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3 SUBJECT NOTEBOOK

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747-400

Takeoff

265 ⇐ V_{2F} - Minimum speed for 30° Bank when in clean configuration following takeoff.

UP ⇒ V_{FUP} - Flap retraction 1 to up (245)

1 ⇐ V_{F1} ⇒ Flap retraction 5 to 1 (225)

5 ⇐ V_{F5} ⇒ Flap retraction 10 to 5 (205)

Approach

238 V_{FL} & Clean manoeuvring speed

218 ~~V_{MA1}~~ & Flap 1 manoeuvring speed

198 $\leq V_{MA5}$ Flap 5 manoeuvring speed

178 $\leq V_{MA10}$ Flap 10 manoeuvring speed

168 $\geq V_{GA}$ & Go Around speed

148 $= V_{REF}$

Boeing molecatain – Takeoff

V_1 and V_R are displayed reflecting the FMC values inserted by the crew.

~~Set the command~~

V_1 is the speed at which an engine can fail and →

- Continue takeoff and reach 35 ft with available distance
- Discontinue the takeoff and stop within the available distance (based on dry runway but not on the use of reversing)

V_R (Rotation Speed the speed at which rotation to the initial climb ~~at~~ attitude should be started

V_2 : Three Engine climb speed the speed used for the initial climb following an engine failure on takeoff

The flaps speed bug schedule displayed on the PFD is based on additions to VREF. For takeoff the bug speeds are generated by the FMC based on the takeoff weight & VREF.

The Flap speed schedule is:

Flap UP	VREF 30 + 80
Flap 1	VREF 30 + 60
Flap 5	VREF 30 + 40
Flap 10	VREF 30 + 20.
Flap 20	VREF 30 + 10.
Flap 25	VREF 30 + 5
Flap 30	VREF 30.

These speed are defined as minimum maneuvering speed.

During flaps retraction, movement of the flap to the next position should be initiated when at or above the maneuvering speed.

To provide adequate buffet margin during the flap retraction the flap buffet is displayed on the PFD until one full flap retraction from takeoff

- the flap 10 BUG is the speed when the flaps are retracted from 20 to 10 when a flap 20 takeoff is made. This is shown as V_{F10} on the takeoff data card.

- the flap 5 bug is the speed when flaps are retracted from flaps 10 to 5, this is shown as V_{F5} on the takeoff data card.

- Flap retraction from 5 to 1 and from 1 to up is completed as the flaps 1 and flap UP bug speed is attained. These speeds are displayed on the takeoff data card as V_{F1} and V_{FUP}

To provide full maneuvering capability a speed of V_{FUP} + 20 is maintained this is the speed used to determine minimum transition climb speed as displayed by the FMC. This speed will be indicated

as V_{2+} on the takeoff card.
Bank angle must be limited to 15° of Bank
if speed is between flap up bug and
V_{2+}. This restriction will be reflected
in flight director commands

A Takeoff Data Card is provide in case FMC
fail
It should be reviewed with pre-takeoff flight
Briefing

Busy indications – Approach

Minimum flap maneuvering speed are displayed for the current and the next lower flap setting relative to the selected V_{REF}

+10 knots fast than it displayed → good

ex Flap 5 maneuvering speed is flaps 5 bug +10 knots

Speed on the scroll.

V_{REF} – Flap Up +10, at approach it is fixed used when maneuvering is required below 250 knots in a clean configuration

V_{MAN} – Flap 1 +10 – Spd for man with flaps at 1

V_{MAN} – Flap 5 bug +10 → spd used in terminal area with flaps 5 selected when it is necessary to slow below the flaps 1 speed but flaps 10 is not is not required

V_{FA10} Flap 10 Vref + 10 spd used with flap 10 selected when on terminal final for instrument approach, abeam the runway, abeam the runway on circling approach, or when required to remain inside procedure turn airspace limits

Go-Around Speed (VGA) Spd used for initial climb out following aborted approach. This spd is displayed on PFD as the flap 10 Vref, or flap 10 minimum maneuvering speed.

V_{REF} Speed, the spd at the 50 ft height used in landing distance performance test. It is the target spd at the runway threshold

Command Speed Bug placement

Takeoff

Command spd bug ⇒ V_2 for T/O until initiating flap retraction

If VNAV is not engaged or if FLCH is selected / engaged ⇒ the PDF will position the command speed bug to the appropriate flap up maneuvering speed by the dividing the desired speed in the IAS/Mach window.

If VNAV is engaged the command speed bug will be automatically reset to the VNAV climb schedule beginning at the flap acceleration height

Cruise Climb and descent

If VNAV not engaged set the bug spd ⇒ same as IAS/MACH window

If VNAV engaged ⇒ automatic bug set

Approach

Bug spd according to flap setting or ATC requested speed

+10 knots can be use during flap extension

When flap and landing gear are extended be prepared to adjust the next lower speed just as the additional configuration drag take effect

Do not reduce below the minimum flap spd until the flap extend to the selected position

Landing

Approach under normal conditions
⇒ V_{REF} + 5.

In turbulence, steep, wind or gust conditions
⇒ increase in the target approach spd

As a rule of thumb for steep, gust wind

position the airspeed increase to V_{REF} plus one half the steady wind plus all the gust factor.

ex: A headwind of 10 knots with gust to 20 ⇒ will result in a targeted final approach speed of V_{REF} + 15 rather than the normal V_{REF} + 5

in Turbulence ⇒ close as pass of target spd

Final approach spd no more than
V_{REF} + 20 no less than
V_{REF} + 5

Flap extension

the flap should not be extended to the next lower position until within 30 knots of the FMC generated flap maneuvering speed for the existing position

Bank Angles

in Normal operation ⇒ 30° ⇒ 25° best

On takeoff or in Missed approach limit bank to 15° until V_{ZF} is reached or above

Taxi-

Cockpit Perspective

You cannot see large areas around the aircraft.

Delayed Engine start

When ~~a~~ lengthy taxi and/or takeoff delay → No 3 engine start ~~time~~ may be delayed

Caution → excessive jet blast near ramp area

Two engine (No 2 and No 3) should not be shut down while taxiing

Only shut 2 or 3 engine when parked

Flap deflection and ~~before~~ before flaps pattern will be accomplished → while taxiing

Start shut down Engine (no 3) while taxiing is done by (st off. capt → taxi

Excessive delay shut → 2 or 3 or all engs

When 3 or more engines were shut down
APU must be operating until all engines
are restarted

If all shut → all checklist items again
starting with the Preflight check

Warning

The Before Takeoff check must be delayed
until all engines are running

Thrust Use.

Check below aircraft

Aircraft response to Thrust lever movement
is slow.

& Idle Thrust is normally adequate
for taxiing.
: A slightly higher Thrust setting
(30 - 40 N1) may be required to

Steering

65% N_f is the normal maximum

To exceed 65% N_f use procedure

Use taxi fuel

Brakes

Do not "Riding"

25 knot max taxi

Slow to 10 to 15 knot on any turn

If at idle thrust, speed exceed 25 knot → brake until 15 & release

By-

Body Gear Steering

To reduce thrust for tight turn

Automatically activated when the nose gear steering angle exceed 20° and taxi is below 20 knots.

Important at heavy weight

If deactivated turn capability decrease

(Caution) - Do not attempt to make a turn away from an obstacle within 10 feet of the wingtip or within 5 feet of the cockpit.

Taxi Speed

You taxi faster than it seems.

EFIS GS display can be used to determine actual speed.

Taxi speed depend → Terrain roughness
→ Surface condition

Nose wheel scrubbing → excessive steering angle
→ " taxi spd for STC

Taxi spd must be closely monitored → long taxi
High taxi spd & heavy weight → tire sidewall cracking

EFIS and FMC

When taxiing towards the takeoff position ensure that the ND displays the LEGS page waypoint sequence are consistent with the ATC departure

Ensure that the assigned runway is displayed on the ND or confirm with that the IRS position is correct

Verify the FMC Take off Ref page is programmed as follows (Thrust etc)

Verify that the autothrottle switch is on the A/T ARM position

Autothrottle switch → A/T ARM position
VNAV / armed, both FCD switches are (LNAV) ON and the desired heading and altitude are set
(Heading select or heading hold if desired)

[Caution] → Flight mode annunciations on the PFD are the only means of confirming that the modes selected are engaged or armed

Takeoff Roll.

Smoothly advance the Thrust levers to ≈ 1.1 EPR to allow the engine to stabilize,

The exact amount of the initial setting is not as important as setting symmetrical thrust esp in crosswind or slick runway Etc

Maintain slight forward pressure on the control to provide better nose wheel rudder pedal steering

Optimum nose wheel steering angle varies from about 10° on a dry runway to 3° to 5° on a wet runway, 1 to 2° on an icy or very slippery runway.

Do not use the nose wheel tiller during the takeoff role unless required due to crosswind In this case, avoid large and/or rapid tiller inputs which might cause nosewheel skidding

Apply aileron as necessary to maintain wing level during strong crosswind conditions. As airspeed increase aileron displacement To maintain wing level decreases

When also on the PNU → Thrust to 1.1 EPR to stabilize engine.

→

Advance the thrust level to a takeoff thrust and push the TOGA switch by TO thrust

- Scan the engine instrument for possible

At speed > 80 knots on takeoff autothrottle engagement is inhibited until the aircraft is above 400 ft AGL.

If autothrottle are not used, manually set the takeoff target EPR before 80 kt

At 80 knots, the PNF should verify that takeoff thrust has been set and if the autothrottles are being used, that the thrust management system has entered the THRUST mode (Hold) (to protect against throttle movement)

Note → until VNAV armed, the climb mode will remain engaged until 400 ft mode altimeter

If VNAV is not armed the climb mode will remain the active mode until THR is selected on the mode control panel

Captain must hand over throttle levers until V1 in case of rejected T/off

When I/c officer inserts the takeoff, he set throttle levers to max T/off power, engage TO/GA and then remove his hand from capt hand in case of RTO

If the T/off is rejected pressure the hold and the autothrottle should be disengaged as the throttle levers are moved to idle

If not then:

RTO autobrakes will brake max when the speed is > 85 kt and all forward throttle levers are moved to idle.

Rotation and liftoff

As the speed approaches V_R, increase forward control wheel pressure so that zero pressure is being held at V_R speed.

At V_R smoothly rotate the aircraft with one continuous motion and a constant rate of increase 2°-3° degrees per second to an initial takeoff pitch angle of 12°.

Proper Rotation is by Feeling not mechanical manoeuvre

Liftoff occurs at 8, 9 to 10° of body attitude.

Minimum tail clearance actually occurs shortly after liftoff.

Caution : Do not apply abrupt nose up input just before or after liftoff. The tail will strike the RWY at 12.5° pitch with main wheel on the RWY and the nose gear still extended

[Caution] If the flight director are selected ON prior to liftoff. Do not follow the flight director command until after the ~~take~~ lift off and clear of the RCC.

When rotation rate is correct the correct heading attitude will result in a liftoff speed of $V_2 + 10$ to $V_2 + 25$ depending on weight

Heavier ∝ rotation rate 2-3°/s ⇒ $V_2 + 10$
Lighter ∝ rotation rate 2-3°/s ⇒ $V_2 + > 10$

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Initial climb

With all engines operating maintain V_2 + 10 to V_2 + 25 kt IAS and takeoff flaps until reaching flap retraction altitude.

Do not retract the landing gear until a positive rate of climb is indicated on the flight display

No turns before 200 ft

Flap Retraction Schedule

Follow the flight director programmed

If no flight director, however the case to a pitch attitude flight greater than one-half of takeoff value → to increase speed for flap retraction

Follow flap bug

After flaps are fully retracted accelerate to 250 kt IAS or V_2 + (flap up + 20) if V_2 + is greater than 250 kt IAS and continue with the planned VNAV climb profile

The minimum maneuvering speed for 30° of bank with flaps up (at heavy gross weight is V_{SR} + (flaps up + 20 knots

Do not use the flaps up bug as a target speed in a clean configuration

Thrust Management

With VNAV engaged the autothrottle remains in the Hold mode until VNAV engages at which time the autothrottle mode changes to THR REF

In order for the FMC to command thrust the flight director must be on and engaged in VNAV.

The normal point for reducing to climb thrust is either flaps or 1500 ft AFA

If the flight director is used for acceleration and cleanup and VNAV is engaged the thrust reductions will be programmed by the FMC

If the flight director is not used and/or is not engaged in VNAV, the PF should request climb thrust at either flaps or 1500 ft AFA The PNF will then select climb thrust using the THR switch on the Mode Control Panel (MCP). Continue to accelerate and retract the flaps on schedule

If undercarriage gear weight the V_{2F} (Flaps Up) engine will exceed 200 knots.

If an engine dies/fails before the flaps reach 5° in 1500ft AAL, do not undertake climb thrust.

If an engine fails after climb thrust is commanded, maintain the thrust levers forward if acceleration or is required

Use of Flight Directors on Takeoff

The flight directors with VNAV armed is the preferred method of managing the AFDS for takeoff.

Prior to Takeoff

Turn both flight directors ON
ARM VNAV and Lateral guidance as appropriate for the departure.

Warning

Do not follow the flight Director pitch command for rotation.

After Takeoff

When clear of the runway, use the flight directors as the primary pitch reference, cross checking indicated airspeed and other flight instrument

The flight director initially commands a pitch attitude of 15° or 1° below the

the pitch limit indicator, which is blue and provides lateral guidance to track the extended runway centerline

As the flight altitude and vertical speed increase, the flight director command pitch to maintain a target pitch of not less than V_2 +10

If VNAV is not armed for takeoff, the TO/GA mode may be used up to the flap retraction altitude, then an acceleration commanded by engaging VNAV or selecting FLCH.

In some cases better to use FLCH to control the

If FLCH is used for acceleration,
- Call for FLCH at the flap acceleration height
- Call for the command speed to the flap up maneuvering speed
- Retract the flaps on schedule
- At the designated thrust reduction point call for climb thrust using the TOGA switch on the mode control panel

If the departure procedure or radar

commence at the ends of the RVR, CRAC can be carried prior to takeoff and will engage when above 50 ft AGL

The autopilot may be engaged above 1000 ft AA

The aircraft should be in trim and the flight directors commands should be satisfied prior to engaging the autopilot

Rejected Takeoff (RTO)

Capt hands on the throttles until PNF announces V one & then quick response

When the 1st officer is making the takeoff and the capt want to abort → he say ABORT.
Then capt → I HAVE the aircraft.

So Capt: say Abort
Retard the Thrust levers to Idle.
Apply max wheel brake

Note: Decision of the actual weight of the takeoff is rejected prior to the throttles hold announcement.

RTO Autobrake if above 85 knot
or if not active push brake pedal to the max.

Apply maximum reverse thrust with directional control as necessary

Verify speedbrake are deployed, if not do manually

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The GO / NO GO Decision.

After V_1, the aircraft accelerate 2 to 5 knot per / sec.

Each additional knot after V_1 requires 225 to 270 ft of additional runway to stop.

A high speed RTO (above 100 knot) is not justified for a blown tire, instrument failure, system failure, or door warning light or hydraulic failure.
RTO can be considered before 100 knot

After 100 knot only Engine failure with loss of thrust is cause of RTO

Takeoff Briefing
should review critical condition which impact a high speed abort ⇒ gross weight limited takeoff, wet or and slip RWY, inoperative thrust reverse + strong crosswind

Safer to continue Takeoff

En Route climb

The FMC generate a fixed speed schedule as a function of cost index and climb weight.

In CS → 250 kt or V_{2} + (flap up) + 20

Weight > 600 000 lb. ⇒ need > 250 kt ATC should be ordered

Above 10000 ft ⇒ ECON CLIMB

These speed will be automatically maintain by the ATS using commands from the FMC when VNAV is selected

Note if precise data not available from FMC use climb spd of 320 knot / 0,8 Mach above 10000 ft

Maximum Angle climb

Below 700 000 lbs the max. angle of climb speed is the flap up maneuvering spd

Above 700000lbs slightly higher

V2F → maximum angle climb speed

High Altitude Mach 0.84 can used for all weight.

MAX ANGLE climb may be selected on the CLIMB page of the FMC CDU to command the AFDS to fly the max angle climb speed at any altitude.

<u>Engine out climb</u>

The engine out climb → max angle profile & varies with gross weight and altitude

<u>Max Rate climb</u> not provided in the FMC but ≈ to the FMC MAX ang climb speed plus 25 knot until 0.84.

<u>Climb Thrust</u>

Once climb is set the electronic engine fuel control will automatically compen

for the various changes in environmental conditions during the climb.

If the electronic engine fuel control is off or inoperative, climb thrust should be adjusted as necess during accel & vehicle climb

Normal cruise

Normally the aeroplane will be operated in VNAV with the plan flight level preselected during the performance initialization of the FMS during the preflight. Therefore as the aeroplane reaches the appropriate cruise altitudes the crew need only to monitor the level off process and ensure the proper display of:

ACT ECON CRZ on the FMS CDU

Altitude selection

Should be the optimum altitude → that gives the best fuel mileage.

The higher the aeroplane flies above the optimum altitude the more the buffet margin is reduced

Cruise Performance Economy

Fuel consumption depends: weight, altitude, route, temperature, wind and speed

This can be penalized by up to twelve

percent per ascending 8000 feet below the optimum altitude, 4% = 4000 ft, 7% = 2000 ft.

Ascending faster than planned, changes headwinds, unbalanced fuel, mistrim and excessive thrust lever movement are the causes of reduced economy

Fuel for En Route climb

The additional fuel required for a 4000 ft en route climb is 500 to 650 pounds depending on weight.
This fuel will be recovered in approximately 25 minutes at the higher altitude if the airplane is not cruising above optimum altitude

Cruise Trim Procedure

If airplane misTrims
1/ check fuel quantities for lateral balance
2/ Set and maintain a balanced thrust condition
3/ Adjust Elevator Trim if necessary

With the autopilot engaged

1/ Allow the aeroplane to stabilize on a constant heading

2/ Trim the rudder in the direction of the down wing. Apply trim incrementally allowing the bank to stabilize after each trim input

3/ When the bank is zero, rudder trim is correctly set

With the autopilot not engaged

1/ While holding wings level, observe the ADI (attitude direction indicator) trim the rudder for zero heading change

2/ While continuing to hold the wings level trim the aileron for zero force

3/ Check for twist of trim

4/ Repeat as necessary to achieve twist-off trim

If unable to trim adequately or if more than one unit of trim is required.

1/ Check the position of the control surfaces on the ELEVATOR panel

2/ Check for abnormal yaw damper operation by individually modulating each channel

3/ Check visually the ailerons for abnormal spoiler or flap configurations

4/ Verify cockpit for anomalies

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High Altitude / High Speed flight

Turbulent Air penetration

If moderate or greater turbulence is anticipated or encountered, operating 4000 ft or more lower is advisable and ⇒

→ Maintain Turbulent air penetration speed of 290 to 310 knots or M. 82 to M. 85 (VB)

→ If the autopilot is engaged, leave engaged unless airspeed, altitude or attitude requires use of manual control.

Maneuver in Turbulence at bank angle below those normally used.

The A/T should be off in severe turbulence

→ During manual flight, after establishing trim setting for penetration speed, avoid large Stabilizer trim

Allow airspeed to vary and maintain altitude

Avoid large thrust changes

- Do not allow the airspeed to decrease and remain below the turbulence penetration speed.
  Increase altitude if unable to keep airspeed level or climb less than 15° if a turn is necessary

- Rely primarily on ADI for attitude reference.
  In severe vertical aircraft dynamics attempt to control the aircraft by reference to non-data instruments

- At high altitude → mach buffet → it cannot prevent and should not be confused with low speed buffet

Long Range Cruise (LRC)

If the FMC is operational → select LRC on the CRUISE page and continue to operate in VNAV. or see above in Pacific Manual

- Reduce Vertical Separation Minimum RVSM
  in transatlantic - 1000 ft FL 290 FL 410

Descent

Descents are normally accomplished using LNAV descent path info supplied by FMC.

If FMC not avail use M.84 / 290/250 knot

Normal descent with idle thrust without speedbrake

It requires ≈ 36 sec & 3 mile to decelerate from 290 to 250 K in level flight

The aircraft should be at 10000 ft and 250 knot when ≈ 30 nm from touchdown.

Plan the descent to arrive at the traffic pattern altitude at flap up maneuvering spd V_{2+} about 15 miles when straight in or 8 miles when making an abeam approach

Use the MAP mode of the ND to plan descent & deceleration rate.

Speed brake

Use it at 2/3 travel to the flight detent allows greater descent rate

Beyond this point → slight pitch up

Full flight speed brake to be avoided except in emergency

Speed brake should not be used with landing flaps

Descent in icing conditions

Descent and Vacate Icing

Distance for descent will increase with the presence of anti-ice → due to + thrust

If Vacate Anti Ice is anticipated the DESCENT FORECAST page of the FMS CDU should be selected and TAI/CDU altitude (altitude where anti ice will be turned on) should be programmed

This should be referred to about descent so FMC can calculate an accurate descent path.

MPH

VNAV Descent Planning

Descent Path/Top of Descent

A FMC VNAV descent is the most economical

For FMC to generate a descent path and display the Top of the descent point (T/D) on the N/D at least one waypoint related altitude constraint must be entered on a CDUS page.

This altitude constraint must be below the current cruise altitude and can be entered manually or is typically placed on the last CDUS page automatically from the data base when a STAR or Instrument Approach is selected from the ARR/VNAV Page.

Entering Forecast winds on the Descent FORECAST page allows the FMC to compute the descent path and Top of Descent T/D.

Top of Descent Procedures

As the aircraft approach the T/D point, there are several possible scenarios crew will be faced to transition the VNAV DES page and capture the descent path.

Scen 1

VNAV ~~would~~ allow an automatic transition from the CRZ page to the DES page once T/D is reached.

ATC should clear → "Pilot discretion"

- Reset the MCP altitude window

- The aircraft remain at the cruise altitude with the CRZ page active (ACT ECON CRZ)

- As the aircraft pass the T/D point, the active VNAV page automatically would from ACT ECON CRZ to ACT ECON DES and the descent path is captured

VNAV PATH, continues to be displayed as the engaged FMA pitch mode

The thrust levers go to idle and IDLE and then HOLD are displayed as the engaged FMA autothrottle

Path error can be monitored on the Vertical Path Indicator and Deviation Scale that appears on the ND and the DES page become active (ACT ECON DES)

Sc 2. Descent prior to T/D and more than 50 mile

Op 1 Cruise Descent

1. Select a lower altitude in the MCP altitude window and push the altitude selector knob.

In this case, the VNAV cruise descent page becomes active and is displayed on the CDU (ACT ECON CRZ DES)
VNAV will command a shallow descent rate of 1250 ft per minute (FPM) until

Level off at the cruise altitude

The engaged auto throttle mode will change initially to THR and then to ACD after the descent rate is attained

The thrust lever can then be adjusted to allow the scale

Upon reaching the selected altitude, the active VNAV page reverts to ACT ECON CRZ and a new T/D is constructed at the altitude

Option 2 - the DES Vane feature

- Reset the MCP altitude window to the cruise altitude clearance

- With the ACT ECON CRZ page displayed on the CDU, use the next page key to access the active ECON DES page.

Select the execute key DES NOW. Verify the prompt is R and execute.

When the execute key is pressed, the active VNAV page becomes ACT ECON DES and the vertical

Path indicators and Deviation Scale appear on the ND.

Since the descent was initiated prior to T/D the aircraft is depicted below the path.

Since the VNAV descent path has not yet been captured, VNAV will command a selected descent (2500 FPM until path capture or level off at the lower altitude, whichever occurs first.

OFF path Descent

Because top of descent info to both drain and speedbrake "direct descents" to a defined waypoints.

The OFF path descent function calculates your descent progress toward a given waypoint altitude constraint ~~respectively~~

Off path Descent info is presented both on the OFF PATH DES page of the FMS CDU as well as on the ND.

Two top of descent circles are calculated and displayed on the ND when selected

The blue outer circle represent the circle of T/D points for a drain idle descent.

The white inner circle represents the circle of T/D points for a full speedbrake idle descent.

Both circles assume the use of normal descent speed schedules, including deceleration

at the (spd) constant altitude, but square at waypoint speed and altitude constraint

The OFFPATH DES selection can be accessed using the OFFPATH DES prompt (6L) on both the descent forecast page.

- Selecting the OFFPATH DES prompt presents you with the OFFPATH DES page

The DES TO field (1L) and

Flight Management Computer System - Long Range Navigation.

The keys to successful en route navigation are continual crew awareness and effective cross-checking.

- Verify FMC
  - Confirm correct waypoint identifier / coordinates
  - Cross check PFD annunciation to confirm proper LNAV / VNAV tracking
- Continual monitor & confirm on-board navigation performance by performing part waypoint procedures as required, maintaining on course VOR radials & use of VOR / DME position and radar monitoring.

Waypoint transition Procedures in SOPs sect 4-45

Use of Radar.

Eventually Navigation on alternate to PFC

Approach

General

Not for use at normal operations.

- Penetrate 10000 ft at 250 knots or less as required by FAR
- When within 15 miles of ground track to the planned touchdown point reduce speed to Vzf.
- When 8 to 10 miles of ground track to touchdown, extend 2° of flaps and reduce to flaps 5 maneuver spd. (flaps 5 Vmc + 10)
- When obtaining the ~~visual~~ Runway or visual approach or approach clearance reconfigure or when previous approach select flaps 10 & reduce to flaps 10 maneuver speed (flaps 10 Vmc + 10)

Flap Extension

To decrease spd with change in Thrust & Drag

- Nose up trim when flaps are extended for CG
- Little change at flap 20
- Small nose up at flap 28
- At flap 30 noticeable pitch down that requires nose up trim

Use of CDU / VNAV

It need a series of legs / waypoint which describe the approach route and missed approach must be present on the legs page.

To load waypoint :

- Data Base Selection - An approach procedure selected through the CDU arrival pages provides the simplest method of selecting waypoint.

Procedure in the data base comply with the obstruction clearance criteria for non-precision approach.

If the approach is not in the database, another approach having the same plan view may be selected.

ICS procedure might be selected if the plan view (route) is identical to VOR which is to be accomplished.

But VOR approach should be declared unusable unless verified and VOR should be used with caution.

- Manual Waypoint Entry, when no procedure is available from the FMC approach page

The waypoints may be conveniently defined by using name of waypoint are navaids in the database, bearing/distance off such fixes, intersections are radial are latitude

Must be done Before Top of descent - Before 10,000

- Fix or VOR Radial Displays

A navaid, waypoint and the appropriate radial may be inserted on the FIX page to create a course line on the ~~FMC~~ map