (or 2 000 ft above ground at the latest)
- Gear down and Flaps 3 selection (or as instructed by the ECAM) should be delayed until established on final approach
- For final approach, speed will be selected to VLS on PFD. (which equates to VMCL-2 in case of two engines inoperative on the same wing)
- When committed to land, speed may be managed. The magenta speed target drops to VAPP i.e. below VLS on PFD. The ATHR must be disconnected and the speed reduced to VAPP using manual thrust.

The flight crew can reset the rudder trim in the later phase of the approach, before engine thrust reduction. On pressing the rudder trim reset button, the trim is removed and the flight crew should anticipate the increased rudder force required. With rudder trim at zero, the neutral rudder pedal position corresponds to zero rudder and zero nose wheel deflection.

Note: *In case of 2 engines failed on the same wing, VLS on the PFD takes into consideration VMCL-2 whereas VAPP (displayed in magenta) and MCDU VLS do not take VMCL-2 into consideration.*
In case of landing gear gravity extension (Engines 1+4 failed, or engines 2+3 failed), the commit point will be at gear down selection. In the other cases, it will be when flying below VMCL of the associated configuration on the approach.

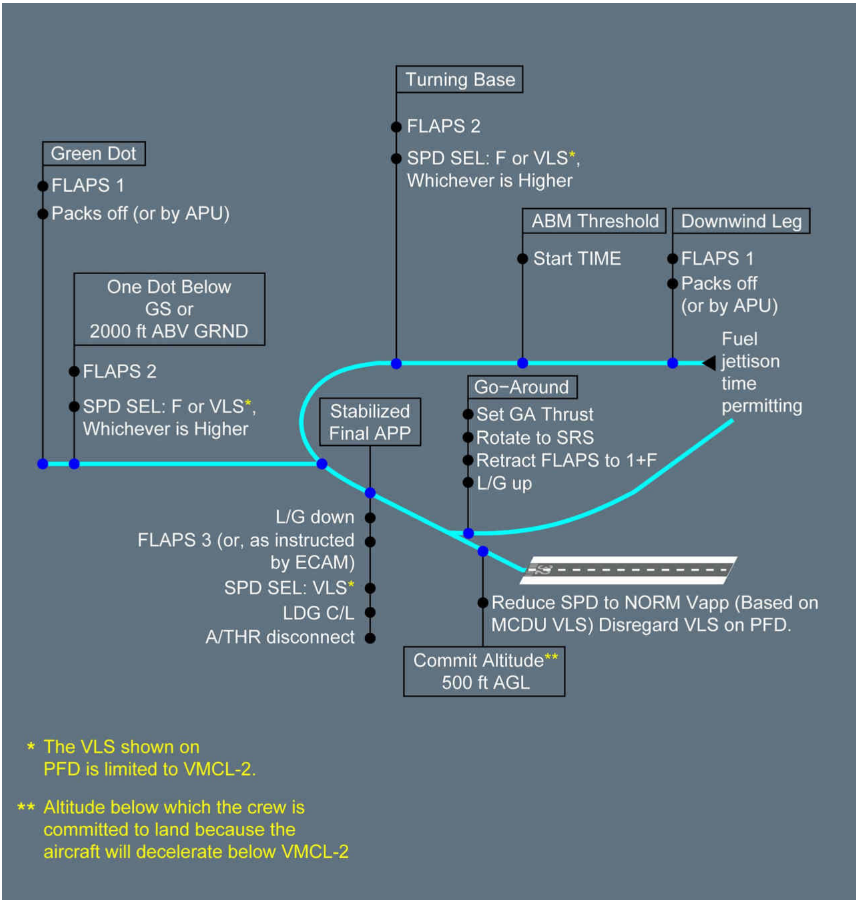
- **One engine inoperative on each wing:**

CAUTION	If gear retraction is not possible, do not attempt a go-around after landing gear extension.



■ **Two engines inoperative on the same wing:**

CAUTION	If gear retraction is not possible, do not attempt a go-around after landing gear extension.



THRUST LEVERS MANAGEMENT IN THE CASE OF INOPERATIVE REVERSER(S)

Ident.: PR-AEP-ENG-00019586.0001001 / 20 MAR 17
Applicable to: ALL

PREFACE

This section provides recommendations on thrust levers management in case of inoperative reverser(s). These recommendations are applicable in case of in-flight failure (including engine failure) and/or in case of MEL dispatch with reverser(s) deactivated.

AT LEAST ONE REVERSER OPERATIVE

If at least one reverser is operative, the general recommendation is to select the reverser thrust on all (A340)/both (A330) engines during rejected takeoff (RTO) and at landing, as per normal procedures.

Note: *The ENG 1(2)(3)(4) (A340) REVERSER FAULT ECAM caution may be triggered after the reverser thrust is selected. This is to remind the flight crew that reverser(s) is/are inoperative.*

NO REVERSERS OPERATIVE

If no reversers are operative, the general recommendation is to not select the reverser thrust during RTO and at landing.
However, the PF still sets all (A340)/both (A330) thrust levers to the IDLE detent, as per normal procedures.

BRIEFING

IMPORTANCE OF THE FLIGHT CREW BRIEFING

Among others, the aircraft status must be reviewed during the flight crew briefing. Any particularities (operational consequences, procedures, associated task sharing and callout) must be reviewed at that time. The flight crew must notably review:
- The status of the thrust reversers and if reverser thrust can be used
- Operational effect (aircraft handling during roll-out).

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ABNORMAL SLATS/FLAPS CONFIGURATION

Ident.: PR-AEP-F_CTL-00019607.0012001 / 04 NOV 20
Applicable to: ALL

CAUSES

Abnormal operation of the flaps and/or slats may be due to one of the following problems:
- Double SFCC failure
- Double hydraulic failure (B+G or Y+G)
- Flaps/Slats jammed (operation of the WTB)

CONSEQUENCES

Abnormal operation of the flaps and slats has significant consequences since:
- The control laws may change
- The selected speed must be used
- An early stabilized approach should be preferred
- The approach attitudes change
- Approach speeds and landing distances increase
- The go-around procedure may have to be modified.

Note: *The FMS prediction do not take into account the slat or flap failures. Since fuel consumption is increased, these predictions are not valid.*

FAILURE AT TAKEOFF

Should a flap/slat retraction problem occur at takeoff, the crew will PULL the speed knob for selected speed to stop the acceleration and avoid exceeding VFE. The overspeed warning is computed according to the actual slats/flaps position.
The landing distance available at the departure airport and the aircraft gross weight will determine the crew's next course of action.

FAILURE DURING THE APPROACH

The detection of a slat or flap failure occurs with the selection of flap lever during the approach. With A/THR operative, the managed speed target will become the next manoeuvring characteristic speed e.g. S speed when selecting flap lever to 1.

At this stage, if a slat or flap failure occurs, the crew will:
- Pull the speed knob for selected speed to avoid further deceleration
- Delay the approach to complete the ECAM procedure
- Refer to LANDING WITH FLAPS OR SLATS JAMMED QRH procedure.
- Update the approach briefing.

In the QRH procedure LANDING WITH SLATS OR FLAPS JAMMED, the Selected speeds and associated Flaps lever position are designed to allow the crew to configure the aircraft for

landing whilst controlling the speed in a safe manner. This procedure may involve reducing speed below the manoeuvring speed for the current configuration which is acceptable provided the speed is kept above VLS except if required by the procedure. In case of slats jammed at 0°, the configuration change is performed intentionally above VFE in order to increase margin to high Angle Of Attack situation. There is no risk of flaps structural overload. *Refer to QRH/ABN-18 Landing with Slats or Flaps Jammed*. The speed reduction and configuration changes should preferably be carried out wings level.
Assuming VLS is displayed on the PFD, VAPP should be close to VLS + wind correction, since this speed is computed on the actual slat/flap position.
The AP may be used down to 500 ft AGL. As the AP is not tuned for the abnormal configurations, its behaviour can be less than optimum and must be monitored.

During the approach briefing, emphasis should be made of:
- Tail strike awareness
- The go-around configuration
- Any deviation from standard call out
- The speeds to be flown, following a missed approach
- At the acceleration altitude, selected speed must be used to control the acceleration to the required speed for the configuration.

Consider the fuel available and the increased consumption associated with a diversion when flying with flaps and/or slats jammed. Additionally, when diverting with flaps/slats extended, cruise altitude is limited to 20 000 ft.

NO FLAPS NO SLATS LANDING

Some items in the QRH procedure NO FLAPS NO SLATS LANDING checklist need to be highlighted:
- More distance is required for manoeuvring.
- The flap handle should be placed into CONF 1 position as required by the QRH to enable the SRS mode in the event of a go-around. VFE displayed on the PFD depends on the flap lever position, so a false VFE will be given.
- Disregard the CONF 2 requirement on the ECAM the status page.
- Autopilot is allowed down to 500 ft AGL.
- At 500 ft, reduce speed to obtain VLS -5 kt (or VREF +45 kt, if VLS not available) at touchdown for performance considerations.
- During the approach the aircraft pitch attitude will be high, increasing the risk of a tail strike on touchdown. Consequently, only a small pitch adjustment is required in the flare to reduce the rate of descent prior to a positive touchdown.
- Due to the high touchdown speed, a prolonged float should be avoided
- Braking considerations apply, *Refer to PR-NP-SOP-250 Deceleration*.

The NO FLAPS NO SLATS LANDING is classified as an extremely improbable failure. It is the reason why the corresponding procedure is not related on ECAM but only in the QRH.

ELEVATOR REDUNDANCY LOST

Ident.: PR-AEP-F_CTL-00019608.0001001 / 15 NOV 21
Applicable to: ALL

INTRODUCTION

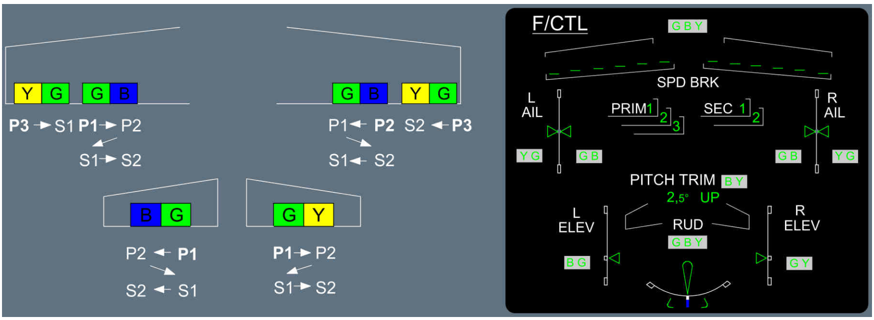
Each ailerons and each elevators are hydraulically powered either by the Green or the Blue or the Yellow circuit and are controlled either by the PRIM or the SEC. This architecture, detailed in QRH/ Operational Data, provides a high level of redundancy.
However, a combination of three failures affecting flight control computers and/or servocontrol and/or hydraulic might lead to the loss of several ailerons and one or both elevators simultaneously. Although the aircraft can be flown in such a configuration, the F/CTL ELEV REDUND LOST procedure (triggered in case of dual failures case) has been developed to anticipate this three failure cases and is designed to smooth the aircraft handling transient.

TECHNICAL BACKGROUND

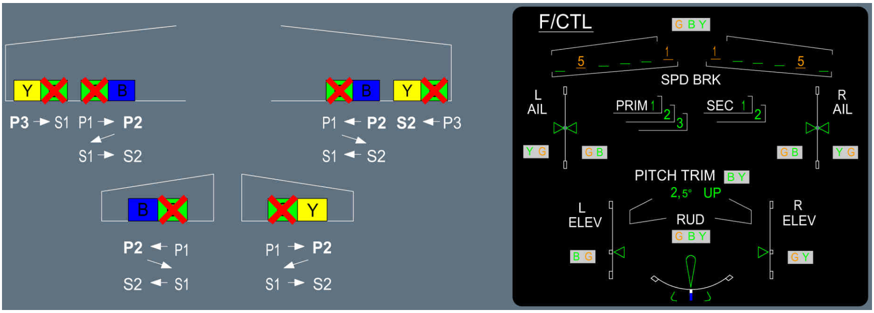
FLIGHT CONTROL ARCHITECTURE AND FAILURES

For a clear understanding, we will study the following example: Loss of the green hydraulic system and PRIM 2, which triggers the F/CTL ELEV REDUND LOST procedure, followed by a SEC2 failure.

Normal situation (before any failure)

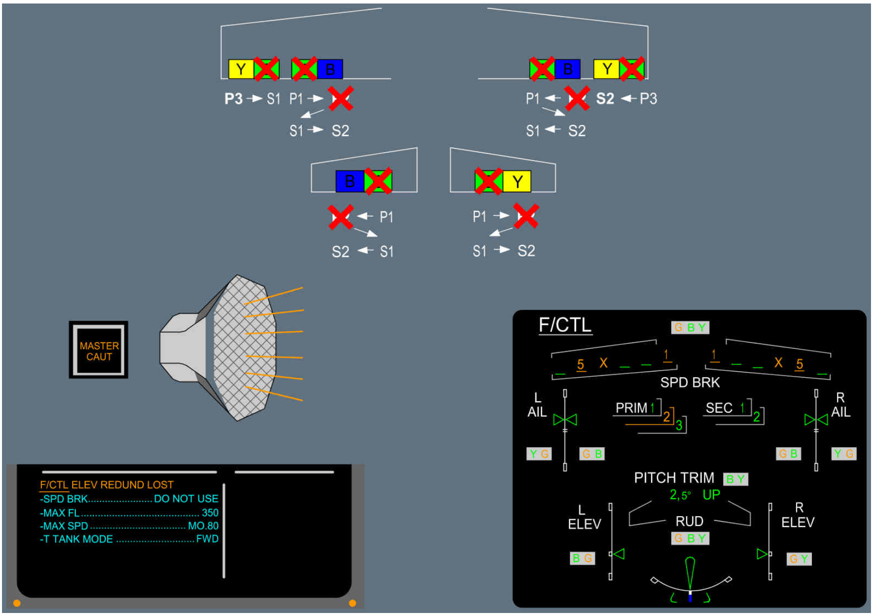


Green hydraulic loss (first failure)



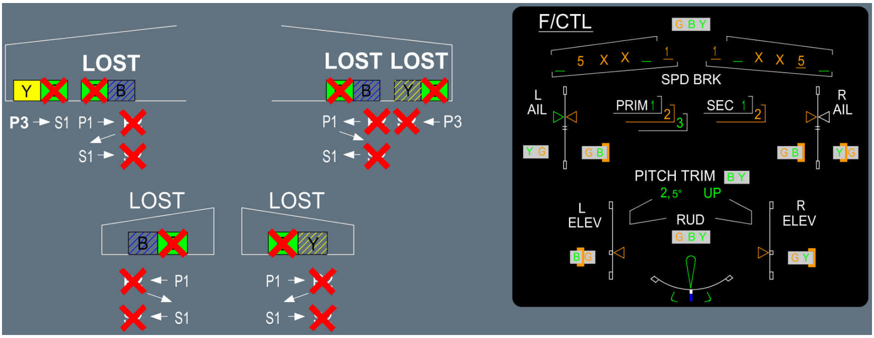
Green hydraulic power is lost. Flight controls computers will switch, this allows the ailerons and elevators to be recovered.

PRIM 2 loss (Second failure)



The **F/CTL ELEV REDUND LOST** procedure is triggered at this stage (when two failures occur). The crew should note that, at this stage, both elevators and all ailerons are available.

SEC 2 loss (third failure)



At this stage, both elevators are lost and only left outboard aileron is available.

FAILED AILERON BEHAVIOUR

When an aileron is failed (due to failure of its hydraulic supply and/or electrical control and/or servojack), it goes to its zero hinge moment corresponding to around 14 ° up. This produces a loss of lift which creates a pitch up moment. The elevators, when available, compensate this effect.

- For the cases where three consecutive failures affecting flight controls lead to the simultaneous loss of both elevators and some ailerons, a 12 ° upwards aileron preset is anticipated (before the third failure) and the resulting pitch up effect can be compensated by the elevators (which are available at this stage) and then trimmed by the THS. This 12 ° upwards aileron preset is a compromise between fuel consumption increase (around 16 %) and the pitch up effect at the time of the third failure. This aileron preset is displayed on ECAM FCTL page.
  If the third and dimensioning failure occurs, three ailerons and both elevators are lost. The failed ailerons go to their zero hinge moment (14 ° up). As the ailerons were previously preset upwards (12 ° up), the transient is smooth. Only a slight upward movement occur but is controllable through the THS. MAN PITCH TRIM ONLY is displayed on the top of PFD.
- For the cases where three consecutive failures affecting flight controls may lead to the simultaneous loss of **one** elevator and some ailerons, **no aileron-preset** anticipation is required. This can be visualized on ECAM FCTL page.
  If the third and dimensioning failure occurs, the remaining elevator compensates the pitch up effect.

PROCEDURE GUIDELINES

Depending on the combination of failures, the AP might be not available. Indeed, in case of ailerons preset, the AP behaviour is less than optimum and automatically disconnects.

Below 2 000 ft or when in CONF 2 however, the aileron preset is cancelled to facilitate the landing manoeuvre and permit the use of AP if available.

The ELEV REDUND LOST procedure requires both speed and FL limitations:

- The speed limitation is introduced to cope with aircraft structure effort, should a third dimensioning failure occur.
- The FL limitation is introduced to maintain stabilizer authority, should a third dimensioning failure occur.

As F/CTL ELEV REDUND LOST is a result of several failures, Landing Performance should be assessed using the EFB performance application.
The decision to divert remains at captain's discretion and is mainly linked to the moment where the failure occurs and to operational considerations such as maintenance, passengers' convenience.
The aft CG warning is generated by the Flight Envelope (FE) computer as a function of the THS position. In case of aileron preset, the THS position counteracts the pitch up effect inducing an erroneous CG computation. This is why any aft CG warning should be disregarded. CG, computed by the FCMC and displayed on ECAM, remains reliable (*Refer to AS-FM-10 General*)

If a third dimensioning failure occurs leading to the loss of both elevators:

- The aircraft longitudinal control is ensured through MAN PITCH TRIM ONLY
- The A/THR may be disconnected to limit engine acceleration/deceleration thus facilitating the aircraft longitudinal control.
- The FL and speed limitations no longer apply

FUEL LEAK

Ident.: PR-AEP-FUEL-00019609.0001001 / 05 MAY 22
Applicable to: ALL

Significant fuel leaks, although rare, are sometimes difficult to detect.

Fuel check will be carried out by:
- Checking that the remaining fuel added to the burnt fuel corresponds to the fuel on board at the gate
- Maintaining the fuel log and comparing the fuel on board to the expected flight plan fuel.

Fuel checks should be carried out when overflying a waypoint or at least every 30 min. Any discrepancy should alert the crew and investigation should be carried out without delay.

In addition, the flight crew can also suspect a fuel leak if:

General indications
- The sum of FOB and FU is significantly less than FOB at engine start, or is decreasing
- There is a discrepancy between the fuel on board and the expected flight plan fuel
- The total fuel quantity abnormally decreases
- A fuel imbalance develops
- Fuel is smelt in the cabin
- The destination EFOB is decreasing or is displayed amber on the FMS F-PLN page

Specific to a hole in a tank
- The fuel quantity of one wing tank decreases abnormally fast
- A passenger or Cabin Crew observes a fuel spray from a wing

Specific to an engine fuel leak
- The fuel flow is excessive, or the N1 indication decreases
- The fuel quantity of one wing tank decreases abnormally fast
- A passenger or Cabin Crew observes a fuel spray from an engine/pylon

Specific to a pipe rupture in a tank
- A tank overflows.

Any time an unexpected fuel quantity indication, an ECAM fuel message or an imbalance is noted, a fuel leak should be considered as a possible cause. Initial indications should be carefully cross-checked by reference to other means, including if possible, a visual inspection.
If a fuel leak is suspected, the flight crew should perform the [QRH] FUEL LEAK procedure.
The main steps of the [QRH] FUEL LEAK procedure are:

■ **If the fuel leak is confirmed coming from the engine/pylon:**
The affected engine is shut down to isolate the fuel leak and the fuel cross-feed valve may be used as required.

- **If the fuel leak is not confirmed coming from the engine/pylon or if the leak is not located:**
  - Isolate each tank: Maintain the cross-feed valve closed and switch off the center pumps. Each wing tank feeds the associated engine.
  - If the fuel quantity decreases faster in one wing tank than in the other wing tank, the fuel leak is identified as coming from one wing tank. In this case, the associated engine is shut down in order to confirm if the leak comes from the wing tank or from the engine.
  - If the fuel quantity symmetrically decreases in both wing tanks and the fuel quantity in the center tank decreases, the fuel leak comes from the center tank or the APU feed line.

If the flight crew confirms that the fuel leak comes from the engine/pylon, the flight crew must shut down the engine in order to:
- Stop the leak
- Prevent fire hazard due to fuel leaking into the hot surfaces of the engine.

During landing, the thrust reversers significantly modify the air flow around the aircraft. The flight crew must not use the thrust reversers in order to prevent contact between fuel and hot surfaces of engines or brakes.

FUEL OVERREAD

Ident.: PR-AEP-FUEL-00024483.0001001 / 09 NOV 20
Applicable to: ALL

Fuel check will be carried out by:
- Checking that the remaining fuel added to the burnt fuel corresponds to the fuel on board at the gate
- Maintaining the fuel log and comparing the fuel on board to the expected flight plan fuel.

Fuel checks should be carried out when overflying a waypoint or at least every 30 min. Any abnormal discrepancy should alert the crew and investigation should be carried out.

The flight crew can suspect a fuel overread if:
- The sum of FOB and FU is significantly more than FOB at engine start, or is increasing
- There is an abnormal discrepancy between the fuel on board and the expected flight plan fuel
- The total fuel quantity abnormally increases
- The destination EFOB abnormally increases.

Depending on the FWC standard, the FUEL F.USED/FOB DISAGREE alert may address both cases of fuel leak and fuel overread.
If the flight crew detects a fuel overread, or if the FUEL F.USED/FOB DISAGREE alert triggers to indicate a fuel overread, fuel management is affected. The flight crew should apply the [QRH] FUEL OVERREAD procedure (*Refer to FCOM/PRO-ABN-FUEL [QRH] FUEL OVERREAD*).

The flight crew should be aware that, for the remainder of the flight:

- The FMS predictions are no longer reliable
- The fuel low level ECAM alerts are still valid. These alerts are triggered by sensors that are independent from the fuel quantity indications.
- The remaining FOB shall be computed from data that the flight crew considers as still valid. It may be fuel used, flight plan FOB, FOB at engine start.
- The unusual discrepancy shall be recorded in the aircraft logbook and maintenance action is due before the next flight.

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HYDRAULIC GENERATION PARTICULARITIES

Ident.: PR-AEP-HYD-00019666.0001001 / 20 MAR 17
Applicable to: ALL

PREFACE

The hydraulic generation may come from:
- The engine driven pumps
- The RAT
- The electrical pumps
- The hand pump.

RAT and electrical pumps have some particularities that need to be highlighted.

RAT

The RAT may be extended manually by pressing the RAT MAN ON pb or may deploy automatically.
The RAT is designed to supply flight controls and the emergency generator (e.g. in all engines flame out case). It can cover high transient demand from flight controls.

The RAT deploys automatically in the event of:
- An all engines flame out
- In some cases of dual hydraulic LO LVL (*Refer to FCOM/DSC-29-10-20 Ram Air Turbine (RAT)*).

The dual hydraulic LO LVL signal is used for the RAT automatic deployment logics. The purpose of these logics is to cover the case of an engine burst affecting several hydraulic lines. It should be noted that, even in case of the green hydraulic circuit LO LVL, the RAT could pressurize the green hydraulic circuit.
The RAT flow varies between 15 % and 45 % of an engine driven pump flow capability according to the aircraft speed.
RAT must not be used in case of green hydraulic overheat.
At low speed, the RAT stalls. Some anticipation is required from the crew to carry out a safe landing.

ELECTRICAL PUMPS

The electrical pumps are not designed to replace the engine driven pump to supply flight controls, as they are power limited (the hydraulic electric pump flow represents 18 % of an engine driven pump flow) and they cannot cover high transient demand from flight controls. Furthermore, if they were used in case of dual hydraulic failure, they could degrade the aircraft handling (flight controls jerk).

As a general rule, do not manually select a HYD ELEC PUMP ON, except temporarily, to retract the spoilers if they remain out after a hydraulic failure.

DUAL HYDRAULIC FAILURES

Ident.: PR-AEP-HYD-00019610.0001001 / 12 NOV 20
Applicable to: ALL

PREFACE

Single hydraulic failures have very little effect on the handling of the aircraft but will cause a degradation of the landing capability to CAT 3 SINGLE. However, dual hydraulic failures, although unlikely, are significant due to the following consequences:
- Loss of AP
- Flight controls law degradation (F/CTL PROT)
- Landing in abnormal configuration
- Extensive ECAM procedures with associated workload and task-sharing considerations
- Significant considerations for approach, landing and go-around.

GENERAL GUIDELINES

It is important to note that the AP will not be available to the flight crew, but both FDs and A/THR still remain. Additionally, depending on the affected hydraulic circuits, aircraft handling characteristics may be different due to the loss of some flight control surfaces. The PF will maneuver with care to avoid high hydraulic demand on the remaining system.
The PF will be very busy flying the aircraft and handling the communications with the flight controls in Alternate Law.
A dual hydraulic failure is an emergency situation, with red LAND ASAP displayed, and a MAYDAY should be declared to ATC. A landing must be carried out as soon as possible bearing in mind, however, that the ECAM actions should be completed prior the approach.
The PF will then request the ECAM actions. A clear reading of STATUS is essential to assess the aircraft status and properly sequence the actions during the approach.
This failure is called a "complex procedure" and the QRH summary should be referred to upon completion of the ECAM procedure (*Refer to AOP-30-60 Use of Summaries*).
While there is no need to remember the following details, an understanding of the structure of the hydraulic and flight controls systems would be an advantage. The F/CTL SD page and the Ops Data section of the QRH provide an overview of the flight controls affected by the loss of hydraulic systems.

The briefing will concentrate on safety issues since this will be a hand-flown approach with certain handling restrictions:
- Use of the selected speeds on the FCU
- Landing gear gravity extension
- Approach configuration and flap lever position

- Approach speed VAPP
- An early stabilized approach will be preferred
- Tail strike awareness
- Braking and steering considerations
- Go-around call out, aircraft configuration and speed.

REMAINING SYSTEMS

Ident.: PR-AEP-HYD-00019667.0002001 / 20 MAR 17
Applicable to: ALL

		Remaining systems		
Flight phase	**Systems**	**HYD G+B SYS LO PR**	**HYD G+Y SYS LO PR**	**HYD B+Y SYS LO PR**
Cruise	Auto pilot	Inop	Inop	Inop
	Control law	ALTN LAW	ALTN LAW	ALTN LAW
	Stabilizer	Avail	Avail	Inop(2)
	Spoilers	2 SPLRS/wing	2 SPLRS/wing	2 SPLRS/wing
	Elevator	R ELEV only	L ELEV only	Avail
	Aileron	L+R OUTR AIL only	L+R INR AIL only	Avail
Landing	Slats/Flaps	FLAPS slow only	SLATS slow only	SLATS/FLAPS slow only
	L/G extension	Gravity	Gravity	Gravity(3)
	Braking	B ACCU PRESS only(1)	ALTN BRK only	NORM BRK only
	Anti skid	Inop	Avail	Avail
	Nose wheel steering	Inop	Inop	Inop
	Reverse	REV 3 only	REV 2 only	REV 1+4 only
Go-around	L/G retraction	Inop	Inop	Inop(3)

(1) *After stopping, the parking brake may be inoperative due to low blue system accumulator pressure.*

(2) *The elevators remain operative and the auto trim function remains available through the elevators.*

(3) *For approach, landing gear will be extended by gravity to preserve green system integrity for flight controls.*

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LANDING WITH ABNORMAL L/G

Ident.: PR-AEP-LG-00019611.0003001 / 09 NOV 17
Applicable to: ALL

To avoid unnecessary application of the L/G GRAVITY EXTENSION and the LDG WITH ABNORMAL L/G QRH procedures, the flight crew must check for the four landing gear green indications on the ECAM WHEEL SD page: at least one green triangle on each landing gear is sufficient to indicate that the landing gear is down and locked. The flight crew must also rely also on the "LDG GEAR DN" green MEMO. This is sufficient to confirm that the landing gear is downlocked.
If one landing gear is not downlocked, the flight crew must perform the LDG WITH ABNORMAL L/G QRH procedure. In this case, it is always better to land with any available gear rather than carry out a landing without any gear. The exception to this is the A340-200/300, when it is prohibited to extend the center gear with one main landing gear not fully extended. The center landing gear structure is not designed to sustain the aircraft weight, in case of main landing gear abnormal configuration. That's the reason why, as per design, the center landing gear does not extend in case of landing gear gravity extension. Indeed, the gravity extension logic has been developed by taking into account an abnormal main landing gear position, following a gravity extension.
In all cases, weight should be reduced as much as possible to provide the slowest possible touchdown speed.
A fuel imbalance may be considered by the flight crew. Landing with a lighter wing on the affected side allows to keep it up longer and delay the moment of nacelle contact. If the imbalance advisory triggers, the flight crew can disregard it, as the aircraft handling qualities are not significantly affected.
Although foaming of the runway is not a requirement, full advantage should be taken of any ATC offer to do so.
The passengers and cabin crew should be informed of the situation in good time. This will allow the cabin crew to prepare the cabin and perform their emergency landing and evacuation procedures.
If one or both main landing gears in abnormal position, the ground spoilers will not be armed to keep as much roll authority as possible for maintaining the wings level. Ground spoiler extension would prevent spoilers from acting as roll surfaces.
The crew will not arm the autobrake as manual braking will enable better pitch and roll control. Furthermore, with at least one main landing gear in the abnormal position, the autobrake cannot be activated (ground spoilers not armed).
On A340-200/300, with one main landing gear not extended, the reference speed used by the anti-skid system is not correctly initialized. Anti-skid operation might be affected, and consequently, the anti-skid must be switched off.

In all cases, a normal approach should be flown and control surfaces used as required to maintain the aircraft in a normal attitude for as long as possible after touchdown. The engines should be shut

down early enough to ensure that fuel is cut off prior to nacelle touchdown, but late enough to keep sufficient authority on control surfaces in order to:
- Maintain runway axis
- Prevent nacelle contact on first touch down
- Maintain wing level and pitch attitude as long as possible.

Considering a realistic hydraulic demand, the hydraulic power remains available up to approximately 30 s after the shut down of the related engine. It is the reason why the recommendations to switch the ENG masters OFF are as follow:
- If NOSE L/G abnormal
  Before nose impact
- If one MAIN L/G abnormal
  Outboard engines: After main gear touch down
  Inboard engines (failure side first): Before nacelle touch down
- If both MAIN L/G abnormal
  In the flare, before touch down

If one main landing gear is in abnormal position, the reversers will not be used to prevent the ground spoilers extension. If the nose landing gear is in abnormal position, the reversers will not be used to prevent the nose down effect induced by the reverse thrust.
The engines and APU fire pbs are pushed when the use of flight controls is no longer required i.e. when aircraft has stopped.

NOSE WHEEL STEERING FAULT

Ident.: PR-AEP-LG-00019612.0001001 / 03 NOV 21
Applicable to: ALL

If the NWS is lost for taxiing, the flight crew can steer the aircraft with differential braking technique. If the flight crew does not have experience with this technique, the flight crew should preferably request a towing to return to the gate. The flight crew can request the towing early in approach, if the failure has been triggered in flight.

TAXI WITH DEFLATED OR DAMAGED TIRES

Ident.: PR-AEP-LG-00021521.0001001 / 04 DEC 18
Applicable to: ALL

In some abnormal situations, after a rejected takeoff or after landing, the flight crew may need to vacate the runway and taxi the aircraft with deflated or damaged tires.
The flight crew must ensure that the number and position of deflated or damaged tires are in accordance with the limitations provided in the FCOM. *Refer to FCOM/LIM-LG Taxi with Deflated or Damaged Tires*.

In order to identify the number and position of the affected tires, the flight crew can use the tire pressure indication available on the <u>WHEEL</u> SD page.
If the number or position of the affected tires is not in accordance with the limitations provided in the FCOM, the ground crew must change a sufficient number of wheels before taxi, in order to ensure compliance with the FCOM limitations.
As indicated in the FCOM limitations, if two tires are deflated on the same main gear (maximum one main gear), or on the center gear, the nosewheel steering angle must be limited to a maximum of 30 °. In order to ensure that this limitation is not exceeded, the flight crew should use the graduations available on the steering handwheel.

The 30 ° limitation for the nosewheel steering angle corresponds to either of the following:
- A steering handwheel position on the 3rd graduation, or
- A steering handwheel position in the middle of the 2nd and 3rd graduation with pedals fully deflected in the same direction.

WHEEL TIRE DAMAGED SUSPECTED

Ident.: PR-AEP-LG-00020559.0001001 / 15 NOV 21
Applicable to: ALL

GENERAL

The flight crew must apply the <u>WHEEL</u> TIRE DAMAGED SUSPECTED procedure in the case of suspicion of damage on one or several tires.

The crew may suspect tire damaged based on several indications. This include, but are not limited to:
- Information from the ATC of the presence of tires debris on the runway,
- A bang noise during the takeoff or just after takeoff,

  <u>*Note:*</u> *A bang noise may not necessarily indicate tire damages. A bang noise may also have other origins (e.g. engine, nose landing gear retraction).*

- A non-commanded sudden yaw noticed during the takeoff roll,

  <u>*Note:*</u> *Directional deviation may also come from lateral gusts during the takeoff run.*

- The <u>WHEEL</u> TIRE LO PR alert triggered after takeoff,

  <u>*Note:*</u> *The <u>WHEEL</u> TIRE LO PR alert may not trigger in all cases as the tire debris may have also damaged the tire pressure sensor.*

- The WHEEL SD page showing amber XX for the tire pressure indication on one or several wheels,

  Note: The tires debris may have affected other tire pressure sensors (or associated wiring) so amber XX may be displayed for other wheels than the damaged ones.

- The aircraft has other damages (brakes, slats/flaps, etc.).

Depending on the situation, one or several of the above factors may help the flight crew in the decision to apply the procedure.

PROCEDURE

FOR LANDING

Damage on one or more tires has an impact on the landing distance. The performance impact of a burst tire is equivalent to a brake released.
The flight crew must assess the number of damaged tires and compute the impact on the landing distance by using the EFB LDG PERF application.

The flight crew must select the appropriate failure case:
- ONE BRK RELEASE failure case if one tire is damaged,
- TWO BRK RELEASE failure case if more than one is damaged.

FOR RUNWAY VACATION AND TAXI

After landing, before the taxi in, it is necessary to assess the exact condition of the wheels and landing gear.
To do so, the flight crew must ask for an inspection of the landing gear before the taxi is initiated and make sure the condition of the affected wheels is in accordance with FCOM limitations.
For more information, *Refer to FCOM/LIM-LG Taxi with Deflated or Damaged Tires*, and *Refer to PR-AEP-LG Taxi with Deflated or Damaged Tires*.

COCKPIT WINDSHIELD/WINDOW CRACKED

Ident.: PR-AEP-MISC-00019621.0001001 / 20 MAR 17
Applicable to: ALL

COCKPIT WINDOWS DESCRIPTION

Refer to FCOM/DSC-56-40 Description

COCKPIT WINDSHIELD/WINDOWS DAMAGE DESCRIPTION

During flight, cockpit windows may be damaged due to:
- Impact with foreign objects
- Electrical arcing of the windows heating system
- Natural ageing of the heating film
- Moisture ingress
- Delamination
- Manufacturing quality defect
- Damage done at installation.

As per design, each structural ply (Inner ply or Middle ply) can sustain twice the maximum differential pressure of a standard flight.
Therefore, depending on the part of the windshield/window that is damaged, the structural integrity of the windshield/window may not be impacted.

COCKPIT WINDOWS DAMAGE EVALUATION

In the case of a cockpit windshield/window cracking, the flight crew should evaluate the damage.

STRUCTURAL INTEGRITY EVALUATION

WARNING	The flight crew must be careful when touching the damaged window. Broken glass chips can cause cuts.

The COCKPIT WINDSHIELD/WINDOW CRACKED procedure (*Refer to FCOM/COCKPIT WINDSHIELD/WINDOW CRACKED* procedure) requires the flight crew to check if the Inner ply is affected. To do so, the flight crew should touch the affected glass with a pen or a finger nail to check if the crack(s) is(are) on the cockpit side (Inner ply):
- If there is no crack on the cockpit side:
  The Inner ply is not damaged. Therefore, the structural integrity is not affected: the windshield/window is still able to sustain the differential pressure up to the maximum flight level.
- If there are cracks on the cockpit side:
  The Inner ply is damaged. The structural integrity of the window may be altered. As the flight crew cannot easily identify if the Middle ply is also affected or not, the flight crew must descend to FL 230/MEA-MORA in order to reduce the ΔP to 5 PSI.

Refer to FCOM/COCKPIT WINDSHIELD/WINDOW CRACKED procedure to get the full procedure.

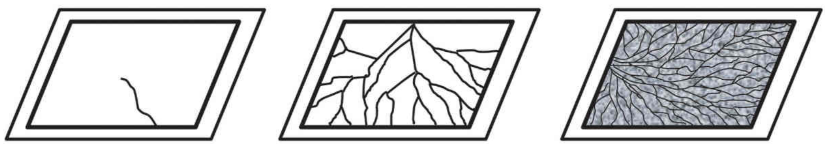
ADDITIONAL VISUAL CLUES:

In addition, visual clues can help the flight crew to assess which part of the window is affected by the crack.

CAUTION	The visual clues given below are not sufficient to assess the structural integrity of the window. The flight crew must do a physical check of the Inner ply of the windshield as required by the COCKPIT WINDSHIELD/WINDOW CRACKED procedure (*Refer to FCOM/COCKPIT WINDSHIELD/WINDOW CRACKED* procedure) and apply the procedure accordingly.

A heating film cracking looks like roughly a straight line across the window starting from a window edge. In most of the cases, the line stops in the middle of the window.
An outer ply cracking usually shows a few broken lines that start from one edge of the windshield or from a foreign object impact, and go through the window to another edge.
A structural ply cracking (Inner ply or Middle ply) has a break pattern that covers the entire surface of the windshield. The small pieces of broken glass impair the visibility.

Typical Cockpit Window Damages



Heating Film Cracking — Outer Ply Cracking — Inner or Middle Ply Cracking

EMER DESCENT

Ident.: PR-AEP-MISC-00019614.0001001 / 01 MAR 23
Applicable to: ALL

The flight crew must rely on the CAB PR EXCESS CAB ALT alert, even if not confirmed on the CAB PRESS SD page. The CAB PR EXCESS CAB ALT alert can be triggered by a cabin pressure sensor, different from the one used to control the pressure and display the cabin altitude on the SD. If the CAB PR EXCESS CAB ALT alert is not triggered, the flight crew should only initiate the emergency descent on positive confirmation that cabin altitude and rate of climb are excessive and not controllable.

The flight crew should perform the actions of the EMER DESCENT in two steps:
- First step: Apply the memory items
- Second step: Perform the read-&-do procedure (ECAM or QRH).

During the first step, the PM should focus on monitoring the FMA to ensure that the PF has correctly established the aircraft in descent.
During the second step, the PF should adjust the settings.
To initiate the emergency descent, the use of AP and A/THR is highly recommended.
At high flight levels, the flight crew should extend the speed brakes while monitoring the VLS. This is in order to avoid the activation of the angle of attack protection, which may result in the retraction of the speed brakes and in AP disconnection.

Note: *When in IDLE thrust, high speed and with speed brake extended, the rate of descent is approximately 6 000 ft/min. To descend from FL 410 to FL 100, it takes approximately 5 min and 40 NM.*

The flight crew should be aware that the MORA displayed on ND is the highest MORA value within a radius of 40 NM around the aircraft.

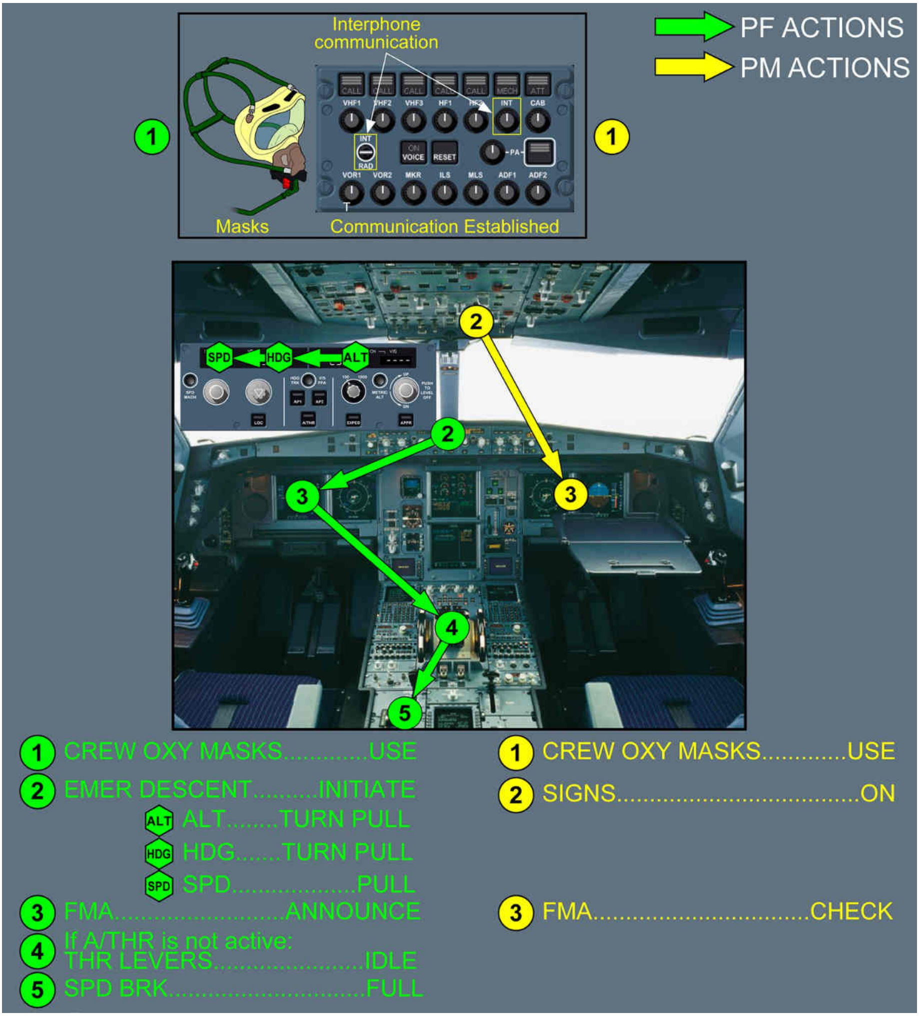
The flight crew should suspect structural damage in case of a loud bang, or high cabin vertical speed. If the flight crew suspects structural damage, apply both of the following:
- Set the SPEED/MACH pb to SPEED, to prevent an increase in the IAS, or to reduce the speed. This action minimizes the stress on aircraft structure
- Carefully use the speed brakes, to avoid additional stress on aircraft structure.

If the cabin altitude goes above 14 000 ft, the flight crew must press the MASK MAN ON pb. When it is obvious that the cabin altitude will exceed 14 000 ft, the flight crew could press the MASK MAN ON pb, before the cabin altitude reaches 14 000 ft.
The TCAS mode selector must remain on the TA/RA position. Avoidance of collision has the priority, even if it requires a temporary interruption of the descent maneuver. The TA/RA TCAS mode enables a maximum protection against collision.

Finally, subsequent to an emergency descent, once the oxygen masks are removed, the flight crew should perform all of the following:
- Close the oxygen stowage mask compartment
- Press the PRESS TO RESET oxygen control slide, to deactivate the mask microphone, and to cut off the oxygen.

Below FL 100, the flight crew should limit the rate of descent to approximately 1 000 ft/min, except during the approach phase.
The checklist point "(PA).....ANNOUNCE" is performed by the PM.

EMER DESCENT - Memory Items



EMER EVAC

Applicable to: ALL

Ident.: PR-AEP-MISC-A-00019615.0001001 / 20 MAR 17

INTRODUCTION

A typical case, which may require an emergency evacuation, is an uncontrollable engine fire on the ground.

This situation, which may occur following a rejected takeoff or after landing, requires good crew coordination to cope with a high workload situation:
- In case of a rejected takeoff, the captain calls "STOP". This confirms that the captain has control
- In all other cases, the captain calls "I HAVE CONTROL" if required, to request hand-over of the flight controls.

Note: If possible, position the aircraft to keep the fire away from the fuselage, taking into account the wind direction.

Ident.: PR-AEP-MISC-A-00016514.0001001 / 12 MAY 23

1 ## DECISION MAKING

As soon as aircraft is stopped, and the parking brake is set, the captain notifies the crew and calls for ECAM ACTIONS. At this stage, the task sharing is defined as follows:
- The first officer carries out the ECAM actions until the evacuation decision point
- The captain builds up the decision to evacuate depending on the circumstances. Considerations should be given to:
  - Fire remaining out of control after having discharged the agents
  - Possible evacuation of passengers on the runway
  - Communicating intentions or requests to ATC.

If the 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" procedure).

Ident.: PR-AEP-MISC-A-00019616.0001001 / 04 NOV 20

EVACUATION PROCEDURE

The EMER EVAC procedure is located in the inside back cover of the QRH. The flight crew must refer to this procedure, if an evacuation is required for a reason other than an engine fire.

Some items need to be highlighted:

- The flight crew must ensure that the differential pressure (Delta P) is equal to 0.
  When automatic pressure control is operative, the flight crew can rely on the CPC, and the Delta P check is therefore not applicable.
  If the automatic pressure control system fails during flight, the CAB PR SYS 1+2 FAULT ECAM alert requires to set the MAN V/S CTL sw to FULL UP position during final approach to cancel any residual cabin pressure. However, since the residual pressure sensor indicator (installed in the cabin door) is inhibited when slides are in the armed position, the EMER EVAC procedure requires an additional Delta P check.

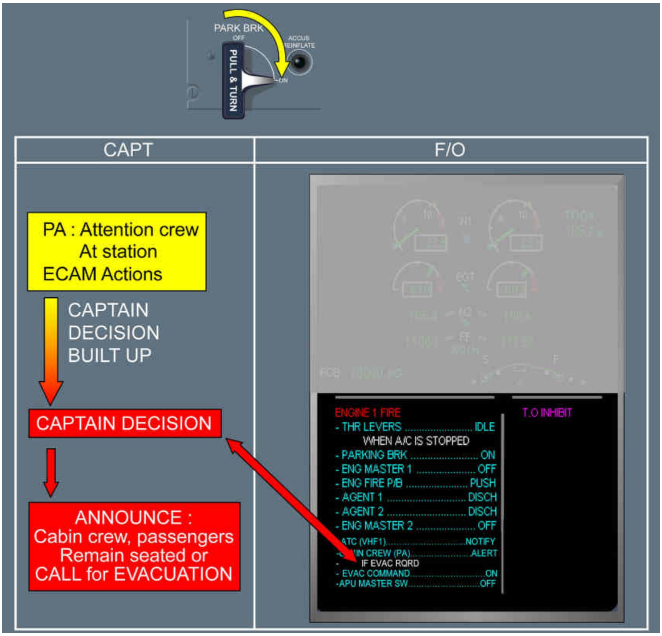
  Note: *At least one automatic cabin pressure control system must be operative at departure. Therefore, the Delta P check does not apply to the case of an emergency evacuation following a rejected takeoff.*

- "CABIN CREW (PA)…ALERT" reminds the captain to provide the cabin crew with the appropriate evacuation instructions, as necessary (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…INITIATE" requires the captain to confirm whether the emergency evacuation is still required. If still required, the captain:
  - Notifies the cabin crew to start the evacuation
  - Activates the EVAC COMMAND pb
  - Advises ATC, if required.

This will be done preferably in this order for a clear understanding by cabin crew.
On ground with engines stopped, the right dome light automatically illuminates whatever the position of the DOME light sw. This allows to have the necessary cockpit lighting to complete the EMER EVAC procedure.
The flight crew will keep in mind that as long as the evacuation order is not triggered, the flight crew may defer or cancel the passengers' evacuation. As soon as the evacuation order is triggered, this decision is irreversible.
When the aircraft is on battery power, the cockpit seats must be operated mechanically.

Ident.: PR-AEP-MISC-A-00019617.0001001 / 20 MAR 17

TASKSHARING



When applying the EMER EVAC procedure, the F/O can select the engine master OFF and push the fire pb, without any confirmation from the Captain.

FLIGHT CREW INCAPACITATION

Ident.: PR-AEP-MISC-00019619.0001001 / 03 NOV 21

Applicable to: ALL

GENERAL

Flight crew incapacitation is a real safety hazard which occurs more frequently than many of the other emergencies. Incapacitation can occur in many form, that range from sudden death to partial loss of function. Sometimes the flight crew does not have any symptom before incapacitation.

DETECTION

In order to help with the early detection of flight crew incapacitation, the Crew Resource Management (CRM) principles should be applied:

- Correct crew coordination that involves routine monitoring and aural crosschecks.
  The absence of standard callouts at the appropriate time may indicate incapacitation of one flight crewmember
- If one flight crewmember does not feel well, the flight crew must inform the other flight crewmember.

Other symptoms, for example incoherent speech, a pale and(or) fixed facial expression, or irregular breathing, may indicate the beginning of incapacitation.

ACTION

In the case of flight crew incapacitation, the fit flight crewmember should apply the following actions:

- Take over and ensure a safe flight path:
  - Announce ″I have control″
  - If the incapacitated flight crewmember causes interference with the handling of the aircraft, press the sidestick pb for 40 seconds
    L2 The time required of 40 s includes the time necessary for AP deactivation (if AP engaged) and the time for offside sidestick deactivation.
  - L1 Keep or engage the onside AP, as required
  - Perform callouts (challenge and response included) and checklists aloud.
- Inform the ATC of the emergency
- Take any steps possible to contain the incapacitated flight crewmember. These steps may involve cabin attendants
- In order to reduce the workload, consider:
  - Early approach preparation and checklists reading
  - Automatic Landing
  - Use of radar vectoring and long approach.
- Land at the nearest suitable airport after consideration of all pertinent factors
- Arrange medical assistance onboard and after landing, providing as many details as possible about the condition of the affected flight crewmember
- Request assistance from any medically qualified passenger, except for flight with only two flight crewmembers onboard (i.e. freighter or ferry flight).

HANDLING THE AIRCRAFT IN THE CASE OF SEVERE DAMAGE

Ident.: PR-AEP-MISC-00019620.0001001 / 20 MAR 17
Applicable to: ALL

In the event of severe damage to the aircraft, the flight crew's immediate action should be to "fly the aircraft". In severe damage cases, it might be necessary for the flight crew to revert to the use of a "back to basics" flying techniques, where bank, pitch, and thrust are the primary parameters to manually control. In addition, as for any flight phase, the flight crew must continue to perform all navigation and communication tasks.
If the damage significantly affects aircraft aerodynamics, flight controls, or engines, then aircraft handling qualities may be affected. Therefore, the flight crew should perform an assessment of aircraft handling qualities as soon as possible, in order to identify how pitch, roll, and yaw are controllable.
During assessment of the flight controls, the flight crew should apply smooth sidestick input and should limit the bank angle to 15°, in order to prevent possible destabilization of the aircraft. In addition, the flight crew should avoid use of the speedbrakes before the end of the flight, unless necessary.

To assess aircraft handling qualities, the flight crew must keep the following basic principles in mind:
- Elevators, ailerons, and rudder are the primary flight controls.
- In addition to use of the elevators, use of the THS (via longitudinal trim control) may also be necessary in order to control pitch.
- On all Airbus aircraft, engines are mounted under the wing. As a consequence a thrust increase results in a pitch-up effect, and a thrust decrease results in a pitch-down effect.
- If damage to the aircraft is severe, it may be necessary to use abnormal flying techniques to maintain control of the aircraft. Each flight control can be used to compensate for an inoperative or damaged surface. For example, the flight crew can compensate for a lack of roll efficiency via the use of rudder input. As another example, the application of asymmetrical thrust enables the flight crew to indirectly control roll, with a slightly delayed response.

CAUTION	Sudden commanded full, or nearly full, opposite rudder movement against a sideslip can generate loads that exceed the limit loads and possibly the ultimate loads and can result in structural failure. This is true even at speeds below the maximum design maneuvering speed, VA.

As soon as control of the aircraft is ensured:

- Depending on the severity of the damage to the aircraft, the flight crew may attempt to use automation. However, if the autopilot and the flight director remain available, their operation may be erratic. Therefore, the flight crew should monitor carefully the AP behaviour, and must be prepared to immediately revert to manual flying techniques.
- The flight crew can start ECAM actions, if applicable. An assessment of the flight deck indications may provide the flight crew with useful information about affected systems. When possible and depending on the situation, a visual check can also provide important information.

Prior to landing and at an appropriate altitude, the flight crew must perform an assessment of aircraft handling qualities in landing configuration in order to help determine an appropriate strategy for approach and landing. The flight crew must perform this analysis at different speeds down to VAPP. If it becomes difficult to control the aircraft when the aircraft goes below a specific speed, the flight crew must perform the approach landing at a speed above this specific speed. The result of the above-mentioned assessments helps to build the correct follow up strategy. The quantity of flight crew workload required to maintain control of the aircraft is one of the decision factors to take into account for this strategy. Good flight crew coordination is essential throughout the assessment process. The flight crew should share their own understanding and view of the situation with their other flight crewmembers.

LOW ENERGY

Ident.: PR-AEP-MISC-00019668.0001001 / 05 MAY 22
Applicable to: ALL

GENERAL

The "SPEED, SPEED, SPEED" aural alert announces a low energy situation. This situation requires a flight crew action to increase the energy.
For more information, *Refer to FCOM/DSC-27-20-10-20 Protections - Low Energy Aural Alert*.

LOW ENERGY RECOVERY

Increase the thrust or/and adjust the pitch depending on the situation, until the aural alert stops.

OVERSPEED

Applicable to: ALL

Ident.: PR-AEP-MISC-B-00016515.0001001 / 20 MAR 17

INTRODUCTION

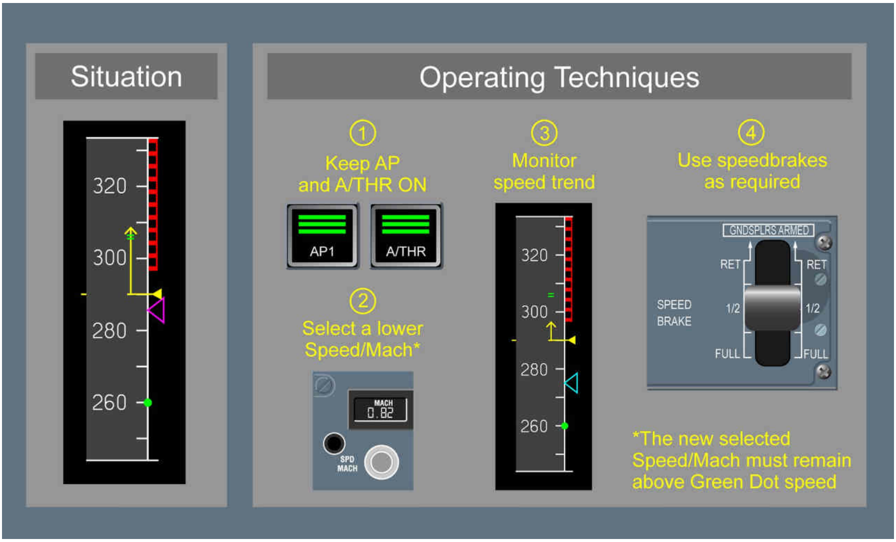
The flight crew must not intentionally exceed VMO/MMO (330 kt/M 0.86) during the flight. However, during normal operations, the aircraft may temporarily exceed VMO/MMO due to wind gradients.

The aircraft is designed to fly up to the maximum structural speed at which the aircraft structure will not be damaged. However, in the case of overspeed, the aircraft may encounter vertical load factors that may exceed the aircraft limits. In this case, exceeding VMO/MMO requires maintenance inspection.

Ident.: PR-AEP-MISC-B-00016516.0001001 / 18 MAY 22

OVERSPEED PREVENTION

Overspeed Prevention Technique



If the aircraft encounters significant speed variations close to VMO/MMO during the flight, the following operating techniques apply.

It is recommended to keep the AP and A/THR engaged. This enables to keep the intended flight path while thrust reduces to idle, if necessary.

The flight crew selects a lower target speed in order to increase the margin to VMO/MMO. However, the flight crew should not reduce the target speed below Green Dot, which is the minimum recommended speed during the flight.

After the selection of the lower target speed, the flight crew monitors the speed trend arrow on the PFD. If the aircraft continues to accelerate, and if the speed trend arrow approaches or exceeds VMO/MMO, the flight crew uses the appropriate position of speed brakes depending on the rate of acceleration. The length of the speed trend arrow is a good indication of the rate of acceleration.

For more information. *Refer to FCOM/DSC-31-40 Airspeed*.

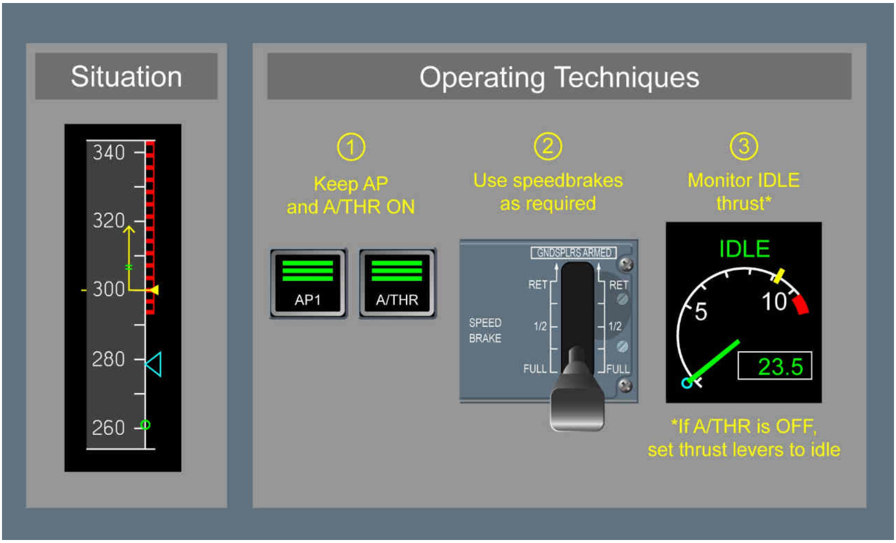
Note:
- *The use of speed brakes is an efficient deceleration mean, that is certified for the whole flight envelope. However, the use of speed brakes results in a reduction of the speed envelope. The use of speed brakes increases VLS and reduces the buffet margin at high altitude.*
- *The use of speed brakes results in a pitch up effect, but the AP and the normal law compensate for it.*

For the descent in DES mode and managed speed, the flight crew should enter descent wind data that is as accurate as possible. This results in an optimized managed speed and vertical profile. This action results in a speed during descent which would be approximately the managed speed target. For more information, *Refer to FCOM/DSC-22_30-60-20 General*.

Ident.: PR-AEP-MISC-B-00019622.0001001 / 03 NOV 21

OVERSPEED RECOVERY

Overspeed Recovery Technique



The flight crew must apply the overspeed recovery technique if the speed/Mach exceeds VMO/MMO.
The OVERSPEED alert is triggered if the speed/Mach exceeds VMO +4 kt/MMO +M 0.006, and lasts until the speed is below VMO/MMO. For more information, *Refer to FCOM/PRO-ABN-OVERSPEED OVERSPEED - ANNUNCIATION*.
The flight crew should keep the AP engaged.

In order to minimize overspeed, the flight crew should extend the speed brakes to the most appropriate lever position depending on the overspeed situation.
If the A/THR is ON, keep it engaged and check that the thrust is reducing to idle. There is no operational advantage in manually setting all thrust levers to idle for overspeed recovery. The engine thrust reduction is the same in both cases.
If the A/THR is OFF, set all thrust levers to idle.
In the case of severe overspeed, the AP automatically disengages and then the high speed protection activates (except in direct law). As a result, the aircraft encounters an automatic pitch up. *Refer to FCOM/DSC-27-20-10-20 Protections - High Speed Protection*.

Note: *The AP does not automatically disengage as soon as the speed reaches the green bars (that represent the threshold when the high speed protection activates) on the PFD. The AP disengagement depends on the speed variations and the high speed protection logic.*

The high speed protection is designed to request the appropriate demand of vertical load factor. Therefore, the flight crew should smoothly adjust the pitch attitude to limit the excessive load factors.

Note: *The flight crew must disregard the FD orders while the high speed protection is active. The FD orders do not take into account the high speed protection.*

The flight crew should keep the speed brakes because the use of the speed brakes is compatible with the high speed protection.

Ident.: PR-AEP-MISC-B-00020662.0001001 / 22 MAR 17

WHEN THE SPEED IS BELOW VMO/MMO

When the aircraft speed is below VMO/MMO with a sufficient speed margin, the flight crew should retract the speed brakes and should select a new speed target. If the flight crew retracts the speed brakes when the speed is close to VMO/MMO, the speed may exceed VMO/MMO again at speed brake retraction. If the A/THR is OFF, the flight crew should manually adjust thrust levers.
After severe overspeed, the flight crew should recover the flight path smoothly, and then should engage the AP in accordance with the recommended procedure for AP engagement.*Refer to AS-FG-10-1 Recommended Practice for Autopilot (AP) Engagement*.

Ident.: PR-AEP-MISC-B-00016517.0001001 / 03 DEC 19

REPORTING

The flight crew should report any type of overspeed event (i.e. if the OVERSPEED warning is triggered) to the maintenance. This report results in appropriate maintenance actions.

Ident.: PR-AEP-MISC-B-00016518.0001001 / 20 MAR 17

LINK WITH TURBULENCE

The significant speed variations near VMO/MMO and above VMO/MMO may be one of the first indication of a possible severe turbulence area.
For more information on the turbulence procedure, *Refer to PR-NP-SP-10-10-3 Introduction*.

OVERWEIGHT LANDING

Ident.: PR-AEP-MISC-00019623.0003001 / 15 NOV 21
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 MLW, but flight tests have been performed successfully up to MTOW. In case of emergency, and under the flight crew responsibility, an automatic landing may be performed up to MTOW provided that the runway is approved for automatic landing.
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 an early stabilized approach.
At high weight, the green dot speed for the current configuration may be close to, or even above the VFE CONF1. In this case, the procedure is to select the speed to VFE next –5 kt (but not below VLS) and then select the next configuration as the speed decreases through VFE next. As the slats extend, VLS will reduce. Once completed, speed should then be managed.
While approaching S speed and when selecting flaps 2, the FLRS may be activated and RELIEF is displayed on the EWD Flap/Slat indication. The flap 2 extension is slightly delayed until the speed gets below the corresponding VFE CONF 2.
The early 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.
The flight crew will elect the landing configuration according to landing performance computation with the EFB. CONF FULL is preferred for optimized landing performance. However, if the aircraft weight is above the maximum weight for go-around, the flight crew will use CONF 3 for landing and 1+F for go-around. The approach climb gradient limiting weight CONF 1+F is never limiting.
If a go-around CONF 1+F 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 flight 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.

Generally speaking, 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.
When the aircraft weight exceeds the maximum landing weight, structural considerations impose the ability to touch down at 360 ft/min without damage. This means that no maintenance inspection is required if vertical speed is below 360 ft/min. If vertical speed exceeds 360 ft/min at touch down, a maintenance inspection is required.

REJECTED TAKEOFF

Applicable to: ALL

Ident.: PR-AEP-MISC-C-00016519.0001001 / 20 MAR 17

FACTORS AFFECTING THE REJECTED TAKEOFF (RTO)

Experience has shown that a rejected takeoff can be hazardous, even if correct procedures are followed.

Some factors that can detract from a successful rejected takeoff are as follows:
- Tire damage
- Brakes worn or not working correctly
- Brakes not being fully applied
- Error in gross weight determination
- Incorrect performance calculations
- Incorrect runway line-up technique
- Initial brake temperature
- Delay in initiating the stopping procedure
- Runway friction coefficient lower than expected.

Thorough pre-flight preparation and a conscientious exterior inspection can eliminate the effect of some of these factors.
During the taxi-out, the takeoff briefing should be confirmed. Any change to the planned conditions requires the crew to re-calculate the takeoff data. In this case, the crew should not be pressurised into accepting a takeoff clearance before being fully ready. Similarly, the crew should not accept an intersection takeoff until the takeoff performance has been checked.
The line-up technique is very important. The pilot should use the over steer technique to minimize field length loss and consequently, to maximize the acceleration-stop distance available.

Ident.: PR-AEP-MISC-C-00020263.0003001 / 03 NOV 21

DECISION MAKING

A rejected takeoff is a potentially hazardous manoeuvre and the time for decision making is limited. It is not possible to list all the factors that could lead to the decision to reject the takeoff. However, in order to help the Captain to make a decision, the ECAM inhibits the warnings that are not essential from 80 kt to 1 500 ft (or 2 min after lift-off, whichever occurs first). Therefore, any warning received during this period must be considered as significant.

SPEED CONSIDERATIONS

To assist in the decision making process, the takeoff is divided into low and high speeds regimes, with 100 kt being chosen as the dividing line. The speed of 100 kt is not critical but was chosen in order to help the Captain make the decision and to avoid unnecessary stops from high speed.

- **Below 100 kt:**
  The decision to reject the takeoff may be taken at the Captain's discretion, depending on the circumstances.
  The Captain should seriously consider discontinuing the takeoff, if any ECAM warning/caution is activated.
- **Above 100 kt, and below V1:**

  Rejecting the takeoff at these speeds is a more serious matter, particularly on slippery runways. It could lead to a hazardous situation, if the speed is approaching V1. At these speeds, the Captain should be "go-minded" and very few situations should lead to the decision to reject the takeoff:
  1. Fire warning, or severe damage
  2. Sudden loss of engine thrust
  3. Malfunctions or conditions that give unambiguous indications that the aircraft will not fly safely
  4. Any ECAM alert.

  Exceeding the EGT red line or nose gear vibration should not result in the decision to reject takeoff above 100 kt.
  In case of tire failure between V1 minus 20 kt and V1, unless debris from the tires has caused serious engine anomalies, it is far better to get airborne, reduce the fuel load, and land with a full runway length available.
  The V1 call has precedence over any other call.
- **Above V1:**
  Takeoff must be continued, because it may not be possible to stop the aircraft on the remaining runway.

DECISION CALLOUTS

The decision to reject the takeoff and the stop action is the responsibility of the Captain and must be made prior to V1 speed. It is therefore recommended that the Captain keeps the hand on the thrust levers until the aircraft reaches V1, whether the Captain is Pilot Flying (PF) or Pilot Monitoring (PM).

- If a malfunction occurs before V1, for which the Captain does not intend to reject the takeoff, the Captain will announce the intention by calling "GO".
- If a decision is made to reject the takeoff, the Captain calls "STOP". This call both confirms the decision to reject the takeoff and also states that the Captain now has control. It is the only time that hand-over of control is not accompanied by the phrase "I have control".

Ident.: PR-AEP-MISC-C-00020266.0001001 / 05 MAY 22

RTO TECHNIQUE

Should a RTO procedure is initiated, the following task sharing will be applied.

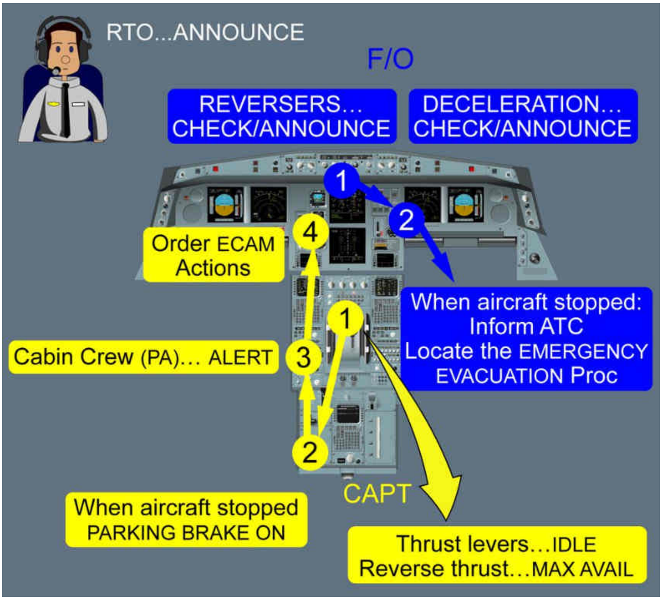
CAPT	F/O
"STOP"................................ANNOUNCE Simultaneously: THRUST LEVERS............................IDLE REVERSE THRUST..............MAX AVAIL.	REVERSERS........CHECK/ANNOUNCE (1) DECELERATION...CHECK/ANNOUNCE (2) AUTOBRAKE...............................MONITOR ANY AUDIO...................................CANCEL
Aircraft stopped Consider positioning the aircraft to keep any possible fire away from the fuselage.	
REVERSERS............................STOWED PARKING BRAKE...............................ON CABIN CREW...............................ALERT ECAM ACTIONS.........................ORDER	ATC...NOTIFY EMER EVAC Procedure (QRH).......LOCATE ECAM ACTIONS.........................PERFORM
The aircraft should remain stationary while the crew evaluates the situation.	

(1) Full reverse may be used until coming to a complete stop. But, if there is enough runway available at the end of the deceleration, it is preferable to reduce reverse thrust when passing 70 kt.

(2)
- Announcing the deceleration means that the deceleration is felt by the crew, and confirmed by the Vc trend on the PFD. The deceleration may also be confirmed by the DECEL light (if the autobrake is on). However, this light only comes on when the actual deceleration is 80 % of the selected rate, it is not an indicator of the proper autobrake operation. For instance, the DECEL light might not appear on a contaminated runway, with the autobrake working properly, due to the effect of the antiskid.
- If a rejected takeoff is initiated and MAX auto brake decelerates the aircraft, the captain will avoid pressing the pedals (which might be a reflex action).
- If the autobrake is inoperative or if the takeoff is rejected prior to 72 kt (autobrake not active and no deployment of spoilers), the captain simultaneously reduces thrust and applies maximum pressure on both pedals. The aircraft will stop in the minimum distance, only if the brake pedals are maintained fully pressed until the aircraft comes to a stop.
- If the brake response does not seem appropriate for the runway condition, FULL manual braking should be applied and maintained. If IN DOUBT, TAKE OVER MANUALLY.
- If normal braking is inoperative, immediately apply the Loss of Braking procedure (*Refer to FCOM/PRO-ABN-BRAKES [MEM] LOSS OF BRAKING*).

After a rejected takeoff, if the aircraft comes to a complete stop using autobrake MAX, release brakes prior to taxi by disarming spoilers.
Do not attempt to vacate the runway, until it is absolutely clear that an evacuation is not necessary and that it is safe to do so.

RTO FLOW PATTERN



Ident.: PR-AEP-MISC-C-00020408.0001001 / 20 MAR 17

TAKEOFF FOLLOWING RTO

Depending on the technical condition of the aircraft and the reason for the RTO (e.g. ATC instruction), the flight crew may consider a new takeoff attempt subsequent to the RTO.

In this case, the flight crew should:
- Reset both FDs and set FCU
- Restart Standard Operating Procedures from the AFTER START checklist.

STALL RECOVERY

Applicable to: ALL

Ident.: PR-AEP-MISC-D-00016523.0001001 / 05 MAR 18

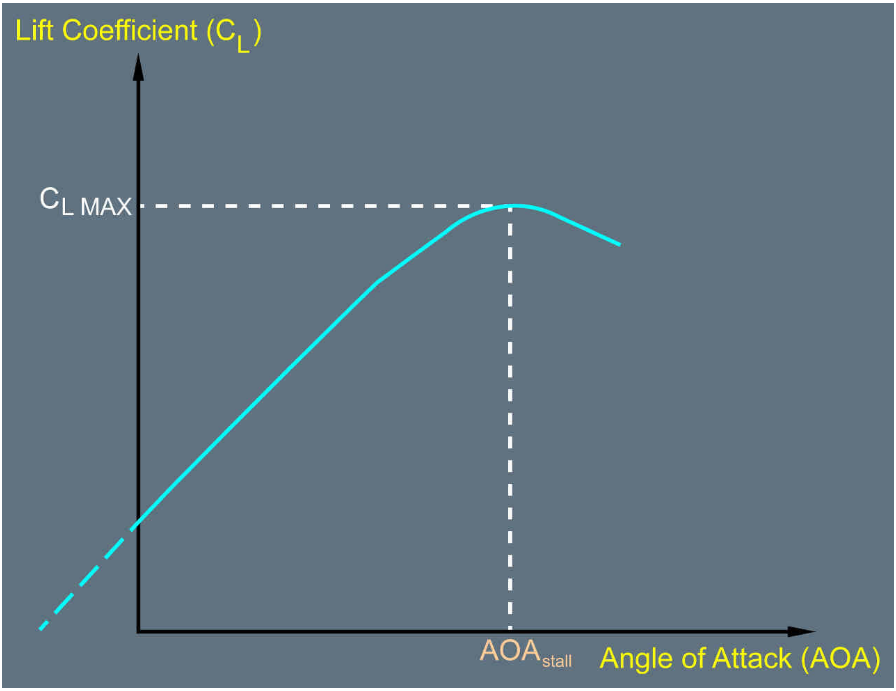
DEFINITION OF THE STALL

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.

Lift Coefficient Versus Angle of Attack

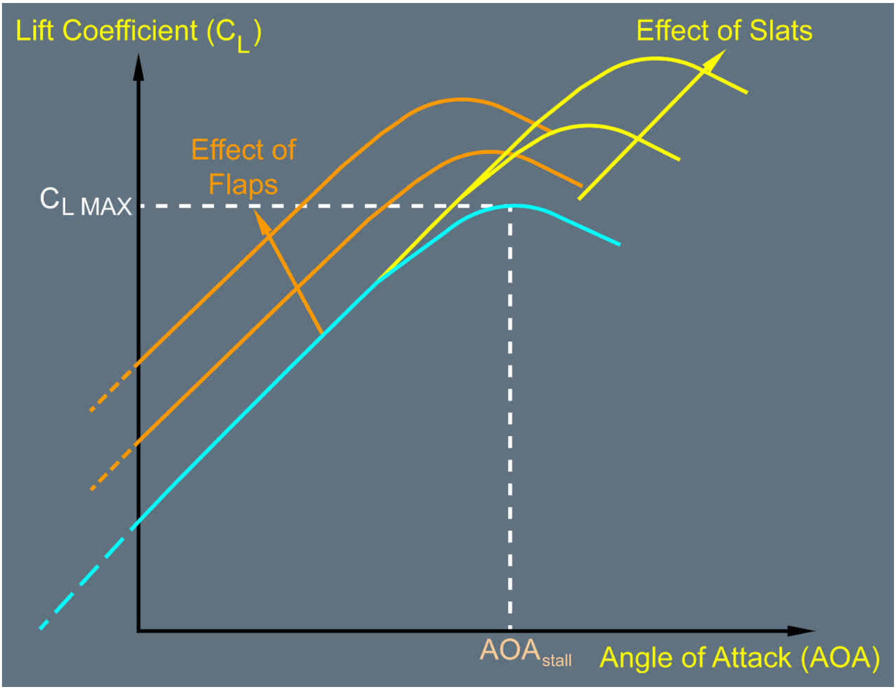


If the AOA further increases up to a value called AOA_{stall}, the lift coefficient will reach a maximum value called $C_{L\ MAX}$.

When the AOA is higher than AOA_{stall}, the airflow separates from the wing surface and the lift coefficient decreases. This is the stall.

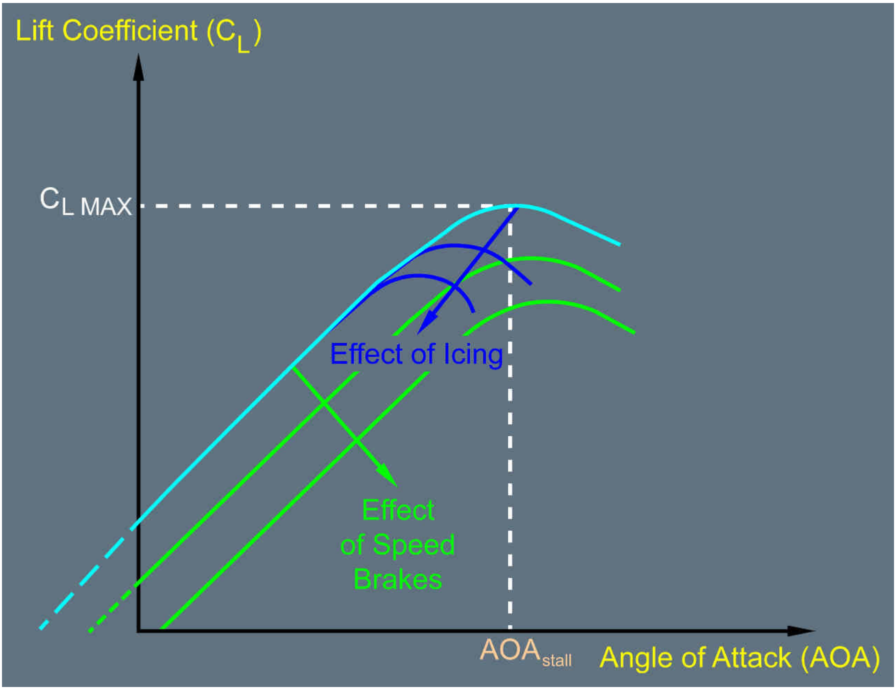
The stall will always occur at the same AOA for a given configuration, Mach number and altitude.

Influence of Slats and Flaps on 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 Speed Brakes and Icing 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.

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

Ident.: PR-AEP-MISC-D-00016524.0001001 / 20 MAR 17

STALL RECOGNITION

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

- Aural stall warning
  The aural stall warning is designed to sound when AOA exceeds a given threshold, which depends on the aircraft configuration and Mach number. This warning provides sufficient margin to alert the flight crew in advance of the actual stall even with contaminated wings.
- 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 aural stall warning is set close to AOA at which the buffet starts. For some Mach numbers the buffet may appear just before the aural stall warning.

Ident.: PR-AEP-MISC-D-00019625.0001001 / 20 MAR 17

STALL RECOVERY

- The immediate key action is to reduce AOA:
  The reduction of AOA will enable the wing to regain lift.
  This must be achieved by applying a nose down pitch order on the sidestick. This pilot action ensures an immediate aircraft response and reduction of the AOA.
  In 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 AOA as the first priority is to regain lift.
  As 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 generates a pitch up that may prevent the required reduction of AOA.

When stall indications have stopped, and when the aircraft has recovered sufficient energy, the flight crew can smoothly recover the initial flight path. If in clean configuration and below FL 200, during flight path recovery, the flight crew must select FLAPS 1 in order to increase the margin to AOA_{stall}.

Ident.: PR-AEP-MISC-D-00019626.0002001 / 10 MAY 21

STALL WARNING AT LIFTOFF

If the aural stall warning sounds at liftoff, the flight crew must fly the appropriate thrust and pitch for takeoff in order to ensure a safe flight path and attempt to stop the stall warnings.
The flight crew applies TOGA thrust in order to get the maximum available thrust. Simultaneously, the flight crew must target a pitch angle of 12.5 ° and maintain wings level in order to ensure safe climb.
Then, when a safe flight path and speed are achieved, if the aural stall warning is still activated the flight crew must consider that it is a spurious warning.
Spurious stall warnings at liftoff may be triggered in the case of:

- Damage to the AOA probes
- Ice Ridges degrading pitot and AOA
- Wake Vortex.

VOLCANIC ASH ENCOUNTER

Ident.: PR-AEP-MISC-00020343.0001001 / 12 MAY 23
Applicable to: ALL

2 Avoid flight into areas of known volcanic activity.
If a volcanic eruption is reported while the aircraft is in flight, reroute the flight to remain well clear of the affected area (volcanic dust may be spread over several hundred miles). If possible, stay on the upwind side of the volcano (at least 20 NM upwind of it if it is erupting).

In hours of darkness or in meteorological conditions that obscure volcanic dust, one or several of the following phenomena indicate that the aircraft may be flying into ash cloud:
- smoke or dust in the cockpit,
- acrid odor similar to electric smoke,
- at night, the appearance of St. Elmo fire and static discharges around the windshield,
- bright white or orange glow appearing in the engine inlets,
- sharp, distinct beams from the landing lights,
- multiple engine malfunctions, such as rising EGT, decreasing power, stall, or flame out.

REPORTING

- Whenever operating in areas affected by volcanic activity, flight crews should be aware of volcanic reporting procedures and be familiar with the use of the ICAO Special Air Report of Volcanic Activity (Model VAR).
- If the aircraft encounters a volcanic ash cloud, the flight crew should report the location altitude, and direction of drift for the ash cloud to ATC, flight conditions and crew duties permitting.

UPSET PREVENTION AND RECOVERY

Applicable to: ALL

Ident.: PR-AEP-MISC-E-00020455.0001001 / 20 MAR 17

DEFINITION OF UPSET

An aircraft upset is an undesired aircraft state characterized by unintentional divergences from parameters normally experienced during operations. An aircraft upset may involve pitch and/or bank angle divergences and may lead to inappropriate airspeeds for the conditions.
An upset condition exists any time an aircraft diverges from what the flight crew is intending to do. Deviations from the desired aircraft state will become larger until the flight crew takes action to stop the divergence. Return to the desired aircraft state can be achieved through natural aircraft reaction to accelerations, auto-flight system response or flight crew intervention.

Ident.: PR-AEP-MISC-E-00020458.0001001 / 20 MAR 17

UPSET PREVENTION

The prevention of an upset situation is possible thanks to an effective monitoring of:
- The environment (turbulences, icing conditions, weather)
- The aircraft energy state
- The aircraft flight path
- The aircraft technical state (Flight controls laws, systems failure).

All flight crew members are responsible of the monitoring to ensure that the aircraft state is understood and correct for the situation.

Each flight crew member should:
- Know and understand the expected aircraft state for the situation
- Communicate expectations
- Keep track of current aircraft state
- Detect and communicate deviations from the intended situation
- Assess risk and decide on a response
- Update and communicate understanding.

An efficient monitoring and effective coordination and communication are keys to prevent upset situations. As such, the flight crew should be able to assess the energy, to stop any flight path divergence, and to recover a stabilized flight path before the upset situation.

Ident.: PR-AEP-MISC-E-00020459.0001001 / 01 SEP 23

3 RECOVERY TECHNIQUES

The flight crew must be or become aware of the upset situation, i.e. recognize and confirm the situation before they take appropriate actions.

COMMUNICATION

Communication between crew members will assist in the recognition of the upset situation and recovery actions. At the first indication of a flight path divergence, the first pilot who observes the divergence must announce it with the callout “NOSE HIGH” or “NOSE LOW”, depending on the situation. The flight crew must use the flight instruments as primary means to analyze the upset situation.
Any recognized divergence of the flight path leading to an upset situation shall be announced by the PF with "UPSET, I have control".
To avoid dual inputs, the flight crew must know at all times who has control. If the PM requires to take control following the upset situation, the PM must apply the takeover technique as per Airbus operational philosophy. *Refer to AOP-10-30-20 Use of Sidestick*.

SITUATION ANALYSIS

The situation analysis process is to:
- Assess the energy (airspeed, altitude, attitude, load factor, thrust setting, position of drag and high-lift devices and the rate of change of those conditions)
- Determine the aircraft attitude (pitch and bank angle)
- Communicate with other crew member(s)
- Confirm attitude by reference to other indicators:
  - For a nose low upset, normally, the airspeed is increasing, altitude is decreasing and the VSI indicates a descent
  - For a nose high upset, normally, the airspeed is decreasing, altitude is increasing and the VSI indicates a climb.

A stalled condition can exist in any attitude and could be recognized by stall buffet and/or stall aural alert. If the aircraft is stalled, apply the stall recovery procedure. *Refer to PR-AEP-MISC Definition of the Stall*.

REFERENCES FOR RECOVERY

The PFD is a primary reference for recovery.

Pitch attitude is determined from the PFD pitch reference scale. Even in extreme attitudes, some portion of the sky or ground indications is present to assist the pilot in analyzing the situation. The bank indicator on the PFD should be used to determine the aircraft bank.
Other attitude sources should be checked: Standby Attitude Indications, the PM instruments, or references outside the cockpit when possible.

ACTIONS FOR RECOVERY

An overview of actions to take to recover from an upset would gather three basic activities:
- Assess the energy (become situationally aware)
- Stop the flight path divergence
- Recover to a stabilized flight path.

The Nose high/Nose low techniques represent a logical progression for recovering the aircraft. They are not necessarily procedural. The sequence of actions is for guidance only and represents a series of options for the pilot to consider and to use depending on the situation. The flight crew may apply these actions or part of these actions, mainly if the recovery is effective.
Depending on the situation, the PF should apply the required actions (See figures "Nose High" and "Nose Low").
During the maneuver, the PM must monitor the airspeed and the attitude throughout the recovery. The PM must also announce the flight path divergence if the recovery maneuver is not efficient.

Nose High Actions

Nose High Actions

- Recognize and confirm the situation
- Takeover and disconnect AP and A/THR (1)
- Apply nose down pitch order (2)

  Note: Excessive use of pitch trim may make the upset situation worse or may result in high structural loads.
- Adjust the thrust (3)
- Adjust the roll not to exceed 60 degrees (4)
- Recover the level flight (5)

Notes:

(1) If the AP and A/THR responses enable to stop the flight path divergence, the flight crew may keep the AP and A/THR engaged.

(2) The flight crew must apply as much nose down pitch order as required to obtain a nose down pitch rate.
In the case of lack of pitch down authority, the flight crew may use incremental inputs on the trim (nose down) to improve the effectiveness of the elevator control.

(3) Select up to maximum thrust available while ensuring adequate pitch control.
Increasing thrust may reduce the effectiveness of nose-down pitch control. It may be necessary to limit or reduce thrust to the point where control of the pitch is achieved.

(4) The bank angle must not exceed 60 °.
If all normal pitch control techniques are unsuccessful, the flight crew can keep the current bank angle or bank the aircraft to enable the nose to drop toward the horizon. The bank angle should be the least possible to start the nose down and never exceed approximately 60 °. If the bank angle is already greater than 60 °, the flight crew should reduce it to an amount less than 60 °.

(5) Recover the level flight at a sufficient airspeed while avoiding a stall due to premature recovery at low speed, or excessive g-loading at high speed.

Nose Low Actions

Nose Low Actions

- Recognize and confirm the situation
- Takeover and disconnect AP and A/THR (1)
- Recover from stall if required (2)

Note: Excessive use of pitch trim may make the upset situation worse or may result in high structural loads.

- Adjust the roll in the shortest direction to wings level (3)
- Adjust the thrust and the drag (4)
- Recover the level flight (5)

Notes:

(1) If the AP and A/THR responses enable to stop the flight path divergence, the flight crew may keep the AP and A/THR engaged.

(2) Even in a nose low situation, the aircraft may be stalled and it would be necessary to recover from a stall first.

(3) In general, a nose low, high-angle-of-bank requires prompt action, because the decreasing altitude is rapidly being exchanged for an increasing airspeed.

(4) The flight crew should reduce the thrust and/or use the speedbrakes to control the speed.

(5) Recover the level flight at a sufficient airspeed while avoiding a stall due to premature recovery at low speed, or excessive g-loading at high speed.

ADR/IRS FAULT

Ident.: PR-AEP-NAV-00019627.0002001 / 20 MAR 17
Applicable to: ALL

Each ADIRS has two parts (ADR and IRS), that may fail independently of each other. Additionally the IRS part may fail totally or may be available in ATT mode.
Single NAV ADR FAULT or NAV IRS FAULT are simple procedures, and only require action on the switching panel as indicated by the ECAM.
Dual NAV ADR or NAV IRS failures will cause the loss of AP and A/THR and the flight controls revert to ALTN LAW.
In the case of a triple ADR failure, AP and A/THR are lost and the flight controls revert to ALTN LAW. The NAV ADR 1+2+3 FAULT warning is triggered and the ECAM procedure requires that the 3 ADRs be switched OFF, to replace the PFD's normal speed scale and altitude indication by the Back-Up Speed Scale (BUSS) and GPS altitude information.
There is no procedure for IRS 1 + 2 + 3 failure but the ECAM status page will give approach procedure and inoperative systems. In this unlikely event, the standby instruments are the only attitude, altitude, speed and heading references

Note: To switch off an ADR, the flight crew must use the ADR pb. Do not use the rotary selector, because this would also cut off the electrical supply to the IR part.

UNRELIABLE AIRSPEED INDICATIONS

Ident.: PR-AEP-NAV-00019628.0001001 / 25 JUL 17
Applicable to: ALL

PREFACE

The ADRs detect most of the failures affecting the airspeed or altitude indications. These failures lead to:
- Lose the associated speed or altitude indications in the cockpit
- Trigger the associated ECAM alerts.

However, there may be cases where an airspeed and/or altitude output is erroneous, while the ADRs do not detect it as erroneous. In such a case, no ECAM alert is triggered and the cockpit indications may appear to be normal whereas they are actually false. Flight crews must have in mind the typical symptoms associated with such cases in order to detect this situation early and apply the "UNRELIABLE SPEED INDICATION" QRH procedure.

MAIN REASONS FOR ERRONEOUS AIRSPEED/ALTITUDE DATA

The most probable reason for erroneous airspeed and/or altitude information is an obstruction of the pitot and/or static probes. Depending on how the probe(s) is obstructed, the effects on cockpit indications differ.

It is highly unlikely that the aircraft probes will be obstructed at the same time, to the same degree and in the same way. Therefore, the first effect of erroneous airspeed/altitude data in the cockpit will most probably be a discrepancy between the various indications (CAPT PFD, F/O PFD and STBY instruments).

CONSEQUENCES OF OBSTRUCTED PITOT TUBES OR STATIC PROBES

All the aircraft systems which use anemometric data, have built-in fault accommodation logics. The fault accommodation logics rely on a voting principle: When the data provided by one source diverges from the average value, the systems automatically reject this source and continue to operate normally using the remaining two sources. The flight controls system and the flight guidance system both use this voting principle.

NORMAL SITUATION

Each PRIM receives speed information from the three ADRs and compares the three values. The PRIMs do not use the pressure altitude.
Each FE (Flight Envelope) computer receives speed and pressure altitude information from the three ADRs and compares the three values.

ONE ADR OUTPUT IS ERRONEOUS AND THE TWO REMAINING ARE CORRECT

The PRIMs and the FEs eliminate the erroneous ADR.
On basic A330 and A340-200/300 aircraft, there is no cockpit effect (no caution, normal operation is continued), except that one display is wrong and the autoland capability is downgraded to CAT 3 SINGLE.
On A340-500/600s and A330/A340-300s, if one ADR deviates, and if this ADR is used to display the speed information on either the CAPT or F/O PFD, a NAV IAS DISCREPANCY ECAM caution is triggered. Furthermore, the autoland capability is downgraded to CAT 3 SINGLE.

TWO ADR OUTPUTS ARE ERRONEOUS, BUT DIFFERENT, AND THE REMAINING ADR IS CORRECT, OR IF ALL THREE ADRS ARE ERRONEOUS, BUT DIFFERENT :

Both the AP and A/THR disconnect. If the disagree lasts for more than 10 s, the PRIMs trigger the NAV ADR DISAGREE“ ECAM caution.
The flight controls revert to ALTN 2 law. The high speed protection and low speed protection are lost.

On both PFDs:
- The SPD LIMflag appears
- No VLS and no VSW is displayed

This situation is latched for the remainder of the flight, until the PRIMs are reset on ground, without any hydraulic pressure.

However, if the anomaly is only transient, the AP and the A/THR can be re-engaged when the disagree disappears.

ONE ADR IS CORRECT, BUT THE OTHER TWO ADRS PROVIDE THE SAME ERRONEOUS OUTPUT, OR IF ALL THREE ADRS PROVIDE CONSISTENT AND ERRONEOUS DATA :

The systems reject the correct ADR and continue to operate using the two erroneous but consistent ADRs. The flight crew can encounter such a situation when, for example, two or all three pitot tubes are obstructed at the same time, to the same degree, and in the same way. (Flight through a cloud of volcanic ash, takeoff with two pitots obstructed by foreign matter (mud, insects)).

EXAMPLE OF FAILURE CASES AND THEIR CONSEQUENCES

The following chart provides a non-exhaustive list of the failure cases and their consequences on airspeed and altitude indications. It should be noted that the cases described below cover situations where probes (eg pitot) are totally obstructed. There can be multiple intermediate configurations with similar, but not exactly identical consequences.

FAILURE CASE	CONSEQUENCES
Water accumulated due to heavy rain. Drain holes unobstructed.	Transient speed drop until water drains. IAS fluctuations. IAS step drop and gradual return to normal.
Water accumulated due to heavy rain. Drain holes obstructed.	Permanent IAS drop.
Ice accretion due to pitot heat failure, or transient pitot blocked due to severe icing. Unobstructed drain holes.	Total pressure leaks towards static pressure. IAS drop until obstruction cleared/fluctuation, if transient erratic A/THR is transient.
Ice accretion due to pitot heat failure, or pitot obstruction due to foreign objects. Obstructed drain holes.	Total pressure blocked. Constant IAS in level flight, until obstruction is cleared. In climb, IAS increases. In descent, IAS decreases. Abnormal AP/FD and A/THR behavior : a. AP/FD pitch up in OP CLB to hold target IAS. b. AP/FD pitch down in OP DES to hold target IAS
Total obstruction of static ports on ground.	Static pressure blocked at airfield level. Normal indications during T/O roll. After lift-off altitude remains constant. IAS decreases, after lift-off. IAS decreases, when aircraft climbs. IAS increases, when aircraft descends.

The above table clearly illustrates that no single rule can be given to conclusively identify all possible erroneous airspeed/altitude indications cases.

IN-SERVICE EXPERIENCE OF HIGH ALTITUDE PITOT OBSTRUCTIONS

Analysis of the in-service events shows that:

- The majority of unreliable speed events at low altitude are permanent situations, due to the obstruction of pitot probes by rain, severe icing, or foreign objects (refer to the table above).
- At high altitude, typically above FL 250, the cases of unreliable speed situation are mostly a temporary phenomenon: They are usually due to contamination of the pitots, by water or ice, in particular meteorological conditions. In-service experience shows that such a contamination typically disappears after few minutes, allowing to recover normal speed indications.

POTENTIAL EFFECTS ON THE BAROMETRIC ALTITUDE

If the barometric altitude is unreliable, the Flight Path Vector (FPV) and the Vertical Speed (V/S) are affected.
In addition, the ATC transponder may transmit an incorrect altitude to ATC or to other aircraft, which can lead to confusion. Therefore, the flight crew should advise ATC of the situation without delay.
Because the barometric altitude may be erroneous, the Autopilot (AP) may not be able to maintain accurately the level flight.

"UNRELIABLE SPEED INDICATION" QRH PROCEDURE

Ident.: PR-AEP-NAV-00019629.0002001 / 12 NOV 20
Applicable to: ALL

INTRODUCTION

The "UNRELIABLE SPEED INDICATION" procedure has two objectives:

- To fly the aircraft
- To identify and isolate the affected ADR(s).

It includes the following steps:

1. Memory items (if necessary)
2. Flight path stabilization
3. Troubleshooting and isolation
4. Flight using pitch/thrust references or the BUSS (below FL 250), if the troubleshooting has not enabled to isolate the faulty ADR(s).

WHEN TO APPLY THIS PROCEDURE?

The flight crew should consider applying the "UNRELIABLE SPEED INDICATION" procedure when:

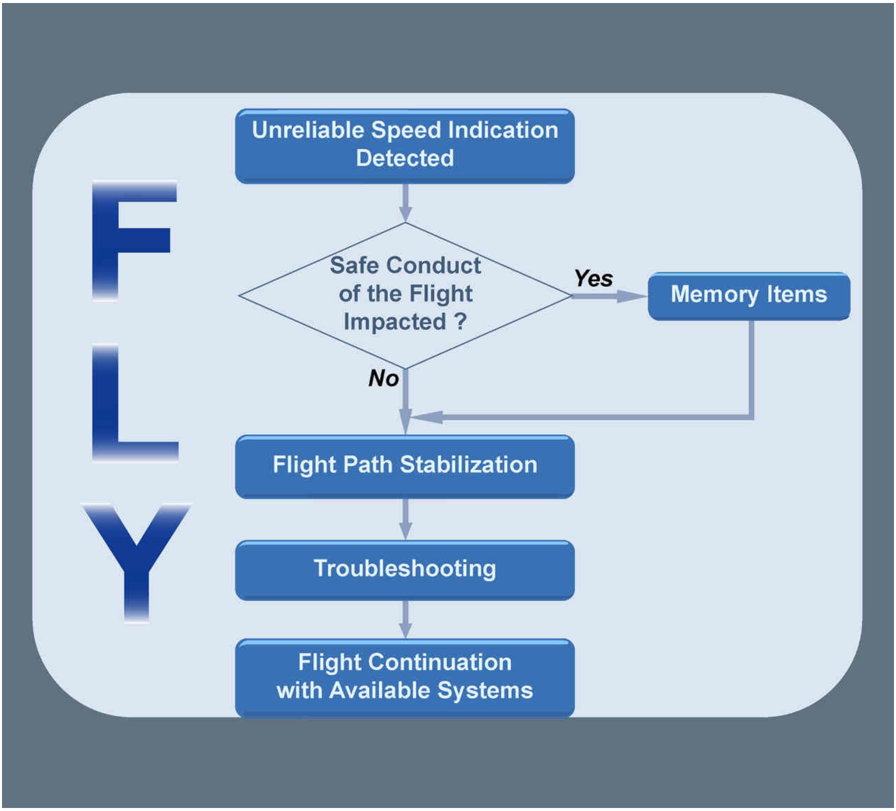
- The “UNREL SPD PROC… APPLY” action line is displayed on ECAM, for example due to the NAV ADR DISAGREE or A.ICE CAPT (F/O) (STBY) PITOTalerts, or
- The flight crew suspects an erroneous indication, without any ECAM alert.

The flight crew can suspect an erroneous speed/altitude indication, in the following cases:

- A speed discrepancy (between ADR 1, 2, 3 and standby indications)
- Fluctuating or unexpected changes of the indicated airspeed or altitude
- Abnormal correlation between the basic flight parameters (pitch, thrust, airspeed, altitude and vertical speed indications). For example:
  - The altitude does not increase, whereas there is an important nose-up pitch and high thrust
  - The IAS increases, whereas there is an important nose-up pitch
  - The IAS decreases, whereas there is an important nose-down pitch
  - The IAS decreases, whereas there is a nose-down pitch and the aircraft is descending.
- An abnormal behavior of the AP/FD and/or the A/THR
- The STALL warning triggers, the OVERSPEED warning triggers, or the FLAP RELIEF message appears on the E/WD, and this is in contradiction with the indicated airspeeds. In this case:
  - Rely on the STALL warning. Erroneous airspeed data does not affect the STALL warning, because the STALL warning is based on AOA data
  - Depending on the situation, the OVERSPEED warning may be false or justified. When the OVERSPEED VFE warning triggers, the appearance of aircraft buffet is a symptom that the airspeed is indeed excessive.
- The barometric altitude is not consistent with the RA height (when the RA is displayed)
- The aerodynamic noise reduces whereas the indicated airspeed increases, or vice versa
- In approach, it is not possible to extend the landing gear using the normal landing gear system.

Note: *Crew coordination is important. The PM should confirm any discrepancy:*
- *Between the standby airspeed indication and the speed indication on his/her PFD*
- *Between his/her PFD and the Pilot Flying's PFD.*

HOW TO APPLY THIS PROCEDURE?



MEMORY ITEMS

The flight crew must ensure a safe flight path. If the safe conduct of the flight is affected, the flight crew applies the memory items.
The memory items enable to rapidly establish safe flight conditions for a limited period of time in all phases of flight and in all aircraft configurations (weight and slats/flaps).

The flight crew must apply the memory items, if they have a doubt on their ability to safely fly the aircraft in the short term with the current parameters, i.e.:
- The flight crew has lost situation awareness, or
- The current pitch and thrust are not appropriate for the current flight conditions, or
- The aircraft has an unexpected flight path for the current flight conditions.

When the PF has stabilized the target pitch and thrust values, the flight crew applies the QRH procedure without delay. The flight crew must apply the QRH procedure without delay, because flying with the memory pitch/thrust values for an extended period of time can lead to exceed the aircraft speed limits.

Note: *The flight crew must respect the STALL warning.*

FLIGHT PATH STABILIZATION

According to the procedure, the flight crew can:
- Level off the aircraft then keep the flight path stabilized, or
- Keep the flight path stabilized.

Note: *If the flight crew has applied the Memory Items, then they must level off the aircraft to stabilize the flight path.*

The objective of these two conditions is to have a stabilized flight path to start the troubleshooting.

In all cases, the initial actions are to disconnect the automations. This prevents the Flight Guidance to use erroneous data for the computation of the aircraft guidance. Initial disconnection of the automation can prevent:
- Erroneous orders, if AP/FD are engaged
- Erroneous thrust change, if A/THR is engaged.

Refer to Example of Failure Cases and their Consequences.

Note: *If the A/THR automatically disconnects, the Thrust Lock function activates. The thrust is locked at its level at the moment of the disconnection until the flight crew moves the levers. The thrust may be locked at idle, due to normal A/THR behaviour, or due to the use of erroneous data.*

To level off the aircraft, the flight crew uses Pitch and Thrust tables of the QRH, See Pitch/Thrust Tables.
The GPS altitude can be used to confirm that the aircraft is maintaining level flight.

Note: *A difference may exist between the barometric altitude and the GPS altitude.*

The GPS altitude remains available on the MCDU GPS MONITOR page.

TROUBLESHOOTING AND ISOLATION

In order to identify and isolate the faulty ADR(s), the flight crew must crosscheck speed and altitude indications on CAPT PFD, F/O PFD and STBY instruments.
To help the identification of the affected ADR(s), the flight crew can use the Pitch and Thrust tables of the QRH procedure.
The Pitch and Thrust tables provide the resulting speed for a given aircraft weight and flight level.

WARNING	Do not instinctively reject an outlier ADR.

When one indication differs from the others, the flight crew may be tempted to reject the outlier information. However, they should be aware that two or even all three ADRs can provide identical but erroneous data.
When the flight crew has identified the affected ADR(s), they must turn off the affected ADR(s). As a consequence this triggers the corresponding ECAM alerts. The flight crew must apply the associated procedures to address all the consequences on the various aircraft systems.

- If the flight crew identifies at least one ADR to be reliable: the flight crew must use it and turn off affected ADR(s)
- If the flight crew cannot identify the affected ADR(s) or if all speed indications remain unreliable, the flight crew must:
  - Above FL 250, turn two ADRs off to prevent the flight control laws from using two consistent but unreliable ADR data. The flight crew must keep one ADR on. For flight continuation, the flight crew uses pitch and thrust tables of the QRH
  - Below FL 250, turn off all ADRs then use the BUSS for the flight continuation.

FLYING TECHNIQUE

PITCH/THRUST TABLES

When flying the aircraft with unreliable speed and/or altitude indications, it is recommended to change only one flight parameter at a time (i.e. speed, altitude or configuration).

- **If the FPV is reliable (i.e. barometric altitude is reliable), or with the GPS altitude information:**

  - Maintain level flight (FPV on the horizon or constant GPS altitude)
  - Adjust thrust
  - Observe the resulting pitch attitude, and compare it with the recommended pitch target in the table:
    - If the pitch necessary to maintain level flight is above the pitch target of the table, the aircraft is slow. Then increase the thrust
    - If the pitch necessary to maintain level flight is below the pitch target of the table, the aircraft is fast. Then decrease the thrust.

  When the pitch required to maintain level off gets close to the table pitch target, re-adjust thrust to keep this target pitch.
  When the conditions are stabilized, the resulting thrust should be close to the value provided in the table.
  This technique enables a fast stabilization of the speed while maintaining level flight.

- **If the FPV is not reliable and the GPS altitude information is not available (no means to ensure level flight):**
  Adjust pitch and thrust according to QRH tables, and wait for speed stabilization.
  Expect a significant time to stabilize the flight path and important altitude variations during the stabilization.

BACKUP SPEED SCALE (BUSS)

For the description of the BUSS, *Refer to FCOM/DSC-34-10-10-30-10 Backup Speed Scale*.

When the BUSS is active:
- The AP/FD and A/THR must be disconnected
- The F/CTL Laws are in Alternate law
- The STALL warning remains operative
- Cabin pressure must be controlled manually
- Depending on the ADIRS standard, the FPV can be available on one or both PFDs as soon as the flight crew switch off all ADRs
- Do not use the HUD
-

CAUTION	When flying with the BUSS, do not use the speed brakes.

  Flying with speed brakes extended affects the relationship between the speed and AOA, and therefore the BUSS may provide erroneous data.

The flight crew adjusts the pitch and thrust to fly the green area of the speed scale.
The BUSS is directly based on the current AOA. Any longitudinal input on the stick will induce an AOA change, and therefore will cause the BUSS to move. If not, the flight crew must disregard the BUSS and use pitch and thrust tables.
When the flight crew turns off all ADRs, the NAV ADR 1+2+3 FAULT ECAM alert triggers. The flight crew apply the associated procedure then, as requested by the ECAM, apply the “ALL ADR OFF” QRH procedure. This QRH procedure provides guidance to:

- Manually control the cabin pressure
- Prepare the approach and landing.

For approach, the flight crew should perform an early stabilized approach.
The flight crew should change the aircraft configuration with level wings.

To retract or to extend flaps, apply the following technique:
- Before retracting the next flaps configuration, fly the upper part of the green band
- Before extending the next flaps configuration, fly the lower part of the green band.

This technique limits the excursion in the amber zones when changing the flaps configuration.

DUAL RADIO ALTIMETER FAILURE

Ident.: PR-AEP-NAV-00019630.0001001 / 12 MAY 23
Applicable to: ALL

1 The Radio Altimeters (RAs) provide inputs to a number of systems, including the GPWS and FWC for auto-callouts. They also supply information to the AP and A/THR modes, plus inputs to switch flight control laws at various stages. Although the ECAM procedure for a RA 1 + 2 FAULT is straightforward, the consequences of the failure on the aircraft operation require consideration.

Instead of using RA information, the flight control system uses inputs from the LGCIU to determine mode switching. Consequently, mode switching is as follows:
- At take-off, normal law becomes active when the MLG is no longer compressed and pitch attitude becomes greater than 8 °
- On approach, flare law becomes active when the L/G is selected down and provided AP is disconnected. At this point, "USE MAN PITCH TRIM" is displayed on the PFD.

  Note: *The L/G GEAR NOT DOWNalert appears in approach when CONF2 is selected*

- After landing, ground law becomes active when the MLG is compressed and the pitch attitude becomes less than 2.5 °.

It is not possible to capture the ILS using the APPR pb pb and the approach must be flown to CAT 1 limits only. However, it is possible to capture the localiser using the LOC pb.
Furthermore, the final stages of the approach should be flown using raw data in order to avoid possible excessive roll rates if LOC is still engaged. Indeed, as the autopilot gains are no longer updated with the radio altimeter signal, the AP/FD behaviour may be unsatisfactory when approaching the ground.
There will be no auto-callouts on approach, and no "RETARD" call in the flare.
The GPWS/EGPWS will be inoperative; therefore terrain awareness becomes very important.
Similarly, the "SPEED, SPEED, SPEED" low energy warning is also inoperative, again requiring increased awareness.

"ABNORMAL V ALPHA PROT" QRH PROCEDURE

Ident.: PR-AEP-NAV-00021746.0001001 / 05 JUN 18
Applicable to: ALL

Note: *This procedure is only applicable for aircraft without OEB49.*

INTRODUCTION

The PRIM use a computed single AOA value, that is a combination of the three AOA measured values, in order:
- To ensure the high AOA protection
- To compute the V Alpha Prot and the V Alpha Max, displayed on both PFDs.

In order to prevent the use of erroneous information from the AOA probes, the PRIM also monitors the AOA measured values. This monitoring can result in the rejection of one or several AOA values.

However, the high AOA protection and the display of the V Alpha Prot may be affected by inaccurate AOA measured values in some exceptional conditions:
- One or several AOA probes blocked, or
- Damage to the probe that causes a small offset in the measurement of the AOA value.

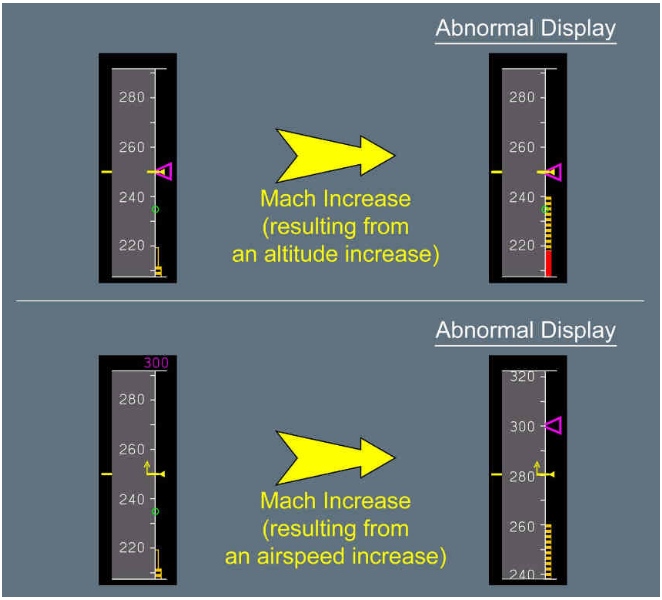
In this situation, the V Alpha Prot may reach the current airspeed and the high AOA protection may initially trigger based on the erroneous computed AOA value.

WHEN TO APPLY THIS PROCEDURE?

When the Mach increases, the flight crew may notice on the PFD an abnormal increase of the V Alpha Prot (top of the black and amber strip).

The flight crew must apply the ABN-NAV “ABNORMAL V ALPHA PROT” QRH procedure (*Refer to FCOM/PRO-ABN-NAV [QRH] Abnormal V Alpha Prot*) if all of the following conditions are satisfied:
- Flight path is stabilized, i.e. during level flight or stabilized climb/descent
- Heading is steady, i.e. there is no turn and no increase of the load factor
- V Alpha Prot exceeds Green Dot speed.

During stabilized flight path with steady heading

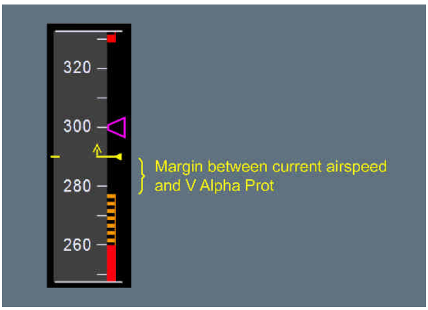


An event of abnormal V Alpha Prot does not cause unreliable speed indications

PROCEDURE

The flight crew must monitor any increase of the V Alpha Prot.
During stabilized flight path with steady heading, if the margin between the V Alpha Prot and the current airspeed decreases below 15 kt, the flight crew must stop increasing both Mach and altitude.

During stabilized flight path with steady heading



Mach Limitation

When Mach increases, the high AOA protection activates for a lower computed AOA value. Therefore, for a level flight at constant Mach, the margin remains constant between the current airspeed and the V Alpha Prot.

Altitude Limitation

When altitude increases at constant Mach, the required AOA for level flight increases. Therefore, for a descent at constant Mach, the margin increases between the current airspeed and the V Alpha Prot.

As a result, Mach and altitude limitations ensure that the margin between current airspeed and V Alpha Prot does not further decrease.

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INTRODUCTION

Ident.: PR-AEP-SMOKE-00019660.0001001 / 15 NOV 21
Applicable to: ALL

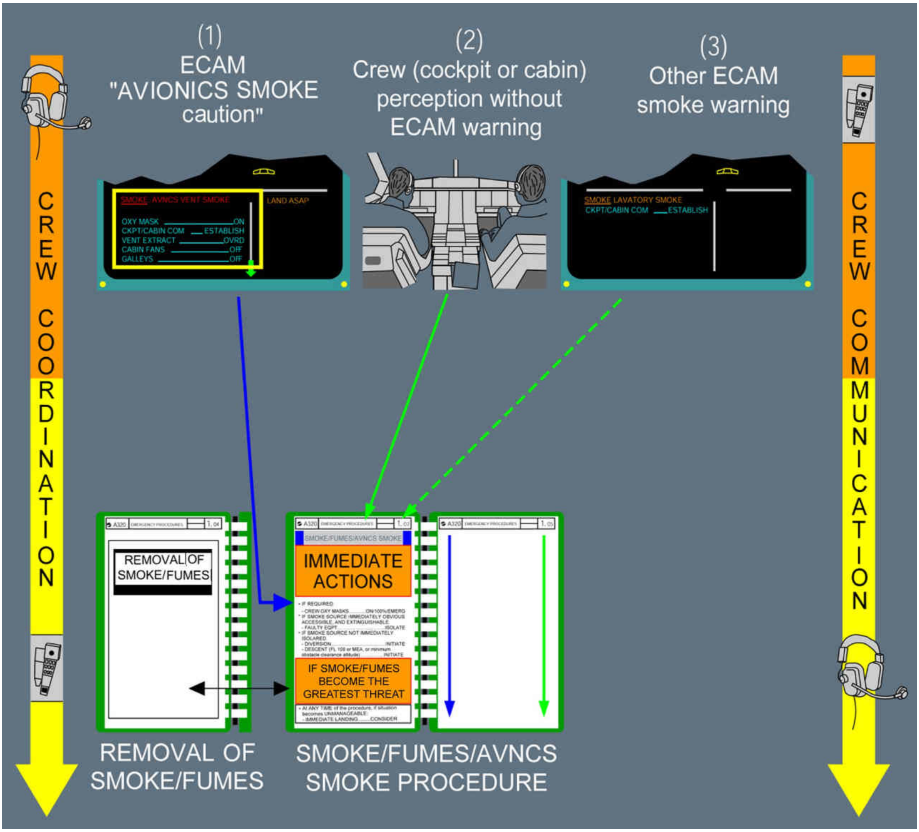
Fire, smoke or fumes in the fuselage may lead to potential hazardous situations. The flight crew will have to deal with the emergency itself, but also with the passengers who may possibly panic if they become aware of the situation. It is essential therefore, that action to control the source of combustion is not delayed.
An immediate diversion should be considered as soon as the smoke/fumes are detected. If the source is not immediately obvious, accessible and extinguishable, the immediate diversion should be initiated without delay.

SMOKE / FUMES DETECTION AND PROCEDURE APPLICATION

Ident.: PR-AEP-SMOKE-00019661.0001001 / 15 NOV 21
Applicable to: ALL

The smoke or fumes will be identified either by an ECAM alert, or by the crew without any ECAM alert.
If the smoke or fumes are detected by the crew, without any ECAM alert, the flight crew will refer directly to the [QRH] SMOKE / FUMES / AVNCS SMOKE procedure.
If the SMOKE AVNCS VENT SMOKE alert is activated, the flight crew can refer directly to the [QRH] SMOKE / FUMES / AVNCS SMOKE procedure, or apply first the ECAM actions, before entering the QRH. ECAM actions are fully compatible with the QRH procedure.
If another ECAM SMOKE alert (e.g. LAVATORY SMOKE) is triggered, the flight crew must apply the ECAM procedure. If any doubt exists about the smoke/fumes origin, the flight crew will then refer to the [QRH] SMOKE / FUMES / AVNCS SMOKE procedure.

Smoke / Fumes Procedure Architecture



COORDINATION WITH CABIN

Ident.: PR-AEP-SMOKE-00019662.0001001 / 15 NOV 21
Applicable to: ALL

Good coordination between cockpit and cabin crew is a key element.
In case of smoke/fumes in the cabin, it is essential that the cabin crew estimates and informs the cockpit crew concerning the density of smoke/fumes and the severity of the situation.

SMOKE / FUMES / AVNCS SMOKE QRH PROCEDURE

Ident.: PR-AEP-SMOKE-00019663.0002001 / 15 NOV 21
Applicable to: ALL

GENERAL

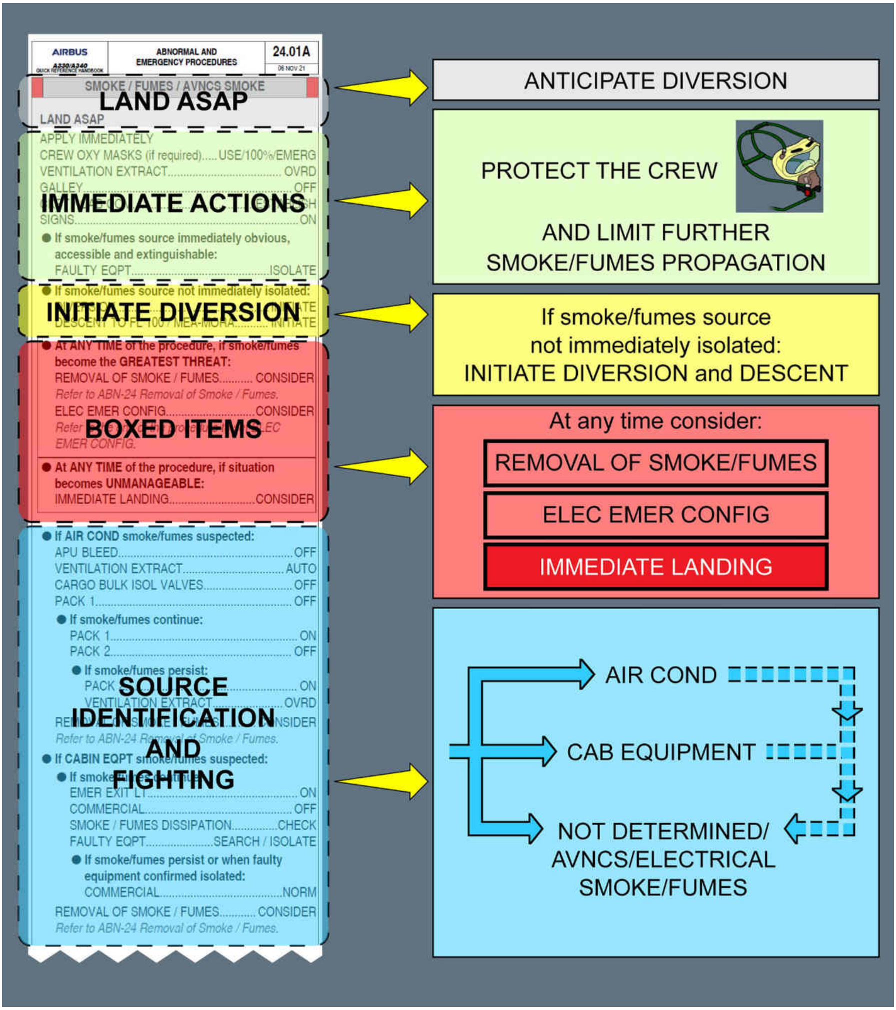
The [QRH] SMOKE / FUMES / AVNCS SMOKE procedure implements a global philosophy that is applicable to both cabin and cockpit smoke/fumes cases.

This philosophy includes the following main steps:
- Diversion to be anticipated
- Immediate actions.

If smoke/fumes source not immediately isolated:
- Diversion initiation
- Smoke/fumes origin identification and fighting.

Furthermore, at any time during the procedure application, if smoke/fumes become the greatest threat, the boxed items will be completed.
The main steps of this global philosophy may be visualized in the [QRH] SMOKE / FUMES / AVNCS SMOKE procedure.

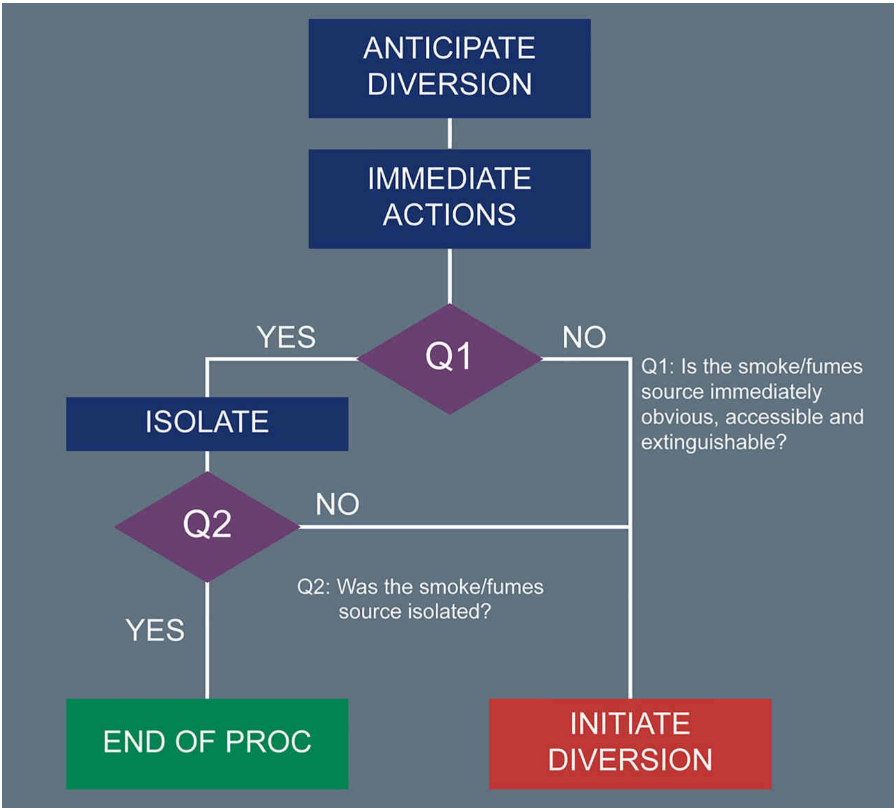
SMOKE / FUMES / AVNCS SMOKE Procedure Presentation in QRH



CONSIDERATIONS ABOUT DIVERSION

Time is critical.
This is why a diversion must be immediately anticipated (as indicated by LAND ASAP).

Then, after the immediate actions, if the smoke/fumes source cannot be immediately identified and isolated, the diversion must be initiated before entering the SMOKE/FUMES ORIGIN IDENTIFICATION AND FIGHTING part of the procedure.



IMMEDIATE ACTIONS

These actions are common to all cases of smoke and fumes, whatever the source.

Their objectives are:
- Flight crew protection
- Avoiding any further contamination of the cockpit/cabin
- Communication with cabin crew.

SMOKE ORIGIN IDENTIFICATION AND FIGHTING

The crew tries to identify the smoke/fumes source by isolating systems.

Some guidelines may help the crew to identify the origin of smoke/fumes:
- If smoke/fumes initially come out of the cockpit's ventilation outlets, or if smoke/fumes are detected in the cabin, the crew may suspect an AIR COND SMOKE. In addition, very shortly thereafter, several SMOKE alerts (cargo, lavatory, avionics) will be triggered. The displayed ECAM procedures must therefore be applied.
- Following an identified ENG or APU failure, smoke/fumes may emanate from the faulty item through the bleed system and be perceptible in the cockpit or the cabin. In that case, it will be re-circulated throughout the aircraft, until it completely disappears from the air conditioning system.
- If only the AVIONICS SMOKE alert is triggered, the crew may suspect an AVIONICS SMOKE.
- If smoke/fumes are detected, while an equipment is declared faulty, the crew may suspect that smoke/fumes are coming from this equipment.
- The crew can notice some cabin odors. The table below references the cabin odors list with suspected origins to help the flight crew to improve the communication coordination with the cabin crew.

DESCRIPTION OF ODORS	SUSPECTED CAUSE (MOST REPORTED LISTED FIRST)
Acrid	Electrical Equipment/IFE Engine Oil Leak
Burning	Electrical Equipment Galley Equipment Bird Ingestion
Chemical	Contaminated Bleed Ducts APU Ingestion
Chlorine	Smoke Hood Blocked Door Area Drain
Electrical	Electrical Equipment
Dirty Socks	APU or Engine Oil Leaks
Foul	Lavatories
Fuel	APU FCU/Fuel Line
Oil	Engine or APU Oil Leak
Skydrol	Engine Hydraulic
Sulphur	Wiring Avionics Filter Water Contamination Light Bulb

According to the source suspected, the crew will enter one of the 3 paragraphs:

1. IF AIR COND SMOKE/FUMES SUSPECTED…
2. IF CAB EQUIPMENT SMOKE/FUMES SUSPECTED…
3. IF AVNCS/ELECTRICAL SMOKE/FUMES SUSPECTED OR SMOKE/FUMES SOURCE CANNOT BE DETERMINED...

Since electrical fire is the most critical case, the crew will also enter paragraph 3 if the source of the smoke/fumes is not identified , or if the application of paragraph 1 and/or 2 has been unsuccessful.
This part of procedure consists of shedding one side, then the other. If unsuccessful, setting the electrical emergency configuration is the last means to isolate the smoke/fumes source.
If the flight crew sets the electrical emergency configuration following a smoke/fumes detection in the avionics compartment ("AVIONICS SMOKE" alert triggered), the ECAM does not display the same procedure as the one displayed following the loss of main generators. In fact in this case, the ECAM displays a specific procedure that takes into account the smoke/fumes detection: As the flight crew has voluntarily set the electrical emergency configuration, the purpose of the ELEC EMER CONFIG ECAM procedure is not to try to restore the generators, but to remain in electrical emergency configuration, and restore generators before landing to perform the landing in normal electrical configuration.

BOXED ITEMS

These items (applying [QRH] REMOVAL OF SMOKE / FUMES procedure, setting electrical emergency configuration, or considering immediate landing) may be applied at any time, in the procedure (but not before the immediate actions).
When necessary, the procedure [QRH] REMOVAL OF SMOKE / FUMES must be applied before the electrical emergency configuration is set. Indeed, in electrical emergency configuration [QRH] REMOVAL OF SMOKE / FUMES procedure cannot be applied, since manual control of cabin pressure cannot be selected.
Once the first step of the [QRH] REMOVAL OF SMOKE / FUMES procedure have been applied, the flight crew will come back to the [QRH] SMOKE / FUMES / AVNCS SMOKE procedure, to apply the appropriate steps, depending on the suspected smoke source while descending to FL 100. Reaching FL 100, the [QRH] REMOVAL OF SMOKE / FUMES procedure will be completed.

LITHIUM BATTERY FIRE IN THE COCKPIT

Ident.: PR-AEP-SMOKE-00019664.0001001 / 04 OCT 19
Applicable to: ALL

Several electronic devices contain lithium batteries, for example:
- Laptop computers,
- Mobile phones,
- Portable electronic tablets, etc.

Fire or smoke from lithium battery is due to thermal runaway in the battery cells.
It is important to know that fire extinguishers are efficient on flames but cannot stop thermal runaway.
The treatment for thermal runaway of lithium battery is to cool the battery by pouring water or non-alcoholic liquid on the device.
The first step of the procedure establishes appropriate tasksharing and communication.
If necessary, transfer control to the flight crew member seated on the opposite side of the fire.
The PF contacts the cabin crew to request initiation of the CCOM “STORAGE PROCEDURE AFTER A LITHIUM BATTERY FIRE".
This CCOM procedure specifies that the cabin crew must fill a container with water or non-alcoholic liquid and must immerse the device in it.
If there is no cabin crew on board (e.g. ferry flight, etc.), the PM must apply the steps of the CCOM procedure.
If there are flames, the PM must use the fire extinguisher.
Before discharging the fire extinguisher, it is important to protect the flight crew respiratory system: the PF must wear the oxygen mask and the PM must wear the smoke hood.
If there are no flames, or when the flames are extinguished, the PM must assess if the device can be removed or not from the cockpit.
If the device is attached to a cable that cannot be easily disconnected, then the device must be considered not removable from the cockpit, and water or non-alcoholic liquid must be poured on it. The device must then be regularly monitored to ensure that the thermal runaway is successfully stopped. If the device is removable, then it must be put in the container prepared in advance by the cabin crew member who takes over the procedure.
If, at any time of the procedure, the smoke becomes the greatest threat, the flight crew must consider applying the SMOKE/FUMES REMOVAL procedure.
Finally, if at any time of the procedure, the situation becomes unmanageable, an immediate landing must be considered.

CARGO SMOKE

Ident.: PR-AEP-SMOKE-00019665.0001001 / 26 NOV 19
Applicable to: ALL

Expect the SMOKE warning to remain after agent discharge, even if the smoke source is extinguished. Gases from the smoke source are not evacuated, and smoke detectors are sensitive to the extinguishing agent, as well. Once isolation valves are closed, the cargo is not ventilated. Thus, the cargo temperature is unreliable.
Order the ground crew not to open the door of the affected cargo compartment, unless passengers have disembarked and fire services are present.
If the SMOKE warning is displayed on ground, with the cargo compartment door open, do not initiate AGENT DISCHARGE. Request that the ground crew investigate and eliminate the smoke source.
On ground, the warning may be triggered due to high level of humidity.

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