

Procedures & Techniques
Operating Speeds
1. SYMBOLOGY AND DEFINITIONS

- Vs : Minimum stalling speed for a specified configuration. It is a function of the aircraft weight and altitude.
- VMCG : Minimum control speed on ground from which a sudden failure of the critical engine can be controlled by use of primary flying controls only. The other engine remaining at take-off power.
- V1 : Speed at which the pilot can make the decision, following failure of critical engine :
 - either to continue take-off
 - or to stop the aircraft.
 Represented by « 1 » on airspeed scale (or V1 value when out of range).
- VR : Speed at which rotation is initiated to reach V2 at an altitude of 35 feet.
- V2 : Take-off safety speed reached before the altitude 35 feet with one engine failed. Represented by the SPEED SELECT symbol on airspeed scale as any speed selected on FCU.
- VMCA : Minimum control speed in flight at which aircraft can be controlled with 5° Max bank, in case of failure of the critical engine, the other engine remaining at take-off power (take-off flaps setting and gear retracted).
- F : Equal to 1.25 VS Slats 15 /Flaps 0 . It is the minimum speed at which the flaps may be retracted to 0°. Represented by « F » on airspeed scale, when the SLAT/FLAP handle is in the 15/15 or 20/20 configuration.
- S : Equal to 1.25 VS of Slats 0 /Flaps 0 . It is the minimum speed at which the slats may be retracted to 0°. Represented by « S » on airspeed scale, when the SLAT/FLAP handle is in the 15/0 configuration.
- O (« GREEN DOT ») : ENGINE OUT OPERATING speed (BEST LIFT TO DRAG RATIO speed or DRIFT DOWN speed) in clean configuration. It corresponds also to the FINAL TAKE OFF speed.
 It is equal to 220 kts at 120t (264500 lbs) ± 1 kt per ton + 2 kt per 1000 ft above 20000 ft
 Represented by « O » (green dot) on airspeed scale, when the SLAT/FLAP handle is in the 0/0 configuration.
Note: O, F and S speed displayed is only valid once the SLATS/FLAPS are in the commanded position.
- VFE : Maximum speed for each slats and/or flaps configuration
- VREF : Reference speed used for a normal final approach, it is equal to 1.3 VS Slats 30 /Flaps 40 configuration.

- VLS: Lowest Selectable speed. It is represented by an amber strip along the airspeed scale which appears 5 seconds after lift-off.

In the T/O schedule VLS = 1.2 Vs of the actual T/O configuration.
 in the LANDING Schedule VLS = 1.3 Vs of the actual landing configuration.

- Change from T/O to landing schedule is triggered by SLATS/FLAPS handle displacement (either retraction or extension).

- Change from landing to T/O schedule is triggered by LOG GEAR SHOCK absorber compression (A/C on ground).

Above 25000 ft VLS is calculated so that there is 0.3 g margin with respect to BUFFETING.

In case of SLATS or/and FLAPS JAMMING, VLS represents 1.3 Vs of the present (ABNORMAL) configuration.

- Vss : Stick shaker speed : The speed at which the stick shaker is activated. It is represented by a red and black strip along the airspeed scale. It is equal to 1.138 Vs in clean configuration, 1.08 Vs in other configurations.
- FINAL APPROACH SPEED : VAPP

$$V_{APP} = V_{REF} + \text{CONFIGURATION CORRECTION (if any)} + \text{WIND CORRECTION}^*$$

$$= VLS + \text{ECAM LDG SPD INCR (if any)} + \text{WIND CORRECTION}^*$$

* For approach with AUTOTHROTTLE system engaged, or when significant ice accumulation has occurred :
 Minimum Wind Correction = 5 kts

Notes: 1. In SLATS30/FLAPS40 landing configuration,

VLS = VREF

2. CONFIGURATION CORRECTION :

is the speed increment to be added to VREF in certain failure cases.

ECAM LDG SPD INCR : is the speed increment to be added to VLS in certain failure cases, and indicated on ECAM. In both cases, the increment is indicated in the LANDING chapter and in the corresponding emergency/ abnormal check list

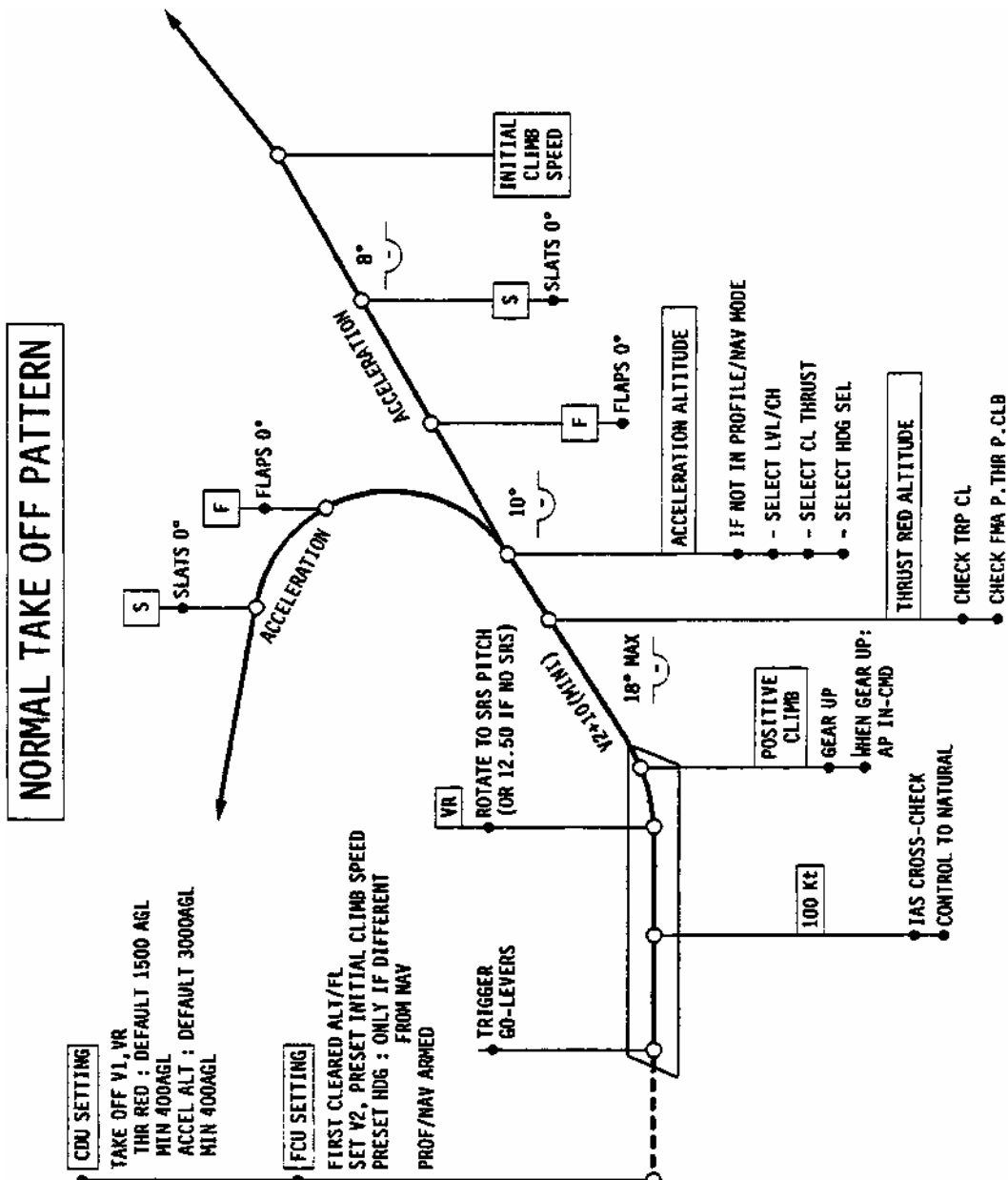
2. WIND CORRECTION

WIND CORRECTION = 1/3 OF TOTAL
WIND OR GUST IF HIGHER

- Maximum wind correction = 15 Kt
- Do not apply a wind correction if configuration correction is 20 Kt or more

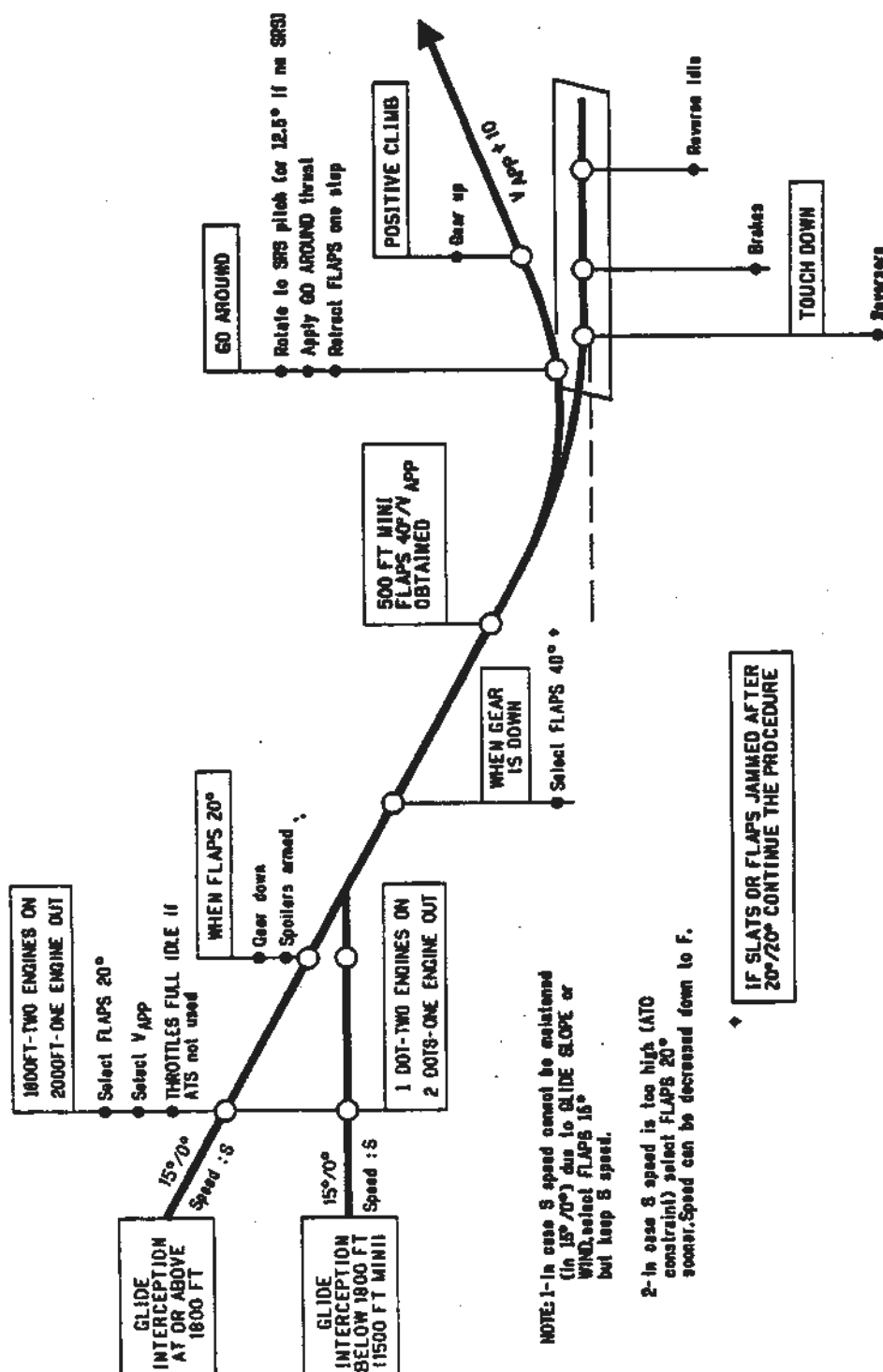
 LANDING		A 310	OCT. 83 AI/V-F 1000
DESTINATION : _____ ALTERNATE : _____			
WEIGHT: _____	V_{REF}: _____	ATIS CODE : _____	
FLAPS: _____	V_{APP}: _____	RWY : _____	
REMARKS :	F : _____	WIND : _____ / _____ Kt	
	S : _____	VISIBILITY / CEILING : _____	
	O : _____	QNH/GFE : _____	
		TEMP : _____ / _____ °C	
		TRANS LEVEL : _____	

 TAKE OFF		A 310	OCT. 83 AI/V-F 1000
CO RTE/FLT N° _____ FROM/TO _____ / _____ DATE _____			
TOW: _____	V₁: _____	ATIS CODE : _____	
FLAPS: _____	VR: _____	RWY : _____	
V₂: _____		WIND : _____ / _____ Kt	
FLEX TEMP : _____	F : _____	VISIBILITY / CEILING : _____	
CG : _____ %	PITCH: _____	QNH/GFE : _____	
S : _____		TEMP : _____ / _____ °C	
O : _____		TRANS ALT: _____	
ACCEL ALT : _____			

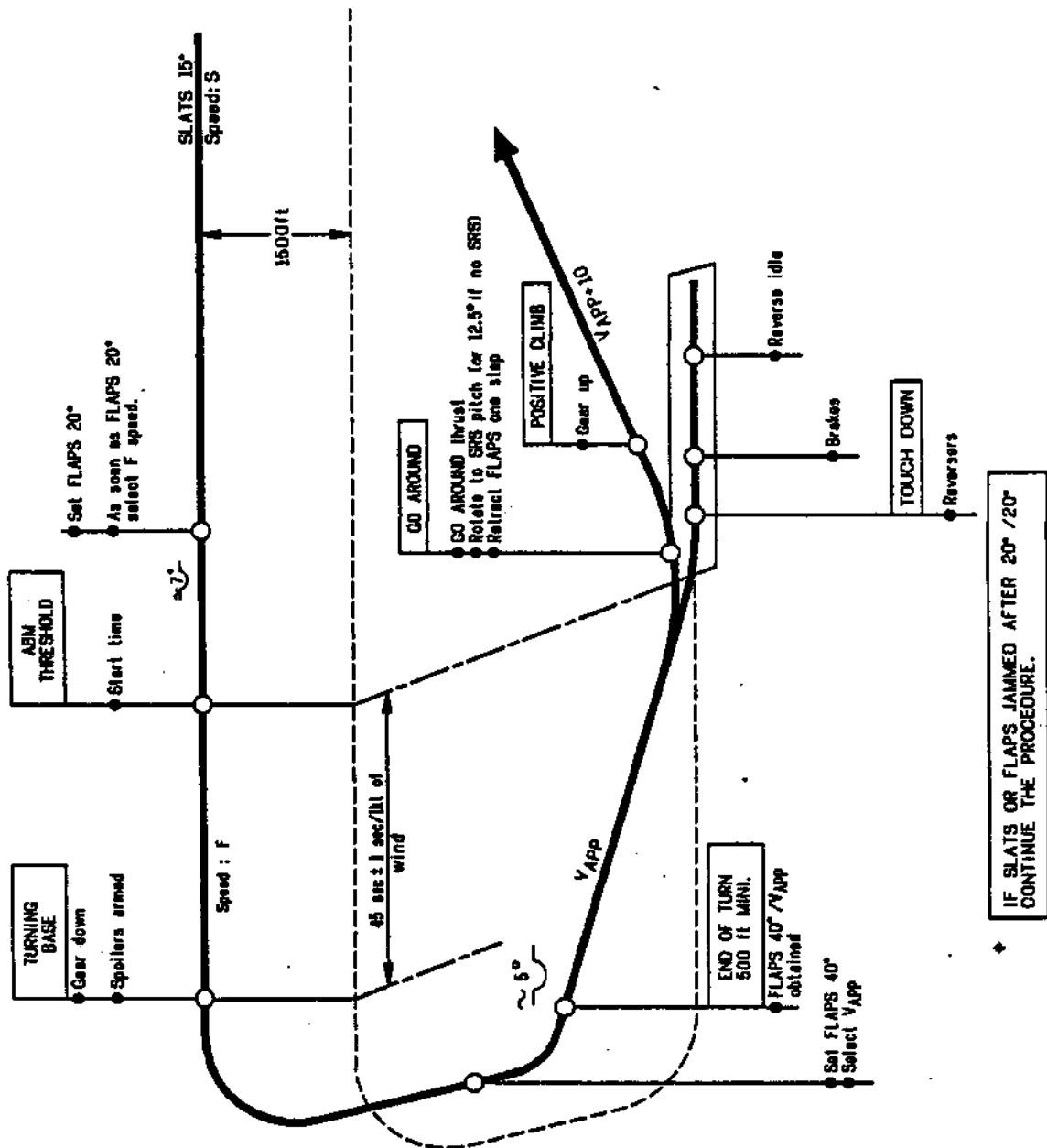


STANDARD APPROACH: DECELERATED APPROACH

Performed manually or with AP engaged on a stabilized final slope of about 3°
(visual or ILS approach)

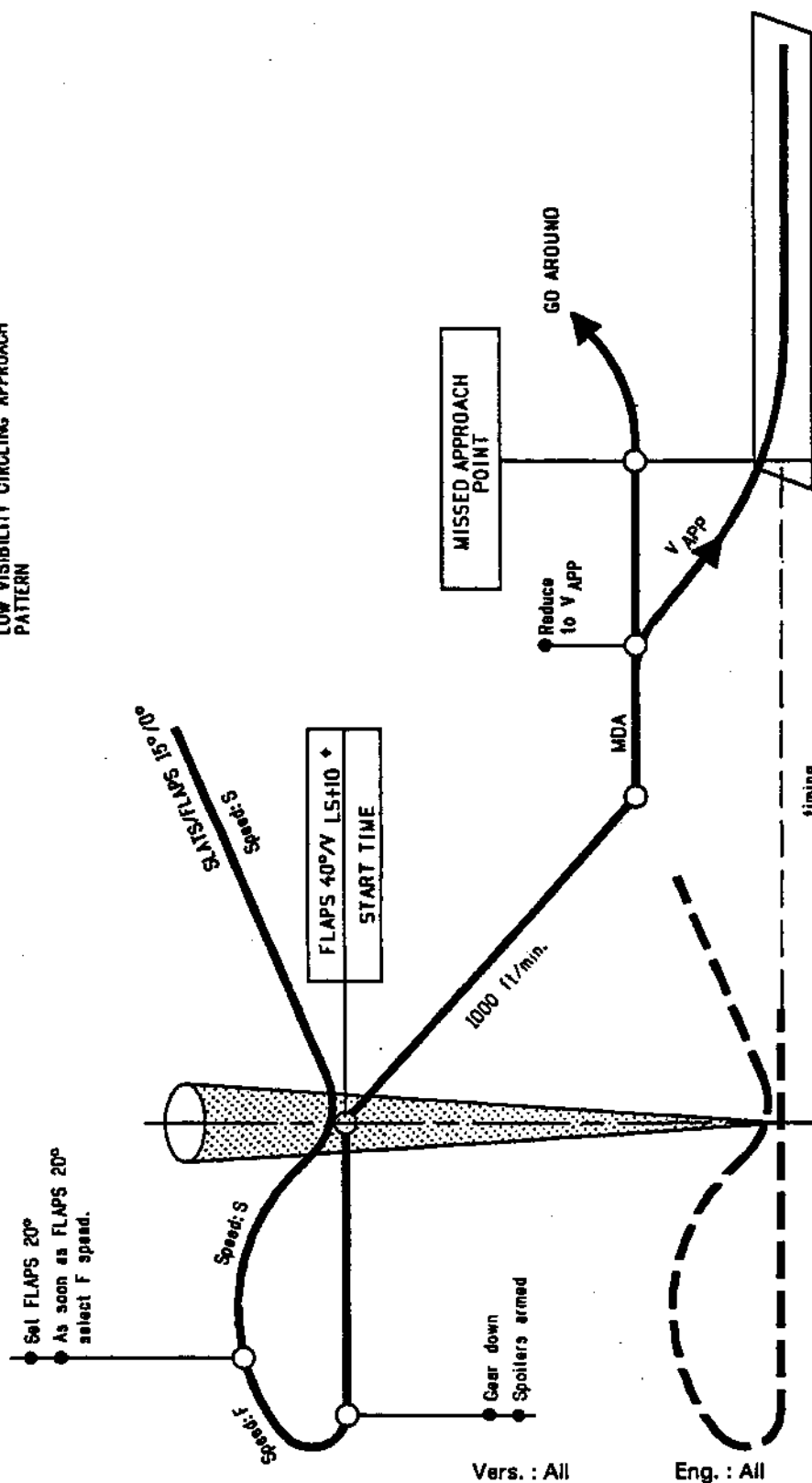


STABILIZED VISUAL APPROACH (1 or 2 ENGINES)

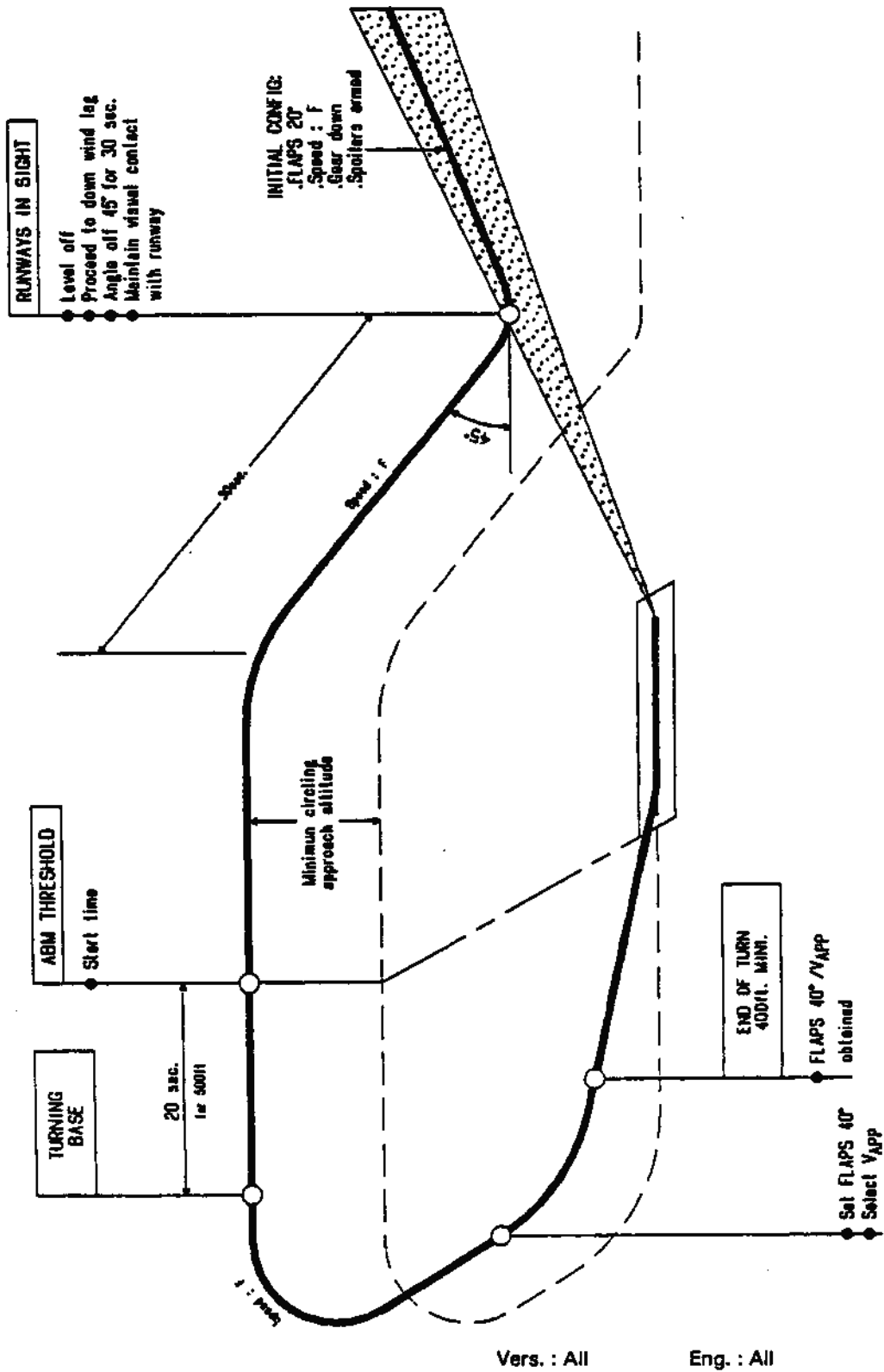


VOR-ADF NON PRECISION APPROACH (1 or 2 ENGINES)

♦ For circling approach maintain
FLAPS 20°/F speed and refer to
LOW VISIBILITY CIRCLING APPROACH
PATTERN



LOW VISIBILITY CIRCLING APPROACH

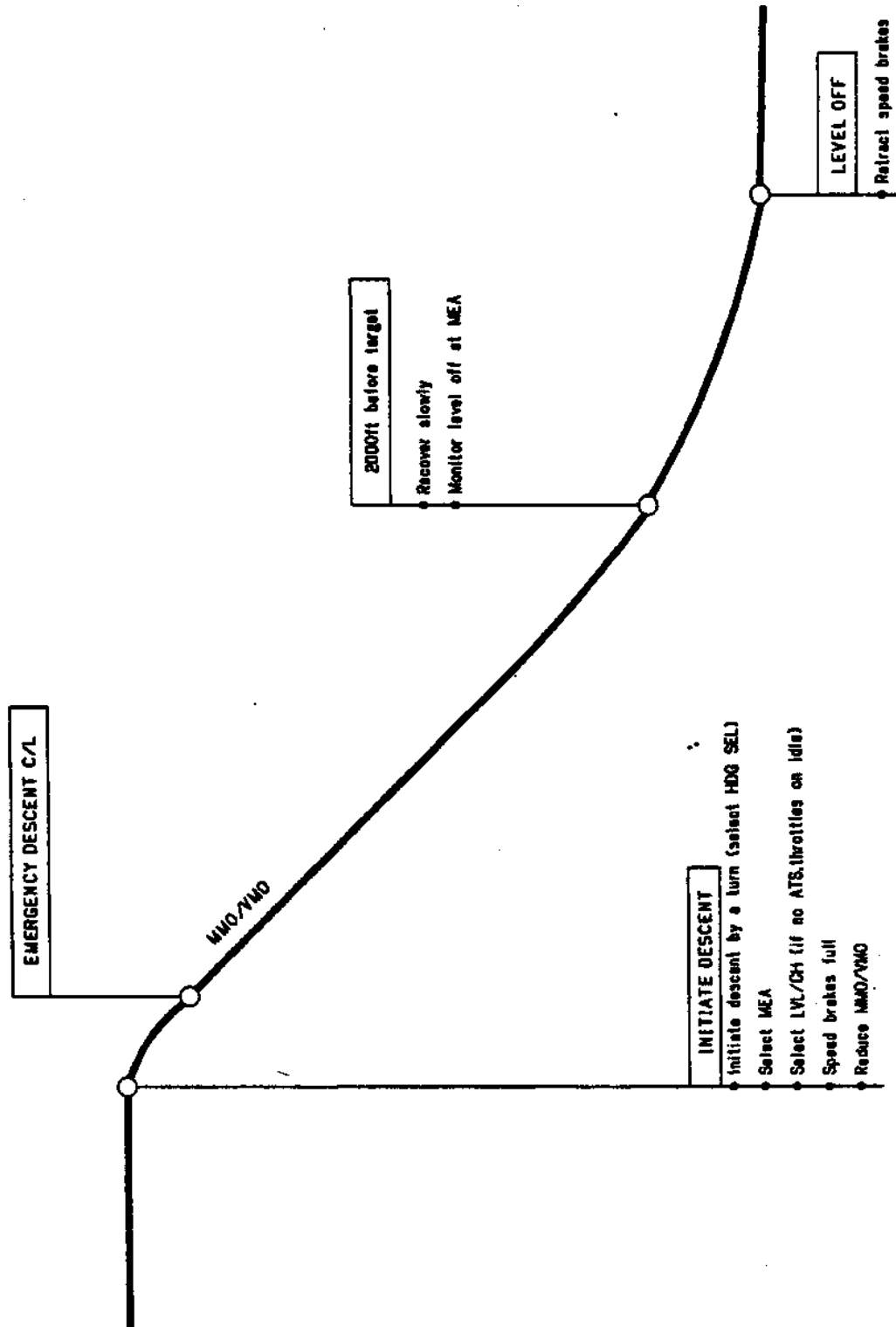


CAUTION: Check max landing weight and distance required



EMERGENCY DESCENT AT MMO/VMO **NO STRUCTURAL DAMAGE IS ASSUMED**

OPS.FCO.B2.0201.018-AA.001



Vers. : All

Eng. : All

Procedures & Techniques
180° Turn on Runway

A standard runway is 45 meters wide. Considering the turn radius of the aircraft, AIRBUS INDUSTRIE recommends a procedure to make that turn in the most efficient way.

Note : Frequent tight 180° turns on the runway have an influence only in fatigue of the landing gear which is subject to high pivoting couples during these turns. For these calculations of fatigue, it has been assumed that three tight turns would be made at each flight.

PROCEDURE
FOR THE CAPTAIN

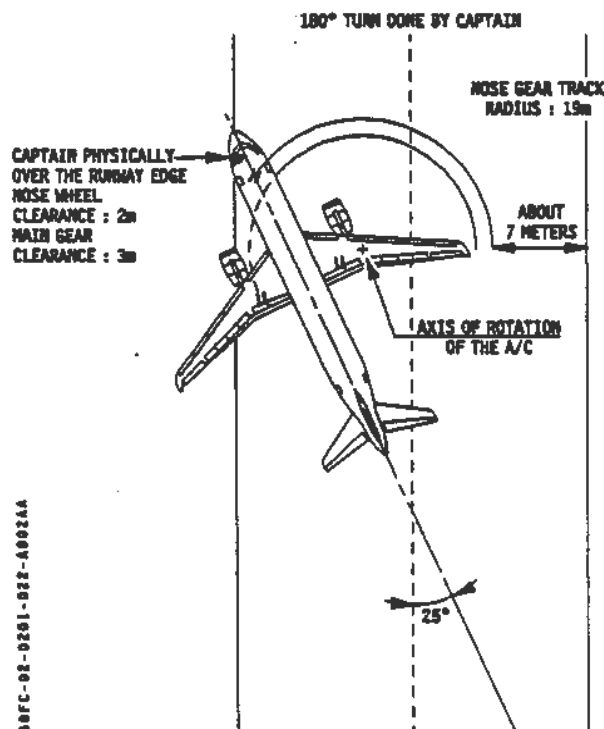
- Taxi on the right hand side of the runway up to about 150 m from the end of the runway.
- Turn left, maintaining 25° divergence with runway axis.
- When the captain is physically over the runway edge, he applies full deflection as quick as possible on the nose wheel and set about 50 % to 55 % N1 for GE engines or 1.05 EPR for PW engines.

The nose wheel will stay about 2 m from the runway edge and the main gear 3 m from the runway edge. The aircraft will turn around his axis of rotation, with a nose gear track radius of 19 m, leaving a 7m clearance to the other edge of a 45 m wide runway.

FOR THE COPILOT

The procedure is symmetrical. The copilot taxies on the left hand side of the runway, turns right (25° with regard of axis) and begins the 180° turn when he is physically over the runway edge.

Note: To avoid the skidding of the nose wheel on a wet runway it is recommended to perform the turn at very low speed, using asymmetrical thrust and differential braking as necessary.



Procedures & Techniques
Use of AFS
1. GENERAL
A. PRELIMINARY NOTE

In this section, the following is described :

- USE OP AFS described without taking into account the possible coupling to the FMS.
Coupling of the AFS to the FMS, will be described in USE OF FMS section
- USE OF FPV.
- USE OF DFA AND WGD if these systems are installed.

B. INTRODUCTION

The A-310 is equipped with a high performance digital Automatic Flight System (AFS). The use of this system is highly recommended to the crew because it:

- reduces crew work load
- maintains a high level of safety
- increases the precision in guidance and tracking of the airplane in all weather conditions down to landing.

The AFS can be used from TAKE OFF, through all phases of flight and down to landing, including roll out.

C. AUTOPILOT/FLIGHT DIRECTOR (AP/FD)

The AP/FD shall normally be used throughout the whole flight either with both FD's* engaged (Manual control of the A/C through the FD BARS on PFD's) or with an AP engaged in CMD** (automatic control of the A/C).

* An AP can also be engaged in CWS (semi-automatic control of the PITCH ATTITUDE and BANK ANGLE).

** Two AP's can be engaged in CMD with LAND or GO AROUND mode.

The FMA (Flight Mode Annunciator) is the normal reference for the actual state of the AP/FD. A FMA is integrated in the upper part of each PFD (PRIMARY FLIGHT DISPLAY).

MAIN RULES OF USE

- 1 - NO PUSHBUTTON EXISTS TO ENGAGE OR DISENGAGE THE FD's.
Their engagement is automatic as soon as electrical power is supplied to the computers (FCC's).
- 2 - HOWEVER ONE FD CAN BE DISENGAGED BY SETTING THE CORRESPONDING « FD/FPV » SWITCH TO OFF or FPV, if no AP is engaged in CMD. (The corresponding FD BARS are out of view).

If an AP is in CMD the FD BARS are out of view when the switch is in OFF or FPV position, but the FD remains engaged.
- 3 - If no AP is engaged in CMD, FMA and FD BARS ON PFD 1 are associated with FD1, FMA and FD BARS on PFD2 are associated with FD2.

If an AP is engaged in CMD BOTH FMA's ARE ASSOCIATED WITH THIS AP, but the FD BARS ON THE PFD's REMAIN ASSOCIATED WITH THE CORRESPONDING FD.

- 4 - A mode is engaged by pressing the corresponding pushbutton on FCU or by pressing either GO-LEVER (for TAKE OFF or GO AROUND mode only).
- 5 - A mode is disengaged by pressing a second time the corresponding pushbutton or by pressing another pushbutton (of an incompatible mode).
- 6 - Each AP is engaged in CMD (in flight) or in CWS (on ground) by means of an AP lever on FCU. In flight, switching from CMD to CWS or CWS to CMD is made by pressing the CWS/CMD pushbutton.
- 7 - It is possible to switch over from one AP to the other. The first AP disconnects when the second is engaged (except in LAND or GO AROUND mode where both AP's can be engaged in CMD).

During an AP switching there is no change in the engaged modes except in the two following cases where the modes come back to the BASIC modes (V/S and HDG):

- If, AP1 being active and FD1 feeding both PFD's (F/O FD switch pressed on F/O SWITCHING panel), AP2 is engaged in CMD. Same thing if AP1 is engaged when AP2 is active and FD2 feeds both PFD's.
 - If, AP1 being active and FD BARS being out of view on PFD2 (FPV/FD switch in OFF or FPV position) AP2 is engaged. Same thing if AP1 is engaged when AP2 is active and FD BARS are out of view on PFD1.
- 8 - Each AP can be disconnected by setting the corresponding AP lever to OFF. Both AP's are disconnected by pressing either AP instinctive disconnect p.b. on the control wheels or when a force above a threshold (15 DAN) is applied on the stick in pitch (except in LAND, GO AROUND mode).
 - 9 - In case of failure, overriding the action of the AP, by exceeding a pre-set force on the flight controls, is possible when AP is in CMD or CWS. But working against the AP, is definitely not a normal procedure and should be avoided.

CAUTION

Working, on the pitch axis, against the AP in CMD may lead to a hazardous situation in LAND and GO AROUND mode.

So if any abnormal flight control behaviour is encountered during these flight phases :

- check AP status (FMA, FCU)
- If AP engaged, disconnect it and take over

Procedures & Techniques
Use of AFS
10 – CWS PARTICULAR USE AT TAKE OFF AND GO AROUND

The function of an AP engaged in CWS is to maintain the A/C attitudes (PITCH and ROLL) when the pilot releases the control wheel, provided no force is applied on the control wheel.

When an attitude is set by the pilot, the force applied on the control wheel is automatically cancelled by the AUTOTRIM, but in certain dynamic phases (rotation at TAKE OFF or GO AROUND) this force cancellation is not immediate.

Consequently one of the following two procedures must be applied to avoid a non desired increase in PITCH

- either holding the control wheel until there is no longer opposite force on it
- or using ELECTRIC PITCH TRIM to obtain a faster force cancellation.

Note : Refer to FCOM Vol. 1 for full description of AP/FD.

TASK SHARING

- 1 - With only the FD's (and with or without an AP in CWS), the pilot flying shall call for the modes to be selected by the non flying pilot.
- 2 - With an AP in CMD, the pilot flying will select the references and engage the modes necessary to achieve the desired task.
- 3 - The use of either of the two AP's or FD's is possible from either crew seat; however it is recommended to use the AP or FD associated to the side of the pilot flying because the reference parameters for guidance, altitude, heading course, are directly related to the respective AP or FD.

D. AUTOTHROTTLE SYSTEM (ATS)

The ATS shall normally be used throughout the whole flight in conjunction with the AP/FD.

The FMA (Flight Mode Annunciator) is the normal reference for the actual state of the ATS.

MAIN RULES OF USE

- 1 - ATS is armed by setting the ATS lever (on overhead panel) to on.
- 2 - Full automatic control of the ATS by the AP/FD is assured when A/THR function is engaged (by pressing A/THR p.b. on FCU or, at TAKE OFF or GO AROUND, by pressing either GO LEVER).
- 3 - If no AP and no FD is available, engaging A/THR function also engages SPD/MACH mode in the ATS. In this case SPD/MACH is the only mode available with A/THR function.

- 4 - Action on either GO LEVER engages THR L (THRUST LATCH mode) at each time this action does not cause THR (THRUST mode) engagement by the AP/FD.

(This is the case for example in APPROACH if SLATS are not extended. In this case GO-AROUND mode does not engage in AP/FD and so THR mode cannot be engaged).

- 5 - A/THR function (and the corresponding active mode) is disengaged by a second action on A/THR p.b. or by pressing either ATS instinctive disconnect, p.b.

THR L is disengaged by pressing either ATS instinctive disconnect, p.b.

- 6 - ATS is disarmed by setting ATS lever to OFF.

CAUTION

Use of ATS is PROHIBITED during TAKE OFF if ENG TRIM is inoperative

2 - PREPARATION BEFORE TAKE OFF
A. DURING COCKPIT PREPARATION

FPV/FD switches.....ON/FD
PITCH TRIMARM
YAW DAMPER/ATS LEVERS (if required)ARM

B. BEFORE PUSHBACK OR START

SPD/MACH setting knob.....TURN TO SELECT V2
SPD/MACH setting knob.....PUSH TO ACTIVATE PRESET
SPD/MACH setting knob.....TURN TO PRESELECT INITIAL CLIMB SPEED

CAUTION

Be sure that PRESET is activated before PRESELECTING the new speed.

TRP.....SELECT TO or FLEX TO

C. DURING TAXIING

ALT knob.....SELECT FIRST CLEARED ALTITUDE
HDG SEL knob.....SELECT INITIAL DEPARTURE HEADING

Procedures & Techniques
Use of AFS
3 - TAKE OFF, CLIMB, CRUISE

A Typical vertical profile which includes the majority of in flight cases from TAKE OFF to CRUISE is presented. The lateral modes are described later. This profile is based upon the use of :

- the autothrottle and both FD's at take off.
- the engagement of one AP in CMD after take off (gear up and stabilized flight path).

But this profile is equally valid for the use of the FD only in manually controlled flight (with or without the use of an AP in CWS).

RECOMMENDATION: For any altitude change (after TAKE OFF) use LVL/CH mode, except for small altitude changes (less than 2000 ft) where use of V/S mode is more advisable.

A. WHEN READY FOR TAKE OFF

GO-LEVERS.....PRESS

- At the same time :
The FD's engage in SRS mode. A/THR function is engaged (A/THR p.b. illuminates on FCU).
- THRUST mode is engaged in ATS (green THR on both FMA's).

CAUTION

Use of ATS is prohibited during TAKE OFF if ENG TRIM is inoperative. So, in order to avoid engagement of THR or THR L modes when SRS mode is engaged after pressing the GO LEVERS, DISARM the ATS (THR or THR L is automatically engaged when SRS is engaged through the GO LEVERS.).

- The FD PITCH BAR on each ADI will move up to indicate A/C acceleration.
- The FD ROLL BAR, remains centered on each ADI. HDG mode becomes active only at 30 ft (A/C heading at 30 ft will be maintained).
-

Note : If a localizer signal is received, (RWY FREQUENCY and HDG selected), depressing GO-LEVERS will engage RWY mode and the YAW BAR will indicate the commands to be executed to maintain the localizer center line (ROLL BAR disappears when YAW BAR appears).
At 30 ft RWY mode disengages and HDG re-engages, YAW BAR disappears and ROLL BAR appears (A/C heading at 30 FT will be maintained).

If the take off is performed using the localizer backbeam (or for aircraft heading more than 40° different from ILS selected course) RWY mode is not engaged.

- As soon as the throttles are at the desired thrust or at 100 KT maximum the A/THR is declutched (blue THR on FMA's).

- At VR, rotate until the PITCH BAR is centered (to maintain $V_2 + 10$ KT or a maximum of 18° pitch attitude).
- In case of engine failure the PITCH BAR will command a pitch attitude to maintain V_2 (or the existing speed if it is greater than V_2).

B. INITIAL CLIMB

When the landing gear is selected up :
ATS is reclutched, THR mode reengages.

Note : A/THR will be reclutched 5 sec at minimum after lift off when LANDING GEAR is selected up or when another mode than TO or FLEX TO is selected on TRP.

THR or SPD mode cannot be engaged before one of these 2 conditions is satisfied.

CAUTION

If ENG TRIM was OFF, rearm ATS and reengage A/THR function. This causes THR engagement if SRS mode is active in AP/FD.

- AP lever 1 (or 2)..... SET TO ON

Note: 1. If AP is already engaged in CWS, press CWS/CMD pushbutton to switch to CMD.
2. AP will take into account the engaged modes.

- In case of ENGINE FAILURE :
 - If the AP is engaged in CMD, it will compensate the engine failure.
The AP will maintain V_2 or the existing speed if greater than V_2 .
 - If the AP is not yet engaged in CMD it is preferable to first stabilize the A/C on its climb trajectory before engaging the AP in CMD.
- When initial turn is desired :
HDG SEL knob..... PULL TO SELECT HDG/S MODE

C. AT ACCELERATION ALTITUDE

- **With two engines :**
 - LVL/CH p.b..... PRESS
 - TRP..... SELECT CL (or CR)
 - The AP will acquire and maintain the PRESET speed.
 - The ATS will acquire and maintain the thrust as selected on the TRP.
- **With one engine out:**
 - At acceleration altitude :
ALT HLD p.b PRESS
ATS will acquire and maintain the PRESET speed.
 - At « GREEN DOT » speed
LVL/CH p.b..... PRESS
SPD/MACH setting knob..SELECT « GREEN DOT »
TRP.....SELECT MCT

Procedures & Techniques
Use of AFS
D. WHEN ALTITUDE CAPTURE CONDITIONS ARE MET

ALT * mode automatically engages (green ALT * on both FMA's).

ATS automatically engages in SPD mode (green SPD on both FMA's) and will maintain the selected SPD (here 250 KT).

When reaching the selected level (here FL50), AP automatically engages in ALT mode (green ALT on both FMA's).

Note : SPD/MACH mode will not engage if A/THR is still declutched (Gear not retracted and TO or FLEX TO still selected on TRP).

E. CLIMB FROM FL50 TO FL60 AT 250 KT (typical path)

In this case a 1000 ft/min. climb is sufficient. Use V/S mode.

ALT SEL knob TURN TO SELECT 6000 FT
V/S knob PULL TO SELECT V/S MODE

ATS remains in SPD mode.

V/S display window synchronizes on A/C actual V/S (here 0 ft/min.).

V/S knob SELECT + 10

The AP will acquire and maintain this V/S.

As in §3.D when ALT * illuminates.

F. CLIMB FROM FL60 TO FL100 AT 250 KT (typical path)

ALT SEL knob TURN TO SELECT 10000 FT

ALT SEL knob PULL TO SELECT LVL/CH MODE

The ATS automatically engages in THRUST mode and will acquire and maintain the thrust as selected on the TRP.

The AP maintains 250 KT.

Note : LVL/CH mode can also be engaged by pressing LVL/CH p.b.

As in §3.D when ALT * illuminates.

G. RECLEARED TO FL310. COMMENCING CLIMB WHILE INCREASING SPEED TO 300 KT (typical path)

ALT SEL knob TURN TO SELECT 31000 FT

ALT SEL knob PULL TO SELECT LVL/CH MODE

SPD/MACH setting knob TURN TO SELECT 300 KT

The ATS automatically engages in THRUST mode.

The AP will acquire and maintain 300 KT.

H. PRESET OF MACH 0.79 (to be done only when cleared for a high level, above FL300 -here FL310)

SPD/MACH setting knob PUSH TO ACTIVATE
PRESET

SPD/MACH selecting knob PRESS TO SELECT
MACH DISPLAY

SPD/MACH setting knob TURN TO SELECT 0.79

CAUTION

Be sure that PRESET is activated before
PRESELECTING the MACH

At the transition IAS/MACH (FL300 for the typical path), MACH mode engages in ATS. Preselected MACH becomes the active MACH.

Note : Switching from SPD to MACH can also be done by pressing SPD/ MACH selecting knob when desired MACH is reached.

As in 3.D when ALT * illuminates. Except that MACH mode engages in ATS instead of SPD mode.

I. CRUISE

The AP maintains FL310 and the ATS maintains MACH 0.79

TRP SELECT CR

Procedures & Techniques
Use of AFS
4 - LATERAL MODES

The following modes are available with both FD's only (with or without an AP in CWS) or with both FD's and an AP in CMD. Described procedures assume that at least both FD's are engaged which is the case in normal operation.

A. HDG mode

There is no specific HDG pushbutton. HDG mode is engaged when another lateral mode is disengaged by pressing a second time the corresponding p.b.

B. HDG SEL mode

HDG SEL knob.....TURN TO SELECT THE HDG
Max bank angle selector.....Set as required

. NORM (25°) if close to OPT ALT

. 15 (15°) if close to MAX ALT

SELECT HDG SEL MODE :

. HDG SEL knob.....PULL

or

. HDG SEL pb.....PRESS

HEADING ACQUISITION LOGIC :

- Before HDG SEL engagement:
whatever the difference is between A/C HDG and selected HDG is, the A/C will acquire the selected HDG in such a way that the minimum turn will be done.
- When HDG SEL mode is engaged :
When the HDG is modified, whatever the new selected value is, the A/C will turn towards the left if the HDG SEL knob has been rotated towards the left (and towards the right if the HDG SEL knob has been rotated towards the right), to acquire the new HDG.

C. VOR mode

The convergence of the A/C towards the selected VOR radial must be manually selected.

VOR/NAV/ILS switch.....SELECT VOR

VOR CONTROL PANEL.....SELECT VOR frequency
and VOR CRS

V/L p.bPRESS TO SELECT VOR MODE

- Intercept at an angle lower than 90°. If the distance to the station is smaller than 30 NM, use smaller (30° or less) intercept angle.
- To capture the desired radial, bank angle is limited to 25° or 15° depending on the position of the HDG SEL outer knob.
- When passing over the station, selected VOR course can be changed by as much as 30° on the VOR control panel.

- The VOR mode comprises 3 phases :

ARM PHASE

BLUE VOR
CAPTURE PHASE

GREEN VOR *
TRACK PHASE

GREEN VOR
D. LOC mode

The convergence of the A/C towards the LOC beam must be manually selected.

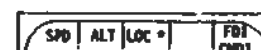
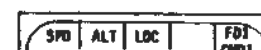
VOR/NAV/ILS switch.....SELECT ILS

ILS CONTROL PANELSELECT ILS frequency
and RWY CRS

V/L p.bPRESS TO SELECT LOC MODE

- Intercept at an angle lower than 115°.
- SUPERVISORY OVERRIDE Is possible during CAPTURE phase when AP is in CMD.
- It is recommended to use this mode to track a localizer when no glide slope is available or when the glide is of poor quality. In this case-the proper descent will be established with the V/S mode.
- To capture the LOC beam, bank angle is limited to 30°.
- the LOC mode comprises 3 phases :

ARM PHASE

BLUE LOC
CAPTURE PHASE

GREEN LOC *
TRACK PHASE

GREEN LOC

Procedures & Techniques
Use of AFS
5 - DESCENT - HOLDING

A typical descent flight path which includes most of the in-flight cases is presented with the same objective as for the climb.

This profile is based upon the use of:

- an AP engaged in CMD with ALT HLD mode.
 - the ATS, since we are at a high level, engaged in MACH mode.
- But this profile is equally valid for the use of the FD only in manually controlled flight (with or without the use of an AP in CWS).

RECOMMENDATION :

For any altitude change use LVL/CH mode. The only exception is for small altitude changes (less than 2000ft) or when a given vertical speed is requested by ATC. In this case use V/S mode.

A. DESCENT FROM FL350 AT MACH 0.79 (typical path)

The descent is initiated at a constant Mach number (the same as in cruise).

ALT SEL knob.....SELECT THE CLEARED FL
(FL200 in typical path)

ALT SEL knob.....PULL TO SELECT LVL/CH MODE

Note : LVL/CH mode can a/so be engaged by pressing

LVL/CH p.b.

The AP maintains M 0.79

Since the selected level is lower than the present one, ATS automatically engages in RETARD MODE (green RTAR on both PFD's). The throttles are automatically reduced towards the idle position.

THROTTLES.....FULLY IDLE

When throttles are stopped automatically at idle position, RETARD is disengaged and ATS is only armed (blue A/THR on PFD's).

APPROACH BRIEFING. Decision height.....SELECT

Note : In case of engine failure, the throttle linked to the inoperative engine must be reduced to idle before HP valve shut off.

Then this throttle must be aligned with the other one. Otherwise the already reduced throttle will come to the mechanical stop at throttle retraction when RETARD MODE engages and both throttles will be declutched.

B. PRESET OF 300 KT SPEED

SPD/MACH setting knob.....PUSH TO ACTIVATE
PRESET

SPD/MACH selecting knob.....PRESS TO SELECT
SPEED DISPLAY

SPD/MACH setting knob.....TURN TO SELECT
300 KT

CAUTION

Be sure that PRESET is activated before
PRESELECTING the SPEED

At the MACH/IAS transition (FL300 for typical path), SPD mode engages in ATS. Preselected SPEED becomes the active SPEED.

C. WHEN ALTITUDE CAPTURE CONDITIONS ARE MET

ALT * mode automatically engages (green ALT * on both FMA's).

The ATS automatically engages in SPD mode (green SPD on both FMA's) and will maintain the selected SPD (here 300 KT).

When reaching the selected level (here FL200), ALT HLD mode automatically engages (green ALT on both FMA's).

D. DESCENT FROM FL200 TO FL100 AT 300 KT AND 2500 FT/MIN

ALT SEL knob.....SELECT 10000

V/S knob.....PULL TO SELECT V/S MODE

ATS remains in SPD mode

V/S display window synchronizes on A/C actual V/S
(here 0 ft/min.).

V/S knob.....SELECT - 25

The AP will acquire and maintain this V/S

Use speed brakes if necessary to maintain the
desired speed.

As in §5.C when ALT* illuminates.

E. DESCENT FROM FL100 TO 4000 FT AND SPEED REDUCTION TO 250 KT

ALT SEL knob.....SELECT 4000

ALT SEL knob.....PULL TO SELECT LVL/CH MODE

SPD/MACH setting knob.....TURN TO SELECT 250 KT

The ATS automatically engages in RETARD mode
(then is only armed - blue A/THR)

The AP will acquire and maintain 250 KT

As in §5.C when ALT * illuminates.

F. DESCENT FROM 4000 ft TO 3000 ft

In this case a 1000 ft/min. descent is sufficient. This can be achieved by using V/S mode.

ALT SEL knob..... SELECT 3000

V/S knob.....PULL TO SELECT V/S MODE

ATS remains in SPD mode

V/S display window synchronizes on A/C actual V/S
(here 0 ft/min.).

V/S knob.....SELECT-10

The AP will acquire and maintain this V/S

As in §5.C when ALT * illuminates.

Note: The USE of AP and FD in LVL/CH mode is not permitted in FINAL APPROACH.

**G. HOLDING AT 3000 ft AND SPEED REDUCTION
TO ALLOW SLATS EXTENSION**

SPD/MACH setting knob SELECT
THE APPROPRIATE SPEED

The ATS will acquire and maintain this speed.

Procedures & Techniques
Use of AFS
6 - APPROACH AND LANDING
A. GENERAL

An approach and/or automatic landing in low visibility conditions is possible providing the aircraft is equipped with :

- a qualified flight crew,
- an AFS with relevant capability,
- a suitably equipped runway.

The most penalizing of the three following parameters defines the capability:

flight crew - aircraft system - runway facilities

and this capability defines the applicable weather minima. The weather conditions in which approaches and/or automatic landings may be made are classified by category according to :

- decision height (DH)
- runway visual range (RVR)

Decision height: is the height of the landing gear wheels above the ground at which the pilot must initiate a missed approach if the required visual references, to continue the approach to land, are not established.

Runway visual range: is the horizontal visibility measured along runway.

CAT I: Operations down to a decision height of not less than 200 ft and runway visual range not less than 2400 ft (RVR = 1800 ft if touchdown zone and runway center line are provided with a lighting system).

CAT II: Operations down to minima of less than DH 200 ft/RVR 2400 ft to as low as DH 100 ft/RVR 1200 ft.

CAT III:

- US definition :

CAT IIIA - A precision instrument approach and landing with no decision height, or a decision height below 100 feet, and controlling runway visual range not less than 700 ft (200 meters).

CAT IIIB - A precision instrument approach and landing with no decision height, or a decision height below 50 ft, and controlling runway visual range less than 700 ft (200 meters), but not less than 150 ft (50 meters).

- JAR CAT III definition : Operations with a decision height between 100 ft and 0 ft or with no decision height and with a RVR which assures a high probability of successful approaches.

RVR should be in the region of 200 to 150 m if neither an automatic ground roll control nor a ground roll guidance display system is used. RVR should be in the region of 100 m if one of the above mentioned system is fitted on the A/C.

Note: The autopilot installed on the Airbus is «fail operational» capable of performing automatic approaches, landings and roll out's in category I, II, III weather conditions.

Following procedures do not constitute approval to conduct CAT II or CAT III operations. Such authorization and associated minima must be obtained by the operator from appropriate operational authorities.

**B. MINIMUM EQUIPMENTS REQUIRED
(BY AIRWORTHINESS AUTHORITIES) TO BE
OPERATIONAL TO MEET CAT 2 or CAT 3 APPROACH
AND LANDING CRITERIA**

CAPABILITY → EQUIPMENTS ↓	CAT 2	CAT 3
AP/FD	1 AP IN CMD (with LAND mode engaged)	2 AP in CMD + 1 FD (with LAND mode engaged)
AP DISCONNECT P.B.	2	2
AUTOTHROTTLE	— *	IN SPEED MODE
AFS FLIGHT MODE ANNUNCIATOR(FMA)	1	2
ILS RECEIVER	2	2
BEAM EXCESSIVE DEVIATION WARNING	2	2
HORIZON	N•1 + N•2 + STANDBY	N•1 + N•2 + STANDBY
EFIS CRT's	3	4
RADIO ALTIMETER	1 (But two displays)	2
AUTO CALL OUT RADIO ALTIMETER**	0	1
DH INDICATION	1 ***	2
FAILURE WARNING COMPUTER	1	2
«c AP OFF » warning	-1	2
« AUTOLAND » light	1	2
« ATS » warning	0	1
ENGINE TRIM	0	1
WINDSHIELD WIPERS	1 ****	1 ****
RAIN REPELLENT	1 ****	1 ****
WINDOW HEAT	1	1
ANTI-SKID SYSTEM	0	1 *****

* ATS is mandatory in CAT3 only but is recommended even in CAT 1 or CAT 2.

** AUTO CALL OUT Radio altimeter setting must be in accordance with approved airline procedures.

*** One unit required for the CM2.

**** One unit required for CM1.

***** One unit required in CAT 3 with no DH.

Note: Compliance with CAT 2 (respectively CAT 3) approach and landing criteria has been demonstrated with CAT 2 and CAT 3 (respectively CAT 3) performance quality ILS beams only.

PROCEDURE FOR ILS BACK-COURSE APPROACH

- tune frequency and set front-course on ILS control panel.
- check approx. approach slope (300 ft/mile is 3°).
- select ND to ROSE or ARC, and VOR/NAV/ILS switch to ILS
- refer to localiser deviation indicated by ND to intercept and maintain localiser back-beam.

-

**CAUTION : Disregard localiser deviation on PFD, this is reversed.
Disregard glide slope indications.**

- Leave final approach fix stabilised in landing configuration at Vapp +10
- do not use FD in LAND or V/L mode ; it is recommended to select FPV to assist in maintaining the required glide slope.
The « FLIGHT PATH TARGET » is not usable since it is referenced to the front-course.

Note : If desired the approach may be flown with AP in CMD using H/SEL to maintain the localizer back-course and V/S to maintain the FPV at the required angle (normally -3°) on the pitch scale. In this case the AP should be disengaged by 200 ft (see AFS limitations). Another technique is to use AP in CWS in conjunction with FPV. In either case it is advantageous to have auto-throttle engaged.

Procedures & Techniques
Use of FPV
1 - GENERAL

The FPV (Flight Path Vector) system provides to the crew a complementary way of flying the A/C.

FPV use is basically different from FD (FLIGHT DIRECTOR) use.

The FPV can be used in two different ways which correspond to two different operational conditions :

- With the FLIGHT PATH VECTOR (FPV) only. In this case the FPV allows the crew to know the actual A/C slope and lateral drift

The «FPV» provides a precise and immediate reference for either controlling or monitoring the flight path. Because it displays the inertial trajectory (relative to ground), **there is no need to compensate for the effect of wind.**

- The vertical displacement from the horizon, read against the pitch scale, is the slope of climb or descent relative to the ground. (γ)

- The lateral displacement from the centre of the fixed aircraft symbol is the drift. (D)

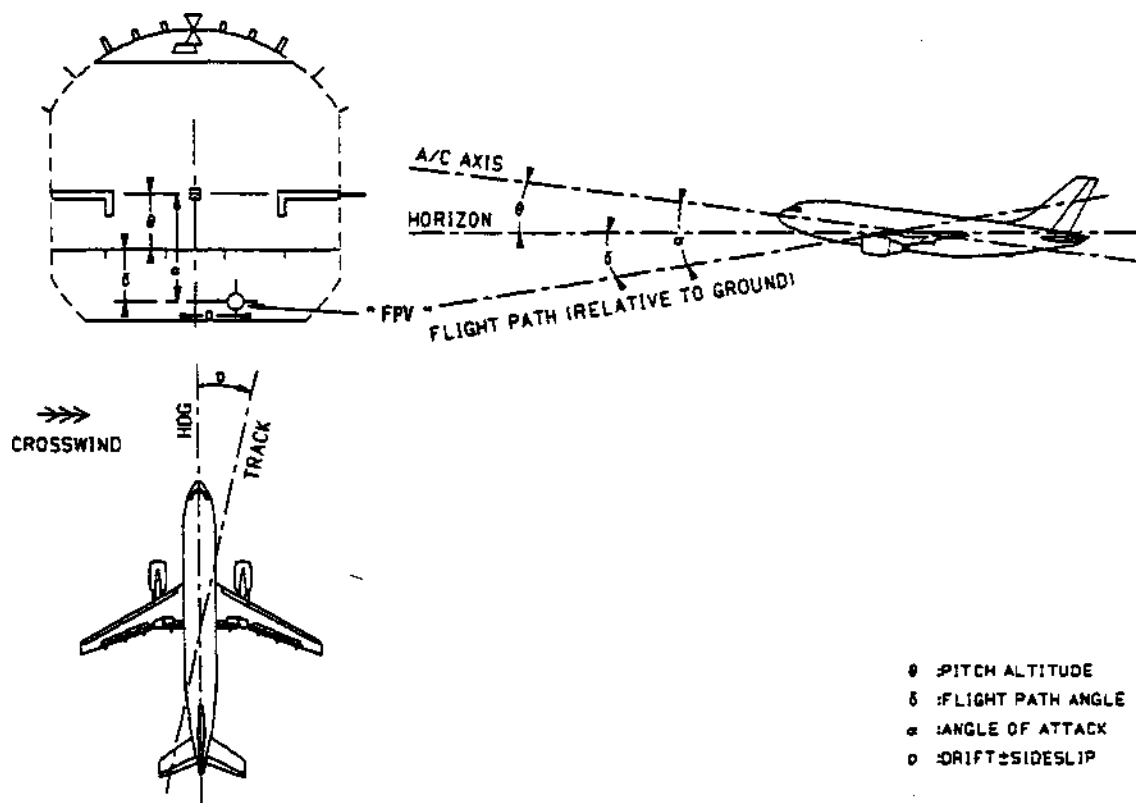
But this doesn't give the crew any reference to fly

- With the FLIGHT PATH VECTOR + the FLIGHT PATH TARGET.

In this case the FPV allows the crew, at the same time to :

- still know its actual slope and lateral drift,
- and fly the references (SLOPE and COURSE) selected through the FLIGHT PATH TARGET.

Use of the FPV is primarily recommended for approaches without precise glide-slope guidance, i.e. non-precision and visual approaches. (For other phases of flight, the Flight Director should in general be used. The FD is the optimum « tool » to fly a precision approach or a take-off climb profile).

PRIMARY INFORMATION GIVEN BY THE FPV (« BIRD »)


Procedures & Techniques
Use of FPV
2 - VISUAL APPROACH (USE OF THE FPV ALONE)
APPLICABILITY :

In VISUAL conditions, when no ILS exists, to know the A/C slope and drift. The FPV, in this case, helps in maintaining a stabilized descent path.

The FLIGHT PATH TARGET (« FPT ») cannot be used, since usually in the case of a VISUAL APPROACH there is not any FIX from which the target slope and course can be referenced.

COMPARISON WITH THE FD :

Allows to get information on the A/C path without the need of selecting references (vertical speed, heading).

OPERATION (FOR A STANDARD CIRCUIT PATTERN)

START OF PATTERN	FD/FPV switch LIFT TO SELECT FPV The FLIGHT PATH VECTOR symbol appears on the PFD. It indicates to the crew the present A/C slope and drift. A HDG BUG also appears against the HDG scale of the PFD. It indicates the HEADING selected on FCU. <i>Notes : 1 - A second action (lift) on the FD/FPV switch will clear the FPV symbol and the HDG BUG and bring back the FD BARS.</i> <i>2 - If no AP is engaged in CMD the AP/FD mode indication on the FMA disappears on the side where the FPV is on.</i>
	HDG SEL KNOB SELECT RECIPROCAL (ON FCU) RWY HDG This reference will appear on the PFD through the HDG BUG. Flying the FPV aligned with the HDG BUG will ensure that the TRACK IS PARALLEL TO THE RWY. FPV KEEP IT ON HORIZON TO MAINTAIN CONSTANT ALTITUDE
	PITCH DOWN THE A/C to bring the FPV on the suitable descent angle. HDG SEL knob SELECT RWY HDG
	FPV KEEP IT ON DESIRED SLOPE FPV KEEP IT ALIGNED WITH THE HDG BUG. This ensure that drift is corrected and RWY AXIS is maintained. If judged to be TOO HIGH : MAKE A CORRECTION BY PLACING the FPV BELOW the target descent angle on the PITCH SCALE. When desired path is RESTORED, BRING FPV back to target descent angle. Conversely If judged to be too low.

Note : The information provided by the FPV is particularly valuable for visual approaches when the visual cues are degraded (e.g. in heavy rain or into sun) or misleading (sloping terrain or runway, or abnormal length/width ratio) or at night with no approach or foreground lights (the « black hole » approach).

3 - NON PRECISION APPROACH (USE OF THE FPV COMBINED WITH THE FPT)

APPLICABILITY

For a NON PRECISION APPROACH, e.g. NDB, VOR LOCALIZER ONLY approach. It allows to have a continuous indication of the flight path being achieved.

COMPARISON WITH THE FD :

For a NON PRECISION APPROACH allows a better accuracy of the track (in slope).

OPERATION

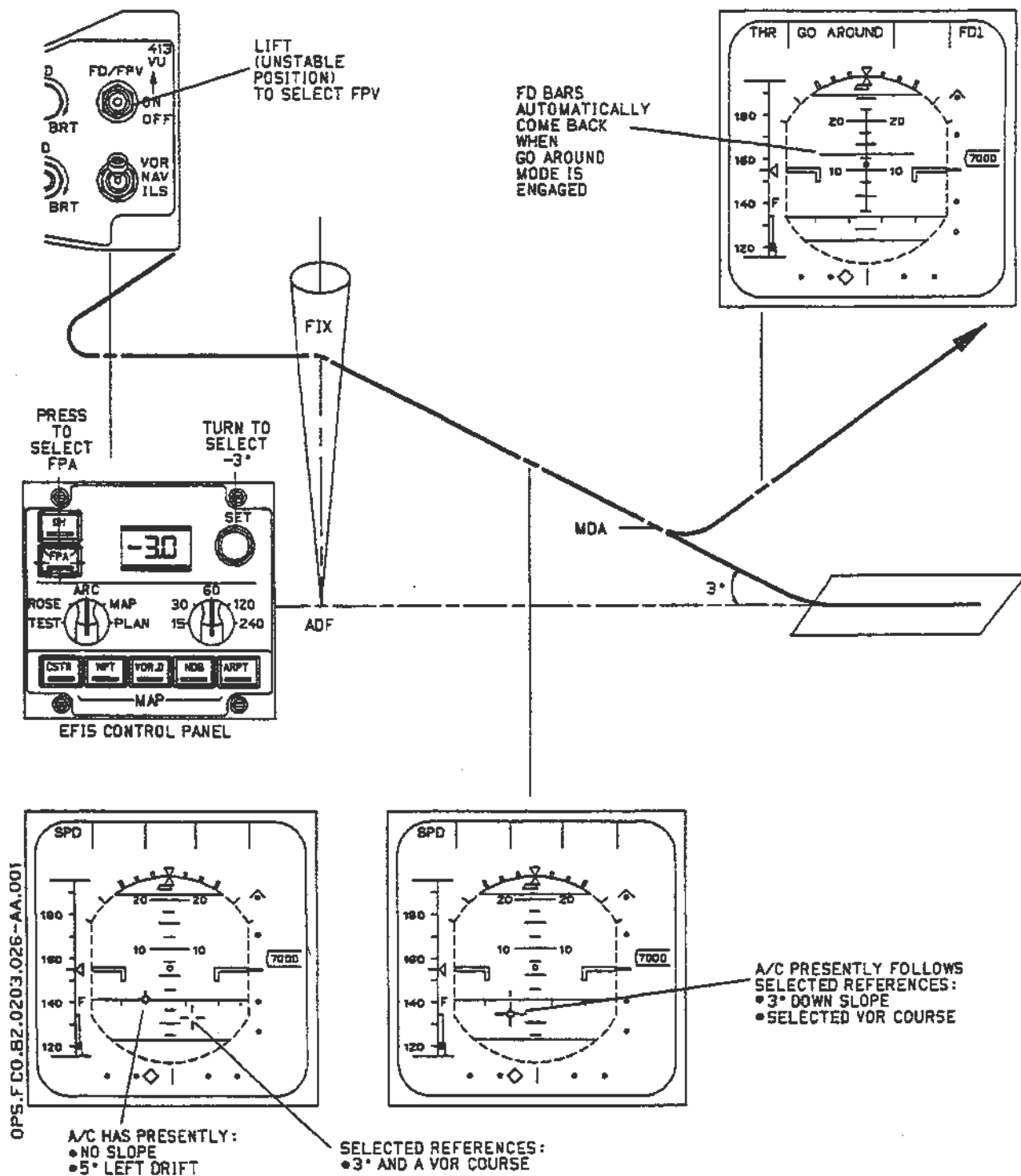
START OFF APPR	FD/FPV switch LIFT TO SELECT FPV The FLIGHT PATH VECTOR symbol appears on the PFD - It indicates to the crew the present A/C slope and drift. A HDG BUG also appears against the HDG scale of the PFD. It indicates the heading selected on FCU. Note : 1 - A second action (lift) on the FD/FPV switch will clear the FPV symbol and the HDG BUG and bring back the FD BARS. 2 -If no AP is engaged in CMD, the AP/FD mode indication on the FMA disappears on the side where the FPV is on. FPA p.b PRESS TO LIGHT THE p.b. The FLIGHT PATH TARGET symbol appears. It indicates : • The last selected SLOPE on the EFIS CONTROL PANEL • The VOR course selected on VOR C.P., if VOR/NAV/ILS switch is on VOR. The LOC course selected on ILS C.P., if VOR/NAV/ILS switch is on ILS. The FLIGHT PATH TARGET symbol is not displayed if VOR/NAV/ILS switch is on NAV. The FLIGHT PATH TARGET symbol is cleared by a second press on the FPA p.b. or a press on the DH p.b.
PRIOR TO FIX	SET knob ROTATE TO SELECT DESIRED SLOPE RWY COURSE SELECT ON VOR or ILS C.P. as appropriate.
PASSING FIX	PITCH DOWN The A/C to bring the FPV into the FPT. Maintaining FPV vertically centered in FPT will ensure that the required slope is maintained with respect to ground. Maintaining FPV laterally centered in the « FPT », provided A/C was on the RWY axis when overflying the FIX, will ensure that the required COURSE (RWY axis) is maintained. CAUTION The SLOPE selected through the FLIGHT PATH TARGET is not linked to the ground as a GLIDE SLOPE. This means that this SLOPE TARGET must be carefully followed, otherwise a parallel slope may be flown. Same thing for the selected COURSE, a parallel course may be flown.
MDA	<u>EXTERNAL VISUAL CONDITIONS SUFFICIENT</u> CONTINUE THE APPROACH <u>EXTERNAL VISUAL CONDITIONS INSUFFICIENT</u> EXECUTE A GO AROUND. BY PRESSING GO LEVERS FD BARS ARE RECOVERED.

4 - OTHER POSSIBLE USES OF THE FPV

- Monitoring automatic precision approach, in conjunction with raw ILS data ;
- It allows, particularly, an immediate and direct indication of flight path deviation due to wind-shear or other abnormality. Note that the GS index indicates position, whereas the FPV indicates rate of change of position, i.e. is predictive and therefore provides an earlier indication than the deviation of the GS.

Cross-check of the achieved climb gradient when obstacle clearance is critical.

In case of unreliable or failed airspeed indication, in which case the angle of attack (given on the pitch scale) of the PFD by the displacement between the centre-dot and the FPV) can be used as relative pitch altitude.

NON PRECISION APPROACH WITH THE FPV


Procedures & Techniques
Operation in Icing Conditions
1 - ICING CONDITIONS

Icing conditions may be expected when the OAT or the TAT is below 8° C and there is visible moisture in the air (such as clouds, fog with low visibility, rain, snow, sleet, ice crystals) or standing water, slush, ice or snow is present on the taxiways or runways.

At temperatures below - 20° C icing conditions encountered should be less severe.

In addition to the above conditions, be alerted by ice buildup on unheated portions of the airplane visible from the cockpit.

An ECAM MEMO : TAT IN ICING RANGE appears when the TAT is between + 5°C and - 15°C.

2 - PROCEDURES
CAUTION

Extended flight in icing conditions with slats extended should be avoided.

2.1. ENGINE ANTI-ICE
A. Use of ENG ANTI ICE

When icing conditions are encountered, detected either visually or by ice detection system (if installed) the ENG ANTI ICE system must be selected ON during all ground and flight operations.

WARNING

USE THE CRITERIA OF TEMPERATURE AND VISIBLE MOISTURE AS THE PRIMARY MEANS FOR SELECTING ON THE ANTI ICE SYSTEM WITHOUT

If the engine is at ground idle when ENG ANTI ICE is selected during descent, it will advance to flight idle.

IGNITION must be set to CONT RELIGHT before selecting ENG ANTI ICE ON. After engine parameters have stabilized, it may be set to OFF.

WARNING

If inlet ice is suspected to have formed prior to turning on the anti-ice system, throttles should be retarded individually to Idle, the IGNITION set to CONT RELIGHT and anti-icing heat applied before reestablishing normal thrust. Reducing the RPM will minimize the danger of internal damage to the engine as ice which has already formed breaks loose and is ingested. Selecting CONT RELIGHT will minimize the potential for engine flameout due to ice ingestion.

Notes : 1. Electrical power supply failure will cause the nose cowl anti-ice valve to open when air pressure is available, independantly of control switch position.

2. Unnecessary use of the engine anti-ice system should be avoided as performance is adversely affected.

B. Ice shedding on ground

Ground operation at minimum idle in icing conditions is permissible for a period not exceeding 30 minutes before any special engine operation for shedding accumulated ice is needed. If the condition exceeds 30 minutes, the engine should be accelerated to an N1 of 60% for a period of 30 seconds.

C. Ice shedding in flight

If during flight in severe icing conditions, ice build up on fan spinner and fan blades is suspected (as evidenced by increasing or high engine vibration level), the following ice shedding procedure should be carried out:

IGNITION.....CONT RELIGHT
THROTTLE (affected engine).....SET 70 % N1

NOTE: Flight profile permitting, more than 70 % N1 may be set for more complete ice shedding.

ENGINE PARAMETERSMONITOR
ENGINE VIB LEVELMONITOR

NOTE: ENGINE VIB level may peak up to full scale, during shedding, before it decreases and stabilizes.

• When vibration level decreases and stabilizes :

RESUME NORMAL ENGINE OPERATION

IGNITIONAS REQUIRED

The above ice shedding procedure may be carried out on a preventive basis, on one engine at a time, by spooling up the engine at 70 %N1 or above (flight profile permitting) for 10 to 30 seconds every 10 to 15 minutes.

2.2. WING ANTI-ICE

- WING ANTI-ICE may be used either to prevent ice formation or to remove an ice accumulation from the wing leading edges.

WING ANTI-ICE supply should be selected ON whenever there is an indication that airframe icing exists. This can be evidenced by ice accumulation around the cockpit windows or on the windshield wipers.

In the event of WING ANTI-ICE system failure, the approach speed must be increased by 10 kts.

- Wing anti-ice supply by the APU is possible up to 20000ft

- In case of suspected significant ice accumulation on non de-iced parts, increase the minimum approach speed by 5 kt and multiply landing distance by 1.1.

Notes : 1. Electrical power supply failure will cause the wing anti-ice valves to close, independantly of control selector position.

2. N1 LIMIT corrections and performance penalties are applicable only when wing anti-ice system is supplied by engine bleed air.

Procedures & Techniques
Power Plant
**ENGINE START WITH EXTERNAL
PNEUMATIC POWER**
PROCEDURE

• BEFORE CONNECT IN EXTERNAL PNEUMATIC POWER
PACK VALVES 1 and 2.....OFF
(to prevent packs contamination)

• BEFORE START
ENG BLEED VALVES.....OFF
X FEED.....MAN/IN LINE

- Closure of both the engines bleed valves eliminate reverse flow leakage.

• CLEARED TO START.

For MIN. RECOMMENDED STARTER AIR SUPPLY PRESSURE refer to table below.

- Two external pneumatic power units may be used in parallel if the pressure/ flow relation is expected to be marginal.
- Proceed as for normal engine start procedure.

• AFTER 1 ST ENGINE START.

IF CROSSBLEED ENGINE START IS CONSIDERED

- Request removal of external pneumatic power unit(s)
- PACK VALVES 1 and 2.....ON
- Apply CROSSBLEED ENGINE START procedure as described further in this chapter.

IF BOTH ENGINES ARE STARTED ON EXTERNAL PNEUMATIC POWER

- Proceed as for normal engine start procedure
- After engine 1/2 start:
- Request removal of external pneumatic power unit(s)
- X-FEED.....AUTO/X-LINE
- ENG 1 and 2 BLEED VALVE.....AUTO
- PACK VALVES 1 and 2.....ON

**MIN. RECOMMENDED STARTER AIR
SUPPLY PRESSURE**

AMBIENT C ALTITUDE (FT)	ONDITIONS TEMPERATURE (°C)	STARTER AIR PRESSURE (PSI G)
0	-40	35
0	15	30
0	55	25
8000	-40	25
8000	0	25
8000	40	25

Note : Pressures are valid with start valve closed. During engine start pressure may drop by approx. 10 %.

ENG START WITH BAT POWER
CAUTION

Ensure chocks are in place

PROCEDURE:

• **BEFORE START:**

GEN 1.....ON

• **CLEARED TO START:**

APU BLEED.....ON

IGNITION.....START B

• **ENG 1 START:**

ENG 1 START button.....DEPRESS AND HOLD

Note: Confirm starter motor operation by taking reference to the control column movement

Start clock. Announce « 20 SECONDS » when elapsed.

Note : 20 seconds represents the minimum for fuel /ever on.

ENG 1 FUEL LEVER.....ON

CAUTION

An EGT rise may occur resulting in an overtemperature

- **When GEN 1 FAULT light extinguishes :**

ENG 1 START buttonRELEASE

• **AFTER ENG 1 START:**

Complete the cockpit preparation.

ENG 2.....START

**CROSSBLEED ENGINE START
PROCEDURE**
CAUTION

Use of engine bleed supply and external pneumatic power supply simultaneously is prohibited.

APU BLEED VALVE.....OFF

BLEED VALVE (receiving engine).....OFF

X-FEED.....MAN/IN LINE

BLEED VALVE (supplying engine).....AUTO

- Continue the normal engine start procedure

Note : To increase airbled pressure of supplying engine throttle may be advanced, if required. It is recommended not to exceed flight idle N2 (max. 5 % above ground idle). This should normally provide sufficient starter air pressure.

If min. recommended starter air supply pressure is not obtained at flight idle, before further N2 increase ascertain with ground crew that intake and exhaust areas of supplying engine are clear for the augmenting jet wake.

After engine start

X-FEED.....AUTO/X-LINE

BLEED VALVE (receiving engine).....AUTO

Procedures & Techniques
0 - General
A. PRELIMINARY NOTE

In this sub-chapter use of FMS (Data entry, F-PLN revisions, etc...) and also actions necessary for coupling to the AFS (PROFILE and NAV modes engagement, etc...) will be described. Other AFS modes are described in the « USE of AFS » sub-chapter.

A flight from TOULOUSE (LFBO) to ATHENS (LGAT) with THESALONIKI (LGTS) as alternate is taken as example.

REMINDER : The database must be loaded and updated to render the system operational.

The depicted examples may only be reproduced with a database containing the same data as that used for the examples.

Finally it is recalled that the airline is solely responsible for the definition, acquisition, updating, loading and use of its own database.

B. INTRODUCTION

The FMS includes two computers (the FMC's) and two Control Display Units (the CDU's). The CDU's allow dialogue between the crew and the FMC's via a screen and an alphanumeric keyboard.

The FMS shall normally be coupled to the AFS (through PROFILE and NAV modes) throughout the whole flight

When this coupling is active, VERTICAL navigation via PROFILE mode and HORIZONTAL navigation via NAV mode is fully controlled by the FMS which sends its commands to the AFS.

NAV mode can be engaged from 30 ft (at TAKE OFF) to LOC capture (case of an ILS approach) or to a minimum authorized altitude (case of a FMS approach).

PROFILE mode can be engaged from THRUST REDUCTION ALTITUDE (value stored into the FMC data base or 1500 ft AGL by default) to GLIDE capture (case of an ILS approach) or to a minimum authorized altitude (case of a FMS approach).

C. MAIN RULES OF USE

- (1) Each FMS function is performed on a specific PAGE displayed on the CDU screen. There are several pages each one grouping information and sub-functions unique to that page.
- (2) A page is called on the CDU screen by pressing a function key, a line select key (in certain cases) or the «NEXT PAGE» key (when several pages are simultaneously called by one key).
- (3) Two different pages can be selected on the two CDU's.
- (4) Data entry into the FMS can be made on either of the CDU's. It will be taken into account by both FMC's.
- (5) Any data entry must be checked. Any F-PLN revision must be checked on F-PLN page B by using COURSE and DISTANCE.

- (6) Insertion of data on a page (in a data field) is always done via the SCRATCHPAD.
- (7) When the SCRATCHPAD is cleared on one side, this does not clear the SCRATCHPAD on the other side (even if, for example, the same message is displayed).
- (8) PROFILE and NAV modes are engaged or disengaged, as any other AFS mode, by means of pushbuttons located on the FCU.
- (9) When PROFILE is active, a level cannot be left without at least two positive actions of the crew :
 - turning ALT knob to select a new level
 - pulling this knob to initiate the level change.
- (10) In certain cases (e.g. pilot action not accepted, a MESSAGE is displayed in the SCRATCHPAD).

D. TASK SHARING

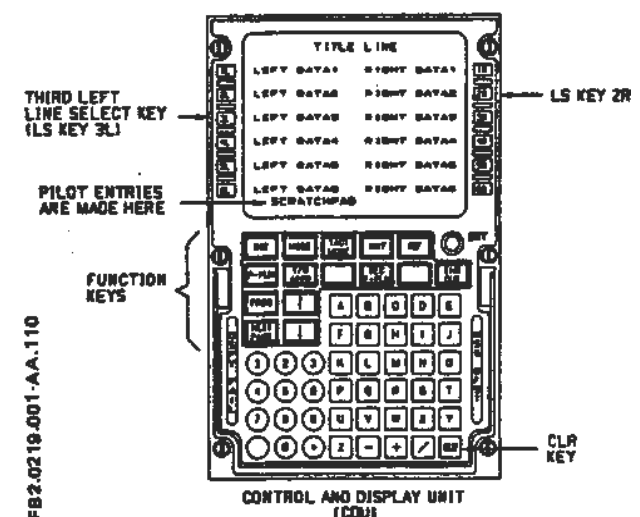
- AP in CMD : PF makes the REVISIONS.
- AP NOT in CMD : PNF makes the REVISIONS.

E. SPECIFIC VOCABULARY

WRITE/INSERT = BASIC PILOT DATA ENTRY PROCEDURE

WRITE = TO TYPE A TEXT ON THE KEYBOARD. THIS TEXT IS DISPLAYED IN SCRATCHPAD.

INSERT = TO TRANSFER THIS TEXT FROM THE SCRATCHPAD TO A DATA FIELD (AND SO TO FMC'S) by pressing the LS key adjacent to this DATA FIELD.

F. CDU ARCHITECTURE


In the following procedures, the place where crew actions are to be performed on the CDU screen will be preceded by the name of the concerned datafield followed by the side and the line number.

Procedures & Techniques**0 – General Recommendations****SID AND STAR**

NAV should not be used to fly a SID or STAR which has been manually built. Furthermore, it is not recommended to build a SID/STAR manually. SID's and STAR'S use specific legs such as DME arcs, VOR radial interceptions, conditional altitude legs which cannot be manually constructed. Only DIRECT TO legs may be manually constructed. Therefore if NAV is engaged to fly a SID or a STAR manually constructed, the A/C will be controlled on direct to legs instead of the legs to be flown.

LEAVING THE LATERAL FLIGHT PLAN

It is not recommended to keep PROFILE if NAV is disengaged to leave the lateral F. PLN, especially during climb, approach and go-around. This is because altitude constraints, generally linked to waypoints, will be matched in the corresponding leg even if these waypoints are not overflowed.

ALTITUDE CONSTRAINTS

Altitude constraints are coded in the DATABASE and linked to waypoints only. They are provided for advisory and for an optimal flight path construction only. THERE ARE NO MINIMUM EN ROUTE ALTITUDE AND NO SAFE ALTITUDE CODES IN THE DATABASE. THEY REMAIN PILOT RESPONSIBILITY.

On ground, raising the FCU altitude above the altitude constraints has no effect on them. When the A/C is airborne in Descent phase and FCU altitude is lowered below the altitude constraints, they remain valid. When the A/C is airborne in Climb phase and FCU altitude is raised above the altitude constraints, they are canceled and replaced by altitude predictions on the CDU.

F-PLN DISCONTINUITIES

Always check that there are no forthcoming discontinuities in the f-PLN. AP disengages as soon as A/C enters a discontinuity. Especially for go-around, NAV and PROF should not be reengaged without a F-PLN checking. A special case is made for a discontinuity following a manual terminated leg. This discontinuity can be cleared only by making a DIRECT TO any WAYPOINT following the leg.

Before performing a F-PLN lateral revision causing a F-PLN DISCONTINUITY, PROFILE should be disengaged in order to avoid the computation of a wrong vertical F-PLN. PROFILE can be reengaged after the F-PLN DISCONTINUITY is cleared.

SPEED CONSTRAINTS AT PROC T

A speed constraint should be inserted at the last waypoint before the turn, otherwise the FMS may enter a PROC T without deceleration and thus overshoot ICAO and/or comfort limits. Consider deceleration using airbrakes to conform to these limits.

PROFILE DISENGAGEMENT

It is recommended to disengage PROFILE by pulling the speed/mach knob on the FCU. The speed window is automatically synchronized and the AFS reverts to LEVEL CHANGE mode.

This procedure should not be used during RNAV approaches because final RNAV approaches must be performed in V/S mode. In this special case PROF should be disengaged by pressing the PROF push-button within 10 sec after dialing VAPP. AFS reverts in V/S mode with V/S automatically synchronized on present vertical speed.

It must be done before G/S interception during ILS approaches.

NAV DISENGAGEMENT

It is recommended to disengage NAV by pulling the HDG SEL knob on the FCU. Pushing the HDG SEL knob will synchronize the FCU heading on actual heading. The AFS reverts to HDG SEL mode.

SPEED TACTICAL MODE

Whenever the crew wants to fly at a specific speed, it is better to do it with the SPD TACT MODE than leaving PROF and using FCU. Thus the vertical guidance is kept. This recommendation is not valid for descent where TACT SPD use would induce a misleading descent path recomputation.

If a specific speed has to be used, it should be done through A/P.

The cost index should NEVER be changed during flight to change A/C speed.

Procedures & Techniques
0 – General Recommendations
REVERTING TO A DEFAULTED VALUE

When a defaulted value has been manually changed, it may be recovered by clearing the manual entry (press the CLR key and the corresponding line select key).

NAV ACCURACY AND EFIS ND

FMC 1 and FMC 2 computes their positions independently with a cross comparison. Each one uses IRS data to compute an INERTIAL position. Whenever it is possible each FMC updates its position with a DME/DME signal or, if not possible, with a VOR/DME signal. This is called RADIO UPDATING which is made automatically when the VOR/NAV/ILS switch is set on NAV or ILS. It takes up to 2 1/2 minutes for FMCs to get a position accuracy of less than 0.3 NM when a DME/DME signal is available if its initial accuracy was low (more than 1 Nm).

The navigation accuracy class is called INERTIAL (I) when there is no radio updating and is called RADIO/INERTIAL (R/I) when there is a radio updating. Accuracy class I or R/I is displayed on PROGRESS page. I is good for en route while R/I is needed in terminal area and approach. Each FMC has 2 purposes : guidance through AP/FD and display of navigation data on ND MAP mode. Each FMC drives its on side AP/FD and ND MAP. Therefore guidance and display are reliable in terminal area only if the master FMC (onside the engaged AP) is in R/I mode.

ND MAP DISPLAY MAY BE VERY MISLEADING IF THE ONSIDE FMC IS IN INERTIAL MODE In approach whatever is the navigation accuracy class of FMCs both ND's may be used in MAP mode. Guidance (NAV and PROF) may be kept whatever is the accuracy but if it is I a crosscheck between bearing/distance from a VOR/DME remotely tuned from the CDU which is displayed on DDRMI compared with BRG/DIST TO the same NAVAID on PROGRESS page is required. A non ILS approach with NAV + PROF engaged must not be performed if the nav accuracy class is I. For a non ILS approach PF ND must be used in ROSE or ARC whatever is the accuracy class.

Messages related to navigation :

- When the NAV accuracy class has been I for more than 10 mn en route or 2 mn in terminal area the message IRS ONLY NAVIGATION is displayed. It is also systematically displayed at the top of descent if the accuracy is I.
- If no IRS is available in NAV mode, the FMCs use only radio instruments for position fixing and the message RADIO ONLY NAVIGATION is displayed. If neither radio nor IRS navigation is possible, the FMCs use a dead reckoning mode and the message DEAD RECKONING NAV is displayed.
- The message INDEPENDENT OPERATION is displayed if one of following conditions exists :
 - a difference greater than 5 NM is detected between A/C position calculated by FMC1 and FMC2.
 - the leg switching in the two FMC is not the same.
 - there is a FCU problem.

If INDEPENDENT OPERATION message is displayed, apply this procedure:

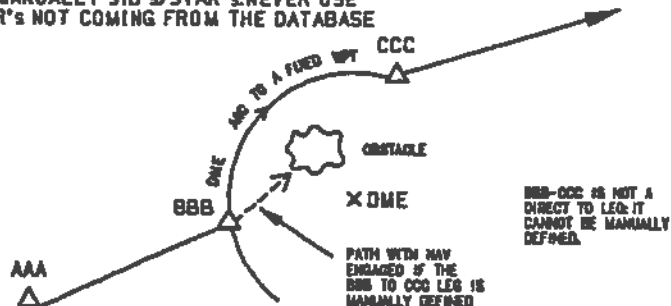
- in some cases PLEASE WAIT message appears a few seconds after INDEPENDENT OPERATION. This means that the FMS tries to come back to dual operation. This message sequence can occur several times ; as long as these two messages are displayed (one after the other) DON'T MAKE ANY ACTION.
- As soon as INDEPENDENT OPERATION is permanently displayed, check F-PLN display on CDU and A/C position given by each FMC with available radio navigation systems.
- Select the AP on the side where the FMC is good.
- In terminal area : select ARC or ROSE mode on the side where the FMC is not accurate.
- The message VERIFY A/C POSITION is displayed if a difference greater than 12 NM is detected between average IRS position (computed by a FMC) and the Radio/Inertial position (computed by the same FMC)

When this message occurs :

- Crosscheck A/C position given by each FMC with other navigation aids.
- If both FMC are good : NO ACTION
- If one FMC is not accurate, couple the AP to the other FMC.
- In terminal area: select ARC or ROSE mode or the side where the FMC is not accurate.

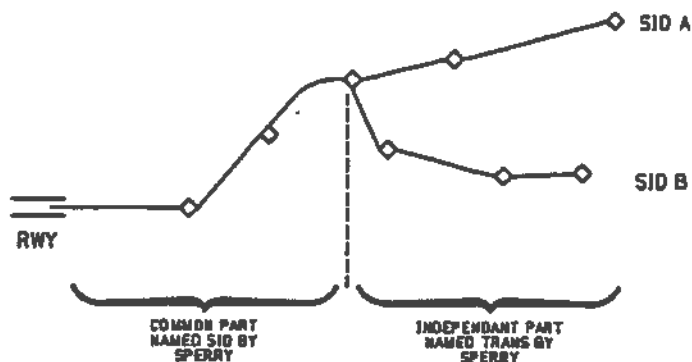
Note : In IRS only navigation this message will not occur as no R/I position is calculated by FMS.

- DO NOT CONSTRUCT MANUALLY SID'S/STAR'S. NEVER USE NAV TO FLY SID'S/STAR'S NOT COMING FROM THE DATABASE

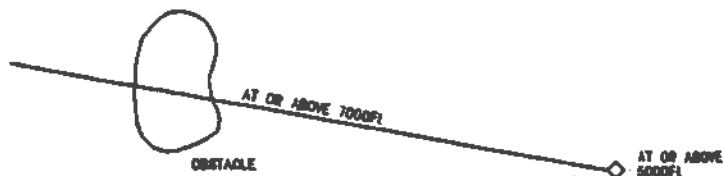


- IT MAY BE NECESSARY TO SELECT A TRANS AFTER A SID/STAR EVEN IF NO TRANS IS MENTIONED IN NAV DOCUMENTS

SID : COMMON PART WITH OTHER SIDS (SAME RWY)+TRANS (INDEPENDANT PART)
STAR : COMMON PART WITH OTHER STARS (SAME RWY)+TRANS (INDEPENDANT PART)



- TAKE CARE OF THE FCU SETTING FOR ALTITUDE CONSTRAINED LEGS.



ONLY THE WAYPOINT CONSTRAINT (5000ft) CAN BE CODED IN THE DATABASE. FCU SHOULD BE SET AT 7000ft TO FLY THE LEG.

Procedures & Techniques
1 – Before Take Off
1A DURING COCKPIT PREPARATION

DATA BASE VALIDITY.....CHECK ON STATUS PAGE

This page is automatically displayed at power on
PERF FACTOR.....CHECK

This value must not be changed by the crew. If it is not zero,
be sure that the value displayed has been set by authorized
people.

VOR/NAV/ILS switch.....SET TO NAV
Autotune functions are activated

INIT A : FMC INITIALIZATION

INIT KEY.....PRESS TO DISPLAY INIT A

COMPANY ROUTE INITIALIZATION

CO RTE/FLT (1L).....WRITE/INSERT

Cost Index and CRZ FL are normally stored with CO RTE
in DATA BASE and thus are automatically displayed. If
not they should be inserted.

AIRPORT PAIR INITIALIZATION

ORIGIN/DESTINATION (1R).....WRITE/INSERT

As soon as the origin/destination is inserted the RTE
SELECTION page is displayed.

First case : there are several routes stored in the DATA BASE
between the given airport pair. The first one is displayed on
the RTE SELECTION page. Others may be displayed by
pressing NEXT key.

* INSERT prompt.....PRESS to select the route
displayed on RTE SEL page

Second case : there is no route (NONE is displayed) on RTE
SELECTION page or pilot doesn't want to select the
proposed routes.

RETURN > prompt.....PRESS

It will be necessary to construct the ROUTE waypoint by
waypoint on the F-PLN page. In this case Cost Index and
CRZ FL are not given with ORIGIN/DESTINATION and
thus should be inserted.

ALTERNATE

ALTERNATE (2R).....CHECK or WRITE/INSERT

Alternate is normally stored in the data base with the
destination.

ALTN key (2R) PRESS to display the ALTN RTE
on RTE SELECTION PAGE

If there is no ALTN route NONE is displayed. It should be
constructed waypoint by waypoint on F-PLN page.

* INSERT prompt.....PRESS to select the
ALTN RTE displayed

DEPARTURE COORDINATES

LAT/LONG (3L, 3R).....CHECK

If the A/C is at a gate with published coordinates, these
may be used to update the airfield coordinates provided
automatically on INIT page A. If the gate coordinates are
not published, airfield coordinates will be used for IRS
alignment. To change coordinates, use the slew keys to
increase or decrease the displayed value.

Check that LAT/LONG values match airport reference
coordinate given by airport chart.

COST INDEX (4L).....CHECK or WRITE/INSERT

If there is a COST INDEX given by DATABASE with the
CO RTE, it should not be changed as it defines the airline
cost policy for this route.

If no COST INDEX is given by DATA BASE use the one
given by the airline.

If no COST INDEX is inserted, there won't be any
prediction for the ECON strategic mode and a message will
be displayed at engine start

IRS ALIGNMENT

When entering the cockpit, MSU's should have been OFF. If
not, set them OFF more than 10 sec and back to NAV, to
erase the displayed coordinates on ISDU.

ALIGN IRS prompt (4R).....PRESS

LAT/LONG are sent to IRS

ALIGN IRS prompt is displayed only if LAT/LONG is
filled and one MSU is set to NAV.

ISDU.....CHECK that valid coordinates
have been sent

CRZ DATA

CRZ FL.....CHECK or INSERT and CHANGE

Normally it is given with CO RTE. CRZ FL is not limited by
MAX ALT computed at weight entry.

CRZ TEMP.....CHANGE if necessary
defaulted to ISA at CRZ FL CRZ WIND

DIRECTION/VELOCITY WRITE/INSERT

Wind at departure will be inserted on F-PLN page B.

Procedures & Techniques
1 – Before Take Off
F-PLN : REVISION AND CHECKING

F-PLNPRESS to display F-PLN page A
RWY/SID is normally stored in the DATABASE with the CO RTE and thus is automatically inserted in the F-PLN. If not it should be inserted as described here under.

STANDARD INSTRUMENT DEPARTURE (SID)

AIRPORT key (1L)PRESS to display
LATERAL REVISION page
SID > prompt.....PRESS to display SID page
RWY to be selected.....PRESS to select

The SIDs menu is modified to allow only the SIDs corresponding to the selected RWY.

SID to be selected.....PRESS to select

The SID may be selected before the runway but it is less efficient as the runway given by ATC may not be compatible to the selected SID.

TRANS (if any).....PRESS to select

TRANS has not the same meaning for SPERRY as for navigation documents. Therefore it may be necessary to select a TRANS while documents don't mention any transition.

EOSID (if any).....automatically selected

* INSERT prompt.....PRESS to insert
RWY/SID/TRANS in the F-PLN

Notes : RWY/S/D insertion may be delayed until TAXI if they are not yet known.

- RWY or SID may be changed by pressing the adjacent Is key or cleared by using the CLR key.
- If a new RWY is selected and is not compatible with the selected SID, this SID and the corresponding TRANS are cleared,
- considering a string of legs with altitude restrictions and terminated without fixed waypoints : if the first altitude is cleared then all the following legs will be cleared until the first fixed waypoint is encountered.
- the discontinuity following a manual terminated leg may be cleared only in flight by activating a DIRECT TO any following fixed waypoint.

CAUTION

- RWY ENTRY IS MANDATORY FOR THE FMS TO UPDATE ITS NAVIGATION REFERENCES ON RWY THRESHOLD AT TAKE OFF WHEN THE GO-LEVERS ARE PRESSED. - NAV MODE SHOULD NOT BE ENGAGED TO FLY A SID MANUALLY CONSTRUCTED AS IT USES SPECIFIC LEGS WHICH CANNOT BE MANUALLY DEFINED (E.G. VOR RADIAL OR ALTITUDE INTERCEPTIONS OR DME ARC FOR INSTANCE)

STANDARD ARRIVAL PROCEDURE (STAR)

STAR/APPROACH may be stored in the DATA BASE with the CO RTE and thus is automatically inserted in the F-PLN. If not it should be inserted as described in the DESCENT PREPARATION paragraph.

OTHER LATERAL REVISIONS (if necessary)

see CRUISE paragraph

F-PLN CHECKING and VERTICAL REVISIONS

ND PLAN MODE.....SELECT
SLEW KEYSPRESS

The F-PLN is slewed on F-PLN page A or B and on ND PLAN mode.

CONSTRAINTS if any.....CHECK each SPEED and ALTITUDE constraint

Final approach outer marker and destination runway are constrained by dummy altitude constraints. These constraints are inserted by DATA BASE in order to prevent the A/C from going below these constraints if PROFILE is not disengaged or if FINAL APPROACH prompt is not pressed (see APPROACH paragraph).

PROC T (if any).....WRITE/INSERT a speed constraint at the waypoint at beginning of PROC T.

HOLDING (one round) if any.....DELETE if not necessary

This leg is written on two CDU line and is not a classical holding with manual termination. It is just an arrival procedure as PROCT inserted in the DATA BASE and flown as a holding by the FMS. If it is not deleted insert a speed constraint as for PROC T.

NEXT KEY.....PRESS to display F-PLN page B

SLEW KEYS PRESS to check course and distance for each leg.

Versus compagny flight log or navigation chart

WIND DIR/VELOCITY at origin WRITE/INSERT
in line 1R

SPECIFIC SPEED TO BE FLOWN AFTER TAKE OFF

The usual target speed after take off is 250 kt (speed limit). It is possible to change it when a 180° turn has to be flown at green dot for instance, or for any other reason.

TACT MODE key.....PRESS

SPEED to be flown.....WRITE/INSERT in 4L

SPEED LS key (4L).....PRESS to activate
TACT SPD MODE

This procedure will allow the use of profile mode at the beginning of climb rather than using the FCU speed knob.

1B WHEN THE CREW GETS THE LOAD SHEET**INIT B : WEIGHT ENTRIES**

INIT KEY.....PRESS to display INIT page A
NEXT KEY.....PRESS to display INIT page B

ZFW (zero fuel weight) and ZFWCG

(ZFW center of gravity) must be known by the FMS in order to initialize the CGCC (center of gravity control computer).

For that purpose ZFW may be directly inserted (in this case BLOCK entry is not mandatory). But it may also be computed by the FMS if TOGW and BLOCK are entered.

ZFW or TOGW.....WRITE/INSERT

ZFWCG.....WRITE/INSERT

Taxi fuel is defaulted according to the airline policy. It may be changed.

FUEL PLANNING ON INIT B only if needed before engine start

BLOCK.....WRITE/INSERT

TOGW is deduced by summing ZFW and BLOCK.
BLOCK is automatically replaced by FOB (fuel on board) at engine start and thus is needed only for fuel computations before engine start.

MAX FL and OPT FL.....CHECK

They are displayed just after BLOCK is inserted.

CRZ FL.....MAY BE CHANGED

1C ATENGINE START

FUEL PAGE.....DISPLAY/CHECK FOB/FF + FQ.

1D BEFORE PUSHBACK OR START
TAKE OFF DATA

TO/APP KEY.....PRESS to display TAKE OFF page
F, S, O speeds.....CHECK

CAUTION : In case of FMS « LAT ONLY » configuration, O,
S and F values are not valid. They must be
manually entered by the crew.

V1 (1L).....WRITE/INSERT

Vr (2L).....WRITE/INSERT

V2 (3L).....SELECT ON FCU KNOB

V2 is recopied from FCU to TAKE OFF page.

THR RED (2R).....CHECK/MAY BE CHANGED

Not lower than 1 500 ft AGL

ACCEL ALT (3R)CHECK/CHANGE if noise abatement
is not required

Not lower than THR RED

TO SHIFT LS KEY (1R).....PRESS SELECT prompt
if take off is initiated at about 1000 m away from the
runway threshold

Pressing this key inserts a 970 m shift from RWY
threshold.

1E TAXI

ALT KNOB (FCU)....SELECT FIRST CLEARED ALTITUDE

PNF.....CHECK/INSERT SID

PAGE SELECTION ON CPU

PF.....F-PLN page A

PNFTAKE OFF page or F-PLN page for revisions

EFIS SELECTION

PF.....MAP mode

If a VOR radial is to be followed PF may select ROSE or
ARC

PNF.....MAP mode

IF NAV MODE IS USED

PROFILE on FCU.....ARM/CHECK FMA

NAV on FCU.....ARM/CHECK FMA

NAV should not be used at take off if the SID to be flown
is not defined in the DATABASE.

THRUST SELECTION ON TRP

FLX TO TEMP.....SELECT ON TRP

If a high temperature leads to FLX TO thrust lower
than the CL thrust the FMS will gradually increase
thrust from the FLX TO thrust to reach the CL thrust
before 20.000 ft. So do not hesitate to use FLX TO and
PROFILE mode at take off.

Procedures & Techniques**2 – Take Off****2A WHEN READY FOR TAKE OFF**

GO LEVERS.....PRESS

The FMS updates its navigational reference on runway threshold coordinates.

FMS NAV UPDATING.....CHECK ON ND A/C
SYMBOL ON RWY THRESHOLD

If GO-LEVERS have been pressed before runway threshold, press go levers again on runway threshold ; the FMS will resynchronize its position on RWY threshold coordinates.

AP/FD.....USE IT as described in USE OF AFS
subchapter up to 30 ft for lateral guidance and
up to THR RED for vertical guidance.

2B AT 30 FT

AP 1 or 2.....ENGAGE
if AP 1 is engaged FMS 1
will be the master, if AP 2 is engaged FMS 2
will be the master

NAV ENGAGEMENT.....CHECK ON FMA

From this moment the lateral navigation is controlled by the FMS through AP/FD.

2C AT THRUST REDUCTION ALTITUDE

Profile is automatically engaged. From this moment vertical navigation and thrust are controlled by the FMS through AP/FD and ATS. Speed window is dashed. Target speed is actual speed.

P. THR/P. CLB ENGAGEMENT.....CHECK ON FMA
AUTO and CL ENGAGEMENT.....CHECK ON TRP

If CLB thrust is higher than FLX TO thrust, the latter is increased slowly to reach CLB thrust before 20000ft.

2D AT ACCEL ALT

TGT SPD..... CHECK IT IS SPD LIM OR TACTICAL SPD

If a TACTICAL SPD has been activated and is greater than the SPD LIM, the message SPD LIM EXCEEDED will be displayed, when the A/C speed overshoots the SPD LIM. It is possible to change the SPD LIM and the corresponding altitude on VERT REV page A.

BARO.....SET TO STANDARD once the highest ALT constraint of the SID has been passed.

The FMS controls the A/C altitude at the value given by the baro. If the baro setting is standard when passing an altitude constraint which is 7 000 ft QNH for instance, it will be passed at FL 70 and not at 7 000 ft QNH.

CONSTRAINTS.....MONITOR THE FMS GUIDANCE

Procedures & Techniques
3 – Climb

A typical vertical path including most of the events which may be encountered is presented. FMS use according to usual ATC clearances is also presented. The SPD TACT mode may be used throughout the climb to control the A/C speed.

3A WHEN INITIAL CLIMB SPEED IS REACHED

PF.....KEEP F-PLN page A
PNF.....SELECT PROGRESS page
AP in CMD : F-PLN revisions are performed by PF
AP not CMD : F-PLN revisions are performed by PNF

3B AT FCU ALT (7000 FT)

A/C levels off. P.SPD/P. ALT are engaged in lieu of P. THR/P. CLB. Predictions are made assuming an immediate return to climb.

3C CLIMB TO FL 200

Clearance for FL 200 is given by ATC. Two positive actions are required to leave FCU ALT.
FCU ALT KNOB.....TURN TO SELECT 20 000 FT
FCU ALT KNOB.....PULL TO INITIATE CLIMB.
P. SPD/P. ALT revert to P. THR/P. CLB.

MAX CLIMB TACT MODE

Expedite reaching FL 200 is requested by ATC
TACT MODE key.....PRESS to display TACT MODE
PAGE

Predictions (time, distance) to FL 200 for MAX CLB mode are displayed after 15 sec.

MAX CLB (3L)PRESS to activate maxi climb mode.

- Max climb is a max angle of climb mode.
- It is performed at green dot. FMS green dot (target speed on PFD) and FAC green dot (0 on PFD) may be slightly different. A/C will climb at the highest. Predictions are made with FMS target speed.
- Max climb mode is active until next level off.
- Max climb is replaced by the selected strategic mode when the level off is reached.

3D CLIMB FROM FL 200 TO FL 290

Clearance to FL 290 is given before reaching FL 200.
FCU ALT KNOB.....TURN TO SELECT 29 000 FT
Here pulling is not needed as A/C is not at FCU ALT.

USE OF PD POINTS

During climb, you are requested to be above FL 260 10 NM before MPR. A PD (Place Distance) point may be inserted then constrained as follows :

MPR/-10.....WRITE on F-PLN page
MPR LS key.....PRESS to insert PD

PD 01 waypoint is created and displayed before MPR. Its insertion must be made by pressing MPR LS key and not the above Is key (AFRIC) as it would have been made for a classical waypoint.

/+ 260.....WRITE/INSERT by pressing the right LS key next to PD 01.

PD 01 is now constrained by an AT OR ABOVE FL 260 constraint.

If this constraint cannot be matched in the present active mode, the message ALT ERROR AT PD 01 - XXX will be displayed, - XXX meaning that A/C will be at 26 000 - XXX ft at PD 01. Moreover an amber FCU level off symbol is displayed on the ND's. MAX CLB tactical mode should be selected in this case.

TURBULENCE

The SPD TACT MODE should be used with a double speed/mach entry:

285/.78 (4L).....WRITE/INSERT
LS KEY 4L.....PRESS to activate

TRANSITION IAS/MACH ALTITUDE

The optimum mach according to the active mode is targeted then held.

CRZ FL CHANGE DURING CLIMB
Increasing CRZ FL :

FCU ALT KNOB.....TURN

The CRZ ALT is automatically changed in the F-PLN. Check it on PROGRESS. The message NEW CRZ ALT is displayed.

Decreasing CRZ FL :

CRZ FL.....CHANGE on PROGRESS
FCU ALT KNOB.....TURN

Procedures & Techniques
4 – Cruise
4A REACHING CRZ FL

A/C levels off.

MAX CRZ thrust is automatically selected inside FMS.
A/C CRZ ALT is held by FMS within a ± 50 FT margin in order to avoid throttle activity. It is cost efficient, so PROF should be used whenever it is possible.

PF.....F-PLN page

PNF.....PROGRESS page

AP in CMD, revisions are made by PF

AP not in CMD, revisions are made by PNF

If a TIME constraint has been inserted in the F-PLN at a downward waypoint, and if this constraint cannot be matched in the present strategic mode, the FMS will order a speed increase or decrease during cruise phase only. In this case CSTR is displayed on the left of PROGRESS page title line.

All following procedures are optional and to be performed only if needed according to cruise conditions.

4B STEP
STEP CLIMB AT OPTIMUM

Assuming that optimum flight level (here 310) is higher than present CRZ FL (comparison may be made on PROGRESS), you may get step predictions (time, distance to the step point) on STEP PRED page as to make a step climb request to ATC

LS KEY 1 R (FROM WPT).....PRESS to display
VERT REV page at FROM WPT

STEP PRED > prompt.....PRESS to display
STEP PRED page at OPTIMUM POINT

STEP FL (1 L) here OPT FL.....WRITE/INSERT
An other FL may be inserted.

WIND AT STEP FL (3L).....WRITE/INSERT
If no wind is inserted, the FMS will use its own computed wind.

AN optimum step point is computed.

TIME/DISTANCE TO STEP POINT.....READ

FUEL/TIME SAVINGS/LOSSES.....READ

These predictions are given for an optimum step since step pred page was accessed from the FROM WPT.

STEP CLIMB AT A GIVEN WAYPOINT

Clearance for FL 310 is given by ATC only after passing STP.

STP RIGHT LS KEY.....PRESS to display
VERT REV page at STP

STEP PRED > prompt.....PRESS to display
STEP PRED page AT STP

STEP FL here 310.....WRITE/INSERT

Other actions and informations are similar to STEP AT OPTIMUM POINT.

STEP CLIMB INSERTION/CONFIRMATION

Your step request is accepted by ATC

* INSERT prompt on STEP page.....PRESS

FCU ALT KNOB.....TURN to select 31 000 FT

FCU ALT KNOB.....PULL

P. CLB ARMED.....CHECK ON FMA

IMM CLB prompt on CDU (1 R).....CHECK

- The A/C will stay at present CRZ FL until step point is reached.
- At step point, a climb will be initiated without any pilot action.
- P. CLB blue on FMA will flash 30 sec before reaching the step point to advise that an altitude change will be initiated without any pilot action.
- If the crew doesn't want to wait until the step point for climbing IMM CLB prompt should be pressed : an immediate climb is initiated.
- If the FCU is not dialed at the step point the step is removed.
- If the FCU ALT is below the STEP FL, the step will be performed at the FCU ALT.

A step of less than 5 min is not accepted.

STEP DESCENT

Same operations as for step climb. STEP FL must be higher than the highest altitude constraint.

IMMEDIATE STEP CLIMB WITHOUT PREDICTIONS

It is also possible to perform a step in the easier following way (without accessing STEP PRED page).

FCU ALT KNOB.....TURN/PULL

CRZ ALT is automatically changed. A message NEW CRZ ALT is displayed. Flight predictions are restarted.

Procedures & Techniques
4 – Cruise
**4C USE OF « DIR TO » FUNCTION AND
« AIRWAY » PAGE**

When passing PONZA (PNZ), ATC asks to fly directly to TEANO (TEA) then to join BRINDISI (BRD) by the UA 14 AIRWAY.

This lateral revision will be done by using the « DIR TO » page then the « AIRWAY » page.

DIR TO WAYPOINT INSERTION :

DIR key.....PRESS
TEA.....WRITE/INSERT IN LINE 1L

The display then returns to the F-PLN page with TEA waypoint inserted and a discontinuity between TEA and the « TO » waypoint of the original F-PLN.

Note : If the DIR TO waypoint is a waypoint belonging to the original F-PLN, it can a/so be entered by simply pressing the left LS key beside the desired DIR TO waypoint (on the DIR TO page). In this case no F-PLN DISCONTINUITY will be inserted into the F-PLN.

All waypoints of the F-PLN can be viewed on the DIR TO page by using slewing.

As soon as the DIR TO waypoint is inserted, an immediate turn manoeuvre is initiated.

AIRWAY INSERTION FROM TEA TO BRD

Access AIRWAY page via LATERAL REVISION page at TEA:

- LS KEY 2 L.....PRESS TO DISPLAY
(next to TEA) « LAT REV FROM TEA » page
- LS KEY 2 L.....PRESS TO DISPLAY
(next to AIRWAY) « AIRWAY » page
- LS KEY 2 L.....PRESS TO VIEW THE
(next to UA 14) UA 14 AIRWAY

UA 14 AIRWAY is displayed with all the waypoints which belong to this airway.

Since we want to introduce the portion between TEA and BRD we have to :

LS KEY 4 L (next to BRD).....PRESS

The display returns to F-PLN page A with the portion of airway (from TEA to BRD) inserted into the F-PLN.

This new route will be followed by the A/C through NAV mode.

**4D SELECTION OF AN OTHER MODE
(STRATEGIC OR TACTICAL)**

If a segment with MIN FUEL mode appears necessary to fulfil the required fuel reserve :

MODE KEY ON CDU.....PRESS
LS KEY 3L (next to MIN FUEL).....PRESS TO
ACTIVATE MIN FUEL MODE

Note : This mode being a STRATEGIC mode, it will be active for the whole remaining flight, unless another mode is selected.

Procedures & Techniques
5 – Descent Preparation
**5A AT 100 NM AT LEAST BEFORE TOP OF
DESCENT**
DESCENT WIND PROFILE INSERTION

This should be made early enough to be sure that the recomputed T/D according to descent wind insertion will be still ahead the present position. This is especially true in case of an increasing tail wind or decreasing head wind insertion where the recomputed T/D will be moved backwards.

DES FORECAST > prompt on PROGRESS.....PRESS
to display DES FORECAST page

Forecasts are for instance

- 290°/80 KT at FL 290
- 290°/70KT at FL150
- 270°/50 KT at FL 80
- 250°/30 KT at destination

They may be entered as follows :

290/290/80.....WRITE/INSERT in 2L
150/290/70.....WRITE/INSERT in 3L
80/270/50.....WRITE/INSERT in 4L
250/30.....WRITE/INSERT in 5L

if no wind is inserted, wind is computed by an interpolation between CRZ wind and no wind at destination according to FMS wind models.

Temperature at destination has not a great influence on T/D computation and therefore is not requested.

STAR/APPROACH INSERTION

It may be automatically inserted in the F-PLN when it is stored with CO RTE in the DATABASE. If not it should be manually inserted as follows :

From the last en route waypoint to the destination we find the :

- en route transition called TRANS (if any)
- STAR
- approach transition called APPR TRANS
- approach (ILS, VOR, RNAV) which includes the RWY.

En route transitions stored in the DATABASE don't have the same meaning as those of official documentation. The common part of several STARS defined in official documents is called STAR by SPERRY, the independent part of the STAR being the so called TRANS. Therefore it may be necessary to select a TRANS to build completely a STAR while there is no TRANS actually defined in official documents.

If a point of the STAR to be flown belongs to the flight plan, the STAR should be built from this point. In this case it will be strung without any discontinuity. Here this common point is KOR as KOR 1E will be the selected STAR.

If KOR is not the last en route waypoint all the waypoints after KOR in the F-PLN are deleted.

KOR left LS key (3 L).....PRESS to display LAT REV
at KOR

STAR > prompt on LAT REV.....PRESS to display
STAR page

APPROACH.....PRESS to select here ILS 33 R

Only STAR'S being compatible with the selected approach are listed.

STAR.....PRESS to select here KOR 1E (4L).

- It is possible to select first the STAR then one of the compatible approaches. Yet, it is less efficient as it will not be certain that the approach given by ATC will be compatible to the STAR first selected.

- TRANS (en route) compatible to the selected STAR are listed.

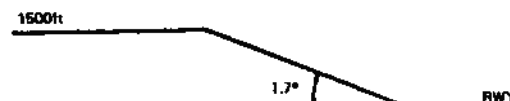
TRANS (if any).....PRESS to select
NONE is displayed when there is no TRANS.

* INSERT prompt.....PRESS

When there is only one APPR TRANS compatible with the selected approach, it is automatically selected and the whole TRANS/STAR/APPR TRANS/APPROACH is inserted in the F-PLN. Otherwise the APPR TRANS page is displayed with a menu of APPR TRANS :

APPR TRANS (if any).....PRESS to select

If no STAR has been inserted in the F-PLN, the defaulted approach computed by the FMS consists of a level off at 1500 ft followed by a 1,7° path angle descent to the runway.



Procedures & Techniques**5 – Descent Preparation****5B WHEN DESCENT CLEARANCE IS GIVEN
BY ATC**

Clearance is given for 2 000 FT.

FCU ALT KNOB.....TURN to select 2 000FT
FCU ALT KNOB.....PULL
P. THR/P. DES ARMED.....CHECK FMA
IMM DES prompt on CDU (1 R).....DISPLAYED

The FMS will hold the CRZ FL until the top of descent. 30 sec before reaching the T/D, P. DES will flash to indicate that the descent will be initiated without any further pilot action.

The descent may be initiated immediately (before reaching T/D) by pressing IMM DES prompt on CDU (F-PLN or PROGRESS line 1R). In this case the descent will be performed at 1 000 FT min (value which can be changed on CDU) until the precomputed path is reached.

**5C IF DESCENT CLEARANCE IS NOT YET GIVEN BY ATC
AT T/D**

When passing the T/D the A/C holds the CRZ ALT as the FCU has not yet been lowered. DECEL prompt is displayed in line 1 R. Pressing this prompt makes the A/C reduce speed to green dot (highest value between FAC and FMS if they are different). As soon as clearance is given by ATC, turn and pull FCU ALT knob. In order to recapture the computed descent path from above, the A/C will initiate a descent:

- at target speed + 20 kt or 290 kt which ever is greater, upper limited by 340 kt, MMO or VMO - 10kt which ever is lower above 10000 ft.
- at target speed + 20 kt or 250 kt which ever is lower below 10000ft.

Procedures & Techniques
6 – Descent
6A REPRESSURIZATION SEGMENT if any

If a repressurization segment is required, it is computed by the FMS assuming a 300 ft/min cabin rate of descent. A message REPR XXX NM BFR T/D is displayed (repressurization XXX nautical miles before the top of descent).

In our exemple XXX is 20 NM. When reaching this distance:

IMM DES prompt on CDU (1R).....PRESS
P. DES ENGAGEMENT.....CHECK ON FMA

Descent is initiated at 1 000 ft/min (this value may be changed manually on CDU Line 1R). Computations are restarted. An intercept point (I/P) is computed where the A/C will intercept the precomputed descent path and is displayed in the F-PLN on CDU.

An overspeed protection avoids VMO exceedance :

- . if A/C speed is above VMO-5kts :
- throttles are retarded to idle
- A/C speed is controlled at cruise Mach
- V/S is no more controlled. Nevertheless -1000 ft/mn or pilot entered vertical speed remains displayed on CDU F-PLN page.

**6B WHEN REACHING THE TOP OF DESCENT
(OR THE INTERCEPT POINT)**

The descent path is initiated without any pilot action.

P. THR/ P. DES ENGAGEMENT.....CHECK FMA
When full idle position is reached by throttles :

RETARD.....CHECK FMA

A vertical deviation scale is displayed on ND (in place of G/S scale) and the VDEV value is displayed on PROGRESS page in line 1 R. It indicates the eventual vertical distance between A/C position and the computed descent path.

VDEV.....MONITOR ON ND and on PROGRESS page
IF ANTI-ICE ONEXTEND HALF AIRBRAKES

6C IDLE DESCENT

RETARD is indicated on the FMA. The computed descend path is earth referenced. The A/C is controlled on the path with elevator and, until one of several conditions is met, there is no speed guidance performed by ATS (RETARD mode). The path has been computed in order to get a glide speed in accordance with the selected strategic MODE. Yet, the speed is monitored by the FMS and if for any reasons (unpredicted winds for instance) this speed doesn't stay in a margin, there will be the following FMS response :

- A/C speed : target speed + 20, or VMAX - 2 kt, MORE DRAG message flashes on PFD asking the pilot to extend airbrakes.

MORE DRAG FLASHES.....EXTEND HALF AIR BRAKES
(full if anti-ice on)

If the speed returns to target speed MORE DRAG disappears at target speed + 5

MORE DRAG DISAPPEARS.....RETRACT AIRBRAKES
(HALF if anti-ice on)

It may be necessary to keep air brakes extended to prevent the speed to increase again.

- A/C speed = target speed - 20 or green dot -10 which ever is the highest.

ATS reverts in P. SPD to increase thrust. If airbrakes have been extended, there is the LESS DRAG message displayed on CDU (not on PFD) instead of P. SPD reversion. If it is not sufficient there is then a P. SPD reversion.

6D P. SPD DESCENT

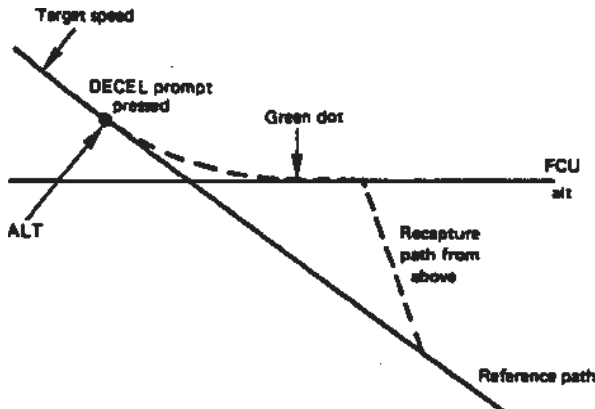
There is a P. SPD reversion each time the following conditions occurs:

- A/C speed falls below target - 20 or green dot -10
 - A constraint (speed or altitude) is encountered. Usually it is the SPD LIM (250 kt/10 000 ft).
 - During any F-PLN recomputation. After they are made, RETARD is recovered.
 - Another performance mode is selected.
- P.SPD is indicated on the FMA.

Usually there is a 10 degrees throttles forward motion and the speed is controlled around this thrust value. In P. SPD, MORE DRAG appears when A/C speed is target speed + 15 kt and it disappears when A/C speed returns below target + 2 kt.

Procedures & Techniques
6 – Descent
AT FCU ALT

As ALT * engages, a DECEL prompt is displayed on the F-PLN page. It must be pressed immediately in order to reach green dot so that the A/C will deviate slower from the descent path.


ALT CONSTRAINT

If the altitude of the constraint is reached before the constrained waypoint, the FMS orders a level off.

P.SPD/P. ALT ENGAGEMENT.....CHECK

If the constraint will not be matched an amber FCU level off symbol is displayed on the NO.

MAXIMUM DESCENT

If ATC asks you to make a quick descent until 7 000 ft for instance:

MAX DES MODE.....SELECT ON TACT MODE page

In this case the descent path is not followed anymore.

At 7 000 ft:

PREVIOUS MODE.....RESELECT

The A/C levels off to return back to the precomputed path.

STEEP VERTICAL SEGMENTS

Along steep vertical segments, predicted speed is computed assuming a minimum available deceleration rate of 10 kts per 1000ft of altitude change.

SPEED CONSTRAINT (250 KT/10 000 ft)

The reference path has been computed to meet the constraint. If this speed constraint is lower than the initial target speed (usually it is the SPD LIM), a decel point is computed (at about 12000 ft for the SPD LIM) and the deceleration is performed at - 1000 ft/min.

TGT SPEED.....CHECK IT SHIFTS
to speed constraint

Procedures & Techniques
7 – Holding

There are 3 kinds of HOLDING patterns which may be coded in the database. Only one, which is the classical holding with manual termination may be manually defined. They are :

- Holding up to an altitude (HA) encountered in SIDs, to climb up to an altitude to avoid obstacles. It is automatically exited by the FIX when the required altitude is reached.
- Holding with manual termination (HM), which purpose is to wait for ATC clearance to continue the descent. It is exited only with manual action. It may be either coded in the database (usually as an arrival procedure) or manually defined on the CDU. It is taken in account in the F-PLN only 3 mn before reaching the fix.
- Holding fix (HF), which purpose, as for procedure turn, is to link two legs with a too great turn angle. It is entered and flown by the FMS as manual holding but it is automatically exited at the second fix overfly. It is encountered in some STARS. It is taken in account in the whole F-PLN for predictions and T/D computation.

HA and HF are displayed on two lines of the CDU (fix identifier then HOLD) while HM is displayed on three lines (fix identifier, then HOLD, then fix identifier again).

Particular attention is required for HM and HF.

7A HOLDING MANUAL

It may be coded in the DATABASE with all its parameters. In this case DATABASE HOLD is displayed on the HOLD page title line. If it is not coded in the DATABASE it may be inserted manually. In this case all its parameters are defaulted and COMPUTED HOLD is displayed in title line. The defaulted parameters are present course, right turn, one minute, ICAO speed. In both cases, parameters may be manually changed on HOLD page, except speed which may be inserted on F-PLN. Here an example of a holding insertion at KOR WPT is described.

HOLD PAGE ACCESSING from F-PLN page

KOR left LS key (3 L).....PRESS
to display LAT REV page from KOR
HOLD > prompt (2 R).....PRESS
to display HOLD page
COMPUTED HOLD AT KOR is displayed and the parameters are defaulted.

HOLDING PARAMETER

INB CRS, TIME/DIST, TURN.....CHECK

They may be changed. In this case a «revert to COMPUTED» prompt is displayed in line 2R. Pressing this prompt reverts to the defaulted parameters.

HOLDING INSERTION

INSERT prompt.....PRESS

There is no F-PLN recomputation as the manual HOLDING is considered to be in the F-PLN only 3 min before reaching the holding fix.

3 MINUTES BEFORE REACHING THE FIX

The A/C decelerates to match the ICAO speed. If it was in descent it reverts to a 1 000 ft/mn rate of descent (P. SPD engages if RETARD was engaged). At the same time IMM EXIT command is available on F-PLN page 1R in line. Pressing this command makes the A/C to revert to its previous descent path.

A/C SPD.....MONITOR
AIRBRAKES.....EXTEND IF NECESSARY

TO LEAVE THE HOLDING

On F-PLN page

IMM EXIT * prompt (1 R).....PRESS

A DIRECT TO FIX (here KOR) is initiated and the A/C returns to the descent path. IMM EXIT is replaced by RESUME HOLD. Pressing RESUME HOLD, re-initiates the same holding pattern.

When a holding is entered, VERT DEV from the path is not displayed any more on the ND's. VERT DEV indication reappears as the A/C leaves the holding pattern and overflies the fix.

7B HOLDING FIX

It should be deleted if it is not needed depending on the arrival course.

As for manual holding :

A/C SPD.....MONITOR
AIRBRAKES.....EXTEND IF NECESSARY

Procedures & Techniques**9 – Performance****PURPOSE**

The following FMS performance charts allow to know in advance or to check in flight the different FMS speed/mach and altitude targets according to the cost index and flight parameters.

ACCURACY

The drawings of these charts give a speed accuracy better than 10 kt.

COST INDEX

The COST INDEX $CI = 60 \text{ kt/kf}$ where

kt = cost of one second of flight

kf = cost of one kilogram of fuel.

When $CI = 0$ the ECON strategic mode corresponds to a MIN FUEL mode. When $CI = 999$ (max value), the ECON strategic mode corresponds to a MIN TIME mode.

CHARTS

There are 8 charts :

- 1 - Optimum initial climb speed.
- 2 - Optimum final climb, cruise and initial descent mach.
- 3 - Optimum cruise altitude.
- 4 - Optimum descent speed.
- 5 - Maximum altitude.
- 6 - Maximum endurance speed (holding clean).
- 7 - Max slope climb speed (MAX CLIMB MODE).
- 8 - Flight envelope.

SPD/MACH targets

The FMS computes an optimum climb speed, descent speed and cruise mach.

During climb, when climb speed is equal to cruise mach, the latter becomes the target for the remaining climb segment, for the cruise and for the beginning of the descent until it is equal to the optimum descent speed.

LIMITATIONS

These charts don't always take care of the operational limitations but these limitations are taken in account by the FMS. These limitations are :

$V_{MAX} = 340 \text{ kt}$ (even if $V_{MO} = 360 \text{ kt}$)

$M_{MAX} = 0.82$

$H_{MAX} = 41\,000 \text{ ft}$ limited by the 1.2 g buffet margin

$V_{MIN} = MAX$ (GREEN DOT FAC, GREEN DOT FMS)

In addition the speed is limited by ICAO rules : 250 kt below 10 000 ft ICAO holding speeds.