PMDG MD-11 Simulation

Flight Management System
Operating Manual

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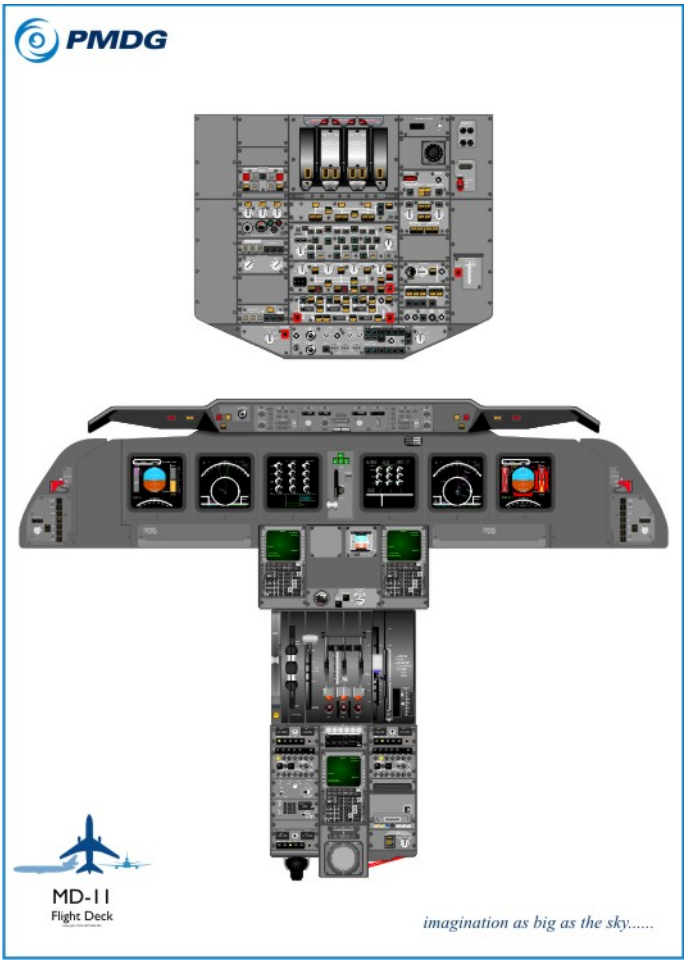

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Introduction

This Flight Management System (FMS) Guide is designed to help simulator pilots learn to operate the Honeywell Flight Management System used in the PMDG MD-11 aircraft simulation.

FMS OPERATING PROCEDURES include normal, abnormal and degraded navigation procedures.

We strongly recommend that pilots unfamiliar with the McDonnell Douglas flight deck take the time to read and follow the tutorial that we have provided with your MD-11 simulation. This will help to increase your understanding of the broad points of using the PMDG MD-11 FMS before you begin learning the finer points and specific operational techniques enclosed in this guide.

This manual provides the simulator pilot with a guide to the operation of the PMDG MD-11 FMS. The FMS is used by pilots for flight planning, navigation, performance management, aircraft guidance, and flight progress monitoring. All FMS navigation data is derived from the navigation database, and it is recommended that simulator users regularly update their navigation database in order to remain current for online flying and accurate navigation.

The FMS provides a means via the Flight Control Panel (FCP) on the glare-shield and the Multifunction Control and Display Unit (MCDU) for the pilot to enter a flight plan, select various flight control modes, and enter other necessary flight data. Flight progress is monitored through the MCDU and the Electronic Instrument System (EIS).

After data entry, the Flight Management Computer Units (FMCU) will generate a flight profile from the origin to the destination airport. The FMCUs will then guide the aircraft along that profile by providing roll, pitch, speed and thrust commands to the Flight Control Computers (FCCs).

NOTE: Access to MCDU pages may take up to 10 seconds or more when the FMC is performing other computations.

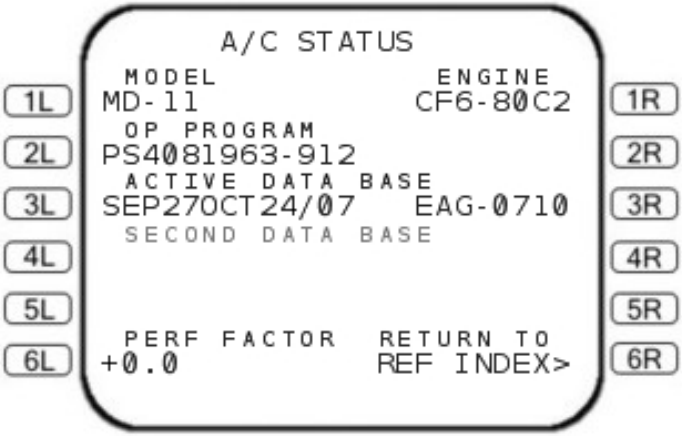
If the MCDU is inactive (will not take commands),

select the MENU page and then select the FMC prompt.

This guide provides the best value if the simulator pilot takes the time to read through each chapter of the manual with the simulator running alongside. This will allow the user to work with the MCDU, and follow through the various pages and displays available within the FMS, gaining familiarity and experience navigating through various pages.

Preflight

Aircraft Status Page



1. Power On Aircraft . . . . . APPLY

   The A/C STATUS page appears on the MCDU automatically after power is applied or when the FMS transitions to preflight phase at the end of a flight. The A/C STATUS page can also be accessed by pushing Line Select Key (LSK) 5L on the REF INDEX page.

2. MCDU Display Data . . . . . CHECK

   All data on the A/C STATUS page should be reviewed for applicability and currency.

3. Active Data Base . . . . . CHANGE/VERIFY

   NOTE: If the aircraft is configured for T/O deflected ailerons, then LSK 1L will display MD-11 DEF AIL. If the aircraft is reconfigured to basic MD-11 from T/O deflected ailerons, then V-speeds and T/O STAB TRIM will be recomputed accordingly.

PMDG TIP
The T/O Deflected Ailerons option can be enabled/disabled from the PMDG Menu (by default it is disabled).

IRS Initialization

1. IRU Mode Selectors (3). . . . . .NAV

   Rotating the IRU selectors from OFF to NAV initiates IRU power-up and full alignment cycle. If the IRU selectors are in NAV, rotating to OFF and back to NAV within 5 seconds initiates a 3-minute alignment cycle. Both methods require the IRS position to be entered in the MCDU. If GNS option is installed and the GNS position is valid, the IRU position entry is not required.

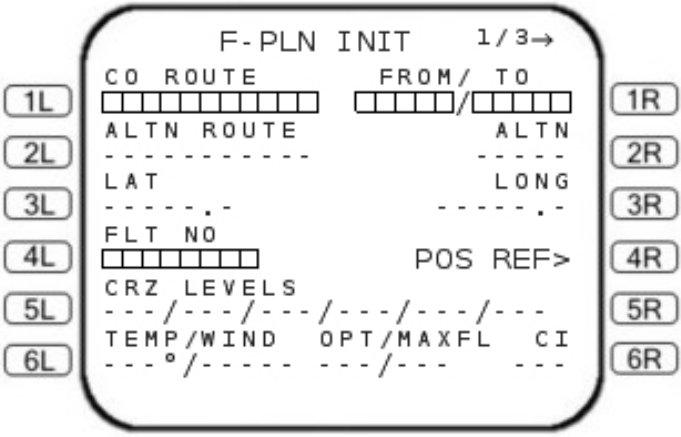
PMDG TIP
A full IRU alignment cycle lasts approximately 10 minutes, depending on latitude. The PMDG menu provides an option to reduce the simulated alignment cycle time.

PMDG TIP
The GNS option can be enabled/disabled from the PMDG Menu (by default it is enabled).

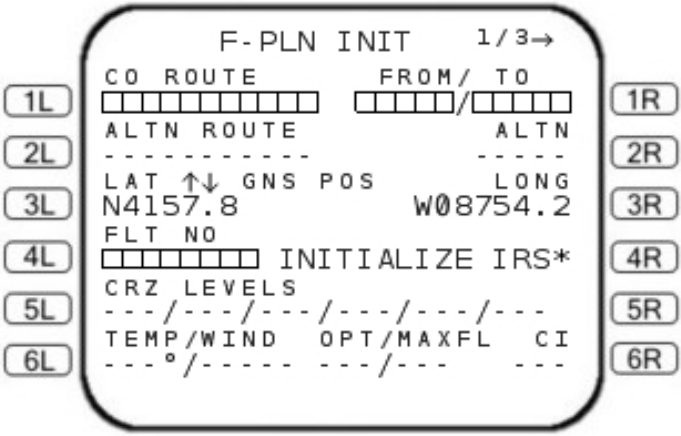
2. F-PLN INIT Page . . . . . ENTER

STEP: Push INIT

F-PLN INIT WITHOUT GNS:



F-PLN INIT WITH GNS:



3. CO ROUTE or FROM/TO . . . . . ENTER

   IRS position can be inserted by entering a CO ROUTE in 1L, FROM/TO (ICAO identifier) in 1R, or latitude in 3L and longitude in 3R. Entering the position with the FROM/TO option will automatically display the stored flight plan data pages. Push the LSK adjacent to the *INSERT prompt or LSK 6R to return to the F-PLN page.

4. LAT and LONG . . . . . .CHECK OR CHANGE

   Verify the accuracy of the LAT and LONG entered in line 3 of the MCDU. Minor changes can be made to the LAT and LONG with the up and down slew keys on the MCDU. If the GNS option is installed and the GNS position is valid, then the GNS position may be used for IRS alignment.

5. IRU Align/Position . . . . . ENTER

   Push the LSK adjacent to the INITIALIZE IRS* prompt to transmit position to the IRUs and begin alignment. When IRUs are in the align mode, the INITIALIZE IRS* prompt changes to POS REF. If the GNS option is installed and the GNS position is valid, the IRU position entry is not required and selecting INITIALIZE IRS* prompt will transfer GNS position to the IRS for use in alignment. A CHECK POSITION message will be displayed on the ND when either of the following MCDU scratchpad (SP) messages are displayed:

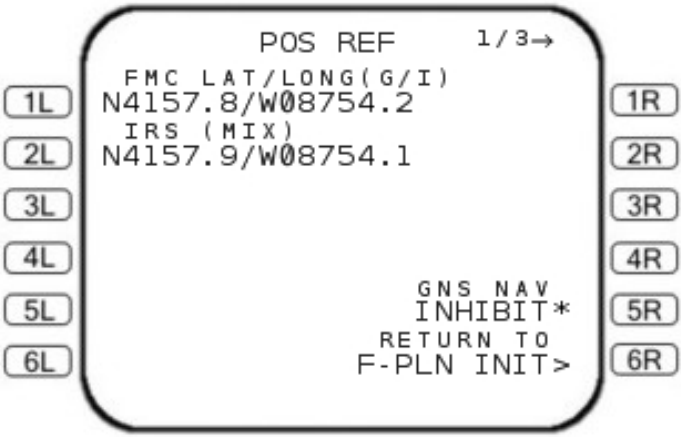
   A. FMC POSITION MISMATCH. This message will be displayed if the FMCs show a position difference of 5 NM; the message will be removed if the position difference becomes less than 3 NM. Compare the position on the POS REF page and use the FMC considered to be the most accurate. The above is generally a result of poor DME position computation.

   B. VERIFY AIRCRAFT POSITION. This message will be displayed if a single FMC radio position varies from the IRSs position. Usually it shows on only one MCDU. Check the IRS STATUS page on that MCDU. If the condition persists, it is advisable to use the other FMC as primary for navigation.

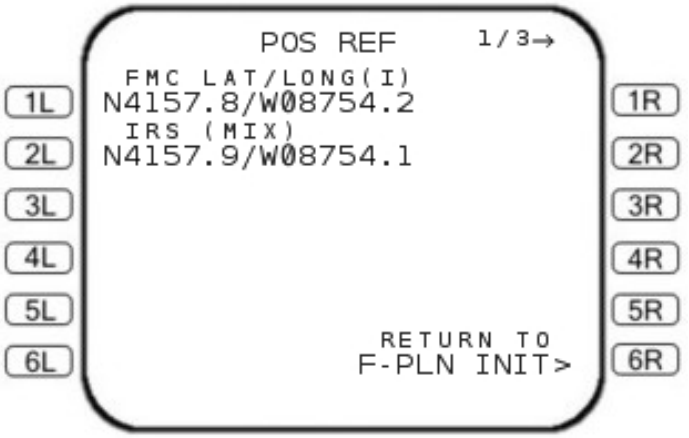
6. POS REF. . . . . CHECK

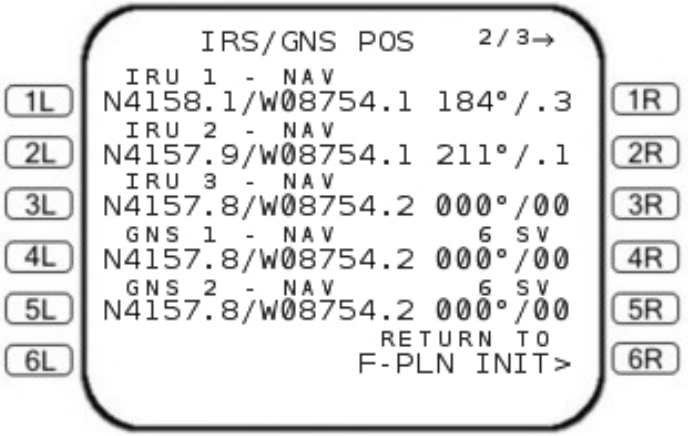
Pushing LSK 4R again will access the POS REF page. The POS REF page is the first of three position information pages and displays the calculated FMC position and the navigation update status in line 1L, the IRS MIX position (an average of the three IRS positions) on line 2L, and RNP and ANP values on line 4. Access the IRS POS page by using the PAGE key. The IRS POS page displays each IRU position and mode status. Note the countdown time on each IRU indicating normal alignment. A 10-minute or more alignment is normal depending on latitude. A 3-minute time indicates a quick alignment has been selected by turning the IRU selectors to OFF and back to NAV within 5 seconds.

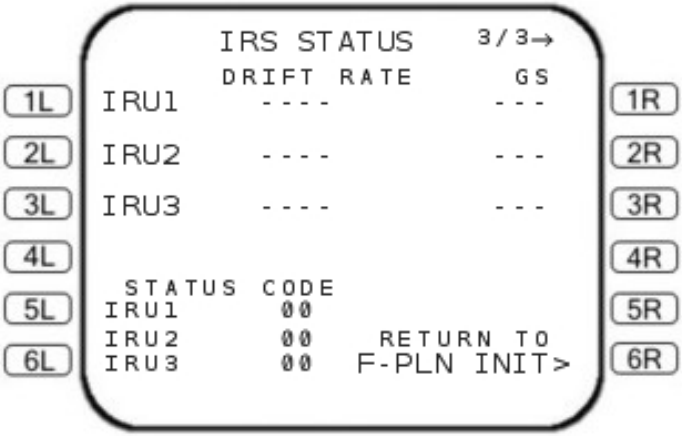
POS REF WITH GNS:



POS REF WITHOUT GNS:







If the GNS option is installed and the GNS position is valid, the POS REF page will display an INHIBIT* prompt on line 5R that allows the GNS position to be dropped from the FMC position calculation. The IRS POS page (with GNS installed) becomes the IRS/GNS POS page and also displays each GNSSU position and mode status as well as the number of satellite vehicles tracked.

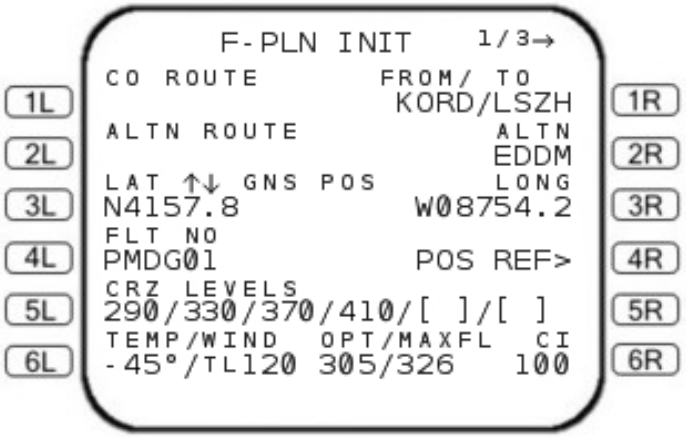
From the IRS POS page or the IRS/GNS POS page pushing the PAGE key will access the IRS STATUS page which will display individual IRU drift rate and ground speed on lines 1L, 2L and 3L. In addition, the IRS status codes will be displayed on lines 5L and 6L.

After completing this step, continue with cockpit preparation. Flight plan data, if not stored, should be inserted prior to beginning the Final Cockpit Preparation procedure.

Flight Plan Entry

1. F-PLN Page. . . . . .Access

   There are two methods of entering the flight plan data:



   A. After inserting a CO ROUTE or FROM/TO (ICAO identifier) with a stored flight plan. Either of these entries will bring up the stored flight plan data. After confirming flight plan data, the flight plan can be inserted with the LSK adjacent to the *INSERT prompt. If a CO ROUTE or stored flight plan was used, start with step 2 below.

   B. After inserting the origin and destination in the FROM/TO prompt, the stored flight plan data page will appear. If there is no stored flight plan, or if the stored flight plan is not desired, push LSK 6R to return to the F-PLN page. Flight plan data will now have to be entered (strung) starting with step 3.

PMDG TIP

After inserting FROM/TO ICAO identifiers stored flight plans for the entered origin/destination are looked up in the following locations:

- The PMDG/FLIGHPLANS folder in the FS installation directory. This folder contains flight plan files in the PMDG format (.RTE or .RT2 file extensions).
- The folder that FS uses to store flight plans ("My Documents/Flight Simulator Files"). This folder contains flight plan files in the FS format (.PLN extension)

All flight plans of any type (RTE, RT2, PLN) found for the entered origin/destination will be displayed in the stored flight plan data pages (one on each page), with file name (including extension) displayed in the title line.

After inserting a CO ROUTE, stored flight plans whose file name (without the extension) matches the entered route identifier are looked up in the following order:

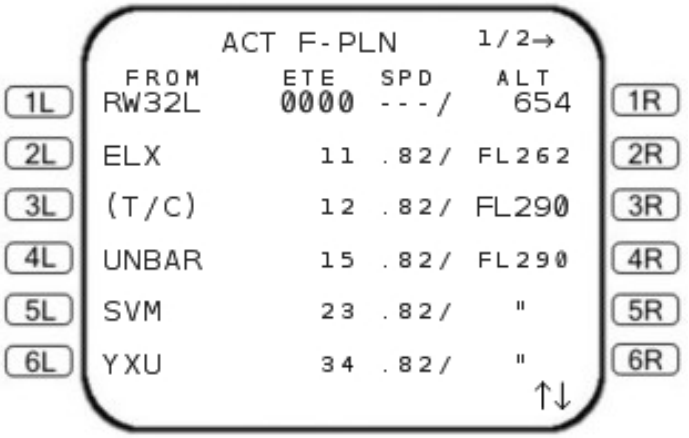
- PMDG RTE type files in the PMDG flight plans folder
- PMDG RT2 type files in the PMDG flight plans folder
- FS PLN type files in the FS flight plans folder

The first flight plan file that matches the CO ROUTE identifier is loaded.

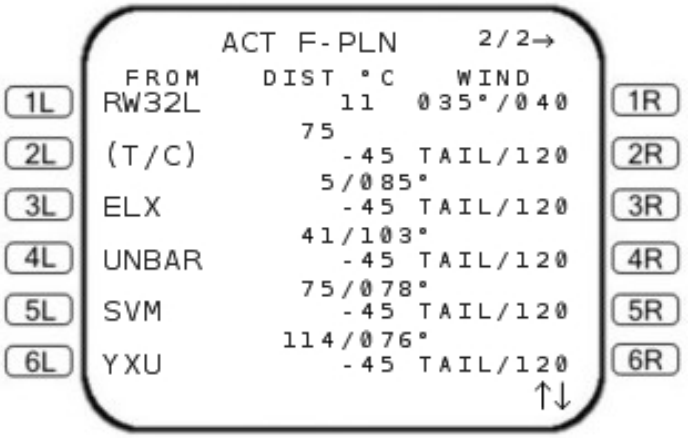
2. CO ROUTE DATA . . . . . CONFIRM

   Step through the flight plan on page 1 or 2 of ACT F-PLN. Page one displays Origin, Waypoint/Navaids, and Destination. Page two displays Origin, Waypoint/Navaids, Distances/Courses, CRZ WIND and Destination. Step through the flight plan with the up/down slew keys and verify flight plan data.

ACTIVE FLIGHT PLAN (page 1/2)



ACTIVE FLIGHT PLAN (page 2/2)



The following data is contained in the F-PLN page 2:

- **Waypoints, Navaids, or Flight Plan Events (1L through 6L)** - The components that make up the flight plan are displayed on the left side of the MCDU. The FROM waypoint is displayed in 1L.

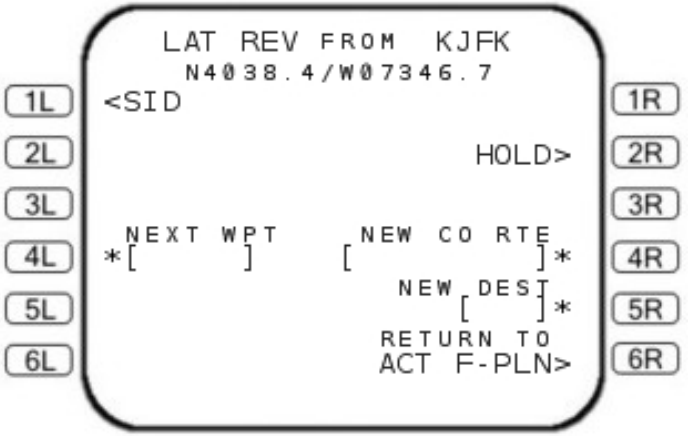
- **Distance Between Waypoints (Center)** - The distance between the flight plan waypoints is displayed in the center field between the lines for the corresponding waypoints.
- **Departure Runway Surface Temperature (1C)** - The departure runway surface temperature is displayed in the center of line 1. This temperature defaults to ISA temperature. Actual temperature can be entered on the CLIMB FORECAST page LSK 5R. After it is changed, it is displayed in large font on the page.
- **Magnetic Course (Center)** - If the magnetic course between two waypoints is different than the previous leg, the course is displayed next to the distance in the center field.
- **Temperature and Winds (1C/R through 6C/R)** - The temperature and winds for the waypoints are displayed on the same line as the waypoint identifier (or event name) on the right side of the MCDU. The temperature defaults to ISA temperature unless there is a value entered on the F-PLN INIT page. Then it is a calculated value for that altitude. Winds default to HD/000 unless there is a value entered on the F-PLN INIT page.

The temperature and winds for climb are from the CLIMB FORECAST page. If parameters do not change on successive legs of the flight plan, ditto marks (") are displayed.

3. SID & RWY . . . . . ENTER

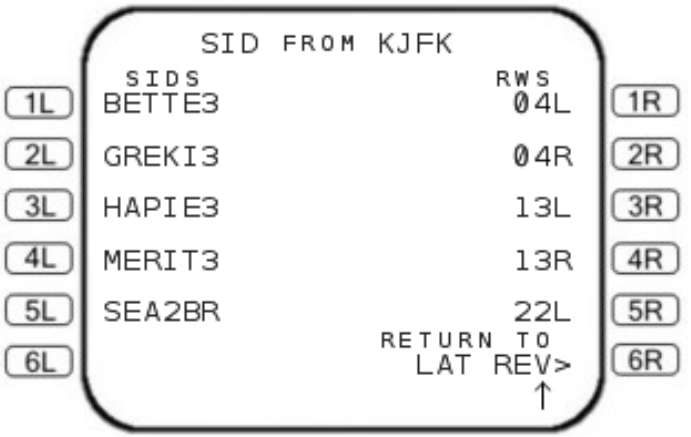
The SID page lists and allows selection of SIDs and runways from the point of origin as well as a selection of a departure transition.

Access the SID page from the F-PLN screen by selecting the LSK adjacent to the origin airport or runway. This will display the LAT REV page, from which the SID page is selected.

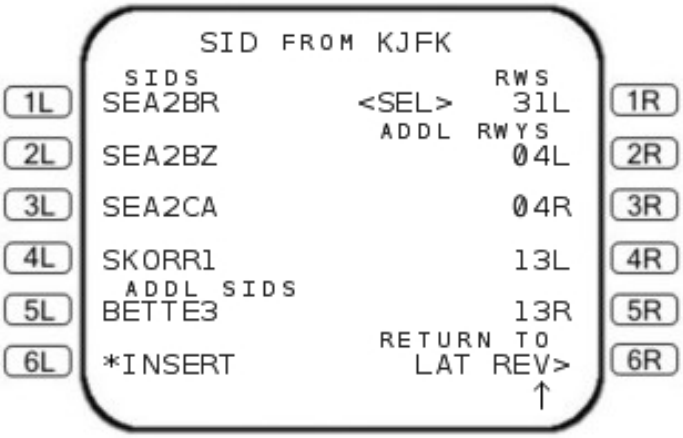


The SID page lists SIDs and their associated transitions and runways from the origin airport. The following screens show the evolving format resulting from the pilot's selection of a SID and runway.

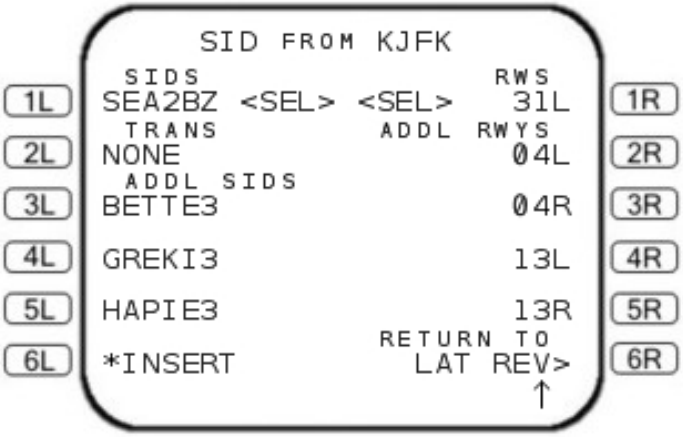
INITIAL DEPARTURE PAGE:



AFTER RUNWAY SELECTION:



AFTER RUNWAY AND DEPARTURE SELECTION:



If enroute transitions are available, they will be listed below the selected SID. Select runway, SID and then transition. The remaining transitions are listed following the remaining SIDs.

The selected combination may be inserted in the flight plan by pushing LSK 6L (*INSERT for the active primary flight plan, or

INSERT for the alternate or secondary flight plans) whereupon the display will return to the accessing F-PLN page. The accessing LAT REV page may be recalled by pushing the LSK 6R (RETURN TO) on the SID page, thus canceling any selections.

If a CO ROUTE or stored route was selected, go to F-PLN INIT. If manually constructing a route, continue with step 4.

4. No CO ROUTE Data . . . . . STRING F-PLN

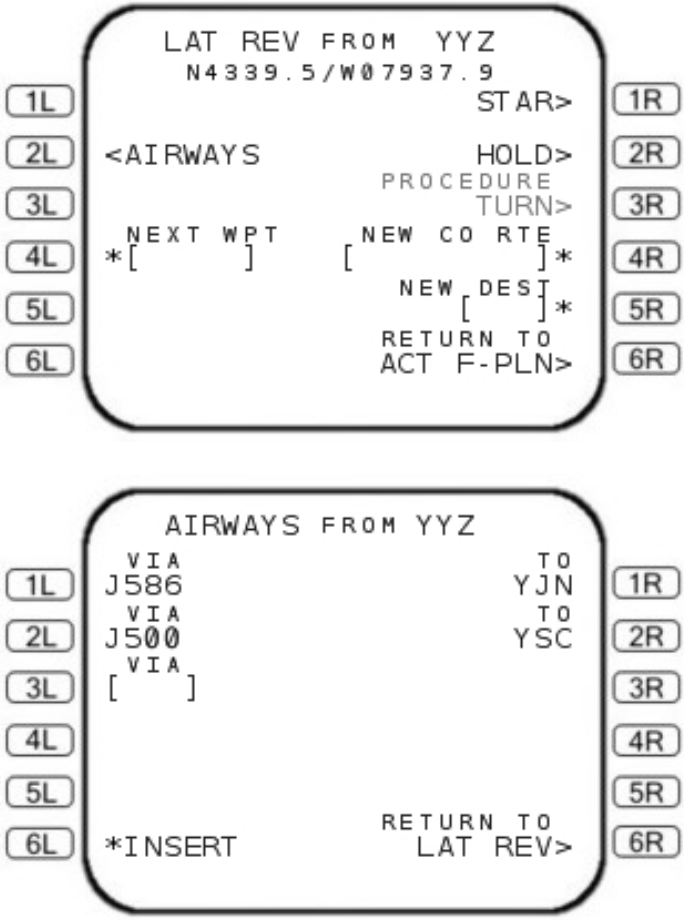
Waypoints may be entered into the flight plan by any one of several methods. Each of these methods is briefly described here. For a more detailed description see section 100 of the FMS manual.

Direct Waypoint Entry to the F-PLN

Type the waypoint description in the scratch pad and enter in sequence on the ACT F-PLN page in the F-PLN DISCONTINUITY line.

AIRWAY String

Select the LAT REV page from the start waypoint and push LSK 2L adjacent to the <AIRWAYS prompt. Enter the airway in line 1L below VIA. Then enter the end of the airway below the TO prompt in line 1R followed by the next airway in line 2L. Continue to string airways or push LSK 6L next to the *INSERT prompt to enter to the ACT F-PLN page. All airway waypoints will be strung onto the flight plan.



Place Distance

Waypoints may be entered from the scratchpad identified by Place and Distance. Enter the waypoint/ + or - distance (i.e. KPT/+20 or KPT/-20) and enter with a left LSK where desired on the ACT F-PLN page.

Place/Bearing/Distance

Waypoints may be entered from the scratchpad identified by Place/Bearing/Distance. Type the waypoint followed by a slash (/), the bearing followed by a /, then the distance. Enter with a left LSK where desired on the ACT F-PLN page.

LAT/LONG

Waypoints may also be entered by typing the latitude and longitude in the SP and entering the desired position with a left LSK. Waypoints entered in this manner will be defined in the ACT F-PLN as NXXWXXX.

Normally the route is only entered up to the STAR transition waypoint. The STAR can be inserted during the preparation for descent. After the flight plan has been entered and ships papers have been received, continue with F-PLN INIT and Final Cockpit Preparation procedure.

PMDG TIP
A flight plan loaded or manually entered (strung) can be saved at anytime from the REF page. Enter the desired name (up to 11 characters) in the scratchpad and then push LSK R6. If LSK R6 is pushed with the scratchpad empty the flight plan file is automatically named using the origin and destination ICAO identifiers and a 3 digit sequence number (e.g. KORDLSZH001; if a flight plan file with this name already exists KORDLSZH002 will be used). All flight plans files saved this way are created in the standard PMDG format (.RTE extension) and placed in the PMDG/FLIGHTPLANS folder in the FS installation directory.

F-PLN INIT

1. INIT Page . . . . . Access

   Push the INIT key to access the F-PLN INIT page.

2. ALTN ROUTE or ALTN . . . . . ENTER

   When the alternate route number (ALTN ROUTE) or alternate ICAO identifier has been entered, the alternate flight plan data page will be displayed. If a stored flight plan is available, it can be selected by pushing the LSK adjacent to the *INSERT prompt. If the stored flight plan is not available or not desired, pushing LSK 6R will return the MCDU to the F-PLN INIT page. Alternate route data can be strung or checked on the ACT F-PLN page below the primary flight plan. If no alternate is desired, the boxes on the F-PLN INIT page can be cleared by entering 0 in the ALTN ROUTE prompt.

3. FLT NO . . . . . ENTER

   Flight number may be entered in the form of any combination of alpha and numeric characters with a length not exceeding 8 characters in total. In this example the flight number PMDG01 was used. After entering the FLT NO in the SP, push LSK 4L to enter.

4. CRZ LEVELS . . . . . ENTER

   At least one FL must be entered for initialization. Five additional cruise levels are optional and may be pilot-entered if separated by slashes.

   NOTE: For low cruise altitudes (e.g. pattern work) cruise speeds may be displayed in Mach on the FMA and on the performance cruise pages, even though the aircraft is in the normal IAS region.

5. TEMP/WIND . . . . . ENTER

   The forecast temperature and wind may be manually entered here. If not entered, temperature will default to ISA temperature for FL entered. Wind entry is the average cruise wind component (trip wind). It may be entered as a tailwind (+, T, TL, or TAIL) or a headwind (-, H, HD, or HEAD). The wind entry must be preceded by a slash (/). If not entered, wind will default to 0 knots HD. Wind bearing is always along the aircraft track.

   NOTE: TEMP/WIND entry is not mandatory but is used in performance computations and should be entered if available.

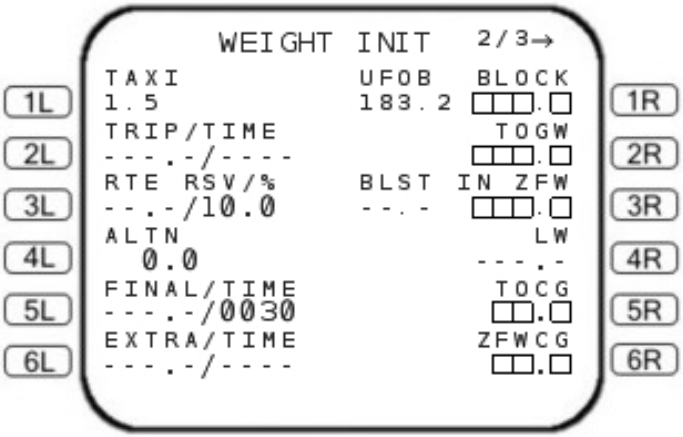
6. Cost Index (CI) . . . . . ENTER

   Cost index reflects time cost relative to fuel cost and is measured in hundreds of pounds per hour of fuel or kilograms of fuel per minute for aircraft configured with the metric option. The numbers entered will govern the aircraft speed and thereby the economy mode of operation. The CI should be entered after the flight plan data has been entered. Entry of the CI initiates performance computations.

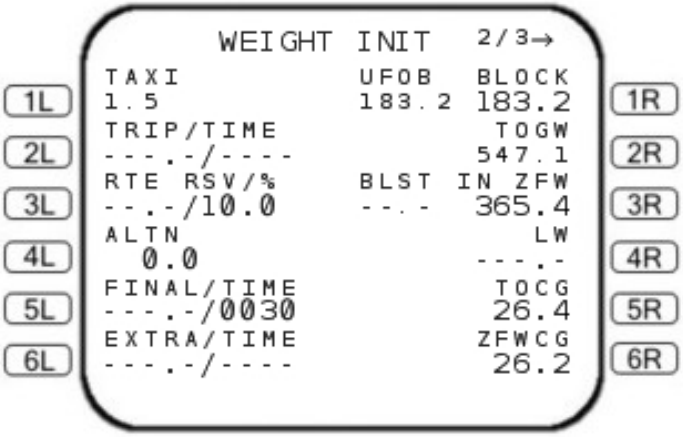
WEIGHT INIT

The WEIGHT INIT page is the second of three initialization pages and is accessed by the PAGE key from the F-PLN INIT page.

WEIGHT INT PAGE BEFORE DATA ENTRY:



WEIGHT INT PAGE INITIALIZED:



Before Engine Start

All lines containing boxes require manual pilot entry. BLOCK, TOGW, or ZFW will be calculated based on which two of these three parameters are entered by the pilot. The calculated value will be displayed in small font and pilot entered values will be displayed in large font. If the pilot entry made for BLOCK, TOGW, or ZFW is cleared, then both the cleared value and the computed value (small font) will revert to boxes. All other line entries are optional, pilot alterable, or FMC calculated.

TAXI - Taxi fuel default value or pilot-entered.

TRIP/TIME - The calculated trip fuel and time to the primary destination. Not pilot alterable.

RTE RSV/% - RTE reserves expressed as actual fuel and percentage of TRIP fuel. Either actual fuel or a percentage may be pilot entered, but not both. If there are no pilot entries, then a default percentage will be displayed and the actual fuel will be computed based on this percentage of TRIP fuel. However, the RTE RSV fuel has an upper and lower limit. Therefore, if the RTE RSV fuel is large or small enough to exceed the respective limit, then that limit will be displayed in large font for actual fuel and the percentage will be back-calculated based on the limited RTE RSV fuel.

ALTN - When an alternate has been specified, predicted fuel to the alternate is displayed and is not pilot-alterable. If no alternate is entered, then the pilot may insert a fuel quantity.

FINAL/TIME - Displays navigation data base holding fuel 1500 feet above the destination airport and is pilot alterable. Only one FINAL FUEL or TIME value may be entered. The value not entered will be calculated by the FMC. This entry field may be used for any contingency fuel needed (i.e. added holding fuel or added divert fuel for weather, etc.).

EXTRA/TIME - This fuel value is calculated by adding all required fuel (above) and subtracting that total from the BLOCK fuel. Should negative values be displayed, it indicates the flight may be into reserve or holding fuel. An INSUFFICIENT FUEL message will be displayed in the SP if extra fuel is zero or less.

BLOCK - BLOCK fuel weight is pilot-entered or calculated from the TOGW, ZFW, and TAXI entries. If the UFOB value to the left of the field is acceptable and with SP blank, pushing the adjacent LSK will enter the UFOB value into the BLOCK field in LARGE font. Pilot entry in this field allows trial entries for fuel planning purposes. After engine start, BLOCK fuel will be replaced by usable fuel on board (UFOB).

UFOB - Current fuel on board as sensed by the fuel quantity sensor, less any ballast fuel from the FUEL INIT page.

NOTE: Before engine start none of the calculations of weight data (ZFW=TOGW+TAXI-BLOCK) account for ballast fuel. Therefore, pilot entries of weight data must already account for ballast fuel. Upon edit of ballast fuel, the pilot will be responsible for correcting the weight data.

TOGW - Takeoff gross weight is pilot entered or calculated from the BLOCK, ZFW, and TAXI entries.

ZFW - The zero fuel weight is pilot entered or calculated from BLOCK, TOGW, and TAXI entries. It is recommended that the Zero Fuel Weight (ZFW) always be pilot entered in line 3R. This will permit the system to compute Takeoff Gross Weight (TOGW) in line 2R by adding the fuel weight measured from the fuel quantity gauging system (FQGS).

PMDG TIP
Right clicking on LSK 3R will display on the scratchpad the actual zero fuel weight value.

NOTE: For TOGW, ZFW or LW entries or calculated values which exceed maximum limits, the MCDU SP message MAX TOGW (or ZFW or LW) XXX.X is shown, where XXXX.X is the maximum value.

For those values of BLOCK, ZFW, TOGW out of an entry range, the MCDU SP message BLOCK (or ZFW or TOGW) OUT OF RANGE is displayed.

LW - The landing weight is a calculated value computed from the ZFW and the EFOB at the destination. It is not pilot-alterable.

TOCG - The takeoff center of gravity is a required pilot entry. The value is obtained from the flight's weight manifest. The TOCG is accurately computed by the fuel quantity gauging system (FQGS) provided an accurate ZFWCG and TOGW are entered by the pilot. This value is displayed on the EIS. The TOCG determines the stabilizer trim for departure and aids the fuel system in maintaining proper CG for best economy.

PMDG TIP
Right clicking on LSK 5R will display on the scratchpad the actual take off center of gravity value.

ZFWCG - The ZFW center of gravity is displayed in% MAC. Pilot entry is required.

PMDG TIP
Right clicking on LSK 6R will display on the scratchpad the actual ZFW center of gravity value.

NOTE: After the initial pilot entries have been made before engine start, edits of weight data will result in another computation according to the following rules:

- *When ZFW is edited TOGW is recalculated*
- *When TOGW is edited ZFW is recalculated*
- *When BLOCK is edited TOGW is recalculated*
- *When TAXI is edited Value displayed in small font (either ZFW, BLOCK, or TOGW) is recalculated*
- *When BALLAST is edited UFOB is recalculated*

NOTE: A cost index entry is required to make FMC performance computations. Calculated entries will

contain dashed line fields until a CI is entered into the F-PLN INIT page.

At Engine Start

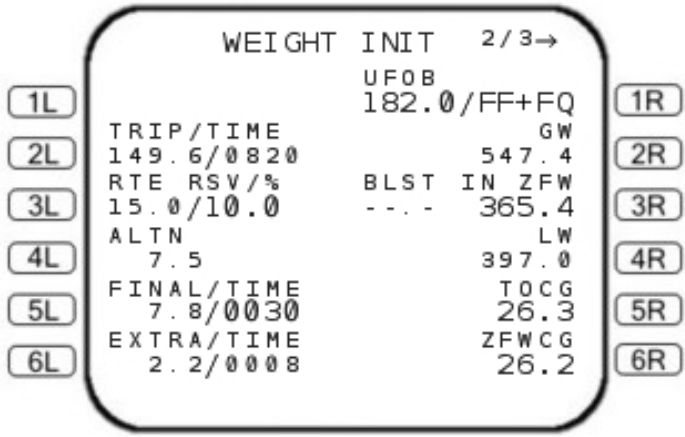
TAXI - This field is no longer displayed.

BLOCK - The BLOCK fuel field changes to show the sensors used for

UFOB calculation (FF+FQ) in the data line and the label line is blank. FF represents the fuel flow sensor and FQ represents the fuel quantity sensor.

ZFW - The ZFW is the same value it was before engine start. Regardless of whether ZFW was entered (LARGE font) or calculated (small font) before engine start, ZFW is always displayed in LARGE font. CHECK ZFW is displayed in the scratchpad if the difference of UFOB and BLOCK is greater than 1000 lb./500 kg.

GW/TOGW - The TOGW is replaced with GW. TOGW is still displayed on the TAKEOFF page. GW and TOGW differ by the amount of TAXI fuel.



After Engine Start

UFOB - The fuel is decreased by time integration of fuel flow sensors and/or fuel quantity readings to determine the accurate weight of the aircraft during the flight. Attempted pilot entry of UFOB with invalid FF or FQ data results in the display of SENSOR IS INVALID in the SP. The flight crew may deselect either sensor used for calculating UFOB, or may reinitialize UFOB by entering a new value (thereby deselecting the fuel quantity sensor). After deselecting either sensor, the flight crew may reselect it by clearing the 1R field.

NOTE: After the initial pilot entries have been made edits of weight data will result in another computation according to the following rules:

- *When UFOB is edited GW is recalculated.*
- *When GW is edited ZFW is recalculated.*
- *When ZFW is edited GW is recalculated.*
- *When BALLAST is edited GW is recalculated and ZFW is not recalculated.*

CHECK ZFW will be displayed in the SP upon BALLAST entry or edit.

INSUFFICIENT FUEL will be displayed in the SP if the EXTRA fuel is zero or less.

GW OUT OF RANGE will be displayed in the SP for those values of GW that are out of range.

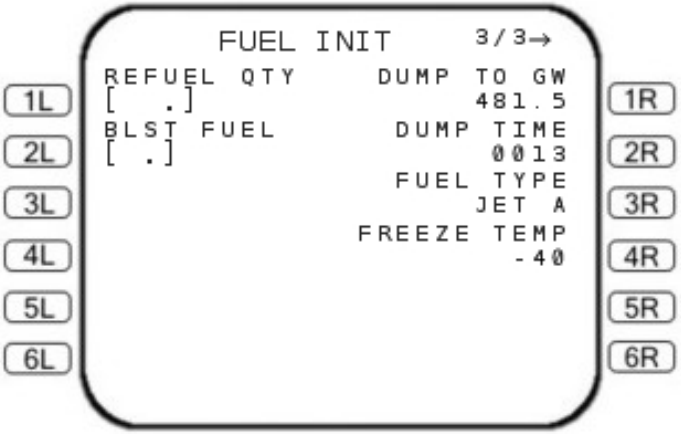
If TOCG differs from the CG determined by the fuel quantity gauging system by more than 2%, then the EIS will display CG DISAG in amber on the EAD and amber boxed CG on the SEC-ENG display.

FUEL INIT

The FUEL INIT page is page 3 of the F-PLN INIT and is accessed by the PAGE key from the F-PLN INIT page.

There are no lines containing boxes, indicating all entries on this page are optional. The pilot may enter fuel-related

parameters specific to a flight and/or after FMC-computed default entries.



REFUEL QTY - Enter the total fuel quantity wanted on board the aircraft when automatic quantity refueling is completed

PMDG TIP
The refueling process can be simulated from the "REFUELING" page accessed through the special "FS ACTIONS SHORTCUTS" menu located on the MENU page. If on the REFUELING page automatic refueling is selected, the REFUEL QTY value entered on the FUEL INIT page will be used.

BLST FUEL - Ballast fuel identifies a certain quantity of fuel on board identified as non-usable fuel. When a quantity is entered as ballast fuel, the prompt BLST TANK appears in line 3L. The line entry is boxed, requiring a pilot entry. If BLST fuel is entered or edited after engine start, CHECK ZFW will be displayed in the scratchpad of the MCDU.

Ballast fuel may be carried in tank 2, the upper auxiliary (UPR AUX) tank or in the tail (TAIL) tank. Enter 2, U, or T.

Attempted entry of any other tank results in the MCDU message FORMAT ERROR. Attempted entry of a BLST FUEL or BLST

TANK number that exceeds the tank quantity limit results in the MCDU message TANK LIMIT EXCEEDED. If the BLST FUEL entry is greater than the largest tank limit the message ENTRY OUT OF RANGE will be displayed, and the entry rejected.

NOTE: Ballast fuel will be retained after every flight until manually cleared by the flight or maintenance crew. The message CHECK BALLAST FUEL will be displayed when FMS transitions to DONE at the end of each flight where ballast is identified.

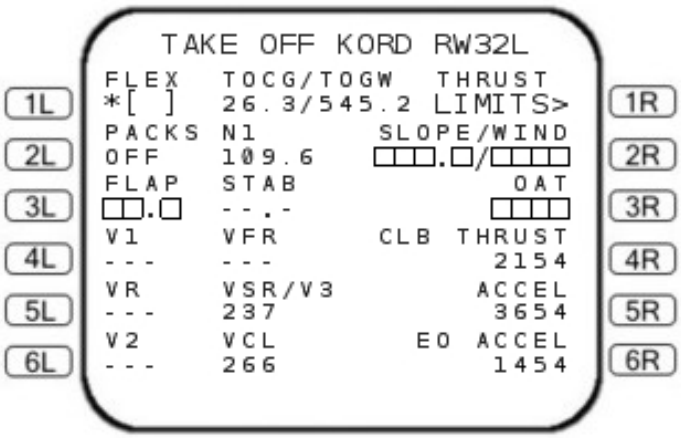
FUEL TYPE - Default to Jet A, but may be pilot altered. Fuels which may be entered include Jet A, A1, Jet B, JP4, and JP5. Enter A, A1, B, 4, or 5. Simply enter the fuel type. Jet A1, for example, is entered as A1, etc.

FREEZE TEMP - Defaults to the specified fuel freeze temperature of the entered fuel. FREEZE TEMP is pilot-alterable, but will cause the FUEL TYPE field to become dashed. The freeze temperature is used in the Fuel System Controller for freeze logic and fuel recirculation.

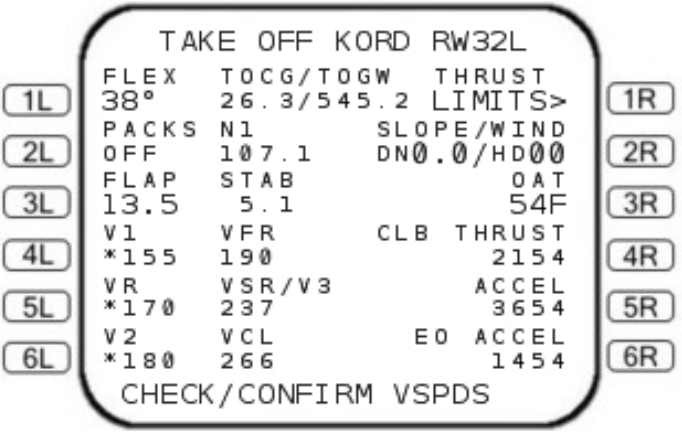
Takeoff Data Entry

The TAKEOFF page is the last page to access for preflight before leaving the gate. Pushing the TO/APPR key will display the TAKEOFF page. After takeoff, when takeoff mode is exited, the page will default to APPROACH which cannot be restored to TAKEOFF for the remainder of the flight.

TAKE OFF PAGE (TO/APPR key):



TAKEOFF PAGE WITH DATA:



FLEX - Allows pilot entry of an assumed temperature for a FLEX TO thrust rating. Range is from the present total air temperature (TAT) indication to 70°C. FLEX entries on this page are automatically entered on the THRUST LIMITS page. To regain full thrust, the assumed temperature may be cleared. TOCG and TOGW will be displayed to the right of FLEX.

TOCG/TOGW - These values are the same numbers as on the WEIGHT INIT page. After engine start, the TOGW on the WEIGHT INIT page will change to GW. As fuel is used, both pages will reflect the change.

FLAP - The flap setting is boxed, indicating a required pilot entry. Range is from 10° to 25° for the basic MD-11. For those MD-11s equipped with deflected aileron for takeoff, there is an additional flap setting of 28°. No flap setting between 25° and 28° is allowed. To the right, the computed stabilizer position is displayed. It is not pilot alterable.

V-SPEEDS - V1, VR, and V2 will be computed for pilot confirmation. Before they are computed, dashes are displayed, but the pilot may enter and clear speeds. Computed speeds are displayed in small font with an asterisk prompting the pilot to confirm the speeds by pushing the associated LSK. The MCDU SP message CHECK/CONFIRM V SPDS is displayed until V-speed confirmation or clearing of the message. Confirmed and pilot-entered values are displayed in LARGE font, but if cleared return to computed small font values.

NOTE: FMS will stop computing V-speeds when throttles are advanced for T/O.

VFR - The flap retract speed will be displayed when V1, VR, and V2 are computer or pilot entered.

VSR/V3 - The slat retract speed is the same as V3 and will be computed and displayed based on aircraft gross weight.

VCL - The operational climb speed is displayed after a TOGW is entered. VCL will be computed and displayed based on aircraft gross weight. This field is not pilot alterable. VCL will become the active FMS speed target above the all engine acceleration altitude and until 10,000 feet.

THRUST LIMITS - Pushing LSK 1R will display the THRUST LIMITS page.

SLOPE/WIND - Runway slope and wind components are mandatory pilot entries. U or + designates an uphill slope, while D or - designates a down-hill slope. H or +, and T or - designate a headwind or tailwind

respectively. Omission of the prefixes with the slope and/or wind will be assumed to be an uphill slope and/or a headwind component, respectively.

OAT - Outside air temperature is boxed indicating a mandatory entry for V-speed computations. Entries may be preceded by a + or - for temperature, otherwise + will be the default. Entries may be made in either degrees Centigrade of Fahrenheit. C for Centigrade or F for Fahrenheit must follow the temperature entered. After the temperature is entered, pushing 3R with no data in the scratch pad shall cause the OAT entry to be converted between Centigrade and Fahrenheit values.

NOTE: Temperature for the FMS OAT must not be taken from the TAT display on the EAD. Another source, such as ATIS, ATC, weather dispatch, etc., must be used.

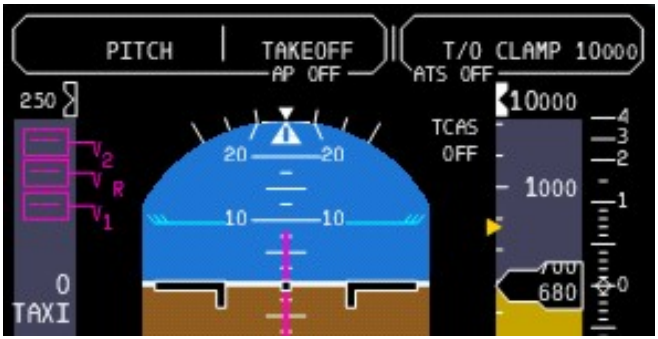
CLB THRUST - Altitude at which takeoff thrust can be reduced to climb thrust. Defaults to 1500 feet above airport elevation. Pilot-alterable, minimum 1000 feet above airport elevation.

NOTE: With FCP altitude set lower than ACCEL or CLB THRUST altitude, the values will be edited to the FCP altitude when the FCC transitions in altitude capture. Upon altitude capture, the FMS speed target will become the climb speed target VCL. Thrust reduction will occur when the FCC enters ALT hold mode.

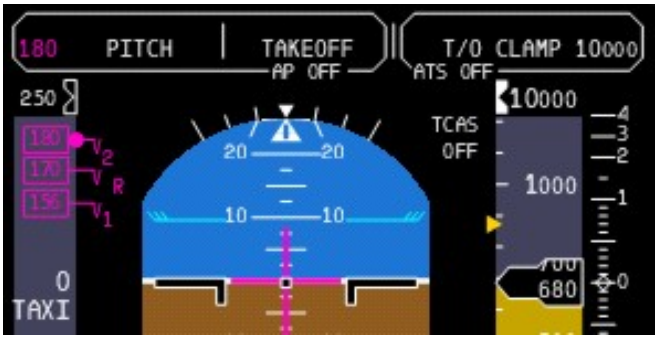
ACCEL - Default 3000 feet above origin elevation (small font) where acceleration above V2 + 10 can begin. Pilot alterable, minimum 1000 feet above airport elevation.

CAUTION: If it is planned that the aircraft will remain in the traffic pattern after the first takeoff and will not climb above the default ACCEL altitude, the ACCEL altitude should be edited below the aircraft's initial level off. This will ensure the FMS speeds are to 1.3 VS and not to 1.2 VS (takeoff or go-around mode).

EO ACCEL - Default 800 feet above origin elevation (small font) where engine out acceleration is initiated. Pilot alterable, minimum 400 feet above airport elevation.



NOTE: V-Speeds are dashed on the PFD until they are confirmed.

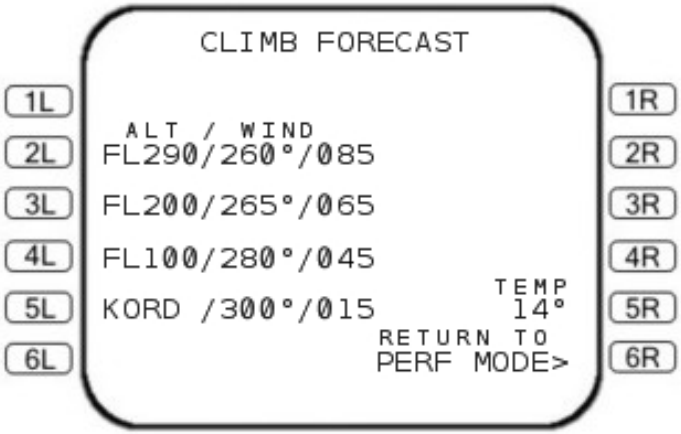


NOTE: Pressing LSK L4, L5 and L6 will confirm the speeds.

Climb Forecast

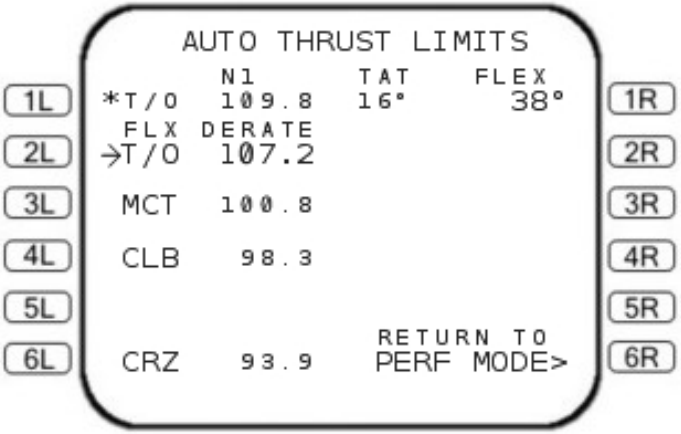
To reach the climb forecast page, press PERF, then the 5R LSK at the FORECAST> prompt.

The CLIMB FORECAST page ALT/WIND entries are accomplished the same as waypoint wind entries. As a minimum, two wind entries are recommended, one of which is the origin airport (line 5L) and the others to be entered in 2L, 3L, or 4L. No matter where the altitude/ wind is entered, it is ordered according to altitude from top to bottom.



THRUST LIMITS Page

The THRUST LIMITS page enables the pilot to select thrust limits. It can be accessed from the PERF, active CLB, CRZ, DES page, the GO AROUND and the TAKEOFF page. Pushing LSK 6R will display the THRUSTS LIMITS page.



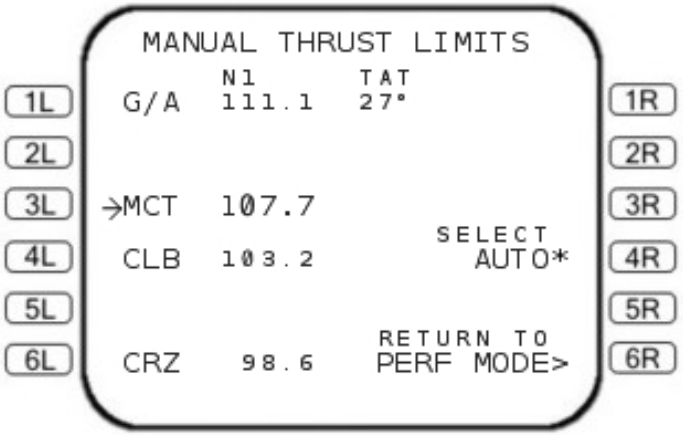
The THRUST LIMITS page is initialized to AUTO for the FMS preflight phase. The active thrust limit rating is preceded by an arrow (N1 value also displayed in LARGE font). A flex

temperature has been pilot-entered (LARGE font) thus automatically selecting FLX T/O 107.2 N1 as the thrust limit. The entered flex temperature must have a value equal to or larger than the TAT, but not exceeding 70°C. With the flex data field cleared (CLR key), the auto selected thrust limit would become T/O. Selections on this page merely set thrust limits; they do not control the thrust required.

MCT and CRZ thrust limits are always ARMED. LSK 3L, 4L, 6L, and 6R are identical as in the preflight/takeoff portions of flight with the exception that the ARMED climb thrust limit is now ACTIVE (preceded by an arrow) and the other climb limits are AVAILABLE FOR ACTIVATION (preceded by asterisks).

MCT automatically becomes ACTIVE if an engine out situation is encountered or in the event of low speed protection. Once the engine-out or low-speed condition has been cleared, the thrust limit will automatically transition from MCT to CLB or CRZ as appropriate for current flight phase.

Any MANUAL mode may be initiated by selecting an appropriate LSK. The MANUAL THRUST LIMITS page is shown in the following screen.



On the MANUAL THRUST LIMITS page, all of the thrust limits are AVAILABLE FOR ACTIVATION and displayed in LARGE font. The ACTIVE thrust limit is preceded by a right arrow with

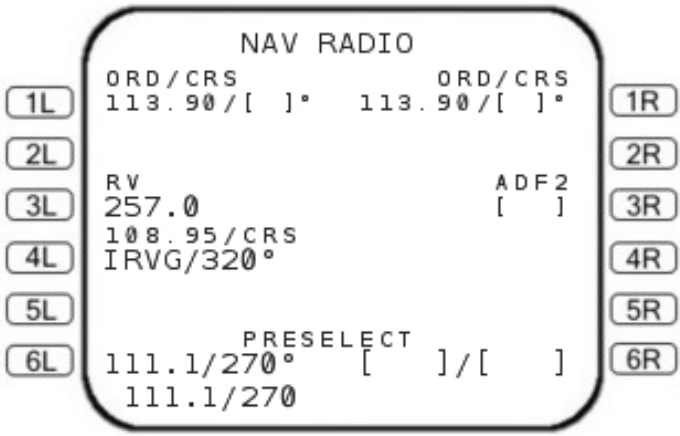
the corresponding thrust rating displayed in LARGE font. Line 4R displays the SELECT AUTO* prompt; selection of this prompt changes the thrust limit mode to AUTO. In MANUAL mode, only crew action can change the ACTIVE limit, except in the event of an engine out, or low-speed protection. Even in these cases, the thrust limit mode remains MANUAL.

NAV Radio Tuning

The NAV RADIO page provides tuning status display and tuning control capability for the VOR, ADF and ILS receivers. It also provides for selection of VOR TRACK and LOC ONLY modes.

On this page small font values in the data line (lower line) are FMC auto tuned frequencies, identifiers or courses. LARGE font values in the data line are pilot-entered data. Label lines remain in small font.

STEP: Push NAV RAD



1L **1R** The selected navaid ident, frequency and course of VOR 1 and VOR 2, respectively.

Label Line - Either the selected ident or frequency is displayed followed by /CRS. This line is always shown in small font.

Data Line - Either the selected frequency or ident is displayed, followed by the course if entered. A course may not be entered without a frequency or ident.

Lines 1L and 1R display the autotuned or manually tuned station for VOR 1 and 2, respectively. If autotuned, the course data (/[ ]) will be blank.

VOR 1 and 2 may be manually tuned by inserting the station three-letter identifier or by entering the station frequency in line 1L or 1R. If tuning was accomplished with the identifier, the frequency will be shown above the identifier in small font. If the frequency was used, the identifier will appear in small font above the selected frequency. If any identifier entered on this page is not found in the data base, MCDU message NOT IN DATA BASE is displayed in the SP. If the frequency is not found, the label line remains VOR/CRS. If more than one selected ident exists, the DUPLICATE NAMES page is displayed for pilot selection of the correct navaid.

When entering the course in line 1R and 1L, the respective CDI on the VOR ND will be set to the selected course. If the station was tuned by entering the identifier in line 1R or 1L, the course line will also be displayed on the ND MAP page from the respective VOR.

NOTE: If the station frequency was used to tune the VOR station, the course may not be displayed on the ND MAP page.

The preferred method of tuning VOR navaid is to use the station identifier. Proper VOR tracking and navigation is provided with either tuning method.

2L	**2R**	If the VOR MODE is available, a small font VOR ARM prompt with asterisk appears on the same side of the MCDU as the selected VOR/CRS. Two VOR ARM prompts may be displayed at a time. Pushing LSK 2L or 2R prepares the FMC for the VOR mode and replaces VOR ARM with VOR ARMED in LARGE font. Once the VOR mode conditions for VOR tracking are satisfied, VOR TRACK (LARGE font) replaces the VOR ARMED display and the aircraft will track that course. VOR mode is only available below 18,000 feet. Any VOR prompt or display may be cleared by use of CLR key.
3L	**3R**	Automatically tuned or pilot-entered ADF frequency or ident. The un-entered item (frequency or ident) will be displayed in the label line.
4L		ILS ident or frequency and course are pilot-enterable and will be displayed in LARGE font. In autotune, the ident is placed in the label line with frequency placed in the data line (small font). The course field displays runway heading derived from the selected runway. Runway heading is used by the AP/FD when autoland is active.

5L With the course entered in 4L, the LOC ONLY prompt with asterisk is displayed in small font if the pin option was selected. Pushing this key provides ILS localizer guidance with disabled glideslope guidance. Upon receiving the LOC ONLY mode request, the AFS is armed to capture the localizer. LOC ARMED is annunciated on the FMA. When the FCC localizer capture criteria are satisfied, the AFS captures and controls to the ILS localizer using the same FCC controls laws as when APPR/LAND is selected. Engaging another lateral control mode cancels the LOC ONLY mode. Descent to the MDA must be accomplished by use of the FCP V/S and altitude set functions. Selecting NAV, APPR/LAND, VOR ARM, or pushing the HDG/TRK select knob will reset the LOC ONLY approach mode. The LOC ONLY mode may also be disengaged by the FMS or may be deselected on the MCDU by selecting another ILS frequency.

6L **6R** PRESELECT provides the pilot with storage capabilities for future entries. Frequency or ident and course are entered by SP and LSK or may be cleared by the CLR key and SP. The navaid course data may be transferred to a different data field by pushing the desired PRESELECT key which drops it to the SP, then pushing the LSK corresponding to the field where the preselect information is desired.

NOTE: Once a radio has been manually tuned, it will not autotune again until that radio frequency is CLEARED.

Departure Runway Change

The situation may arise requiring the pilot to change runways and/or departure during taxi. Upon throttle advance for takeoff, FMS position will be updated to the proper point on the runway. A change of the

departure runway (also SID and transition) may be accomplished by accessing the flight plan and completing a LAT REV to the present takeoff runway. A discontinuity will be created between the new runway and the first waypoint on the flight plan.

Clearing the F-PLN DISCONTINUITY will connect the new runway with the first route waypoint and enable new FMC computation of F-PLN predictions.

> *NOTE: A DISCONTINUITY will not be generated and inserted into the F-PLN if the SID termination waypoint is a common waypoint with the original F-PLN route. In this case, F-PLN waypoints between the origin runway and common termination waypoint will be deleted.*

Because the runway has been changed, the message CHECK/ CONFIRM VSPDS is displayed in the SP and the V-speeds must be reentered prior to departure. Also, the FLEX T/O thrust settings will be reset to maximum T/O thrust and will require reselection.

TOGW Update

The TOGW may be updated on the WEIGHT INIT page. Access to this page is gained by pushing the INIT and PAGE keys.

Changing the GW after engine start changes the ZFW and could affect ZFWCG and the TOCG. Check these values and the V-speeds.

> *NOTE: If the UFOB is invalid (dashed) and GW is invalid (dashed), the pilot must first enter UFOB before entering a GW. When UFOB is pilot-updated, the fuel quantity (FQ) is removed from the UFOB computation and only fuel flow (FF) is used to update UFOB.*

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Takeoff

During takeoff, the pilot flying should monitor the MCDU T/O page and the pilot not flying should monitor the ACT F-PLN page.

The FMC will update its reference position to the programmed runway threshold coordinates when throttles are advanced to takeoff thrust. FMS NAV may be armed before T/O at pilot's discretion. If NAV is armed prior to T/O, F/D NAV guidance will be available at 100 feet AGL. The AP may not be connected below 400 feet AGL if NAV is armed/engaged. (CAWS AP disconnect will sound if attempted.)

The NAV mode will not arm/engage if any of the following conditions exist:

- Aircraft on the ground and less than three engines operating
- LAND or AP GA modes active
- Below 100 feet above the destination altitude (on arrival). FMS SPD may be engaged above 400 feet AGL

NOTE: If AP is engaged below 400 feet AGL, NAV button pushes will be ignored until above 400 feet AGL.

FMS PROF mode may be armed before takeoff at pilot's discretion and will be available at 400 feet AGL.

The PROF/FMS SPD mode will not engage if any of the following conditions are present:

1. A/C STATUS page displays NO FMS SPD/PROF message on the SP.
2. SENSOR STATUS page indicates any of the following computers have failed:
   - All three IRUs
   - Both ADCs (three ADCs for some aircraft)
   - Both FCCs
3. The following information is not entered or is not valid on the MCDU:

- Valid gross weight or ZFWCG airborne
- Cost index (CI)
- CRZ level for takeoff, climb, and cruise phase
- V2 speed

4. Both MCDUs have failed to the master FMC.

NAV armed/track may be cancelled by the following:

1. Pushing FCP HDG/TRK select knob to select existing heading
2. Selecting APPR/LAND (when LOC capture occurs)
3. Selecting VOR ARMED or LOC ONLY (when capture occurs)

NOTE: The NAV mode will automatically disengage when the FMC enters a F-PLN DISCONTINUITY.

PROF mode will disengage with any of the following:

1. Rotating the vertical speed wheel
2. Pushing or pulling the altitude preselect knob to engage the FCP altitude hold or altitude select mode (level change)
3. Engaging the AP/FD GA or glideslope mode
4. FMS disengagement of PROF

If the autothrottles are not engaged when PROF is selected, they will engage when the PROF switch is pushed.

The absolute altitude floor or ceiling in all AFS modes, including FMS PROF, is the altitude displayed in the FCP altitude window except in LAND mode.

The FMS SPD mode may be selected independently from the PROF mode if desired. When the FMS SPD mode is active, the FMA speed target and speed control legend changes from white to magenta in color. The FMS SPD mode is canceled when:

1. FCP speed is selected by pushing or pulling the IAS/MACH select hold or select mode).
2. GA mode selection.

Pushing the FMS SPD button within 10 seconds after preselecting an FCP speed results in editing the speed on the active PERF page in the EDIT field. A solid magenta circle will immediately be displayed on the PFD airspeed tape. The IAS/MACH select window on the FCP will display dashes. Pushing the FMS SPD switch a second time will cause the FMS to return to the ECON speed profile. If the FMS SPD switch is not pushed within 10 seconds of an FCP speed pre-selection, the magenta circle will turn to a shadow bug. Pulling the speed knob with a shadow bug displayed will manually edit aircraft speed but not FMS speeds.

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Climb

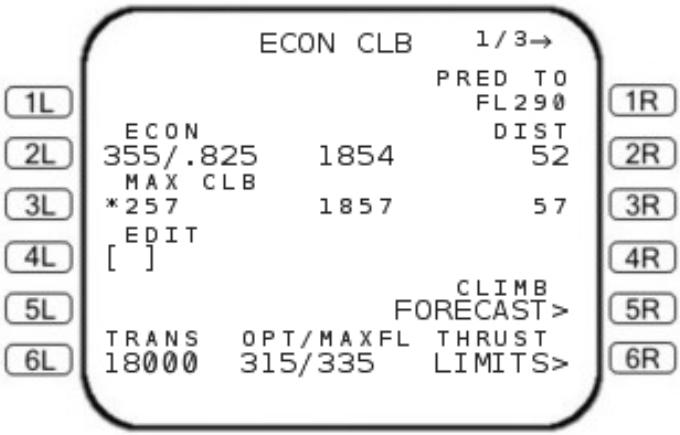
The FMS CLIMB (CLB) phase begins when the aircraft climbs above the thrust reduction altitude with all engines operating and ends when the top of climb (T/C) is attained.

Speed is controlled to V2 + 10 until the acceleration altitude where it begins to increase to the speed limit of VCL knots below 10,000 feet. Above 10,000 feet, the FMS target speed for the active performance mode is selected for the remainder of the climb. Altitude and speed constraints are observed during the climb if they exist. During the climb to altitude it may be desirable to modify the flight plan or climb schedule. These modifications could alter climb performance, entered altitude, speed, or time constraints and/or routing. FMS operation to accommodate these changes will be discussed in this section.

Climb Performance Change

The climb performance may be changed on the active PERF page by selecting an alternate performance mode. To climb at 320 KIAS, the speed may be entered via the IAS/MACH preselect and FMS SPD switch or from the PERF page as shown in the following example. Pushing the PERF key displays the MCDU page shown in the following screen.

STEP: Push PERF

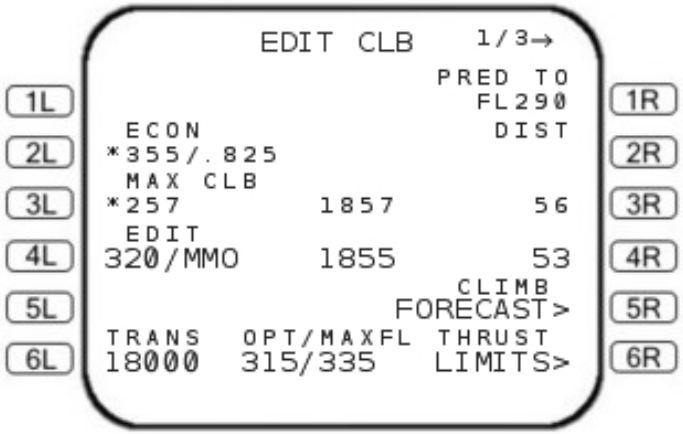


Entering 320 in the SP and pushing LSK 4L enters the speed in the EDIT brackets. Pushing LSK 4L again selects it (LARGE font) to control aircraft speed as shown in the following screen.

STEPS: 1. Type 320 in the scratchpad

2. Push 4L

3. Push 4L



Reselecting ECON speed or MAX CLB (best angle of climb) speed changes the pilot-selected climb performance mode, but the edit value will be retained in small font with an asterisk or possible future reselection. Clearing the EDIT speed is not allowed.

MAX CLB gives the recommended speed for best angle of climb. This speed schedule is slightly above VMIN and is approximately 1.4 V stall. Selecting MAX CLB, when at high speed in ECON or EDIT, provides the opportunity to exchange that high speed for altitude.

NOTE: When FMS SPD mode is disengaged, the ACTIVE mode will not automatically revert to ECON. When FMS speeds are reengaged, the ACTIVE mode will be the last engaged FMS SPD mode (ECON, EDIT, MAX). If ECON was not the last engaged mode, EDIT or MAX will become active and a second FMS SPD button push will engage ECON.

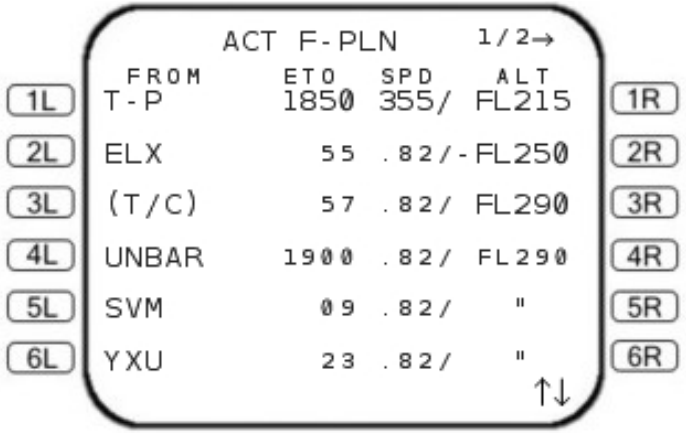
At most weights MAX CLB speed falls below the slat retraction speed. Climb at MAX CLB speed with the slats still extended will not achieve the desired gradient. If not previously edited, and best angle of climb is required, retract the flaps and slats according to the normal speed schedule, and then select an EDIT FMS speed equal to VMIN + 10 knots.

Vertical Climb Revisions

When vertical altitude restrictions or deletions of restrictions occur during climb, the FMC can be modified to provide updated vertical guidance and performance. Changes to waypoint and airspeed constraints, altitude speed limits and CRZ FL may be accomplished. There can only be one altitude/speed limit for the CLB phase or one in the DES phase of flight. The initially selected CRZ FL must be eventually attained or changed or the FMS will not transition to the CRZ phase of flight. Altitude restrictions may be inserted and cleared by direct entry into the F-PLN or through a VERT REV to the revise waypoint. For example, ATC instructs PMDG01 to cross ELX AT OR BELOW FL250. AT OR BELOW FL250 is inserted into the F-PLN by typing /-250 in the SP and pushing LSK 2R. An AT OR BELOW uses a minus (-) sign, an AT altitude is accomplished by no sign, and AT OR ABOVE uses a plus (+) sign.

STEPS: 1. Type /-250 in the scratchpad

2. Push 2R



To enter an airspeed constraint at a waypoint, enter the constraint airspeed with or without the trailing slash (/) and push the revise waypoint right LSK.

To clear both airspeed and altitude the CLR key and SP may be used. The altitude or airspeed constraint entry may also be accomplished by a VERT REV to the constraint waypoint. Pushing ELX's right LSK results in the VERT REV AT ELX. Entry of 250 in the SP and pushing LSK 5L results in FL250. The FMC is not certain of the constraint being a *CLB or a DES* altitude constraint and invites pilot's clarification. Pushing LSK 6L *CLB enters the altitude as a climb in the F-PLN.

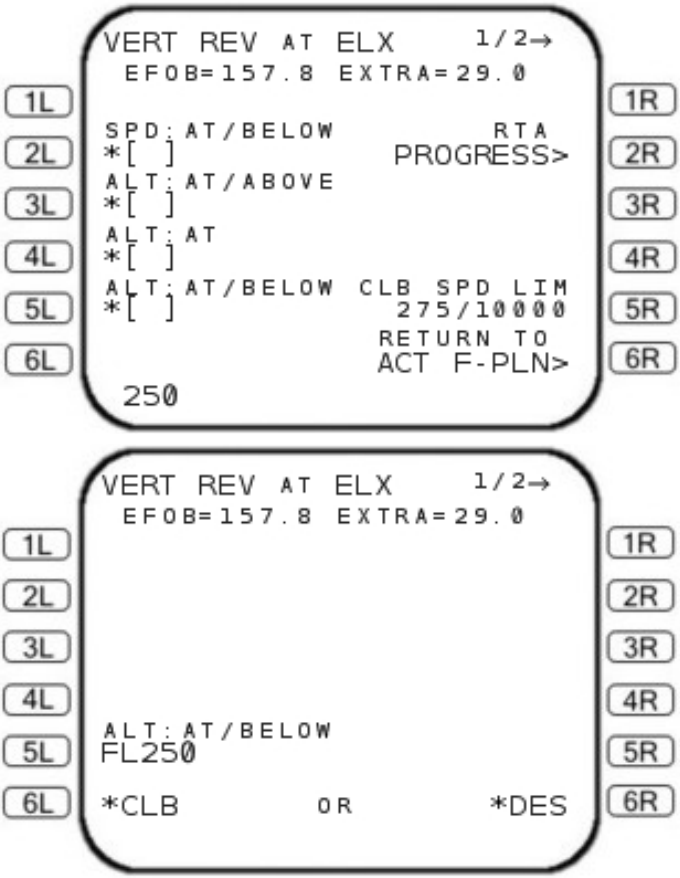
The EIS navigation display depicts the altitude constraint.

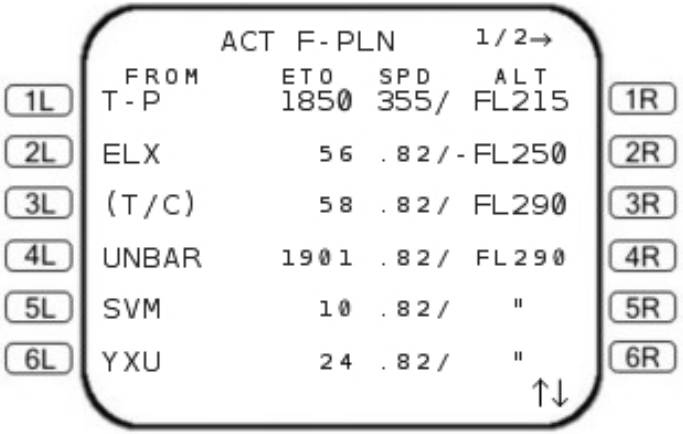
STEPS: 1. Push the RIGHT LSK abeam ELX

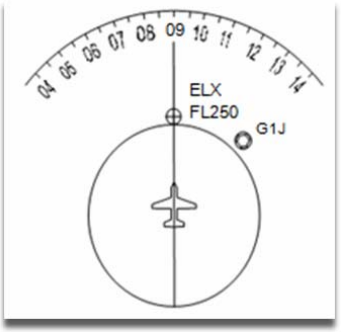
2. Type 250 in the scratchpad

3. Push 5L

4. **Push 6L**


VERT REV AT ELX 1/2→
EFOB=157.8 EXTRA=29.0
SPD:AT/BELOW
*[ ]
RTA
PROGRESS>
ALT:AT/ABOVE
*[ ]
ALT:AT
*[ ]
ALT:AT/BELOW CLB SPD LIM
*[ ] 275/10000
RETURN TO
ACT F-PLN>
250
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R
VERT REV AT ELX 1/2→
EFOB=157.8 EXTRA=29.0
ALT:AT/BELOW
FL250
*CLB
OR
*DES
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R





Only attitude constraints that are defined by the flight crew as AT or AT OR BELOW are restrictive in the takeoff/climb phase of flight. If conflicting altitude constraints (consecutive altitude constraints which would require a descent in the takeoff/climb phase) are encountered, then they are resolved as follows:

- The restrictive altitude of each lower (conflicting) constraint is made equal to that of the higher constraint.
- Each lower (conflicting) altitude is displayed in the flight plan at its associated waypoint.
- MCDU message CHECK ALT CSTR - XXXXXXX is displayed if conflict exists. XXXXXXX is the name of the waypoint.

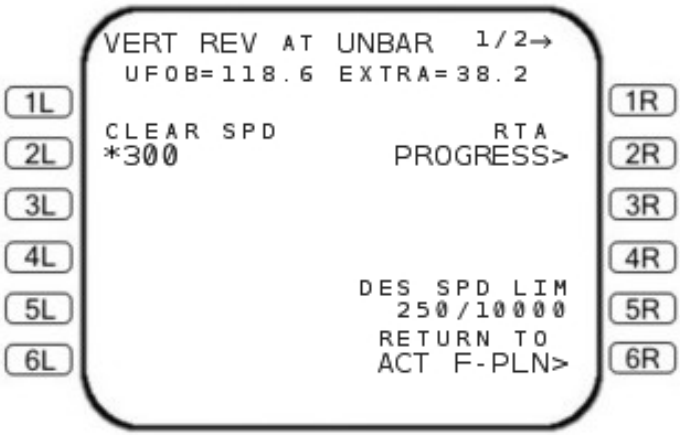
Altitude constraints that exist above the CRZ ALT will be automatically deleted when the FMS transitions from CLB. In this case the MCDU message CLB ALT CSTRS DELETED will be displayed.

A speed (SPD) constraint may be inserted at waypoint ELX by entering a value into the data field associated with 2L. Simply type the speed into the SP and enter by pushing LSK 2L. An airspeed constraint can also be inserted at waypoint ELX on the VERT REV AT ELX page.

NOTE: Mach constraints cannot be made.

Speed constraints entered at cruise or descent waypoints become effective after sequencing the waypoint. This speed then becomes the upper limit for the remainder of the flight, unless removed.

When a constraint is active, a prompt is displayed on the VERT REV page of the FROM waypoint (next figure) to give the pilot a way to remove the constraint, if necessary. Pushing 2L removes the constraint and resumes normal speed.



A climb speed limit is computed and displayed into the flight plan as VCL knots at or below 10,000 feet. The limit may be found on any climb waypoint VERT REV page and may be cleared by use of the CLR key or altered by pilot entry into data field 5R.

If it is desired to level and cruise at an altitude below the initial CRZ ALT found on the F-PLN INIT page, it will be necessary to change the F-PLN INIT initial CRZ FL or the FMS will not transition to CRZ flight.

If an altitude conflict exists between the FMS target altitude and the FCP selected altitude such that the aircraft is between the two, ???? is displayed on the left side of the title line (replacing TIME) to indicate the conflict. This condition can occur when the FCP altitude is set below aircraft altitude in CLB or above aircraft altitude in descent.

The pilot may select a speed higher than 250 knots by preselecting it on the FCP and pulling the speed knob. This action will override the FMS speed and fly the selected speed. However, this selection does not affect the NAV or PROF selections.

Above the speed limit and after all entered climb speed constraints, the FMS will command speed targets as selected on the active CLB PERF page. These speed targets appear on the speed tape as an open magenta circle. Pushing the FMS SPD button commands the aircraft to fly the FMS speed target (magenta circle becomes solid).

Holding Patterns In Climb

With a holding pattern in the climb portion of the flight plan, 3 minutes prior to the waypoint at which a hold exists, the aircraft will begin a deceleration to the holding speed. The default holding speeds are limited by the ICAO upper speed limit as shown below. The holding speed, like any other speed, is bound by the upper and lower speed envelopes (VMAX - 10 and VMIN + 5). Above the acceleration altitude, the holding speed and ICAO limit will override the operational climb speed VCL (below 10,000 feet) and override the FMS ECON speed above 10,000 feet. The holding speeds should be edited on the FLIGHT PLAN page to VCL.

ICAO SPEED LIMIT FOR THE HOLDING PATTERN	
ALTITUDE	**UPPER SPEED LIMIT**
Up to 14,000 feet	230 KIAS
14,000 - 20,000 feet	240 KIAS
20,000 - 34,000 feet	265 KIAS
Above 34,000 feet	.83 Mach

Required Time Of Arrival (RTA)

The RTA function is used to adjust flight speeds in order to cross over a specified waypoint before, after, or at a given time.

NOTE: RTAs are intended for use with waypoints 1 hour or more downtrack. While controlling to an RTA, FMS cruise speed mode must be ECON. The FMS assumes ECON speed mode beyond the RTA fix. The FMS does not provide for an independent selection of a different cruise speed mode beyond the RTA fix.

The FMC provides the capability for AT, AT OR BEFORE, and AT OR AFTER RTA entries. On the RTA PROGRESS page 2/2, the RTA entry in line 1R must be followed by a minus (-) for an AT OR BEFORE or followed by a plus (+) for an AT OR AFTER. Absence of a - or + sign will signify AT RTA. One RTA may be specified for each of the primary and secondary flight plans. The RTA fix entry must specify an existing flight plan waypoint. Pushing LSK 1R prior to descent fight phase will enable the RTA function.

Activation of RTA mode is allowed while on the ground. However, no RTA cruise speed adjustment will be calculated. Instead, a departure time will be calculated based on the entered RTA and FMS ECON predictions. After takeoff, an RTA entered in preflight is automatically deleted from the flight plan as UTC is substituted for estimated time enroute. Therefore, in order to meet a desired RTA at a waypoint, it is necessary to reinsert into the F PLN. RTAs modify cruise flight speed prior to the associated waypoint and then only if the FMS ECON mode is active for that part of cruise. However, RTAs may be entered

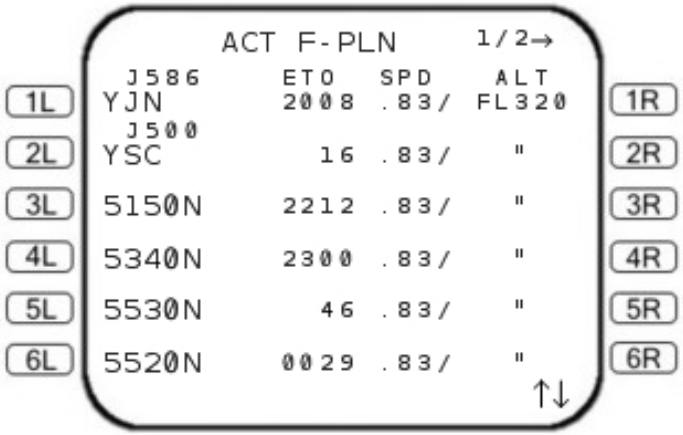
at any waypoint. The restrictive speed will be that speed necessary to reach the associated waypoint at the desired time (±30 seconds).

NOTE: Arrival time control performance will be ±30 seconds when accurate forecast winds have been entered and the aircraft is not thrust or speed limited.

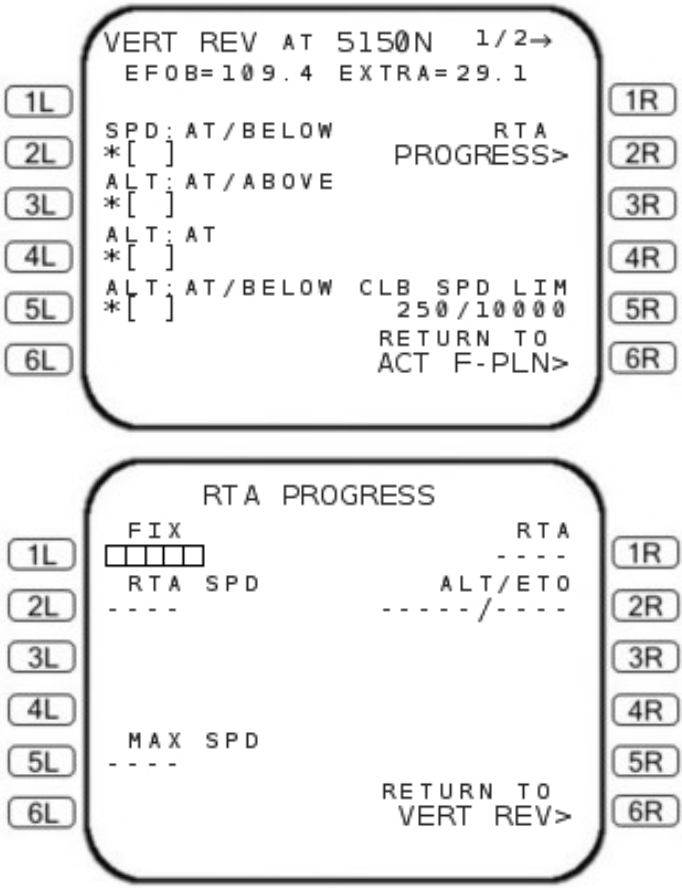
RTA PROGRESS, and the SEC RTA PROGRESS MCDU pages are used for entering RTA. Access to the RTA PROGRESS page is via the VERT REV page or from the next page key from the PROGRESS page. Access to the SEC RTA PROGRESS page is via the SEC VERT REV page or from the next page key from the SEC PROGRESS page.

As in the example, it was requested that PMDG01 arrives at 5150N at 22:20 UTC. To reenter the RTA constraint, perform a VERT REV, on the F-PLN next to any cruise waypoint.

STEP: Push 3R



STEP: Push 2R

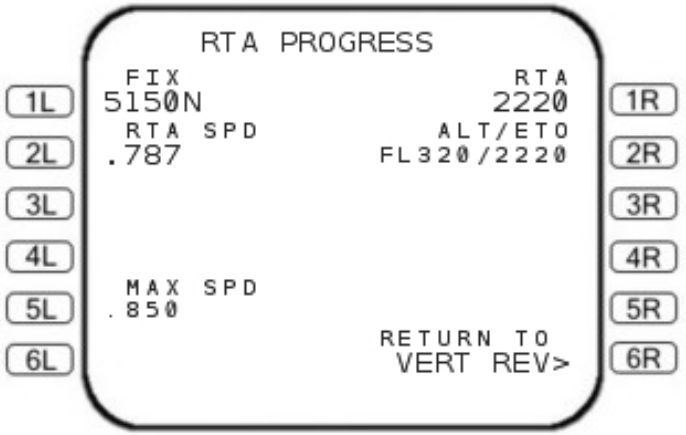

VERT REV AT 5150N 1/2→
EFOB=109.4 EXTRA=29.1
SPD: AT/BELOW
*[ ]
RTA
PROGRESS>
ALT: AT/ABOVE
*[ ]
ALT: AT
*[ ]
ALT: AT/BELOW
*[ ]
CLB SPD LIM
250/10000
RETURN TO
ACT F-PLN>
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R
RTA PROGRESS
FIX
RTA
- - - -
RTA SPD
- - - -
ALT/ETO
- - - - -/- - - -
MAX SPD
- - - -
RETURN TO
VERT REV>
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R

STEPS: 1. Type 5150N

2. Push 1L

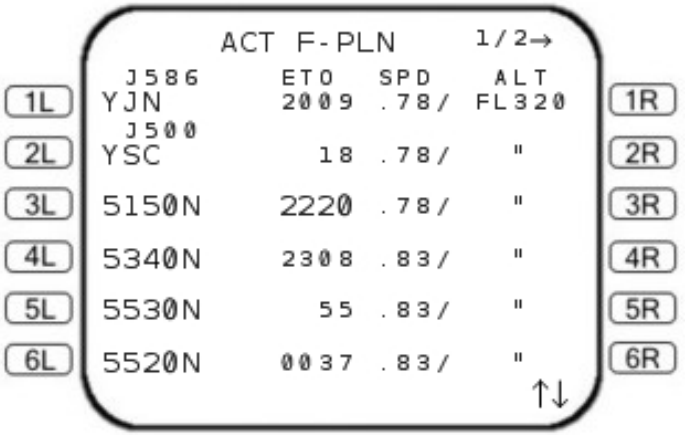
3. Type 2220

4. Push 1R



STEPS: 1. Push the 6R to return to VERT REV

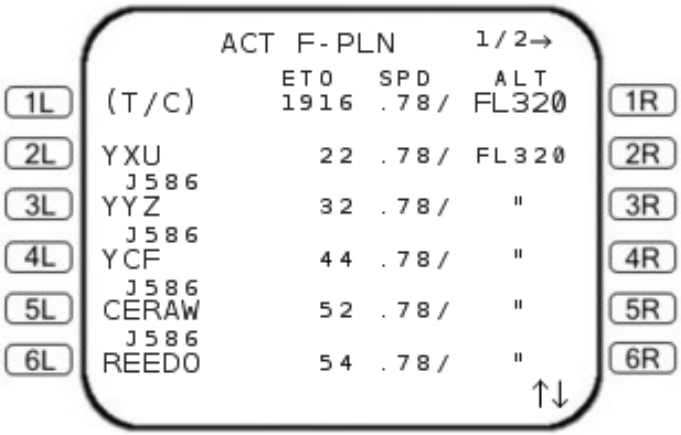
2. Push the 6R to return to ACT F-PLN



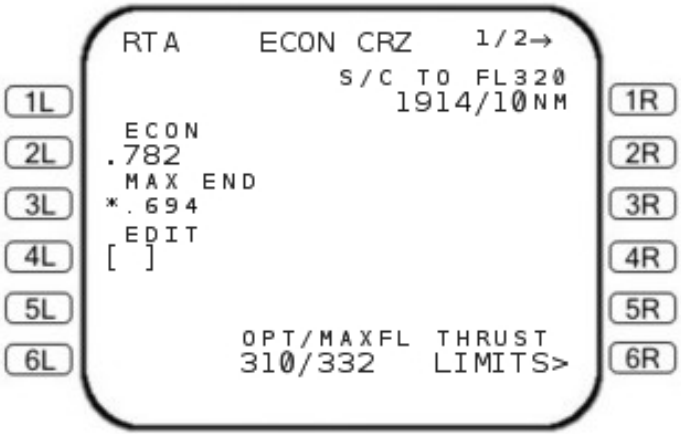
Scrolling back to the T/C point, it can be noted that the cruise speed has been adjusted to .78 Mach to arrive at 5150N at the assigned

time of 22:20 UTC. The PERF page shows a similar commanded speed.

STEP: Scroll through the flight plan by pressing the DOWN arrow



STEP: Push PERF



The time constraint may be cleared by returning to the VERT REV page by pushing the CLR key and LSK 2R.

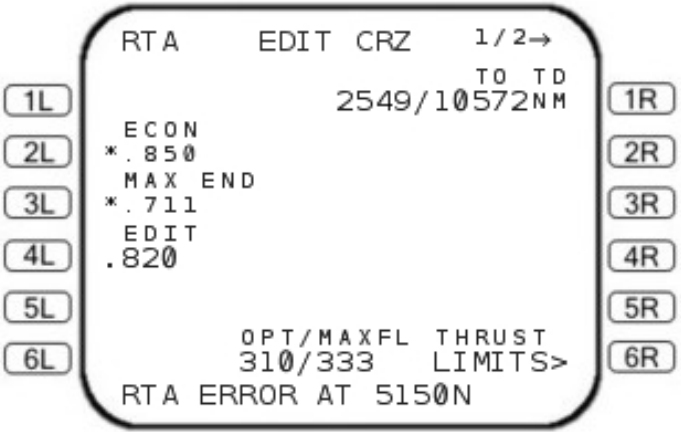
During RTA constrained ECON CRZ the pilot may choose a different speed mode such as MAX END or EDIT speed. This choice may

create more than a ±30 second error at the constrained waypoint. If it does, the MCDU message RTA ERROR AT 5150N will be displayed.

STEPS: 1. Type .82 in the scratch pad

2. Push 4L

3. Push 4L

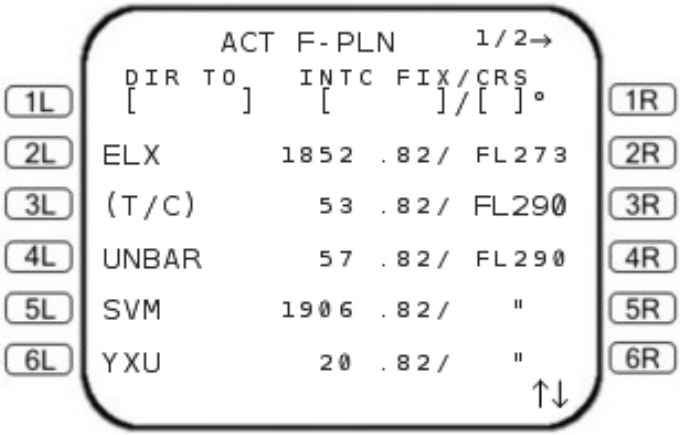


Direct-To a Waypoint

During climb it is common to be either cleared DIR TO a waypoint to intercept a course to a waypoint either on or off the flight plan. The DIR INTC function key allows the pilot to select, review, and insert a direct path from the aircraft's present position to a selected fixed waypoint or to intercept a pilot-defined inbound course to any waypoint. When the DIR TO waypoint is identical to any fixed waypoint in the flight plan, then a direct leg is strung to that waypoint with intervening waypoints being deleted or retained as abeam waypoints. If the DIR TO waypoint is not in the F-PLN, a direct leg is created to the waypoint followed by a DISCONTINUITY.

Pushing the DIR INTC key displays the DIR TO and INTC FIX/CRS prompts on the F-PLN page.

STEP: Push DIR INTC



1L DIR TO - Replaces the FROM field of the active F-PLN page 1. The field allows entry of the desired waypoint which can be selected from the active flight plan by pushing its left LSK with the SP empty or by manual entry of a waypoint not in the F-PLN. In either case, the entered waypoint is asterisked with the ND displaying the proposed route change as a dotted magenta line. When asterisked, the *ABEAM POINTS prompt appears in line 2L.

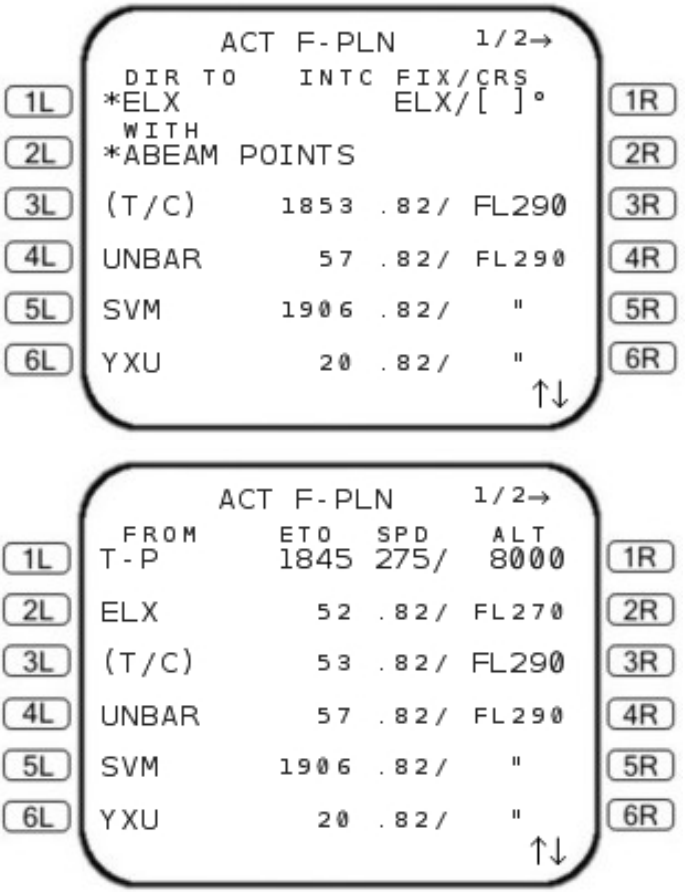
1R INTC FIX/CRS - The waypoint entered in line 1L is also entered in line 1R followed by a trailing asterisk. A unique and separate waypoint and inbound course entry may be made via the SP using a slash (/) to separate waypoint and course. Waypoint and course may be entered separately. After the inbound course is entered, a trailing asterisk is displayed and insertion into the F-PLN is possible by again pushing the LSK next to the asterisk.

The F-PLN waypoints can be scrolled. When a left LSK is pushed adjacent to a fixed waypoint with the SP empty, the waypoint is entered into lines 1L and 1R. Waypoint entry can also be entered as either an IDENT, LAT/LONG, or PBD via the scratchpad.

To execute a maneuver direct to ELX, the pilot need only push LSK 2L to enter ELX into line 1L. The asterisk appears and the proposed routing may be viewed on the ND (soft DIRECT TO, dotted magenta line). Pushing LSK 1L inserts a turn-point (T-P) into the F-PLN at the present position FROM point. A maneuver is immediately initiated to proceed directly to the entered waypoint.

STEPS: 1. Push 2L

2. Push 1L



After inserting an INTC FIX into the F-PLN, if the existing heading intercepts the inbound course short of the chosen waypoint, the aircraft will continue flying directly to an FMC-created intercept waypoint. If the SP message NOT ON INTC HEADING is displayed, the aircraft is not on an intercept heading to the selected course. The intercept waypoint must be within 1000 NM of both the aircraft and selected fixed waypoint. Otherwise, the F-PLN is unchanged and the SP message NOT ON INTC HEADING is displayed.

Transition To Cruise

The FMS transitions from a climb or descent to cruise mode of operation when the aircraft altitude equals cruise flight level ±50 feet and the cruise flight level equals clearance altitude ±50 feet.

Intentionally Left Blank

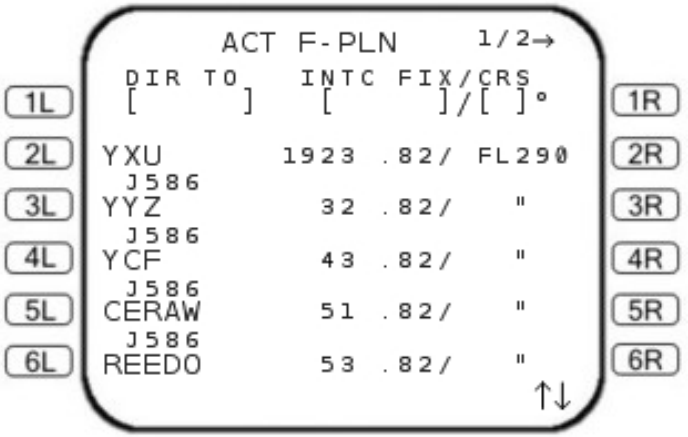
Cruise Flight

Cruise flight is the phase of flight between T/C and T/D. During cruise the pilot may be required to make navigation changes, position updates, position reports, monitor flight progress, change cruise altitudes, and prepare for descent into the destination airport. Preparing for descent can include STAR selection, descent forecast winds entry and review of approach and go around data. (Further information about flight planning and navigation can be found in those sections.)

Intercept Waypoint Inbound Course

IF cleared to intercept an inbound course to a fix or waypoint either on or off the planned route of flight, the DIR INTC function key will allow the pilot to define a waypoint and inbound course from which the aircraft's course will create an intercept waypoint enroute to the selected waypoint. Just like the DIR TO, when the selected waypoint is identical to any waypoint in the F-PLN, a direct leg is strung to that waypoint with the intervening waypoints deleted. If the INTC FIX/CRS waypoint is not on the F-PLN, a direct leg is created to the waypoint followed by a DISCONTINUITY. Pushing the DIR INTC function key displays the INTC FIX/CRS brackets found in line 1R.

STEP: Push the DIR INTC key



1R INTC FIX/CRS - The waypoint or LAT/LONG or Place-Bearing-Distance is entered in 1L is also entered in line 1R, followed by open brackets. A unique and separate waypoint and inbound course entry may be made via the SP using a slash (/) to separate waypoint and course. Waypoint and course may be entered separately. After the inbound course is entered, a trailing asterisk is displayed and insertion into the F-PLN is possible by again pushing the LSK adjacent to the asterisk.

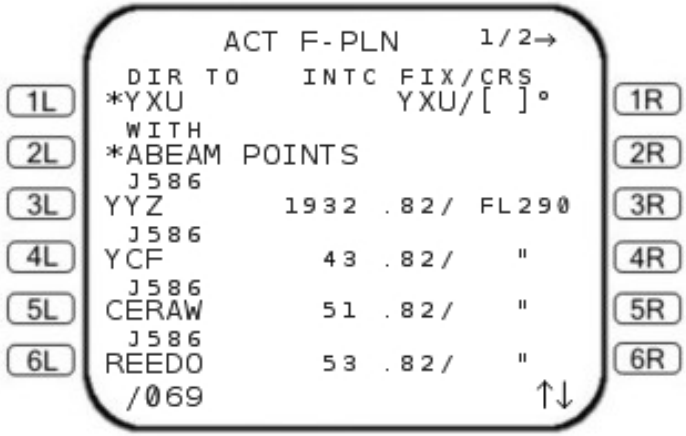
As an example of INTC FIX, enroute to London (YXU), it is desired to intercept the 069° inbound course to that navaid.

Entering the waypoint YXU by pushing LSK 2L as shown and entering the course 069° is accomplished as shown in the following screen.

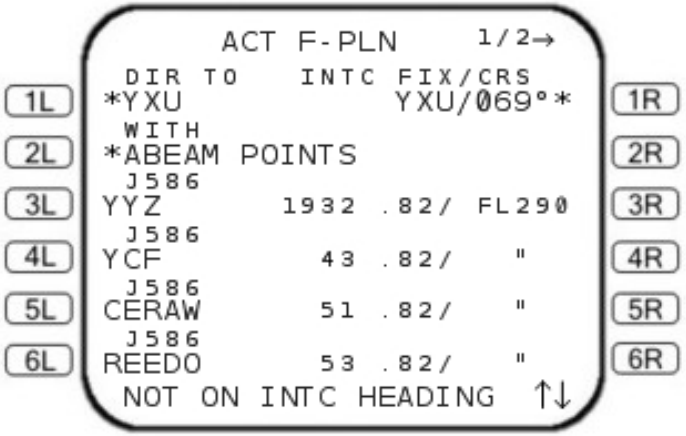
STEPS: 1. Push the 2L LSK

2. Enter /069 in the scratch pad

3. Push the 1R LSK

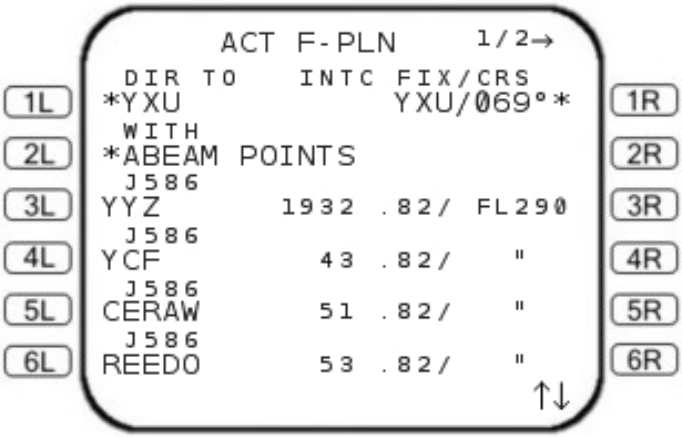


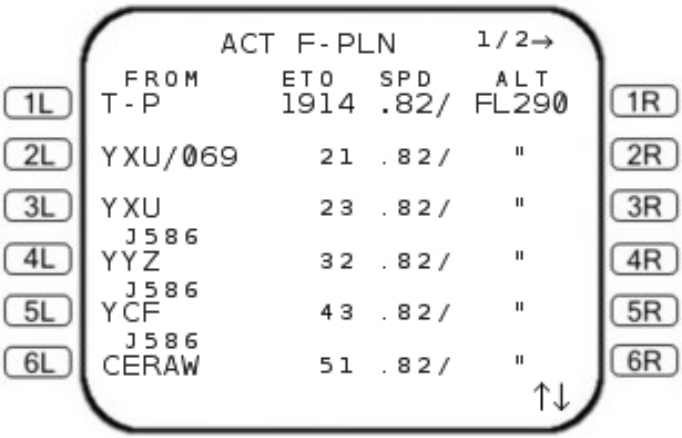
If the existing aircraft's course intercepts the inbound course short of the chosen waypoint, the aircraft will continue flying directly to an FMC-created intercept point. If the SP message NOT ON INTC HEADING is displayed, the aircraft is not on an intercept course to the selected course. The aircraft heading must be altered to the desired intercept heading and LSK 1R must be reselected.



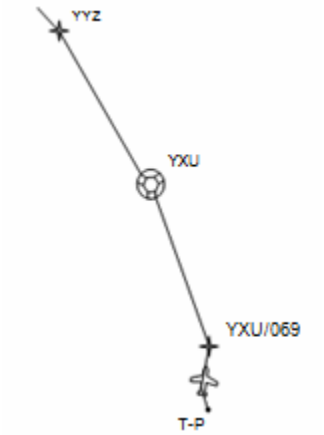
Pushing the NAV button after the turn is complete will reengage FMS NAV and guide the aircraft to intercept the course to the waypoint. That intercept waypoint is shown in the F-PLN as waypoint/course (YXU/069). The intercept waypoint must be within 1000 NM of both the aircraft and selected fix waypoint. Otherwise, the F-PLN is unchanged and the SP message NOT ON INTC HEADING is displayed.

STEP: Push 1R


ACT F-PLN 1/2→
DIR TO INTC FIX/CRS
YXU YXU/069°
WITH
*ABEAM POINTS
J586
YYZ 1932 .82/ FL290
J586
YCF 43 .82/ "
J586
CERAW 51 .82/ "
J586
REEDO 53 .82/ "
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R

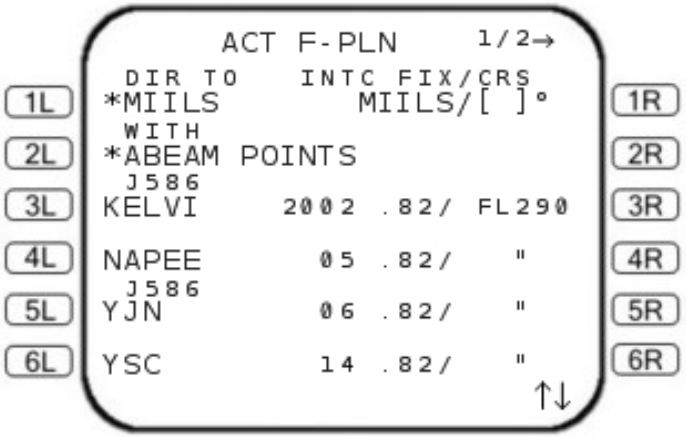

ACT F-PLN 1/2→
FROM ETO SPD ALT
T-P 1914 .82/ FL290
YXU/069 21 .82/ "
YXU 23 .82/ "
J586
YYZ 32 .82/ "
J586
YCF 43 .82/ "
J586
CERAW 51 .82/ "
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R

The aircraft will maintain the selected heading until intercepting the 069 radial to YXU. The route will look similar to the following:



Abeam Waypoints

In a previous section the DIR TO function was described. When a waypoint is selected to proceed DIR TO and entered into line 1L, an insertion asterisk appears and line 2L is replaced with the asterisk option WITH ABEAM POINTS.

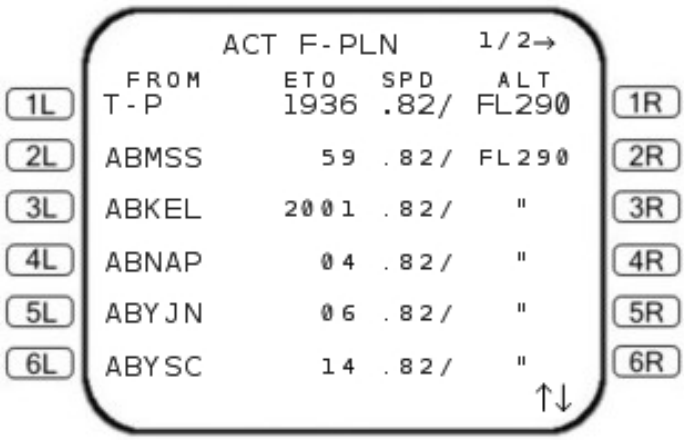


Selecting this option performs the same DIR TO function as line 1L with the automatic insertion of up to 40 abeam points along the new path. Abeam waypoints are defined as the location where a perpendicular intersection is created by the DIR TO leg and a line that passes through an existing flight plan waypoint deleted by the DIR TO. If a deleted flight plan waypoint is more than 100 NM from the DIR TO leg, the respective abeam waypoint will be excluded from the function.

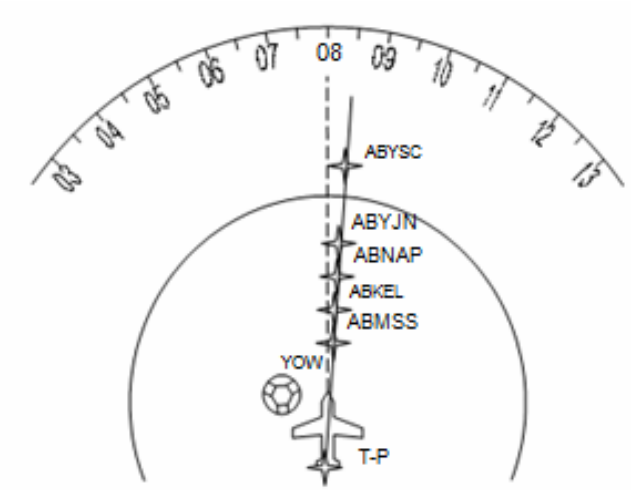
When the FMS memory used to store pilot-defined waypoints or flight plan waypoints is full and creation of ABEAM waypoints cannot be accomplished, ABEAM WPTS INCOMPLETE will be displayed, in the scratchpad.

To select ABEAM waypoint MIILS, is selected for DIR TO routing and the option *ABEAM POINTS is selected.

Notice that there are two waypoint fixes, KELVI and NAPEE, which are found in the F-PLN. When the DIR TO with ABEAM POINTS is inserted into the flight plan, all waypoints are prefixed with AB thus the YXU VOR is displayed as ABYXU and in the case of KELVI and NAPEE the last two letters are truncated for display (ABKEL and ABNAP respectively.) Wind data defined for deleted waypoints shall be copied to the respective abeam waypoints.



The resultant navigation display is shown below:

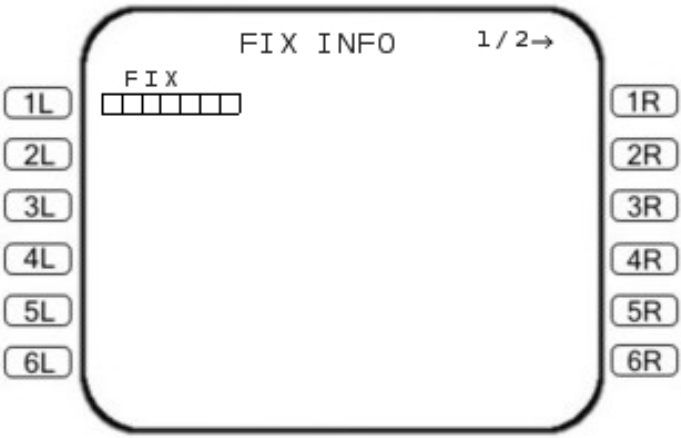


FIX INFO Page

The FIX mode key provides access to two FIX INFO pages which provide the pilot with the bearing and distance from a specified fix to the aircraft and the capability to obtain predicted down path crossing times, distances, and altitudes from a user-defined radial off the reference fix. The specified fix may be a waypoint, a waypoint/course intercept point on the ACT F-PLN or an abeam point. The operation of each page is identical.

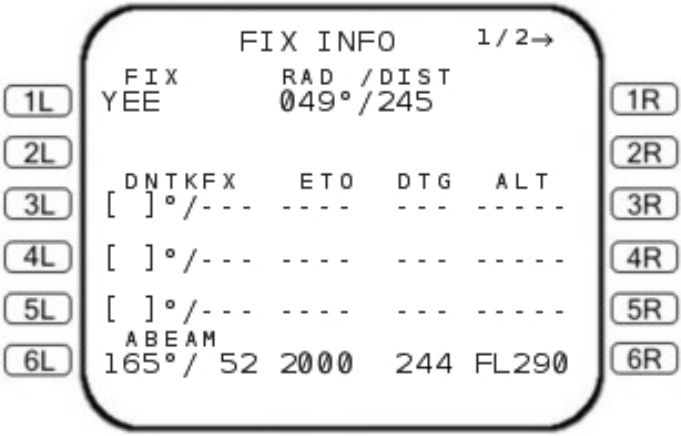
The results of pushing the FIX mode key are shown in the following screens. Choosing a fix of interest such as Midland (YEE) and entering into line 1L via the SP results in the FIX INFO page.

STEP: Press the FIX key



STEPS: 1. Enter YEE into the scratch pad

2. Press 1L

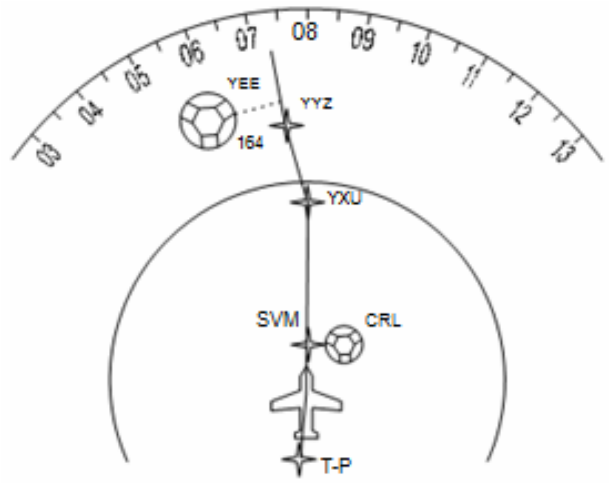


1R FIX, RAD/DIST - FIX of interest entered into the FIX data field 1L. RADial and DISTance from that point to the aircraft.

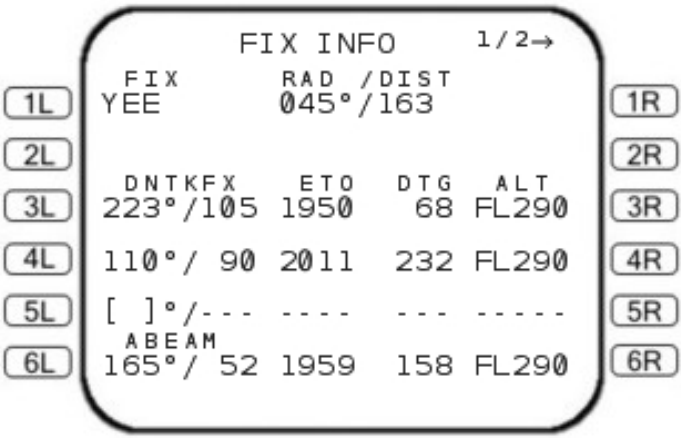
3L DNTKFX, ETO, DTG, ALT - Course from that fix may be entered in lines 3L, 4L and/or 5L. Predictions are calculated for the radial distance or down track distance (DNTKFX) from the fix to over the F-PLN intercept point, the estimated time over (ETO) to the intercept point, the distance to go (DTG) to the intercept point, and the predicted altitude (ALT) over the intercept point. Course entries which do not intercept the active F-PLN or the intercept with a leg transition or any leg not terminating at a fix are displayed in LARGE font followed by the NO INTERCEPT message on the same line. Lines 3L, 4L, and 5L can be cleared by pushing the CLR key.

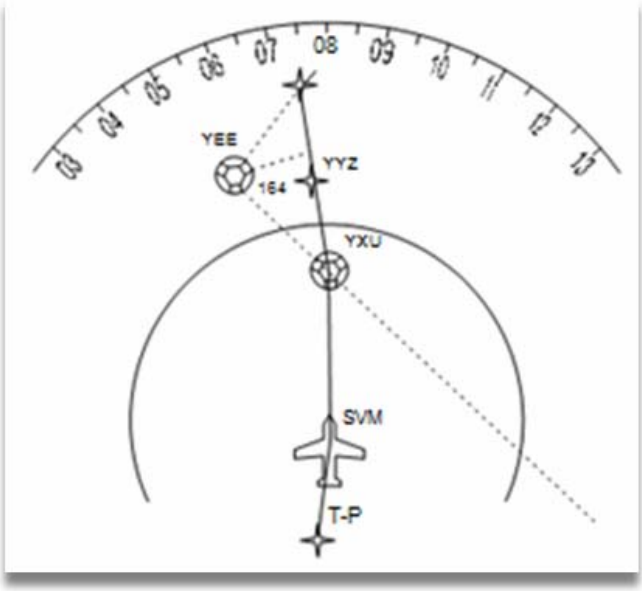
6L ABEAM - The abeam course to the flight plan track with the same information as in line 3L above. If there is not an abeam course to the flight plan, then the abeam field is dashed with the NO INTERCEPT message.

The radial/distance and ABEAM points are automatically computed and displayed. The ND display shows the abeam course of 164 degrees.



As an example of fix courses and their display the courses of 223 degrees and 110 degrees are entered into lines 3L and 4L.





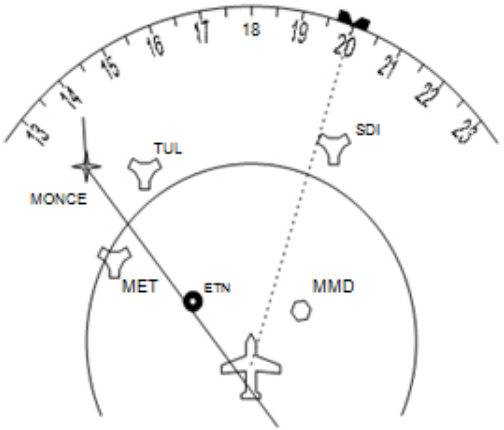
If more than one intercept point exists for a given course, the data is displayed for the one nearest the aircraft along the flight plan. All

intercept points must be within 999 NM of the reference fix for predicted data to be displayed. Course resulting in intercept points outside this range are displayed, but the predicted data is dashed.

Off Route Navigation

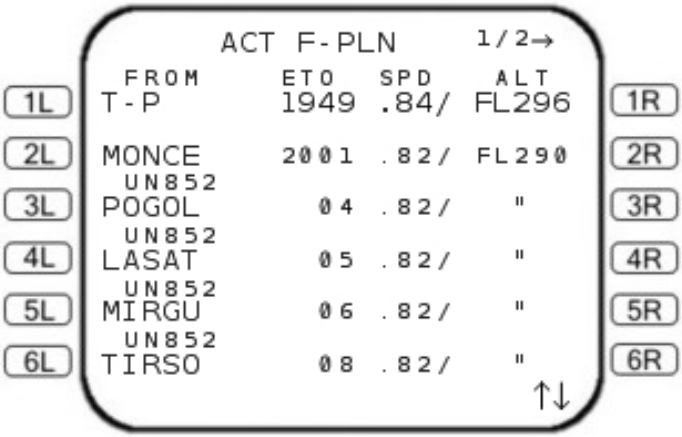
It may be necessary to navigate off the F-PLN routing. The HDG/TRK select knob conveniently accomplishes this task when pulled but also disengages the FMS NAV function. When NAV is once again pushed to engage lateral NAV, the aircraft will either turn to intercept the active F-PLN leg with up to a 45° intercept or continue straight ahead in a heading hold based on distances from the F-PLN route. If the aircraft has remained within the 10 NM capture zone, it turns to intercept the ACT F-PLN leg. If the aircraft is more than 10 NM on a diverging vector from the F-PLN routing, it would be necessary to turn to an intercept course and close the distance to 10 NM before the FMS NAV would reengage and provide intercept guidance.

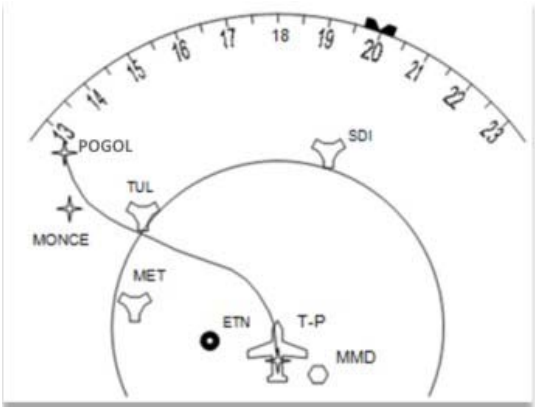
The pilot navigates off a DIR TO MONCE routing as shown below:



When the FCP NAV button is pushed to reengage lateral navigation, the FMC remembering the active leg DIR To function, computes a new DIR TO MONCE using a new T-P.

This routing is shown in the following screen:

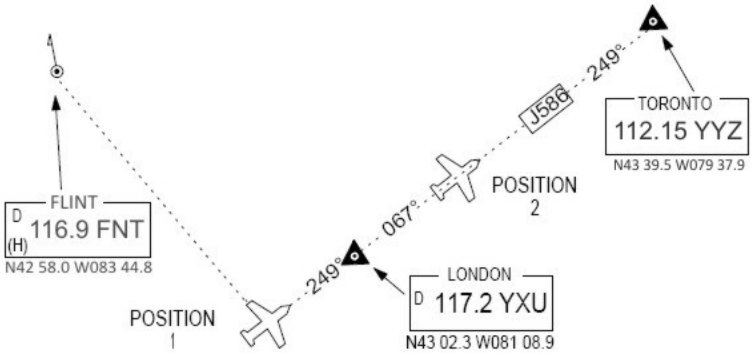




If F-PLN leg sequencing (TO waypoint becomes FROM waypoint) is lost, upon pushing the FCP NAV button, the aircraft will fly back to the still active leg. When off route and navigating further than 7 NM laterally from a TO waypoint, normal F-PLN leg sequencing may be maintained by clearing the FROM waypoint. Pushing FCP NAV to intercept and fly back to the flight plan route will occur normally.

Enroute Navaid Use

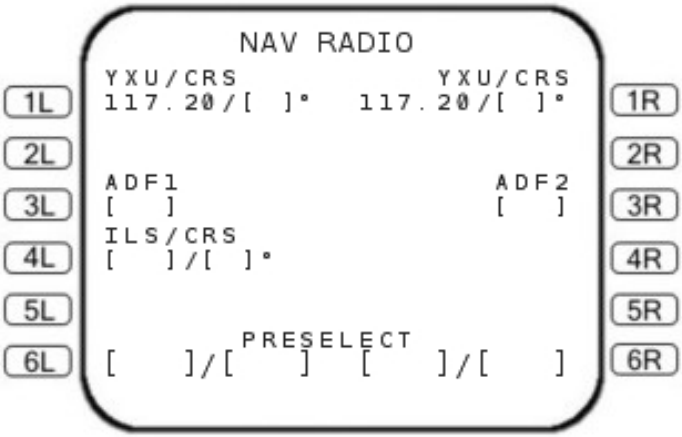
Radio information may be found on the NAV RAD page or through the REF page and NAVAID prompt. Those pages will be discussed in this section. Other supporting information may be found in NAV RADIO Tuning and Detailed Navigation Information Sections. For illustration purposes, the aircraft will be flying from Salem (SVM) to London (YXU), then to Toronto (YYZ) as shown below.



Autotuning

In flight the pilots may access the NAV RADIO page NAV RAD to confirm automatic VOR radio tuning. In position one, both FMCs have tuned London (117.2) for display on the EIS. FMC 1 has tuned VOR 1 in line 1L and FMC 2 has tuned VOR 2 in line 1R.

Pushing the NAV RAD key will bring up the following display:



Radio navaids for EIS display are automatically selected according to the following priority:

1. Manually tuned navaid
2. Navaid specified for current F-PLN leg via nav data base
3. Upcoming F-PLN waypoint (if navaid)
4. Preceding F-PLN waypoint (if navaid)
5. Closest navaid which is a F-PLN waypoint
6. Closest VOR/DME or VORTAC within 300 NM
7. Closest VOR with 300 NM

NOTE: All navaids that are automatically selected should meet the figure of merit criteria in the following table:

FIG. OF MERIT	AIRCRAFT ALTITUDE	LATERAL DISTANCE	NAVAID CLASS DESIGNATOR
0	<=12,000 ft MSL	<=40 NM	T (Terminal)
1	<=18,000 ft MSL	<=70 NM	L (Low Altitude)
2	-	Lesser of 130 NM or LOS	U (Unclassified)
3	-	Lesser of 130 NM or LOS	H (High Altitude)
4	-	Lesser of 125 NM or LOS	H (High Altitude)

The ADF is tuned by the FMS using the following priorities:

1. Manually tuned NAV database navaid
2. NAV database navaid specified for the current leg
3. NAV database navaid at the upcoming flight plan waypoint
4. NAV database navaid at the preceding flight waypoint

If no NAV database navaid can be selected from these priorities, then an ADF station is not selected for tuning. A NAV database ADF is never used in radio position computations.

FMS Position

The FMC internal position is calculated using a combination of three IRUs for an IRS position. Radio DME/DME or DME/Bearing or Localizer data is used to calculate a radio position. Normally two of these sources of position and ground speed information are combined to reflect the FMC position displayed on the POS REF page. There are three modes available for updating the FMC position (in order of priority):

1. Radio/inertial
2. Inertial only
3. Radio only (advisory only)

If none of these modes are active, the aircraft position will not be computed.

GNS Position

If the GNS option is installed and the GNS position is valid, then the FMC position is calculated using a combination of position data from two GNSSUs and three IRUs for an FMC position. With the GNS installed and a valid GNS position, the GNS position data is used as the primary sensor. With the GNS installed there are four modes available for updating the FMC position and they are in order of priority:

1. GNS/inertial
2. Radio/inertial
3. Inertial only
4. GNS only
5. Radio only (advisory only)

RNP Navigation

Required navigation performance is an accuracy requirement for a particular area, airspace, route, procedure, or operation, where accuracy is a 95% position certainty radius around the computed aircraft position. The FMS continuously monitors input from the available navigation sensors (radios, IRUs, and GNS) to compute a position and actual navigation performance (ANP) value in units of nautical miles. The FMS RNP function is used as an integrity monitor for aircraft position. The RNP/ANP values are displayed on the POS REF page.

Radio Tuning

For the remainder of this section, radio tuning for navigation will be discussed.

Each FMC shall use signals from the radio sensors that are tuned by that FMC. If FMC, MCDU or radio sensors become degraded, fail, or SISP configuration is changed, the FMC will only provide as much tuning capability and position accuracy as allowed by the radios it controls.

Radio position may be computed using the following prioritized methods:

1. DME/DME
2. DME/Bearing
3. Localizer Update

DME/DME - Slant range distance from two independent DMEs used to calculate a ground-referenced radio position. The first DME is selected as an existing procedure-specified navaid (must have DME) for the current flight segment or if none are specified the closest DME navaid. The second DME selected will be the closest DME which allows the angle to be nearest to 90 degrees.

DME/Bearing - This selection occurs only if DME/DME tuning cannot be accomplished. The known position of the navaid and the range and bearing are used by the FMC to calculate the radio position. Only

collocated navaid facilities can be used. The following selection priority will be used:

1. Manually tuned VOR/DME or VORTAC
2. Procedure specified for current leg
3. Within 50.8 NM of the destination, a VOR/DME or VORTAC within 5 NM of the destination
4. VOR/DME or VORTAC closest to the aircraft

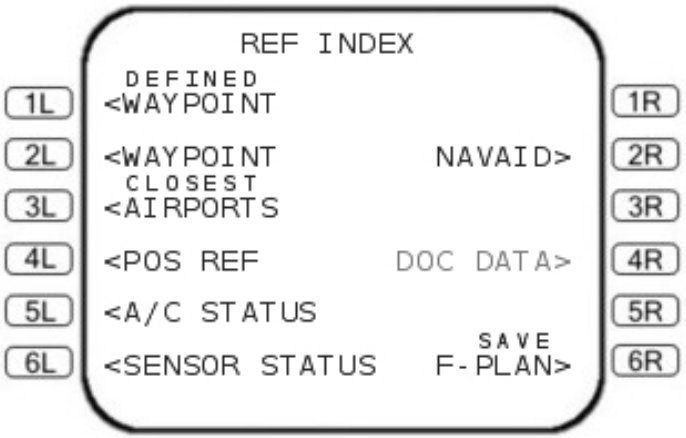
The selected navaid (not specified for approach transition or final approach) will be excluded from selection if the aircraft is flying away from it (inertial position available). If a procedure-specified navaid exists that is not equal to the manually tuned navaid, the message TUNE AAA-FFF.FF is displayed.

Localizer - The localizer update uses the ILS localizer deviation signal, center beam bearing, physical LAT LONG, and a radio-corrected inertial position to determine the update position. This method is only used when controlling to the beam within 20 NM of the localizer facility and with a relative angle of less than 45 degrees. The localizer used must either be manually entered by the crew (takes priority) or automatically selected and tuned from the data base for the destination approach and runway in the F-PLN. If the aircraft is within 20 NM of the destination and invalid data is continually received for 3 seconds, the MCDU message ILS UNTUNABLE is displayed.

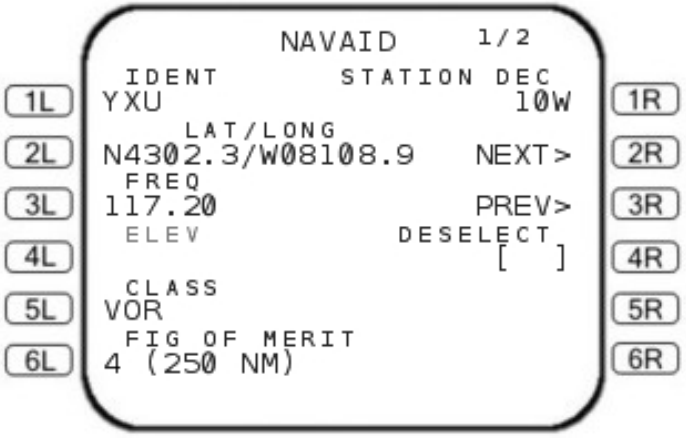
Monitoring

To view the navaids automatically tuned by the FMC, the REF key and the NAVAID page (LSK 2R) must be selected.

STEP: Press the REF key



STEP: Press the 2R LSK at the NAVAID> prompt



A maximum of four individual navaid pages automatically tuned by the FMC may be available at any one time. They are presented as follows:

- Page 1: Navaids for EIS display
- Page 2,3: Navaids for radio position computation
- Page 4: ILS/DME for display (within 25nm of destination)

If a navaid for EIS display (NAV RAD page) is also being used for positioning, then the navaid for ILS/DME display, if present, will move up to page 3.

Title Right-hand corner displays the page number and total number of tuned navaid pages available. This line is blanked if a database navaid IDENT is entered in line 1L.

1L DENT - Navaid identifier. Navaids autotuned by the FMC. Pages are accessed by pushing LSK 2R (NEXT>) or LSK 3R (PREV>) keys.

However, any navaid in the data base may be referenced by typing in the navaid ident. Once an untuned ident is entered, tuned stations can no longer be observed by the pilot or accessed by pushing LSK 2R or 3R until the field is cleared. If there are no tuned navaids, four boxes will be displayed.

2L LAT/LONG - Navaid LAT/LONG. If a noncollocated, VOR/DME is displayed, the LAT/LONG is for the VOR.

5L CLASS - The navaid class can include the following:

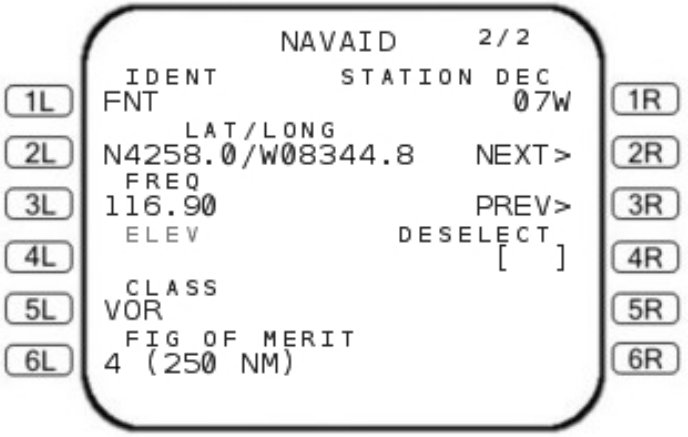
- VOR
- DME
- LOC
- ILS
- ILS/DME
- VORTAC
- VOR/DME

6L FIG OF MERIT - Figure of merit is explained in the previous table (Figure of Merit Criteria).

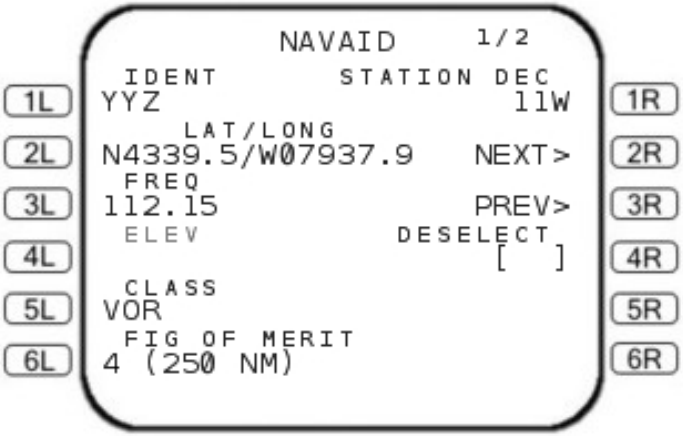
1R STATION DEC - Station declination (variation) of the navaid. Only displayed for VORs, VORTACs or VOR/DMEs.

4R DESELECT - Ident of the deselected navaid is displayed. The pilot may enter a navaid ident into the field. Deselection results in that navaid not being autotuned or used for position update. However, manual tuning is still allowed. ONLY ONE STATION AT A TIME may be deselected. Clearing the first deselected navaid or entering another navaid for deselection allows the FMC to again use the first deselected navaid.

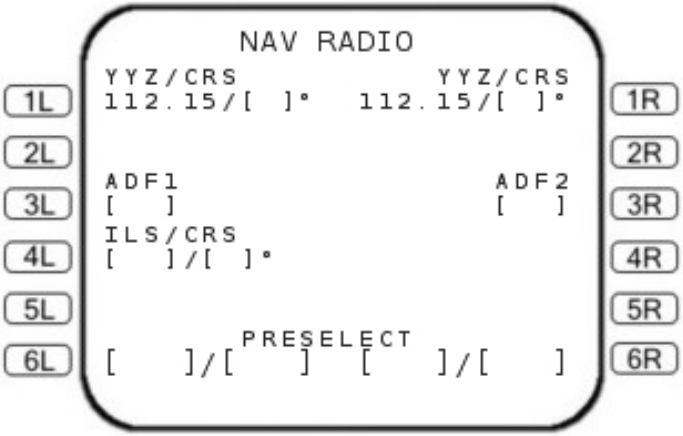
It can be ascertained from the page numbers in the title field that three navaids are being FMC-autotuned. Since three pages are available and the aircraft is not within 25 NM of the destination (no ILS/DME tuned), the three pages are the EIS displayed navaid and two DMEs for DME/DME position calculation. Navaid pages 2/3 and 3/3 are shown below.



As the aircraft progresses to position 2, an automatic navaid retuning occurs on page 1 as shown in the following screen.



STEP: Push NAV RAD



Navaid Deselection

One navaid at a time may be deselected from autotuning and position update by entering its ident into line 4R. The CLR key and SP will clear the field or another ident may be entered to regain tuning access to the deselected navaid.

As an example, from position 2, Toronto normally would have been tuned by the FMC. Toronto (YYZ, 113.3) is deselected. This deselection forces the FMC to tune another navaid for display in accordance with the tuning priorities, which show that the FMC has automatically chosen the preceding F-PLN navaid to tune for EIS display.

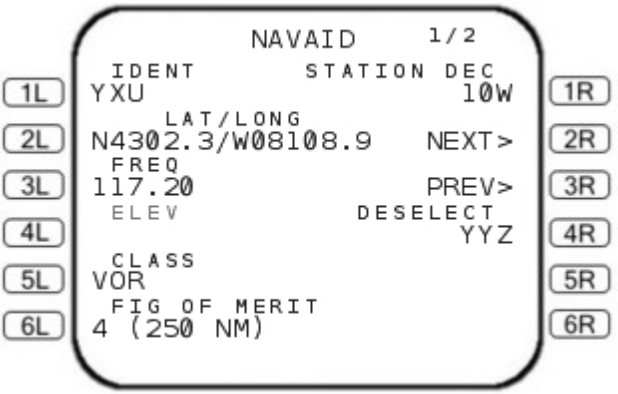
The following screen depicts the results of deselecting YYZ and YXU being autotuned in place of YYZ.

STEPS: 1. Type YYZ in SP

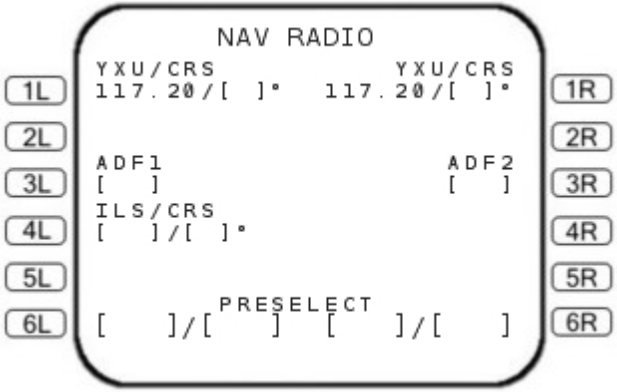
2. Push REF,

3. Push 2R

4. Push 4R



STEP: Push the NAV RAD key



NAV Database Information

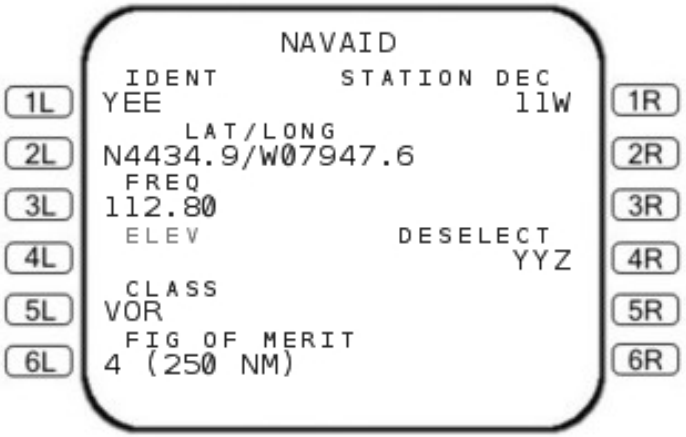
Information for any navaid in the data base can be displayed by entering the navaid ident into the IDENT line 1L of the NAVAID page. Entering Midland, Canada (YEE) in the IDENT field displays the NAVAID data.

STEPS: 1. Push the REF key

2. Push 2R

3. Type YEE into the scratch pad

4. Push 1L



After YEE is entered, the title line page prompt and NEXT and PREV prompts are removed and FMC-autotuned navaids can no longer be displayed until the IDENT field is cleared. FMC automatic tuning is still operable.

POSITION REFERENCE Pages

The POSITION REFERENCE series of pages are described in the following paragraphs.

POS REF Page 1/3

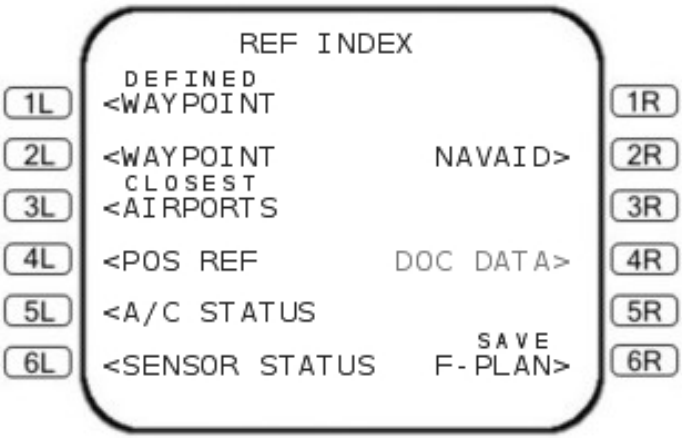
Pushing the REF key or the INIT key provides access to the POS REF page prompt. Pushing its LSK 4L accesses the first of three POS REF pages. The FMC position may be manually updated on page 1/3. The POS REF page provides comparative position data to include the FMC position and an IRS MIX position (average IRU position).

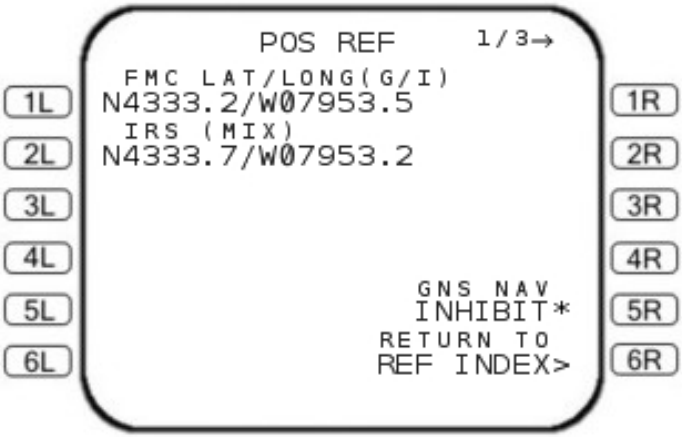
The second page, IRS or IRS/GNS POS pages display all three IRU positions and GNSSU positions.

POS REF Page 3/3, the IRS STATUS page, provides IRS drift and GS error rates at flight termination

STEPS: 1. Push the REF (or INIT) key

2. Push the 4L LSK





FMC LAT/LONG - Displays the current FMC position. Pushing LSK 1L with the SP empty freezes the displayed FMC LAT/LONG position. The displayed FMC LAT/LONG title line is replaced by POS FROZEN label. Pushing LSK 1L a second time unfreezes the position which catches up to where the aircraft position is without update.

The label line for 1L also indicates in parentheses the position update mode the FMS is using in the navigation solution for the current position. Possible modes are:

- INERTIAL/LOC/GPS - I/L/G
- INERTIAL/LOC/DME/DME - I/L/DD
- INERTIAL/LOC/VOR/DME - I/L/VD INERTIAL/LOC - I/L
- GPS/INERTIAL - G/I
- INERTIAL/DME/DME - I/DD
- INERTIAL/VOR/DME - I/VD
- DME/DME - DD
- VOR/DME - VD
- INERTIAL ONLY - I
- GPS ONLY - G
- NO NAV - Blanks displayed

The FMC position may be updated by entry of a waypoint, navaid, LAT/LONG, or place/bearing/distance at any time. Entry in line 1L results in the POS FROZEN label and appearance of an UPDATE prompt in line 1R. Pushing LSK 1R updates the aircraft position and unfreezes the LAT/LONG.

A CHECK POSITION message will be displayed on the ND when either of the following SP messages are displayed:

1. FMC POSITION MISMATCH - This message will be displayed if the FMCs show a position difference of 5 NM or greater or twice the RNP distance (NM). The message is removed if the position difference becomes less than 3 NM or twice the RNP distance (NM), respectively. Compare the positions on the POS REF

page, and use the FMC considered to be the most accurate. The above generally is a result of poor radio DME position computation.

2. VERIFY AIRCRAFT POSITION - This will be displayed if a single FMC radio position varies from the IRSs. Usually it shows on only one MCDU. Check the POS REF page on that MCDU. If the condition persists, it is advisable to use the other FMC as primary for navigation.

   NOTE: It is possible to have the message, VERIFY AIRCRAFT POSITION, on both MCDUs if a single IRS has drifted more than 12 NM. Comparison of all three POS REF pages should confirm this. Use the FMC considered to be the most accurate.

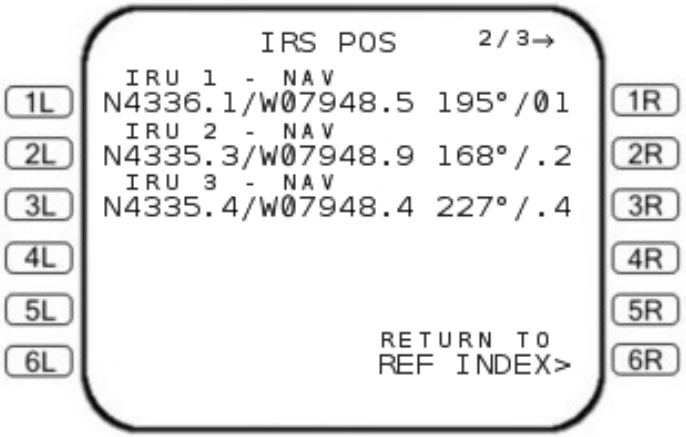
IRS (MIX) (2L) - The IRS triple mix position is displayed in 2L.

RNP/ACTUAL (4L) - The RNP (Required Navigational Performance) based on the phase of flight and ACTUAL (Actual Navigation Performance - ANP) are displayed in 4L.

GNS NAV INHIBIT (5R) - The GNS NAV INHIBIT* or ENABLE* prompt in 5R displays the standby, or armed GNS state that the FMS changes to when LSK 5R is pressed. The pilot inhibits or enables GNS use in the FMS navigation solution by pushing LSK 5R. This function can be used to clear GNS soft faults as described in the following segment.

IRS POS Page

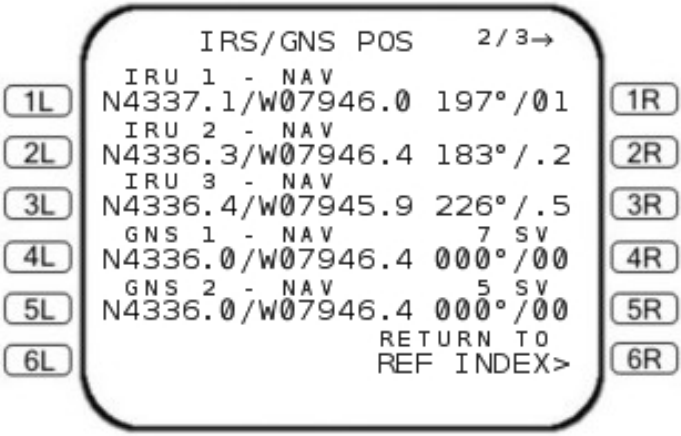
The IRS POS page is accessed by pushing the PAGE key from the POS REF page.



Lines 1 through 3 display the position of each IRU used to calculate the IRS position along with the relative bearing and distance from the FMC position to each IRU once the IRUs are aligned. The label lines display either NAV or ALIGN and, if ALIGN, the time remaining for IRU alignment. In the IRU ALIGN mode, dashes are displayed in data lines. In NAV, the IRU LAT/LONG position is displayed.

IRS/GNS POS Page (POS REF page 2/3 with GNS installed)

The IRS/GNS POS page is accessed by pushing the PAGE key from the POS REF page.

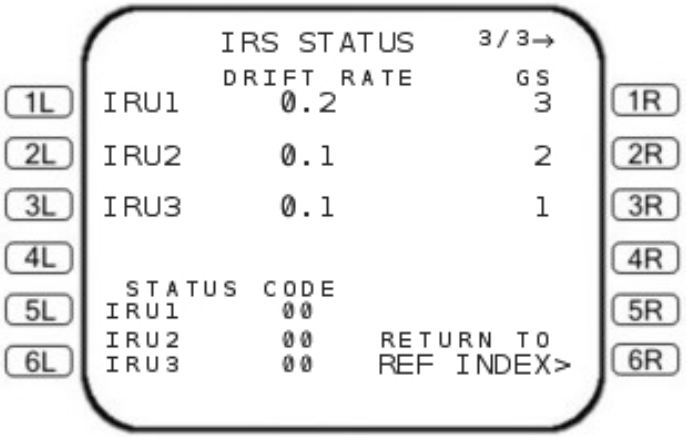


Lines 1, 2, and 3 display the position of each IRU used to calculate the IRS position along with the relative bearing and distance from the FMC position to each IRU once the IRUs are aligned. The label lines display either NAV or ALIGN and, if ALIGN, the time remaining for IRU alignment. In the IRU ALIGN mode, dashes are displayed in data lines. In NAV, the IRU LAT/LONG position is displayed. Lines 4 and 5 display the position of each GNS used to calculate the GNS position along with the relative bearing and distance from the FMC position to each GNSSU once the GNSSUs are in the NAV mode. The label lines display either NAV or ACQUIRE and the number of satellite vehicles tracked. If no position data is available from the GNSSUs, dashed lines are displayed. If a position is available the GNSSU LAT/LONG position is displayed.

IRS STATUS Page (POS REF page 3/3)

Pushing the PAGE key from the IRS/GNS POS page accesses the IRS STATUS page.

This page displays IRS drift and groundspeed (GS) error rates computed at flight termination and IRS Status Codes.



IRS Status Codes

The status codes between lines 5L and 6L on the IRS STATUS page are explained below:

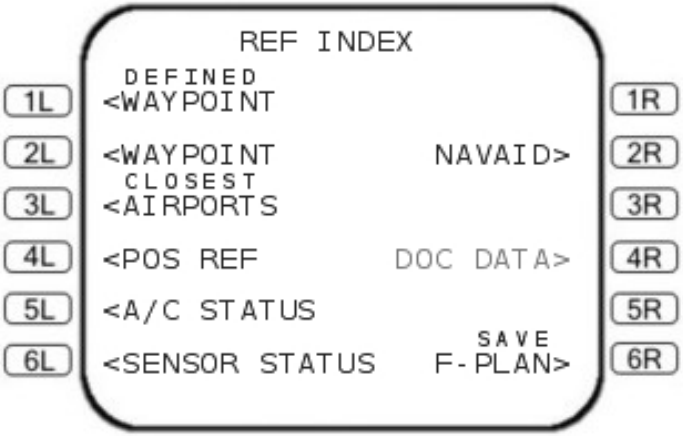
01	IRU critical fault on the ground (remove IRU)
02	IRU non-critical fault (service IRU when convenient)
03	PPOS not entered yet, starting at beginning of align
04	IRU critical fault in the air (remove IRU)
05	Excessive motion detected during align or rapid align
06	Air data reference (ADR) data fault or data outside limits
07	Input power test failed. Check circuit breakers.
10	Alignment is prohibited (IRU temperature below -15°C)

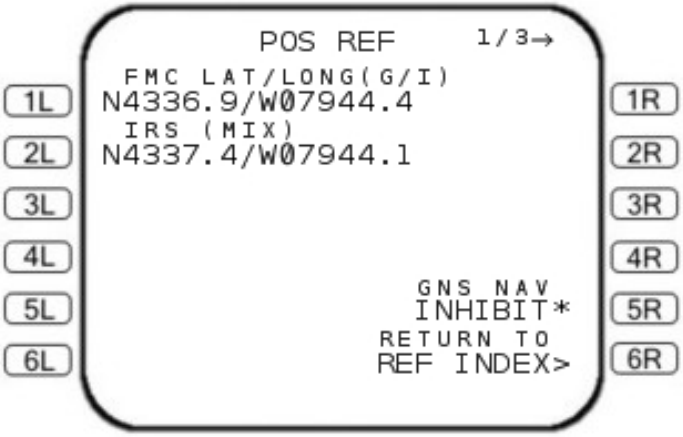
FMC Position Update

The FMC position may be updated both on the ground and in the air using the POS REF page. Access to that page is gained through the REF or INIT keys and POS REF prompts.

STEPS: 1. Push the REF key

2. Push the 4L





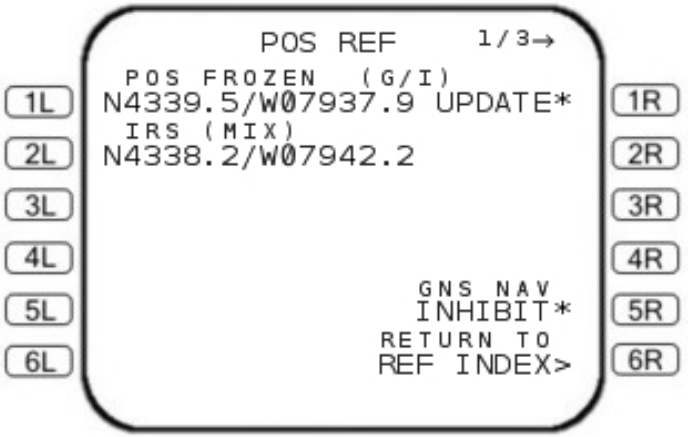
A waypoint, navaid, LAT/LONG or place/bearing/distance can be typed in the SP and entered into line 1L. That entry causes a POS FROZEN title to be displayed, LAT/LONG entered between lines 1L and 1R and UPDATE* prompt to be displayed in line 1R. When aircraft is precisely at the update point, pushing LSK 1R will update the FMS position to the newly entered coordinates. The update may be cancelled by departing the MCDU page for another page.

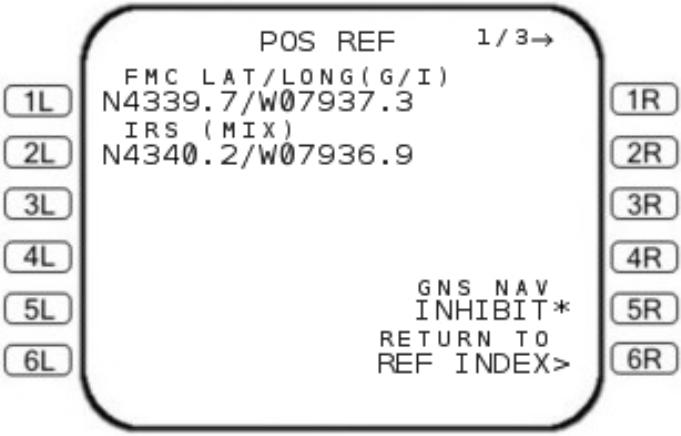
The FMC position is updated over the navaid Toronto (YYZ).

STEPS: 1. Type YYZ into the scratchpad

2. Push the 1L

3. Push the 1R (Over the YYZ)



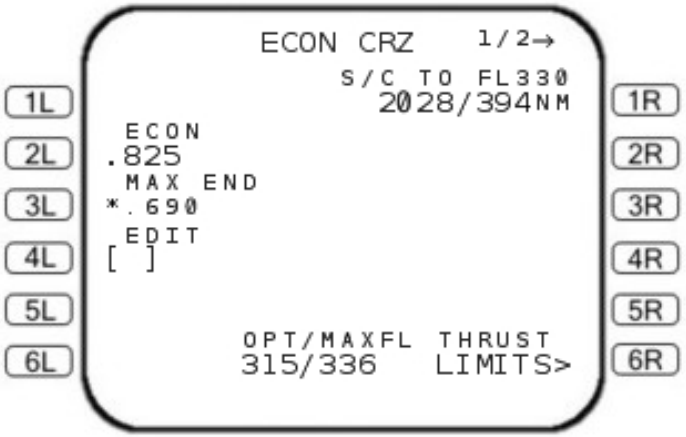


Cruise Performance Page

During the climb phase, the active PERF page was the CLB page, and CRZ and DES were PRESELECT pages 2/3 and 3/3. When the FMS transitions to CRZ including any step climbs (S/C), the active PERF page becomes the CRZ page and its preselected speed mode is made active. In CRZ there is only one PRESELECT page and that is DES (page 2/2). The CRZ PERF page is shown below.

NOTE: When FMS SPD mode is disengaged, the ACTIVE mode will not automatically revert to ECON. When FMS speeds are reengaged, the ACTIVE mode will be the last engaged FMS SPD mode (ECON, EDIT, or MAX). If ECON was not the last engaged mode, EDIT or MAX will become active and a second FMS SPD button push will engage ECON.

STEP: Push the PERF key



3L MAX END - Mach calculated by the FMC which provides minimum drag and hence maximizes endurance (time aloft).

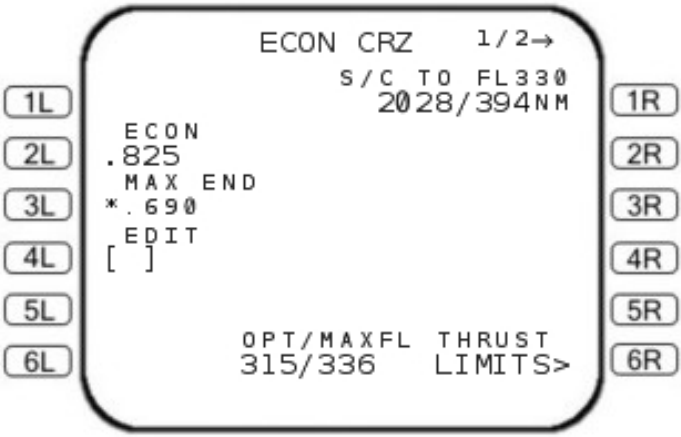
1R S/C TO FL330 - Time and distance to the next S/C point whichis displayed in LARGE font but is not editable. If the next S/C is within 200 NM of the T/D, the label for this field is replaced with TO T/D, and time and distance is computed to the T/D.

The aircraft speed and, therefore, performance, may be changed by selecting MAX END (LSK 3L) or an edited speed via LSK 4L or IAS/MACH selector and the FMS SPD switch. The speed .82 is entered into line 4L via the SP.

STEPS: 1. Enter .84 in the scratchpad

2. Push 4L to enter the speed Mach .84 into the EDIT field

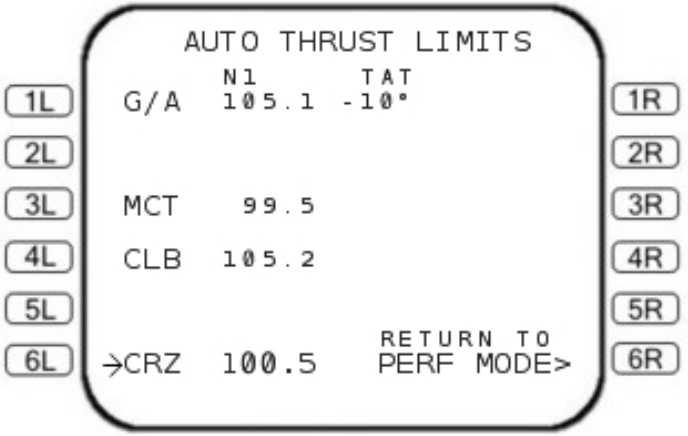
3. Push 4L again to change the active speed to the edited speed



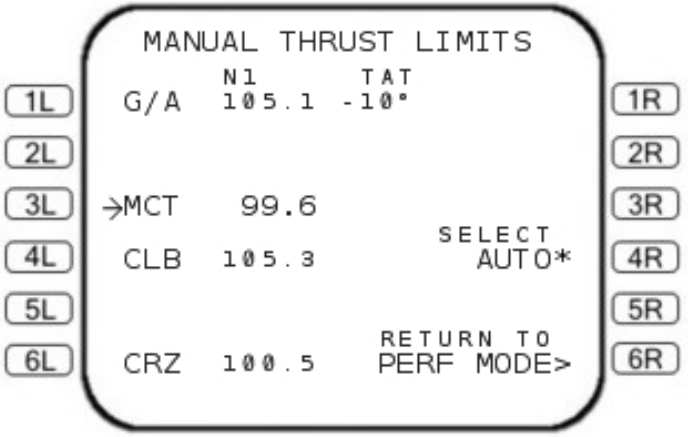
NOTE: For low cruise altitudes, cruise speed can be displayed in MACH on the flight mode annunciator and PERF pages, even though the aircraft is in a normal CAS range.

Selecting line 6R provides access to the AUTO THRUST LIMITS page.

The MANUAL THRUST LIMITS title is displayed after selecting line 3L.



Push 3L to select MCT. The page title changes to MANUAL THRUST LIMITS, as shown below.

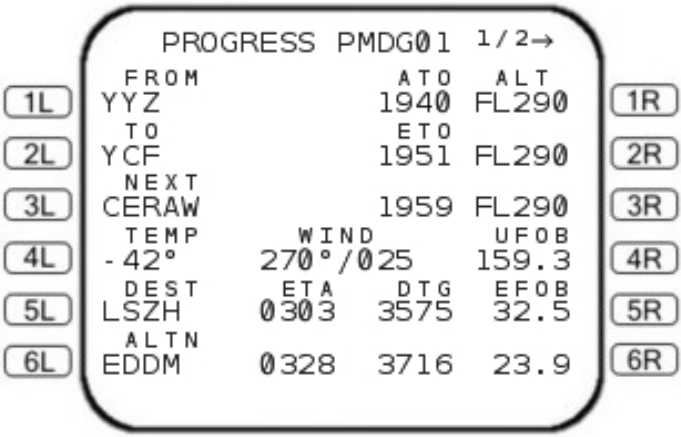


Flight Progress

The PROG key provides access to the PROGRESS page which displays dynamic flight information pertinent to the present situation. Page layout is specifically tailored to facilitate oceanic position

reporting. Starting with the flight number in the title line and including the position (FROM) with actual time over (ATO) and altitude, the next (TO) reporting point with ETO and the next succeeding reporting point along the route of flight. Pertinent remarks could include the current TEMP and WINDS found in line 4.

STEP: Push the PROG key

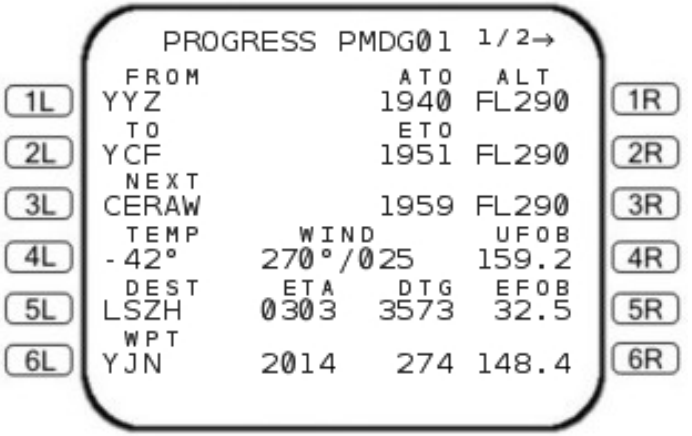


UFOB in line 4R completes current situation information. Predictions at the destination and alternate airports include ETO, distance to go, and estimated fuel on board.

An existing flight plan waypoint can be entered in line 6L to obtain ETA, DTG, and EFOB predictions for that waypoint. The waypoint entry does not affect the existing flight plan and can be cleared via the CLR key. Attempted pilot entries into lines 1 through 5 are NOT ALLOWED. The entry of St. Jean (YJN) in line 6L provides the predictions.

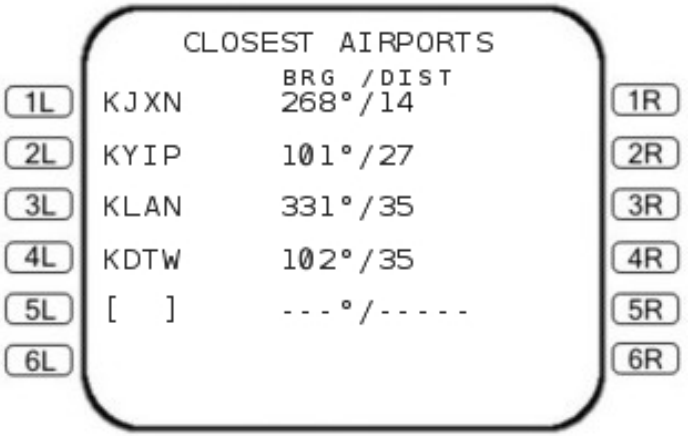
STEPS: 1. Type YJN into the scratchpad

2. Push the 6L LSK



Closest Airports

Push 3L (CLOSEST AIRPORTS prompt) on the REF INDEX page to display the CLOSEST AIRPORTS page (figure below).



The CLOSEST AIRPORTS page provides the four airports closest to the current aircraft position. Pilot-defined runways are not included in this list. A fifth entry is reserved for pilot entry, as displayed in the following screen.

If the information on the CLOSEST AIRPORTS page is utilized, the pilot must verify the data in lines 1 through 4 by entering the airport identifier under examination into line 5L of the CLOSEST AIRPORTS page to verify identifier, bearing, and distance. This information will be correct in line 5.

Other methods of verifying the information in lines 1 through 4 include: (1) selecting the MAP and ARPT switches on the FCP for the ND if the airport is expected to be within 640 NM of the aircraft, or, (2) utilizing the FIX INFO page which will provide radial/distance information to any entered waypoint or airport identifier.

PMDG TIP
The runway length limit above which an airport is included in the NAV Database can be set from the PMDG Menu (by default all airports, regardless of runway length are included).

Sensor Status Page

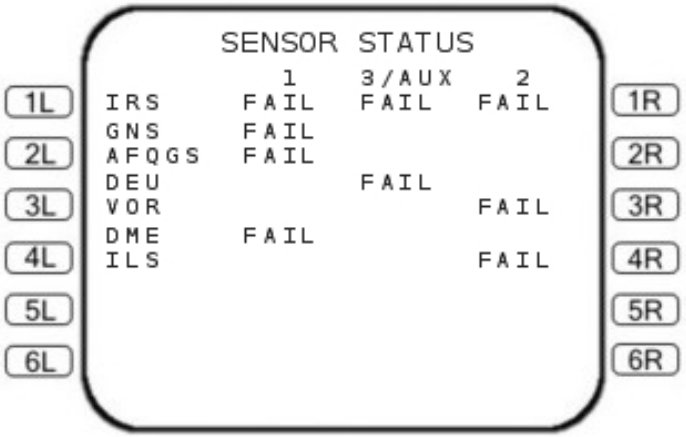
The SENSOR STATUS page displays the status of sensors that are sending data to the FMS. Any failures are displayed under three columns (1 - No. 1 system, 2 - No. 2 system, 3 - No. 3 or auxiliary system). If there is only one sensor or system, any failure is displayed in column 1 If one of the sensors displayed on this page fails, SENSOR FAIL is displayed on the scratchpad.

Sensor types that can be displayed on the SENSOR STATUS page include:

- IRU
- GNS (if installed)
- AFQGS
- DEU

- VOR
- DME
- ILS

Push 6L (SENSOR STATUS prompt) on the REF INDEX page to display the SENSOR STATUS page (figure below).



Cruise Flight Level Change

Cruise flight level changes can occur in the form of scheduled or unscheduled climbs or descents. Step climbs (S/C), unscheduled climbs, delayed climbs, unscheduled descents and decelerations will be discussed in this section.

Climb

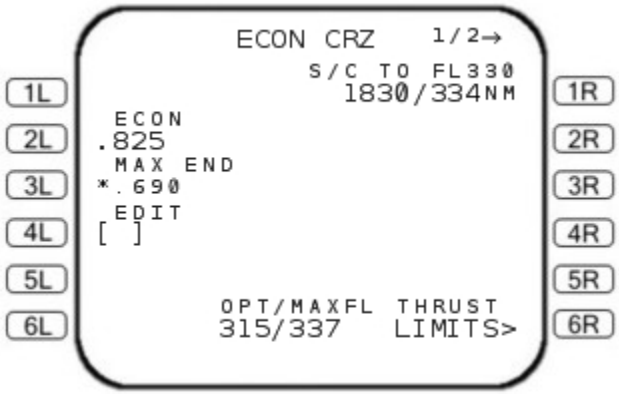
During cruise it may become necessary to climb to a higher altitude than the CRZ FL. Two cases exist, one where there is a planned S/C and the second where a S/C does not exist in the F-PLN. Where a S/C exists, preselecting the FCP altitude prior to the S/C will allow the FMS PROF to automatically execute the S/C. The PERF page remains the CRZ page during climb.

Where a S/C exists, continued PROF cruise without changing the FCP preselected altitude will result in aircraft level flight. Changing the CLR ALT by turning the attitude select knob to the S/C altitude will execute the climb. The PERF page will remain the selected speed CRZ titled page.

If the climb is not executed at the step climb point, the step distance on the PERF page will keep resetting and the S/C symbol will keep moving ahead of the aircraft on the ND. This action reminds the crew that the aircraft is ready to climb to the new flight level as soon as the FCP ALT is dialed up.

A temperature on the VERT REV page 2 will cause the FMC to recompute the step climb and other predictions. While it is recomputing, the toggling of the step climb will temporarily cease. After recomputation, depending on the temperature entry, it is possible that the newly predicted step climb is now really ahead of the aircraft. In this case, the S/C symbol will no longer move until the aircraft sequences the step climb point.

STEP: Push the PERF key



Where a S/C exits and an immediate climb is required prior to the S/C point, the pilot must preselect the altitude on the altitude select knob and pull. This action disengages PROF, sets a new FMS CRZ ALT, and begins the climb. PROF may be pushed to reengage and to subsequently guide the aircraft throughout the remainder of the climb

and the S/C, if it still exists. If the S/C is canceled by the climb, an SP message CRZ FL(s) REMOVED is displayed. The PERF page will display the selected speed and CLB title.

The FMS has the capability to constrain the aircraft to an altitude at a waypoint in cruise. The format is /SFLXXX which is entered on the right side of the ACT F-PLN page adjacent to the desired constraining waypoint with a flight level of XXX. The flight level must be equal to one of the flight levels on the F-PLN INIT page. This capability applies primarily in step climb operation between flight levels defined in the FMS. Once the aircraft sequences the waypoint which has the constraining altitude and sequences the S/C point for that altitude, a vertical alert will be provided and the aircraft will begin to climb, provided the FCP altitude has been raised to the new cruise flight level.

NOTE: Altitude constraints should not be used to adjust a cruise level downward. The FMS will transition to a descent flight phase indefinitely.

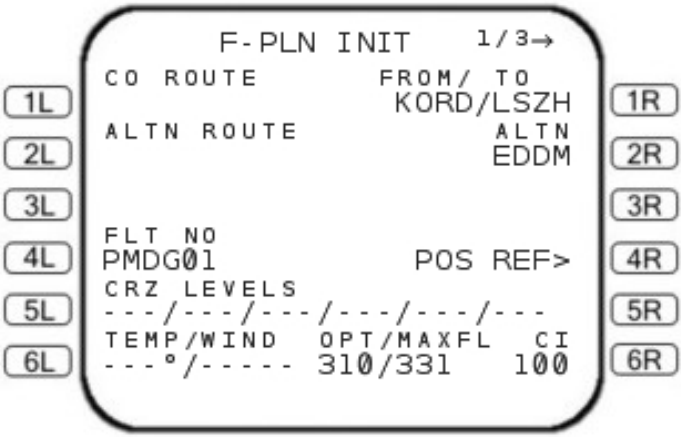
Entry of an altitude constraint during cruise flight will relocate the associated S/C to that constrained waypoint For example, entering S330 (S is the operative prefix) as an altitude constraint (direct F-PLN or VERT REV entry) will move the optimum FL330 S/C from the optimum position in the F-PLN to the newly constrained waypoint. However, only F-PLN INIT CRZ LEVELS may be constrained in this manner. The pilot, upon nearing the altitude constrained waypoint and S/C, should preselect the S/C altitude on e FCP and, if necessary (flashing VERT ALERT not observed on the FMA or aircraft does not begin to climb), pull the FCP altitude knob. The aircraft will climb to the S/C altitude. If the FCP altitude knob was pulled, the PROF button must be pushed to reengage FMS PROF.

Where no S/C exists and an immediate climb is required, it may be accomplished by preselecting the new altitude. PROF will remain engaged and initiate an immediate climb to the new CRZ FL. CRZ ALT is reset on the F-PLN lNIT page. The PERF page will display the selected speed and CLB title.

Descent

Where PROF is engaged and the FMS is guiding to the CRZ ALT, the CLR ALT may be lowered for descent by preselecting the altitude with the altitude select knob. PROF will guide the aircraft in level flight until the T/D is sequenced. At this point, the FMS will transition to the descent phase and begin a descent along the descent path. The F-PLN INIT page CRZ LEVELS data field will be automatically cleared and dashes will be displayed. Dashes will be displayed for the CRZ LEVELS when descent begins. The PERF page will be titled DES.

STEP: Push the INT key

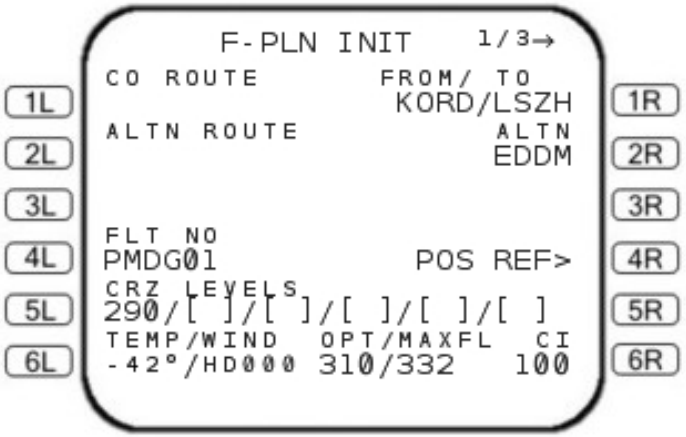


Where PROF is engaged and an immediate descent is desired, the pilot must preselect the altitude with the altitude select knob and pull or set a V/S on the pitch wheel. Both these events disengage PROF and begin descent. Both of these actions transition the FMS to DES (PERF page DES) and clear the CRZ ALT on the F-PLN INIT page. Reengaging PROF mode at this point will cause the FMS to engage the same mode as selected. When the aircraft levels at the new cruise altitude, the FMS may be transitioned back into the CRZ phase of flight by inserting the desired CRZ ALT in the F-PLN page. See screen below where FL 290 is entered as the new CRZ ALT. Otherwise, the FMS will remain in the descent mode until the vertical descent profile is reintercepted. A descent profile intercept point (I/P)

will be displayed on the ND at this point. If PROF is pushed and reengaged prior to the I/P and the CLR ALT lowered, the FMS will continue the descent along the vertical descent profile.

STEPS: 1. Enter 290 into the scratch pad

2. Push the 5L



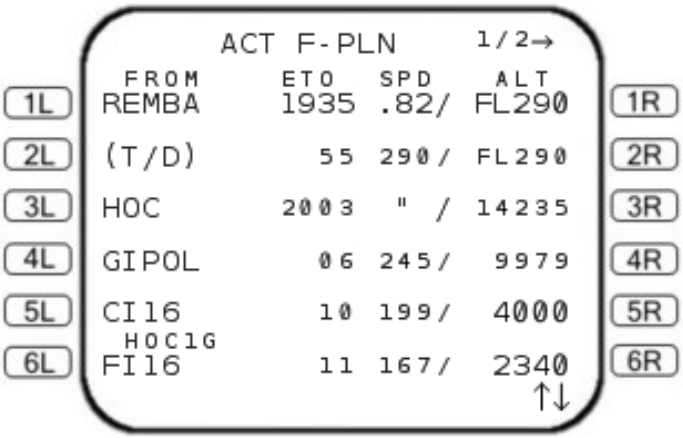
Deceleration

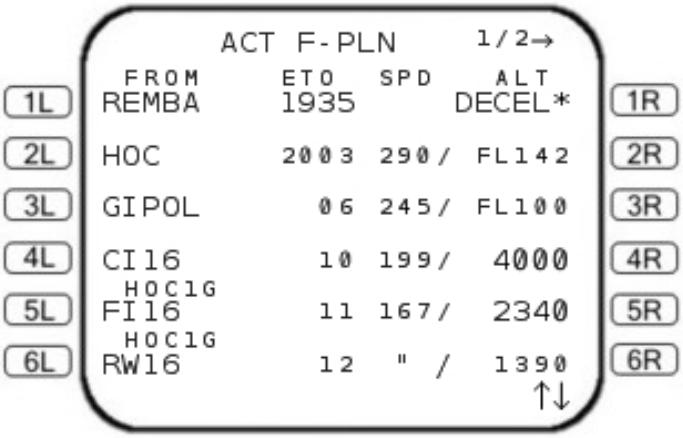
If the T/D is overflown before lowering the CLR ALT, the aircraft will maintain level flight. On the F-PLN page the DECEL* prompt will appear in line 1R. Activating DECEL defines a speed target of VMIN + 5 while maintaining level flight. The deceleration should result in a situation that is more favorable to return to the descent path once clearance to descend is obtained. Once DECEL mode has been selected, either dialing the CLR ALT DOWN or selecting any other speed mode will cancel the DECEL mode. After the CLR ALT is reset by preselecting a lower altitude with the altitude select knob, the aircraft will begin descent attempting to recapture the vertical profile. The descent target speed in this case will be either a casual return speed (ECON descent speed + 20 KIAS) or the FMS ECON speed.

For example, in the following screen the aircraft is approaching the T/D but the FCP altitude has not been set lower. Upon sequencing the

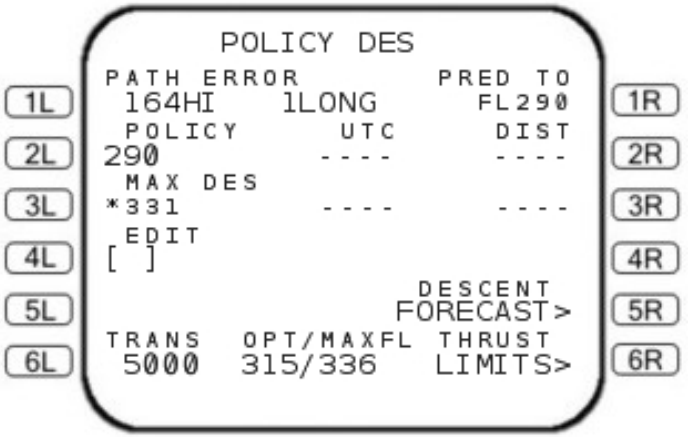
T/D the DECEL* prompt appears in line 1R. The PERF page, ECON DES which means the FMS has passed the T/D and transitioned to DES even though the aircraft is maintaining the same altitude.

STEP: Push the F-PLN key





STEP: Push the PERF key



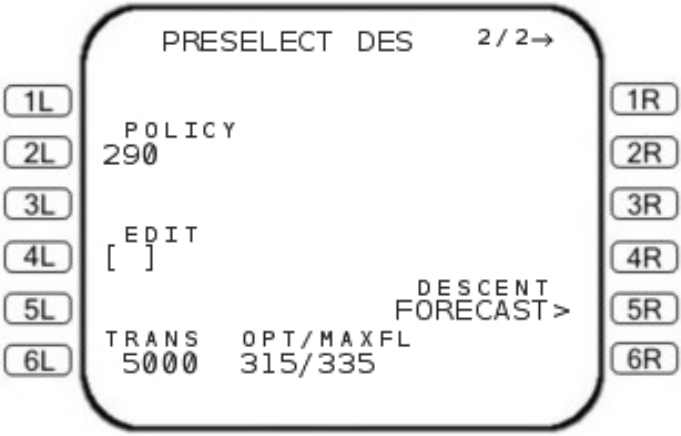
Descent Forecast Wind Entry

As soon as practicable in FMS operation, but not later than 40 NM before the T/D point, descent winds should be entered into the DESCENT FORECAST page and inserted into the F-PLN. These winds are used to build an accurate destination wind model used in fuel and descent predictions to include determining an accurate T/D point.

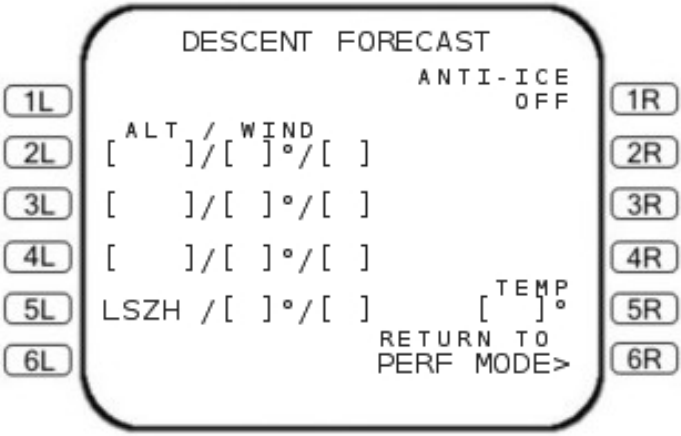
During cruise, the DESCENT FORECAST page may be accessed by pushing the PERF key, and then pushing PAGE to sequence to page 2/2, and finally pushing LSK 5R (DESCENT FORECAST>) to show the display.

STEPS: 1. Push the PERF key

2. Push the PAGE key



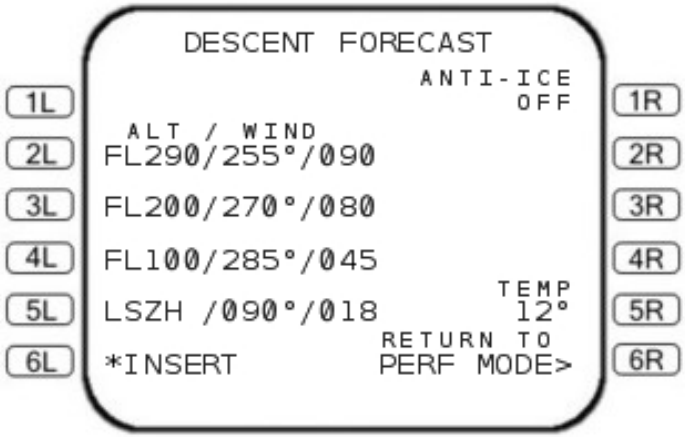
STEP: Push the 5R LSK



2L	**4L**	ALT/WND - Wind data consists of bearing and magnitude which are considered a single entry (i.e. 255°/90 is considered a single undivided entry). When brackets for altitude are shown, altitude alone or an altitude/wind may be entered but not a wind alone. Once ALT/WINDs are entered, the FMS sorts them in descending order from top to bottom.
5L		Destination is always displayed and may not be changed or cleared. Destination winds should be entered.
5R		TEMP: Temperature at destination may be entered and/or cleared. Destination winds should be entered.
1R		ANTI-ICE: Selects the anti-ice option for descent path computations only. This is done to anticipate the use of anti-ice during some or all parts of the descent.

Whenever an altitude or wind entry or edit is performed, the *INSERT prompt in line 6L will reappear to enable insertion of new data into the FMC. The data entered or edited on this page has no effect on the system until the *INSERT prompt is pushed. If the page is exited without pushing *INSERT, then the entered or edited data is not retained. Winds for descent into Zurich are entered into DESCENT FORECAST page.

STEPS:
1. **Type 290/255/90 in scratchpad**
2. **Push 4L**
3. **Type 200/270/80 in scratchpad**
4. **Push 4L**
5. **Type 100/285/45 in scratchpad**
6. **Push 4L**
7. **Type 90/18 in scratchpad**
8. **Push 4L**
9. **Type 12 in scratchpad**
10. **Push 5R**

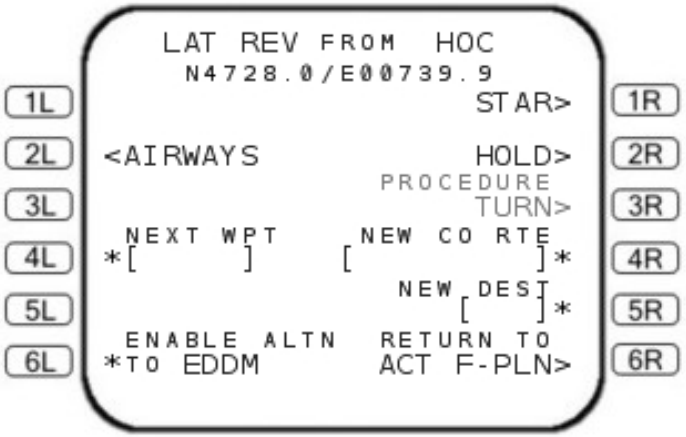


NOTE: Altitudes should be entered as a FL above the transition level. If the destination is changed to other than the destination airport, all previous wind entries on this page are deleted.

STAR Selection

The STAR TO page permits selection of STAR, profile descents, transitions, approaches, and runways for the destination airport. Profile descents are treated identically to STARS. Access to the STAR selection page is normally made by a LAT REV to a revise point short of the destination. STAR cannot be selected from the FROM point. A LAT REV of the destination results in the destination becoming a waypoint in the flight plan in addition to being the destination. As the STAR, approach and any transitions are selected, they are inserted into the flight plan while deleting all waypoints in the flight plan beyond the revise point. When the approach is selected, the missed approach legs stored with that approach are automatically selected and strung into the revised flight plan.

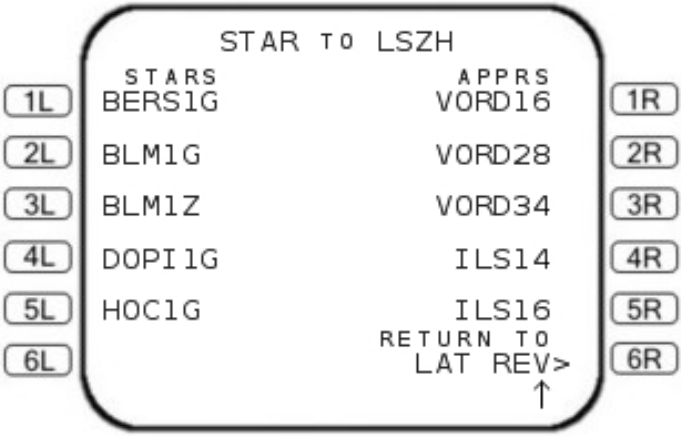
For access to the STAR TO page, scroll to the end of the flight plan, choose the desired point short of destination for the LAT REV (REMIR), and push its associated LSK. From the LAT REV FROM REMIR page, select STAR > (LSK 1R) to display the STAR TO page.



PMDG TIP
The proper procedure for inserting a STAR is to bring up the F-PLN page, then push the LSK next to either the last fix before the destination, or a fix that is known to be along the arrival route. This will display the LAT REV page from which the STAR can be selected.

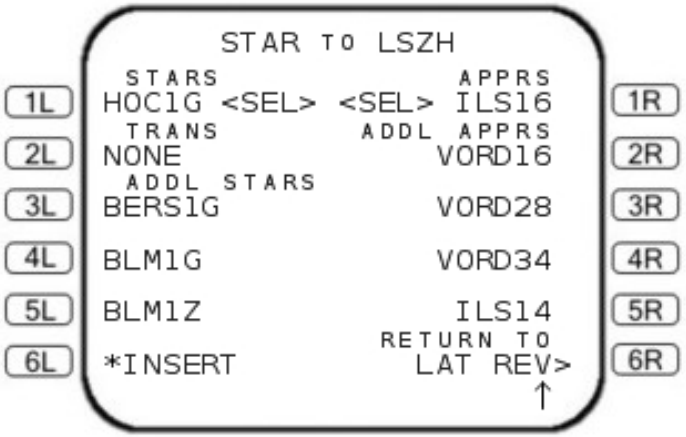
The STAR page, called up from the LAT REV page, is similar to the SID page. It lists standard or custom arrivals (STARS and profile descents) as well as standard or custom runway approaches to the entered destination airport for selection by the pilot. Profile descents are treated in the same manner as the STARS. Refer to the following screen.

STAR PAGE WITH STARS and APPROACHES DISPLAYED



Either the STAR or approach (runways) can be selected first. The elected STAR and approach are indicated by <SEL> next to the identifier. When the STAR is selected before an approach or runway, the list on the right side of the page first shows approach identifiers for the approach procedures that end at runways compatible with the selected STAR and vice versa.

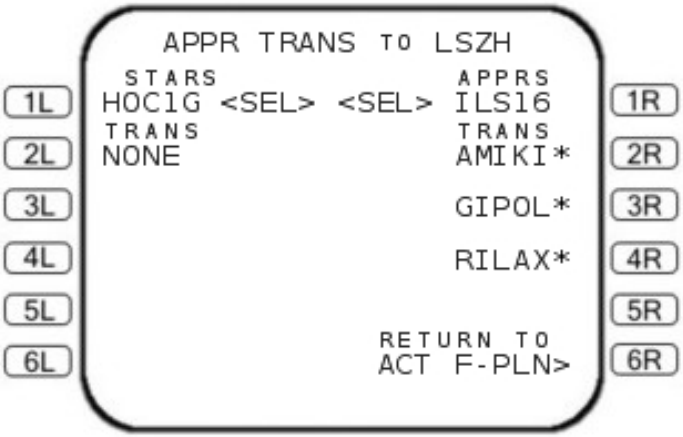
STAR PAGE WITH STAR and APPROACH SELECTED



After a STAR is selected, enroute transitions to the selected STAR will be displayed below the selected STAR. The APPROACH TRANSITION page is displayed after inserting to allow selection by pushing a LSK. The display is returned to the originating F-PLN page after selecting an approach transition or by selecting the RETURN prompt in line 6R if no transition is desired. The following figure shows an example of the APPR TRANS page.

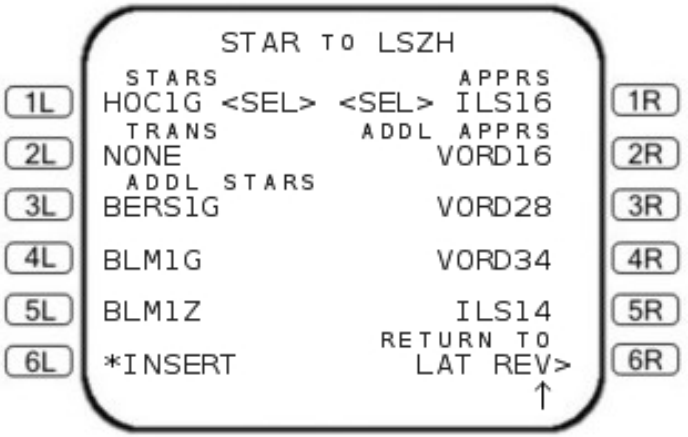
PMDG TIP
The proper order for building an arrival, transition and approach is to select the STAR, the approach, the runway and then the transition. While it is possible to select the transition once the STAR has been selected, the transition will be de-selected if you select the approach or runway after the transition has been selected. As such, the proper order is to select the STAR, the approach, the runway, and then the transition. This is normal behavior in MD-11.

APPR TRANS Page



If a non precision approach has been selected boxes will be displayed in the line 2R for a minimum profile altitude (MIN PROF) to be entered on the STAR/approach selection page. This data field is only displayed when a non-precision approach has been selected (figure below). Also, the *INSERT prompt is not displayed until a value is entered in 2R.

STAR PAGE WITH NON-PRECISION APPROACH SELECTED



Approach and Go-Around Page Review

The APPROACH page may be selected (after takeoff) by pushing the TO/APPR key. A typical approach page is shown below.

STEP: Push TO APPR

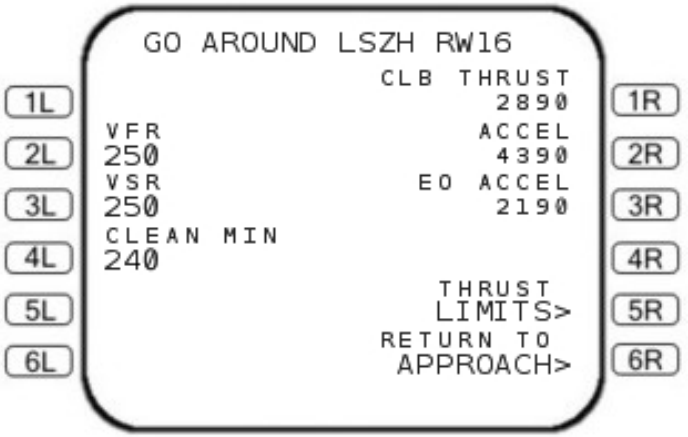
The pilot may insert values into line 5L VAPP and 4R TIMER MMSS data fields. All other fields are FMC calculations that cannot be altered.

1L	**2L**	Minimum maneuvering speeds (1.3 Vstall) for a clean and slat extended configuration computed using destination predicted weight and altitude at the predicted slat extension point.
3L		Minimum maneuvering speed for flaps 28 using weight and altitude at the destination predicted 28 flap extension point.
4L	**6L**	Available slat/flap settings for landing with the chosen configuration in LARGE font without an * (asterisk). Pushing the * selection line 6L causes the settings to swap with the new setting in line 4L display in large font.
5L		VAPP and VREF - VAPP is computed as VREF+5. VREF cannot be changed by the pilot but VAPP can be changed to allow for landing winds. VREF is 1.3xVSO.
1R		LW: FMC Computed landing weight
2R		LENGTH: Runway length from the database.
3R		ELEV: Runway elevation from the database.
4R		TIMER MMSS: Timer value in minutes and seconds used to initialize the EIS displayed timer. May be cleared by the CLR key. The timer can be set to a max of 59 minutes and 59 seconds.
6R		GO AROUND> prompt is displayed only during cruise, descent or approach phases of flight. Pushing LKS 6R provides access to the GO AROUND page.

NOTE: VAPP edits performed on the APPROACH page will be retained until either the pilot clears the edit, performs another edit, or the FMS transitions through DONE phase of flight.

Pushing LSK 6L provides access to the GO AROUND page as shown in the following screen.

STEP: Push 6R



This page is similar to the TAKEOFF page and is accessed either from the APPROACH page or automatically when the GA button on the center throttle is pushed. The climb thrust reduction and acceleration altitudes default to 1500 feet and 3000 feet above arrival waypoint elevation. They may be altered by the pilot.

- VFR is calculated as current configuration 1.3 Vstall + 10.
- VSR is the higher of V3 or VFR and is lower bounded by stick-shaker speed.
- Clean minimum airspeed is computed as 1.3 Vstall with clean configuration using current weight and altitude.

Transition To Descent

The transition from cruise to descent occurs when the aircraft sequences the T/D in the vertical flight plan. The transition also occurs when the pilot initiates an early descent by lowering the FCP CLR ALT and pulling or turning the V/S wheel.

Descent

The descent phase normally occurs when the aircraft departs the entered CRZ FL and extends until flaps are extended for landing. The descent vertical path is calculated by starting from the destination and computing in the reverse direction to satisfy decelerations, configuration changes, altitude and airspeed constraints, attitude speed limits, forecast winds, PRESELECTED DES speed, idle thrust and other constraining factors. This computation identifies the T/D.

When PROF and FMS speed modes are engaged and when cleared for descent, the pilot should set the lower altitude in the FCP altitude window without pulling the altitude knob. This removes the existing altitude constraint, and allows the aircraft to descend.

In descent with FMS PROF and speed engaged, a speed on thrust mode will be used when on path. The FMA will display THRUST in the speed window and PROF in the altitude window. Slight throttle movements may be seen in descent in order to maintain the FMS SPD target.

For discretionary descents, just prior to descent the aircraft may decelerate or accelerate from cruise speed to the vertical profile descent speed target if it is different from the cruise speed. Normally, the cruise and descent speed is the same unless it was either pilot-edited in PRESELECT DES or the CRZ FL is less than approximately FL250.

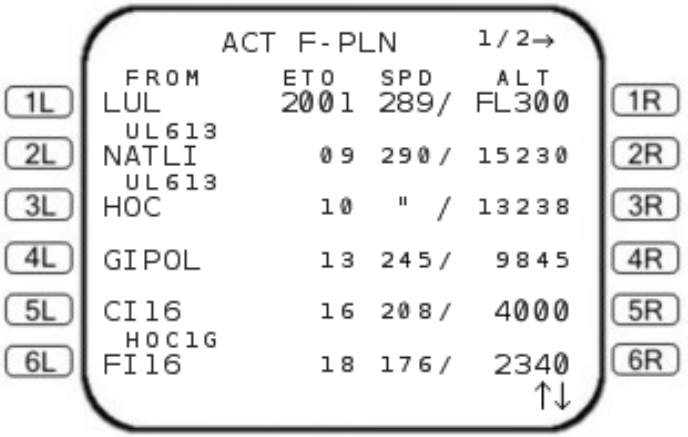
The chosen descent speed is maintained until approximately 2000 feet above the speed limit altitude (default 10,000 feet) where it changes to speed limit (default 250 KIAS) - 5 knots.

When engaged in FMS PROF and AFS speeds, the aircraft will continue to control to the FMS path and AFS speed.

NOTE: In descent between 10,000 and 12,000 feet FMS speed edits above 245 knots will not be due to the 250/10K speed restriction. The pilot may perform FMS speed edits in this area by first transitioning into cruise by entering a cruise flight level on the INIT page.

As descent progresses, the FMC calculates the appropriate deceleration distance from destination to slow to the approach speeds. When the flaps are extended, the FMS transitions to the approach phase.

Thrust limit during descent is maintained at CRZ limit until the slats are lowered for landing. An example of a descent FPLN can be seen below. The T/D was located prior to LUL. LUL has become the FROM waypoint at FL300. Notice the AT altitude of 4000 feet at waypoint CI16 (Centerline Fix RWY16).



Early Descents

Early descents are accomplished at the ECON or pilot-selected speed. When below path is initiated by pilot action, engaging PROF will result in the FMS maintaining the same guidance mode as previously selected by the pilot. A below path situation could reintercept the descent path or result in leveling at the FCP altitude or an FMS constraint altitude, whichever occurs first, until path reinterception. The FMA mode will display PITCH in the speed window and IDLE in the altitude window.

NOTE: When performing an Early Descent, the PROF mode should not be re-engaged until the aircraft is at least 300' below cruise flight level.

A typical early descent in PROF mode would occur as follows. Prior to T/D, clearance to descend is received. The FCP altitude is preselected to the cleared altitude and the V/S wheel is used to select 1000 feet/minute descent. PROF mode is reengaged causing the FMS to fly -1000 feet/minute until the descent path is intercepted and flown.

If PROF mode is engaged in descent and a flight plan change occurs resulting in the FMS being below path the FMS will select a nominal rate of -750 feet/minute descent until intercepting the descent path or target altitude. The FMA mode will display THRUST in the speed window and V/S in the altitude window.

Late Descents

Late descents result in a more complex situation. The T/D is computed as an engine idle descent path and if the aircraft attains a position above path, a speed change or ADD DRAG must be used to regain the descent vertical path. Above path conditions can be the result of late clearance to descend from ATC, altitude constraint entry during descent or strong tailwinds not entered in the FORECAST WIND page. If more than 300 feet above descent path, the FMS speed will only increase if the FMS speed mode is ECON or POLICY. The FMS speed target will not increase if EDIT FMS speed is being used. In the MACH range of descent, the ECON speed target will become ECON +0.02 Mach number, but will not exceed Mmo -0.02, or Mmo -10 knots KCAS, whichever is more restrictive. In the Calibrated Airspeed (CAS) range of descent, the FMS speed target will increase to ECON +20 knots but will not exceed VMO -10 knots KCAS. To aid in regaining the path, speed brakes may be needed. When the path can be made wIthout speed brakes, the RMV DRAG message is displayed. If an altitude constraint cannot be met, the MCDU message ALTITUDE ERROR AT XXXXXXX is displayed. XXXXXXX is the constraint waypoint name. Late descents are accomplished in a SPD/IDLE mode. The FMA will display PITCH in the speed window and IDLE in the altitude window.

If on path and aircraft speed is target speed + 10 knots fast, the ADD DRAG message is displayed on the ND and cleared when the speed is only 3 knots fast. As speed decays below target -5 knots, the RMV DRAG message is displayed. If on path and speed constraint cannot be met, the message SPD ERROR AT XXXXXXX is shown.

Descent speed limit - In PROF mode if aircraft speed is above the limit speed at limit altitude plus 500 feet, the FMC target altitude will become the descent speed limit altitude and the aircraft will level. The message SPEED LIMIT EXCEEDED will appear it the aircraft must fly level. When aircraft speed is 3 knots lower than the limit speed, the message is cleared and the aircraft resumes descent.

If engaged in FMS PROF mode and AFS speeds, the aircraft will not level off at the descent speed limit (10,000 feet default), if the aircraft speed is above 250 knots.

NOTE: During descent, a potential overspeed condition can occur in AFS speed control. To avoid this overspeed condition, prior to the T/D, preselect the glareshield control panel (GCP) speed to 350 or 310 maximum respectively as follows:

- *If landing fuel is expected to be above 25,000 pounds/12,000 kilograms, edit to 350 KIAS.*
- *If landing fuel is expected to be below 25,000 pounds/12,000 kilograms, edit to 310 KIAS.*

ADD DRAG and RMV DRAG are advisory messages. The amount of drag added or reduced is at the discretion of the pilot.

The ADD DRAG message is not displayed in cases of the FMS level flight segments when airspeed is higher than required.

In approach phase, below path, the FMS will command altitude hold until on path is achieved. It is the pilot's responsibility to comply with the 250 KIAS constraint below 10,000 feet.

Below Path

Early descents result in below path conditions. Speed control will be ECON speed or pilot-edited. If the early descent was initiated by pilot action, when PROF is engaged the FMS will maintain the same guidance mode as previously selected by the pilot. The aircraft would then reintercept the profile from below or level at the FCP or FMS altitude constraint until the vertical path is acquired and the FCP altitude constraint is lowered. If the below path condition occurred while the FMS PROF mode was engaged, the FMS will select a rate of -750 feet per minute until the profile is acquired.

During the approach phase (FLAPS extended), the FMS will command altitude hold until on path is achieved.

The intercept point to the vertical profile will be displayed on the ND as I/P. To re-enter the cruise phase of flight a new cruise altitude must be entered on the F-PLN INIT page of the MCDU. When this is done, a new descent profile and T/D wiII be displayed.

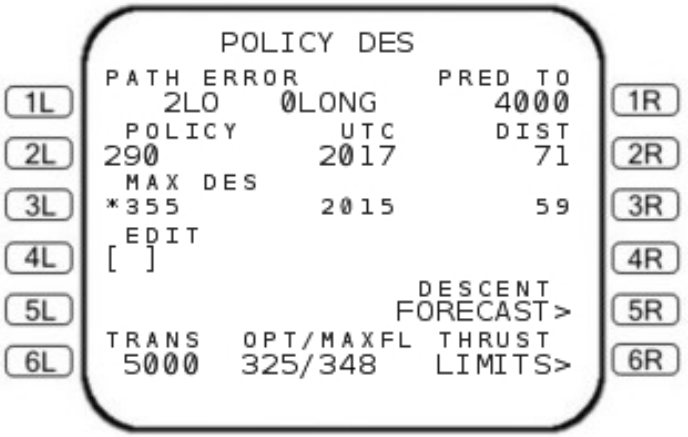
NOTE: If above or below path, the intercept PROF point (I/P) as displayed on the ND can be expected to adjust as a result of vertical speed changes during air mass descents.

Descent Performance Change

The descent PERF page is listed to change aircraft performance during descent. Time and distance to a pilot-selected altitude can be computed, and access to DESCENT FORECAST and THRUST LIMITS pages can be made from this page. Transition altitude from the NAV data base is displayed for information.

PMDG TIP
The NAV database used in Flight Simulator does not contain information about Transition altitudes. Therefore, we have allowed manual entry of Transition altitudes into field 6L. The default value is 18,000 ft.

STEP: Push the PERF key



Descent performance modes of ECON, MAX DES, and EDIT are available in 2L, 3L, and 4L. MAX DES is the speed that provides the maximum rate of descent. POLICY mode may be entered only during preflight, but may be cleared to ECON mode with the CLR key.

PMDG TIP
By default POLICY mode selected as the preferred descent speed mode, with a value of 290 IAS. Through the PMDG Options menu, this value can be changed, or the ECON mode may be selected as the default mode.

Predictions of distance and time to the pilot entered altitude in 1R are calculated. Without a pilot entered altitude, the FCP altitude is displayed in small font and used for computations.

If an altitude conflict exists between the FMS target altitude and the FCP selected such that the aircraft is between the two, raising the FCP altitude above the current aircraft altitude, ??? is displayed on the left side of the title line and an immediate level off is performed.

NOTE: When FMS speed mode is disengaged the active speed mode will not automatically revert to ECON

when FMS speed mode is reengaged. The active mode will be the last engaged speed mode (ECON, EDIT or MAX). If ECON was not the last engaged mode, EDIT or MAX will become active and a second FMS SPD button push will engage ECON

1L displays the path error (vertical deviation). The number in 1L indicates how far (in feet) the aircraft is above (HI) or below (LO) the calculated descent path. The number in the center indicates how far (in nm) the aircraft is laterally from the calculated descent path.

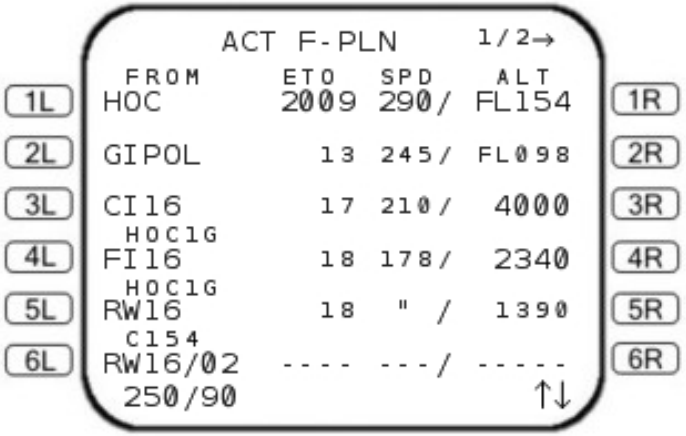
Vertical Descent Revisions

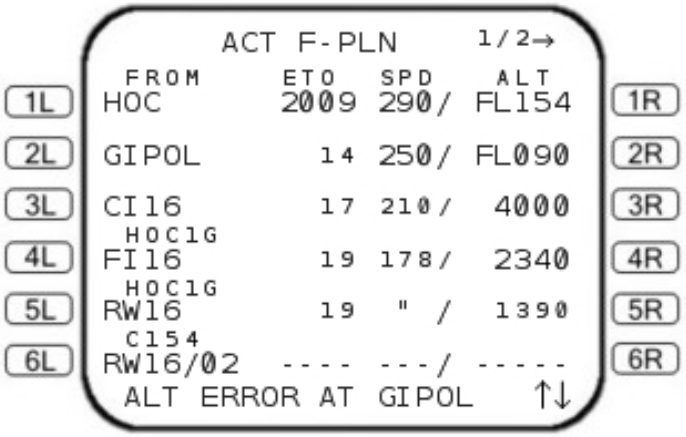
Altitude and speed restrictions may be entered at waypoints either directly into F-PLN or via a VERT REV in the same manner as Vertical Climb Revisions. Any vertical revisions, or for that matter, lateral revisions which disturb the vertical descent profile, will result in an above path or below path situation which resolved to an on path condition. While the performance computations are made, the aircraft will fly the existing vertical descent profile.

As an example of both an airspeed and altitude restriction entry, ATC has instructed PMDG01 to cross GIPOL at 9,000 feet and 250 KIAS.

STEPS: 1. Enter 250/90 in the scratch pad

2. Push the 3R LSK





Notice that when this constraint is entered, the vertical profile changes and the FMC generates the message ALT ERROR AT GIPOL. This is due to the GIPOL CROSS AT ALTITUDE changing from an unconstrained FLO85 to an AT altitude of FL100. If entry of a descent constraint is attempted without a destination, the MCDU SP message NO DESTINATION is displayed.

Holding

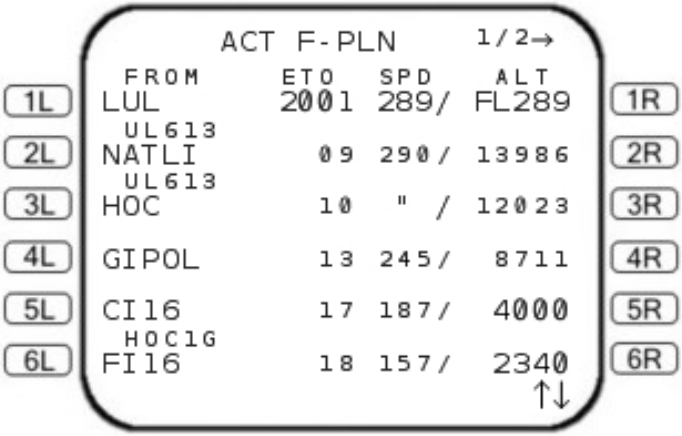
A holding pattern may be inserted at any waypoint or the FROM waypoint for holding at the present position. A revision at an existing holding fix is permitted. Any inserted change becomes effective upon the next crossing of the holding fix. Changes are activated immediately if made on the active leg prior to entry of the holding pattern. A LAT REV (left LSK) provides access to the HOLD selection prompt and the holding page.

WARNING: **When entering procedure turns or holding airspace, FMS NAV may not constrain the aircraft from maneuvering beyond protected airspace. Pilots are responsible for procedural compliance, both in entry procedure and airspeed limits. The latter can be accomplished with an FMS speed constraint or FCP selected speed.**

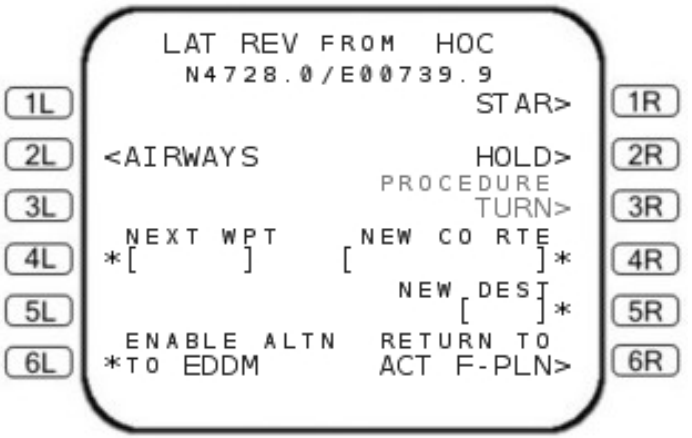
Access to the HOLD page at HOC is gained by:

STEPS: 1. Push the F-PLN key

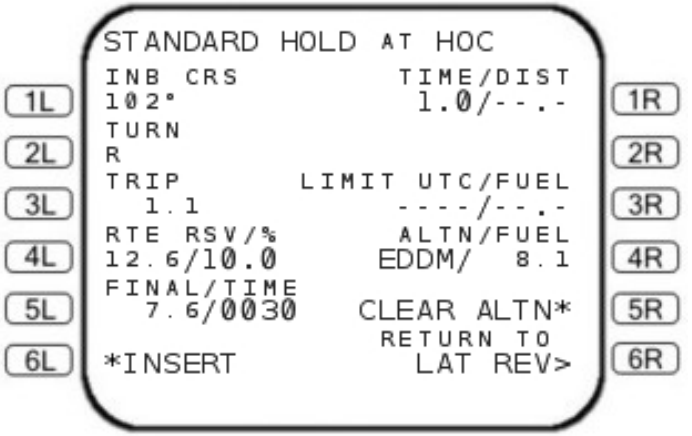
2. Push the 3L LSK



This will display the ACT F-PLN page initially, and then bring up the LAT REV from HOC page from which you can enter hold information.



STEP: Push the 2R LSK



An explanation of holding page data lines follows:

Title Page

HOLD AT - (Waypoint or PPOS). Previously modified holding pattern or pilot-defined holding pattern already defined for the waypoint PPOS is a special case FROM waypoint holding page.

DATABASE HOLD AT - (Waypoint). Enroute holding pattern defined from the nav data base.

STANDARD HOLD AT - (Waypoint). Holding pattern parameters were defaulted by the FMS.

1L INB CRS - Holding inbound course defaults to:

1. Database or pilot-defined holding pattern inbound course.
2. Inbound course from the flight plan.
3. Current track (when page accessed) for PPOS or discontinuity holding.

2L TURN - Default is right (R) but pilot may enter left (L) or (R).

3L TRIP - FMC calculated trip fuel from the holding fix to the destination.

4L RTE RSV/% - Route reserve fuel from the holding fix to the destination.

5L FINAL/TIME - Fuel and time allowance for holding at the alternate.

6L *INSERT - Inserts hold into F-PLN.

1R TIME/DIST - Time (in minutes) and leg distance of holding pattern. Default time is 1.0 minute at or below 14,000 feet and 1.5 minutes above 14,000 feet. The altitude used to determine this is the predicted altitude at the revise point when HOLD page was accessed. For a PPOS HOLD, the aircraft altitude at the time the FROM point was accessed is used. Either time or distance may be entered as the leg defining parameter but not both.

NOTE: The time of a holding pattern with a default time of 1.5 minutes will not be automatically modified to 1.0 minutes when the aircraft descends to an altitude at or below 14,000 feet. The time may be modified on data line 1R of the holding page.

2R REVERT TO STANDARD - Return to default hold parameters in existence before alteration by the crew. REVERT TO DATABASE is displayed when the hold parameters from the nav data base are modified and inserted by the crew. Selecting 2R causes previously displayed data to return.

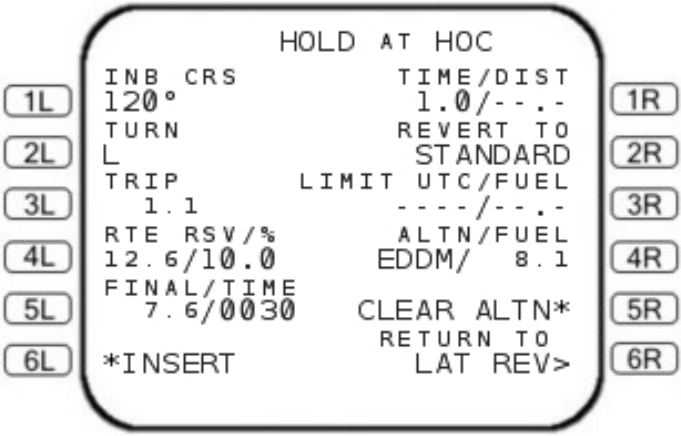
As an example, ATC has instructed the pilot to hold on the 120-degree inbound course to HOC left turns. As shown on following page, 120 is typed in the SP and entered in 1L causing the REVERT TO STANDARD prompt to appear in 2R.

STEPS: 1. Enter 120 into the scratch pad

2. Push the 1L LSK

3. Enter L in the scratch pad for "left turns"

4. Push the 2L LSK



3R LIMIT UTC/FUEL - Calculated values in LARGE font are shown and pilot entry is not allowed. Dashes displayed if value not available.

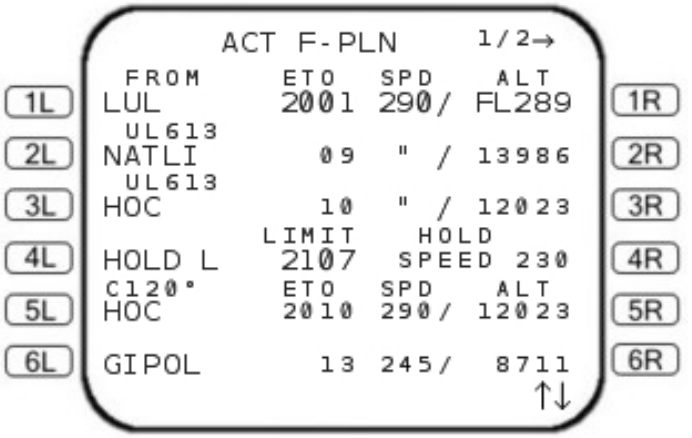
LIMIT UTC - Predicted time at which FOB is equal to LIMIT FUEL.

LIMIT FUEL - Fuel necessary to complete the flight plan with no changes to fuel reserves.

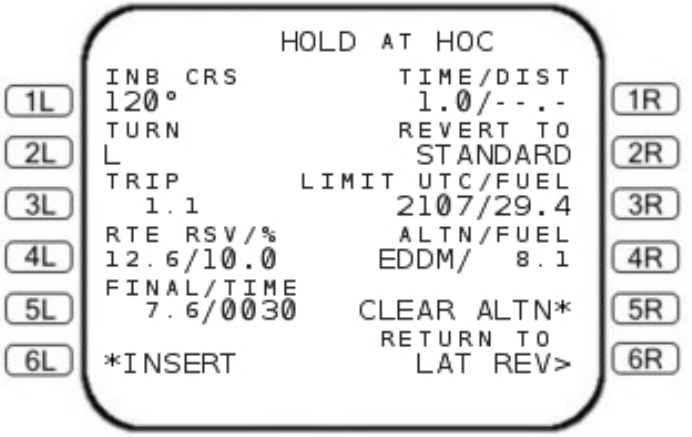
(LIMIT FUEL = TRIP + RTE RSV + ALTN + FINAL)

The entry in 3R is not displayed until the holding pattern is inserted into the F-PLN. Then it is displayed on both the F-PLN and the holding page. Pushing 6L *INSERT inserts the holding pattern into the flight plan. After computations are complete, the LIMIT time and fuel are displayed.

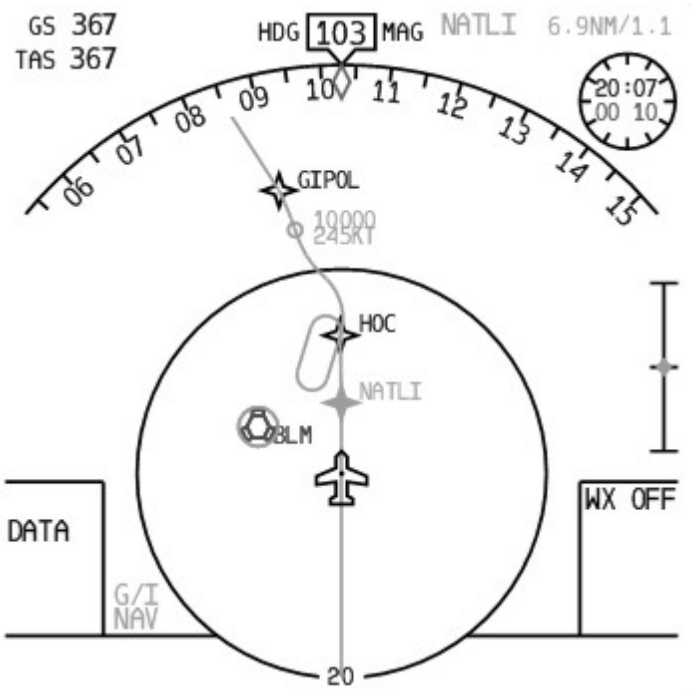
STEP: Push the 6L *INSERT



HOLD page with computation completed:



The following is displayed on the Navigation Display:



4R ALTN/FUEL - Alternate airport and to fuel to fly from the destination airport to the alternate airport. If there is no alternate, then NONE is displayed but a fuel entry may be entered.

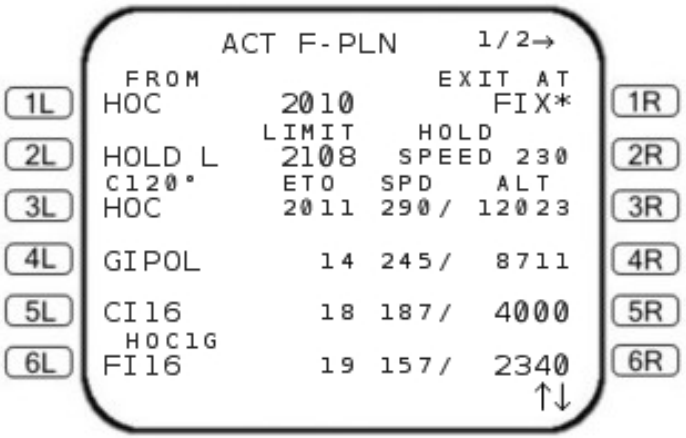
5R CLR ALTN - Displayed if an ALTN destination exists and the revise point is in the primary portion of the F-PLN. Pushing 5R when the prompt is displayed, deletes the alternate destination and route legs setting ALTN fuel to zero.

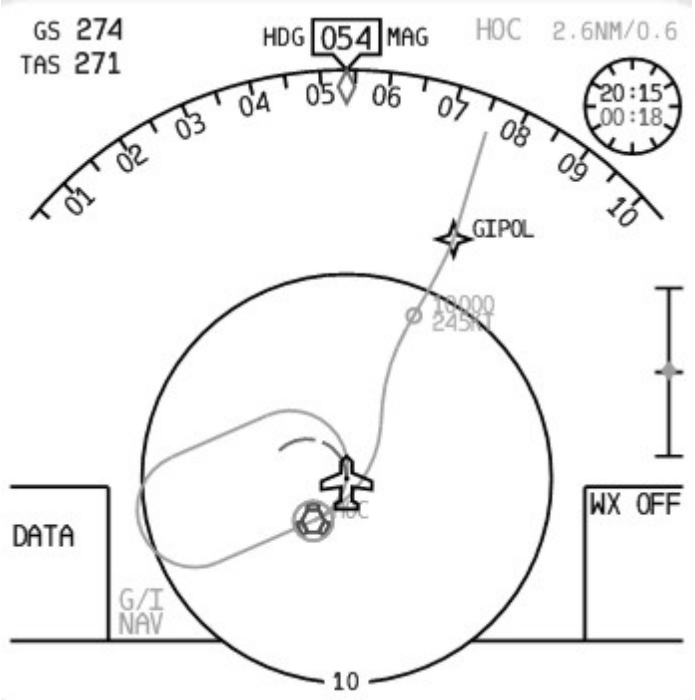
It is conveniently placed on this page so the pilot can cancel the requirement for altitude fuel should the flight crew deem it feasible, thereby displaying additional holding fuel and time.

Three minutes prior to REMIR, the aircraft will begin a deceleration to the holding speed. The holding speed, like any other speed, is bounded by upper and lower speed envelopes (VMAX - 10 and VMIN + 5).

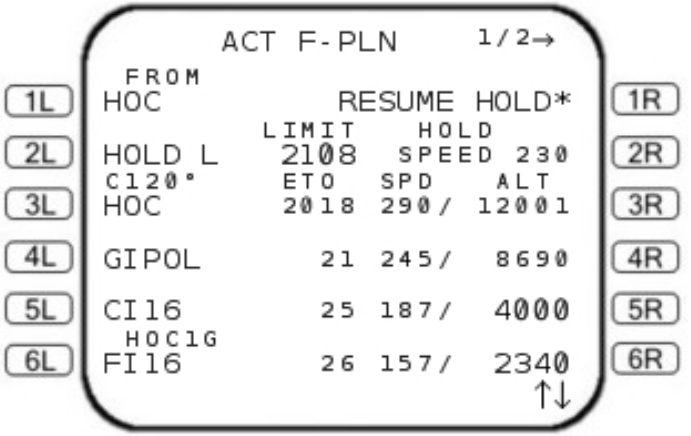
NOTE: FMS holding speeds default to ICAO speed limits and can be edited as necessary.
If using FMS ECON SPD, once flaps are extended the FMS speed target will be VMIN + 5. If in an FMS EDIT, the speed target will remain at the EDIT speed during a hold, even when flaps are extended.

If descent in holding is required, the PROF descent rate defaults to 750 ft/min descent. As HOC is sequenced, the ACT F-PLN page and ND display will look similar to the following displays.





The EXIT AT FIX* prompt in 1R is displayed three minutes prior to holding entry for a manually terminated holding pattern (Pilot selects exit). For a navigation data base holding pattern which requires one turn in holding, the EXIT AT FIX prompt is displayed at initial holding fix passage. Pushing this prompt selects exit of the holding pattern and displays the prompt RESUME HOLD*. Pressing RESUME HOLD*, reinserts holding and displays EXIT AT FIX. Upon selecting EXIT AT FIX, the aircraft turns immediately to the holding fix and departs holding after arrival at the fix.



VOR Mode

The NAV RAD page includes the option of selecting VOR ARM (2L and/or 2R) when a VOR frequency is tuned with a course entered into 1L or 1R. Selecting this option (pushing 2L or 2R) displays a VOR ARMED prompt and notifies the FMS to arm and capture the VOR course. VOR ARMED is then displayed on the FMA. When the FMC VOR capture criteria are satisfied, the roll control window on the FMA changes to VOR1 or VOR2 to indicate which VHF NAV receiver is selected by the FMC. Both may be armed but only one can be selected and control the aircraft. The FMS then captures and controls to the selected VOR course in response to steering commands from the FMC. Over the VOR station, control is to the selected VOR heading (VOR1 or VOR2 CRS displayed in the FMA window). The NAV RAD page will show VOR TRACK in 2L or 2R when the FMC is providing control guidance to the AFS.

The armed mode may be reset by entering a new course, clearing the course, tuning another VOR, selecting NAV, selecting LOC ONLY, selecting APPR/LAND, or pushing the HDG/TRK select knob. Pushing the HDG/TRK select knob to select a heading will also cancel the VOR ARMED mode.

NOTE: If a course change over a station is accomplished on the same VOR receiver, then the crew may use /CRS or a preselect of /CRS to change the course and remain engaged in the VOR mode. However, if the frequency or ICAO ident is used in conjunction with the course change, the VOR mode will disengage and must be rearmed.

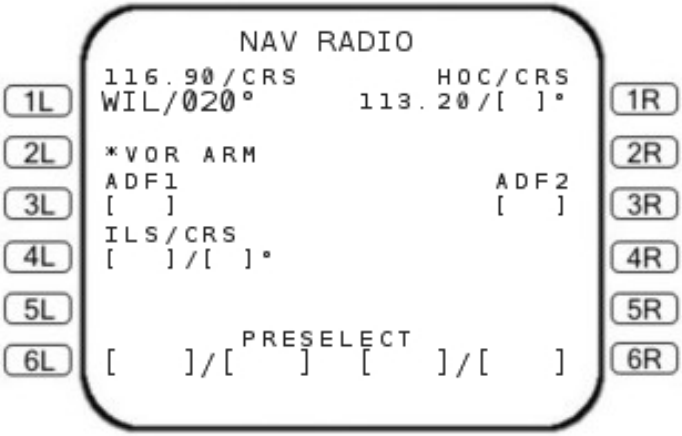
Auto tracking of the VOR course described above is only possible below 18,000 feet. Above 18,000 feet VOR tracking may be armed but it will not engaged until the aircraft descends below 18,000 feet.

In the example below, the WIL VOR course of 020 degrees is armed and tracked.

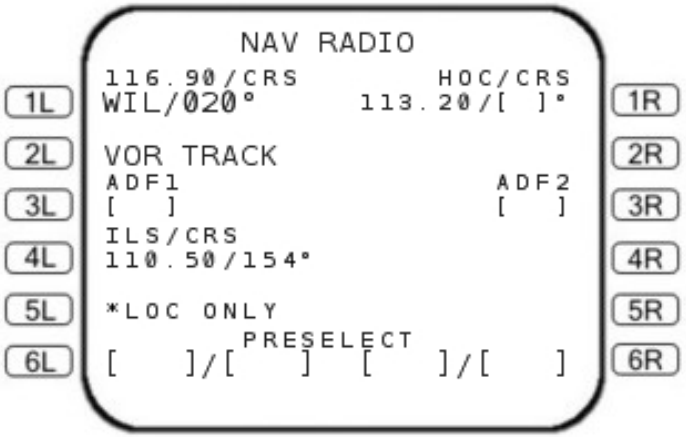
STEPS: 1. Push the NAVRAD key

2. Type WIL/020 in the SP

3. Push the 1L LSK



Push the 2L LSK to ARM the VOR tracking. 2L changes to VOR ARM with to large fonts. When the VOR course is captured, 2L changes to VOR TRACK:



Alternate Diversion

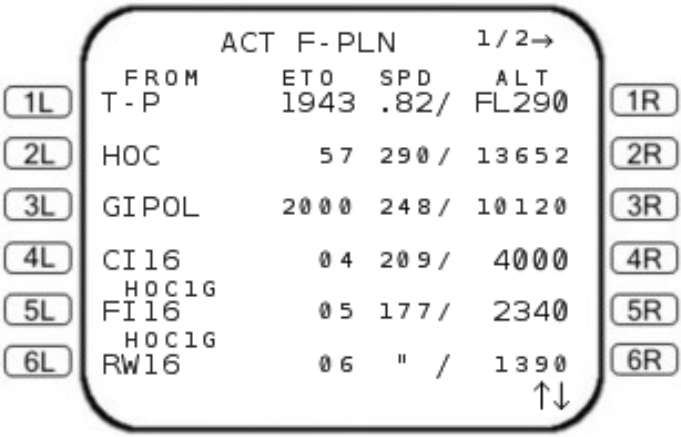
Early alternate divert decisions are supported by the FMS with the ENABLE ALTN TO XXXX function of the LAT REV page. Pushing 6L, the ENABLE ALTN TO function, inserts the alternate portion of the active F-PLN into the primary portion of the flight plan, thus activating it. The function is available for any fixed waypoint in the primary F-PLN. When used, the active flight plan including speed, altitude and time constraints will be beyond the point from which the lateral revision is made. Routing becomes the revise point, F-PLN DISCONTINUITY, original destination as a flight plan waypoint and alternate routing to the new destination. The new cruise altitude will be the ALTN cruise altitude, which may be on the F-PLN INIT page. Normal F-PLN modifications may be made after the alternate flight plan has been incorporated into the primary F-PLN.

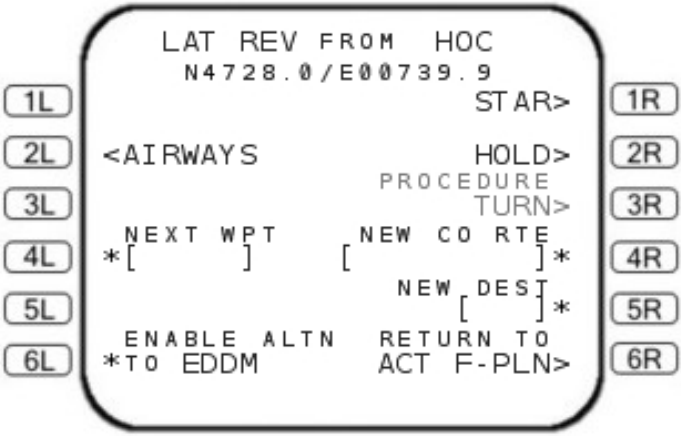
As an example, after sequencing HOC in screen below, a LAT REV and ENABLE ALTN TO EDDM is accomplished.

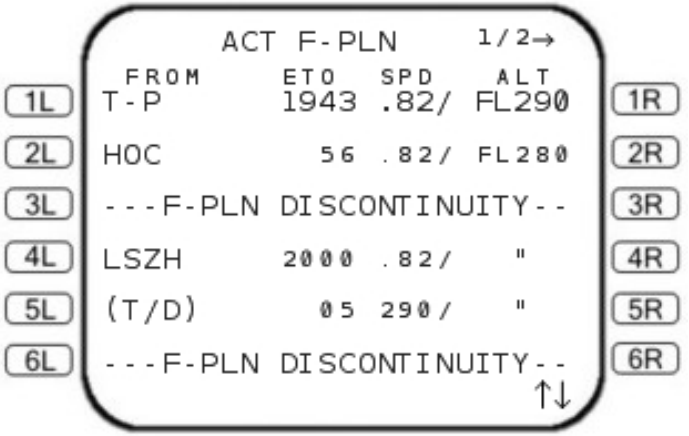
STEPS: 1. Push the F-PLN key

2. Push the 2L LSK

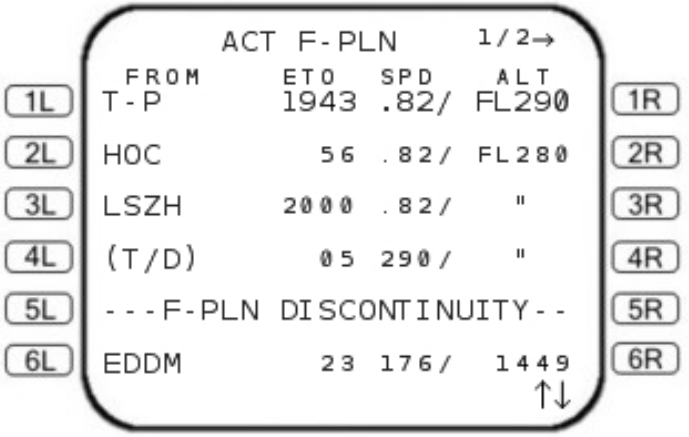
3. Push the 6L key







Clearing the DISCON produces a flyable F-PLN. STAR and runway revisions may be made to EDDM.



If alternate diversion via the ENABLE ALTN TO function is desired, it may be accomplished during the missed approach but the routing will be from the revise point to the destination as a waypoint and then to the alternate airport. The pilot may desire to accomplish a DIR TO or NEW DEST revision to accomplish the divert.

NOTE: If ENABLE ALTN is not used, selected LAT REV and inserting a NEW DEST airport is required in order to tell the FMC to do a search for the airport runways and STARS associated with the alternate airport.

Transition to Approach

Transition to approach occurs when the flaps are extended.

Intentionally Left Blank

Approach

In this section the approach speed targets and thrust modes, different approaches, and post approach options will be detailed. The FMS vertical speed and thrust profile will be discussed first.

The FMS speed target passing the descent speed limit will be 5 knots less than the speed limit, normally 245 KIAS. Speed targets will then reflect any speed restrictions as entered into the F-PLN at subsequent waypoints.

Approach Speeds

While in ECON speed, FMS approach speeds will decelerate from 245 KIAS to VAPP speed in discrete steps. The first deceleration will be from 245 to "clean min" + 20. The solid magenta circle FMS speed target will drop to that speed. At the next deceleration point, the FMS speed target will drop to "slat extend min" + 20. If the slats have not yet been extended, this next available speed target will be displayed as an open magenta circle limited by the current configuration VMIN amber "foot." This will prompt the pilot to extend the slats. Upon slat extension, VMIN reduces accordingly for the new configuration, thus allowing display of "slat extend min" + 20 as a solid magenta circle FMS speed target. The next deceleration displayed will be "flap 28° min" + 5. Again if flaps have not yet been extended, an open magenta circle will be displayed limited by the current configuration VMIN amber "foot". This indicates that the pilot should extend flaps. A final target of VAPP will be displayed at the last deceleration point. VAPP = VREF + 5 for the selected landing configuration (35° or 50° flaps entered on the APPROACH page).

> *NOTE: Once flaps are extended. the FMS target will become VMIN + 20 for the current configuration for flaps less that 28° and VMIN +5 for flaps greater than or equal to 28°.*

While in EDIT mode, the ECON approach speeds will be displayed as open magenta circle FMS available speed targets at each deceleration point ("clean min" + 20, "slat ext min" + 20, "flap 28° min" + 5 and VAPP), limited by the current configuration VMIN amber

"foot" as described in ECON mode above. An FMS speed edit. may be done at any time.

NOTE: Once established on the low altitude speed limit (10,000 feet/245 KIAS), FMS speed edits are absolute. That is, when engaged in FMS edit speed, the speed target will remain fixed throughout the approach until one of the following occurs:

- *Another speed edit is performed*
- *ECON is selected*
- *A speed constraint exists in the flight plan*

VAPP edits performed via the MCDU on the APPROACH page will be retained until the pilot clears the edit, performs a new edit, or the FMS transitions through the DONE phase of fight.

Ideally the descent and approach speed targets should define an idle thrust smooth deceleration to VAPP where power is used to maintain VAPP for the remaining approach path. In reality, altitude restrictions, computed versus actual drag, and other variables can affect the timing and location of the above speed changes.

The active thrust limit changes to CLB thrust limit when the slats and flaps are lowered for landing. When GA is selected below the GA thrust reduction altitude, the thrust limit mode will change to GA mode. When the aircraft altitude is equal to or greater than the GA thrust reduction altitude, the thrust limit mode changes back to CLB.

ILS Approach

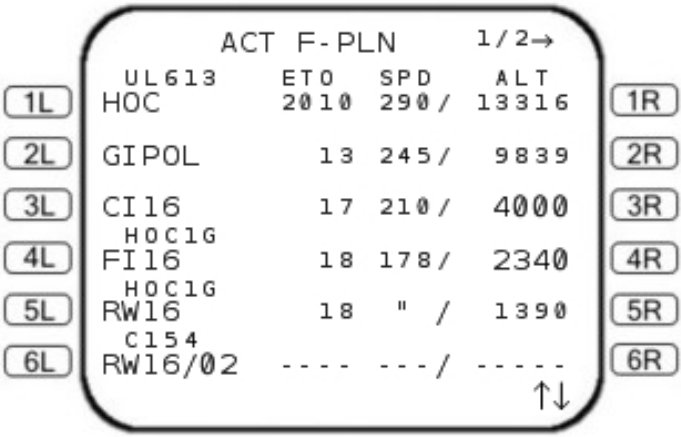
During cruise or early descent, a LAT REV to a revised waypoint short of the destination and STAR selection can include selecting the ILS approach to the active runway at the destination. The associated ILS approach contains waypoints designed and located to position the aircraft at a point from which ILS capture can occur. FMS NAV will provide steering guidance to the AP/FD to intercept the LOC with a 20-degree intercept. Vertical altitude targets are provided to the AP/FD which meet altitude constraints along the approach path and position the aircraft to intercept the glideslope. Pushing the APPR/

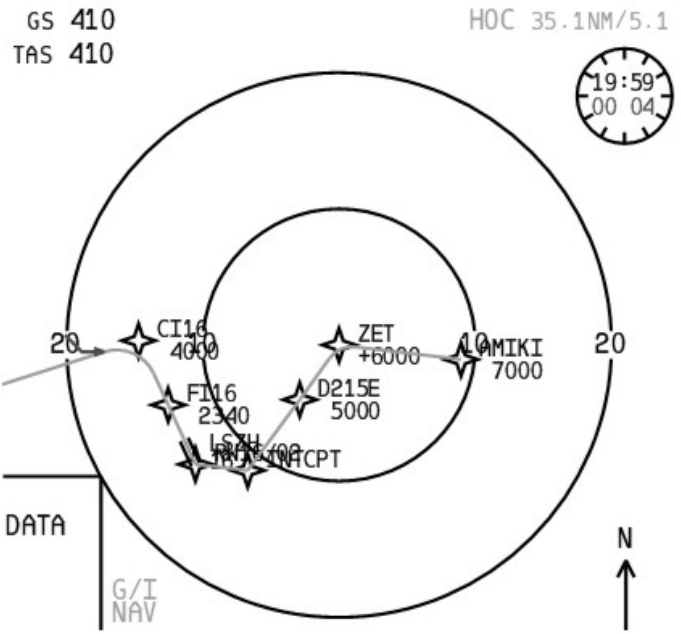
LAND button with a valid localizer signal arms the AP/FD to capture the localizer and glideslope and if AUTO FLIGHT is engaged, provides control to autoland touchdown and rollout.

FMS SPD, if engaged, will provide speed targets during the approach.

The FMC tunes the ILS Localizer (and DME if available) when the aircraft is within 25 NM of the destination. If the aircraft is within 20 NM of the destination and invalid data is continually received for 3 seconds, the MCDU SP message ILS UNTUNABLE is displayed. The frequency should be confirmed by the crew and if necessary manually tuned.

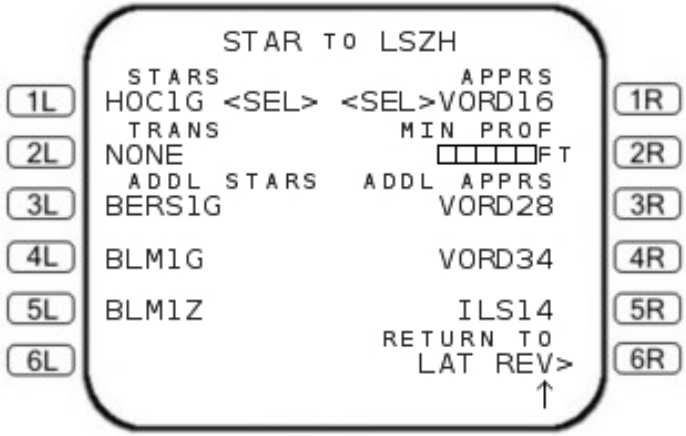
The F-PLN STAR and ILS16 approach to LSZH is shown in the following screen. If the ILS is tuned by entering a frequency, the FMS will not look up the identifier from the NAV data base for MCDU display. The identifier will, however, be decoded and displayed on the PFDs and NDs.



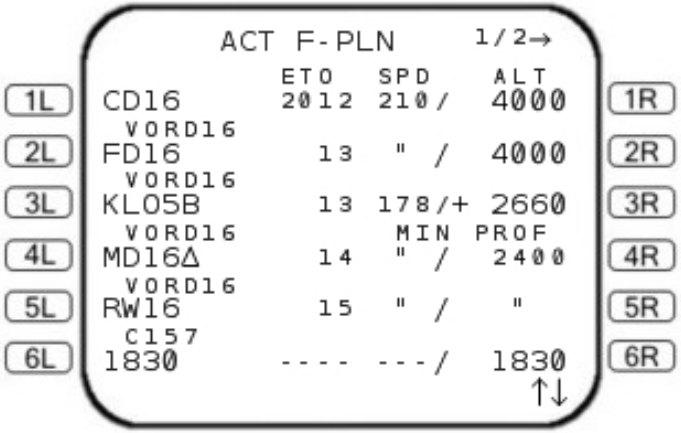


Nonprecision Approaches

If a non-precision approach has been selected from the NAV database (such as VOR, NDB, or LOC), boxes shall be displayed in LSK 2R for entry of a MIN PROF altitude (limited from 200 feet to 5,000 feet above airport elevation). The usual entry is the published MDA.



The *INSERT prompt shall be available after a MIN PROF altitude has been entered.



Editing the MIN PROF altitude after the selected nonprecision approach has been inserted causes the entered MIN PROF altitude value to be displayed in small font with an asterisk. Editing the MIN PROF altitude value and confirming it by pushing LSK 2R will cause the MCDU to revert to the F-PLN page without restringing the STAR/APPR and without initiating a descent path reconstruction. Selecting LSK 6L shall restring the selected STAR/APPR and cause the MCDU to revert to the F-PLN page.

NOTE: The FMS PROF mode will automatically disengage at the pilot-entered MIN PROF altitude and the aircraft will revert to AFS basic modes. AFS basic modes are ALT HOLD or VERT SPEED depending on the GCP altitude setting and AFS pitch mode reversion criteria.

The FCP MDA minimums bugs and the altitude selector should be set to the same published minimum altitude prior to starting the approach.

Once at the MDA, the FCP altitude selector can be reset to the missed approach altitude in anticipation of a go-around.

LOC Approach

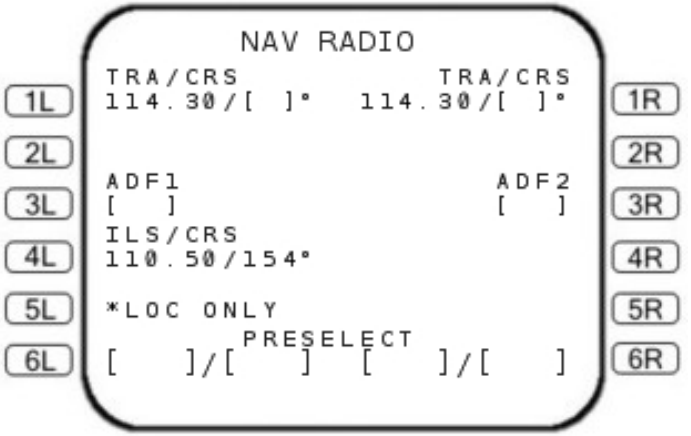
For purposes of the FMS, a LOC approach means that a localizer approach was selected from the NAV data base and no glideslope exists. In this instance, vertical path guidance is programmed by the FMS down to the MDA.

LOC Only Approach

For purposes of the FMS, a LOC ONLY approach means that a full ILS approach was selected from the STAR page and the glideslope portion is either temporarily unavailable or not desired to be used. In this case a MIN PROF field is not presented when inserting the approach, therefore, descent in PROF mode is not possible below the FAF altitude. The vertical path deviation indication on the ND should not be used for vertical path guidance beyond the FAF as it does not represent the correct descent path for the approach.

The NAV RADIO page has the option of selecting LOC ONLY when a runway heading is entered into the localizer course field (4L). Selecting this option by pushing 5L engages ILS localizer guidance without glideslope guidance. When the LOC ONLY request is received, the AFS is armed to capture the localizer. LOC ARMED is annunciated as the flight mode annunciator.

The LOC ONLY mode selection on the NAV RADIO page (5L in figure below) is for separating localizer from glideslope when a full ILS has a glideslope that is inoperative or unreliable.



When the FCC localizer capture criteria are satisfied, the AFS captures and controls the aircraft to the ILS localizer using the same FCC control laws as when APPR/LAND is selected. Engaging another lateral control mode cancels the LOC ONLY mode. Descent to the minimum descent altitude (MDA) from the glideslope intercept altitude must be accomplished using the FCP V/S or flight path angle (FPA) modes.

Selecting NAV, APPR/LAND, VOR ARM, or pushing or pulling the HDG/TRK select knob resets the LOC ONLY approach mode. The LOC ONLY mode can also be disengaged by the FMS or deselected on the MCDU by tuning another ILS frequency.

VOR Approach

VOR approaches may be flown in the NAV and PROF modes by selecting the appropriate VOR database approach and engaging NAV for lateral guidance and PROF for vertical guidance down to the MDA or by following raw data with the use of appropriate FCP controls. VOR approaches may be flown in NAV, TRACK, HEADING or VOR.

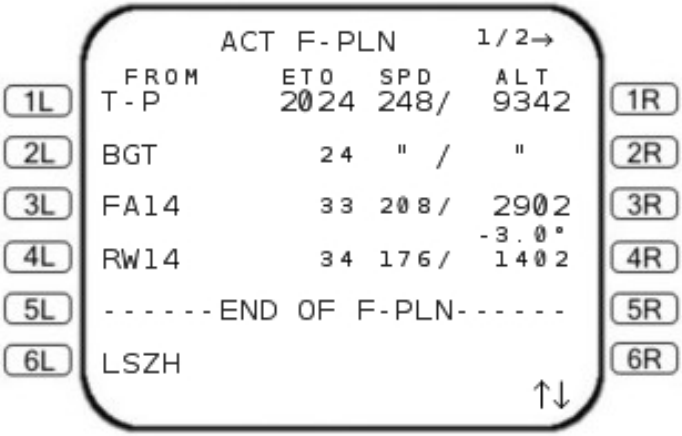
VFR Approach

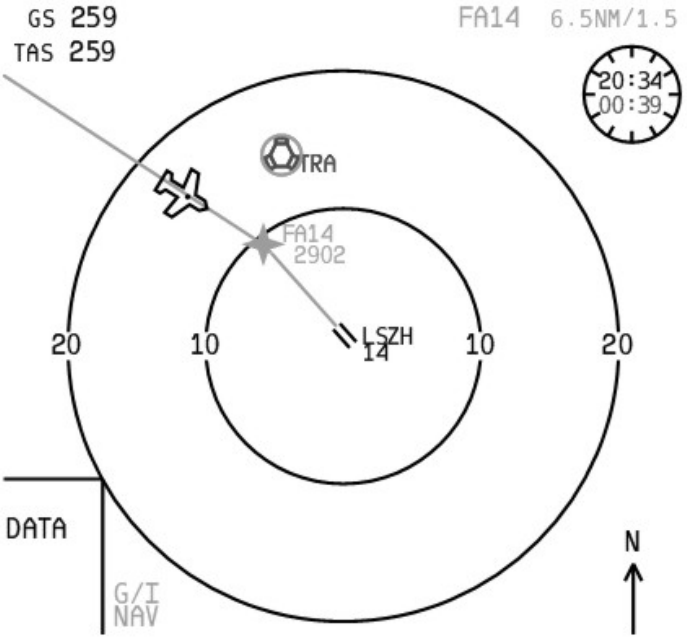
A VFR approach may be into the F-PLN as an approach during the STAR and RWY selection process. If the approach is entered, a final approach waypoint is added to the flight plan just prior to a 3-degree final approach path.

The approach waypoint precedes the destination runway by 8 NM and has an associated altitude constraint equal to the runway elevation plus 1500 or 2000 feet The identifier for this waypoint is FAnnn. where nnn is the destination runway number.

The final approach waypoint may be cleared manually or by entering a waypoint into the flight plan following the final approach waypoint. Clearing the waypoint by either of these two methods will cancel the VFR approach.

The above function is provided to assist the crew in positioning the aircraft 8 miles from the airport on an extended center-line position with an approximate 3-degree descent path to the selected runway. It is not intended for nor should it be used as an IFR procedure.





Landing Runway Change

Runway changes just prior to landing are a common occurrence whether it is to a parallel runway or a completely different runway. The FMC may be prepared ahead of time to aid the pilot in handling the workload associated with this change. However, planning and tailoring the F-PLN must be completed well before the final approach phases of flight.

The FMS Secondary (SEC) F-PLN provides the pilot with the capability to develop an altered F-PLN which incorporates a new approach and landing runway at the destination. General instructions to accomplish this task are to access the SEC F-PLN by pushing SEC-F-PLN key, copy the Active F-PLN into the SEC F-PLN, after the STAR to include a new approach and landing runway, clear any DISCONs, and review the SEC F-PLN routing for intended backup plan routing, approach and landing runway. If the SEC F-PLN

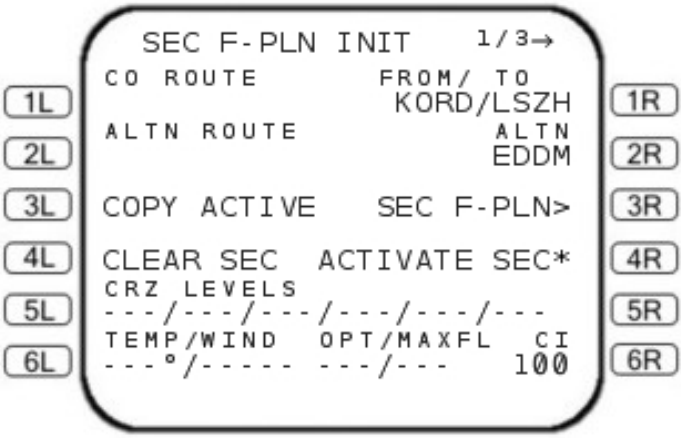
represents the plan you want, exit back to the ACT F-PLN and continue with the flight.

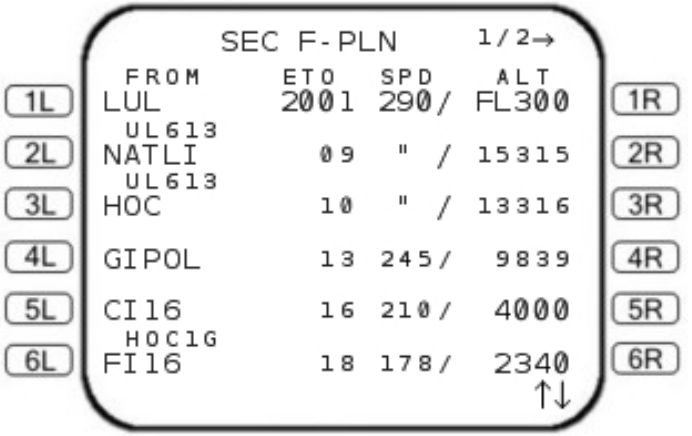
If a change in runway does occur simply push the SEC F-PLN key, ACTIVATE SEC by pushing 4R, and, if necessary, perform a DIR TO the waypoint where ATC has instructed you to join the new approach. The aircraft could be hand flown there also.

STEPS: 1. Push the SEC F-PLN prompt

2. Push the 3L LSK to COPY ACTIVE flight plan.

3. Push the 3R





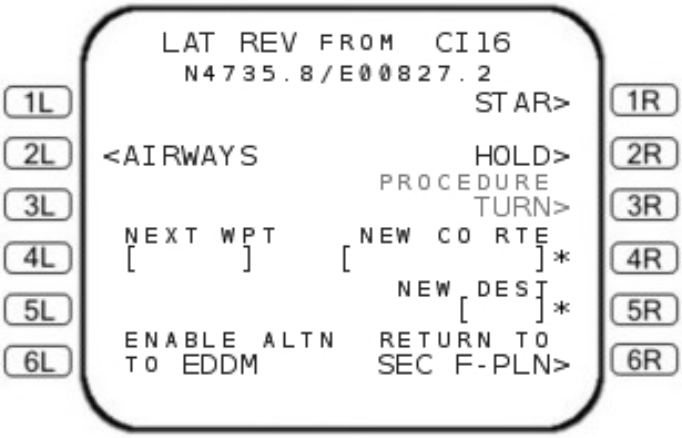
NOTE: These FMS procedures will retrieve the waypoints for any standard terminal area of arrival or instrument approach and place them in the flight plan. In the case of an ILS approach, they will also retrieve the localizer frequency and the final approach course from the database and insert them on the NAV RAD page. In order to protect the ILS receivers from uncommanded frequency changes during the critical autoland process, frequency changes are inhibited once the approach has begun. Anytime a side step ILS landing is required and the FMS shows LOC and GS or DUAL LAND or SIMGLE LAND or APP ONLY perform the following procedure:

- *Disconnect the autopilot*
- *Insert the new ILS frequency and course in the NAV RAD page*
- *Push the APPR/LAND switch on the GCP*

Changing the landing runway is accomplished through a LAT REV to a waypoint short of the destination, STAR selection and changing the selected runway.

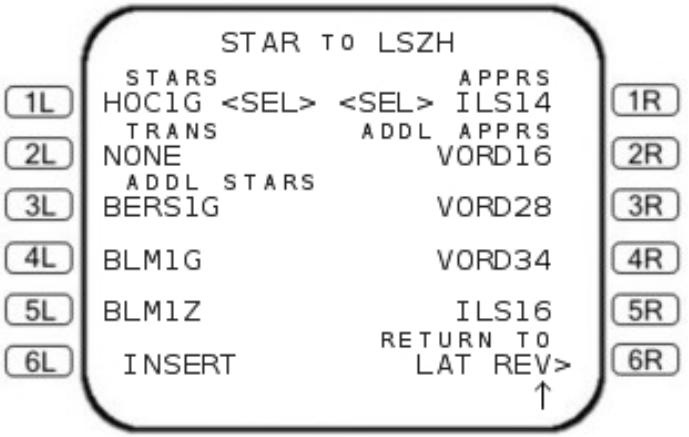
STEPS: 1. In SEC F-PLN page push 3L LSK for a LAT REV at CF16

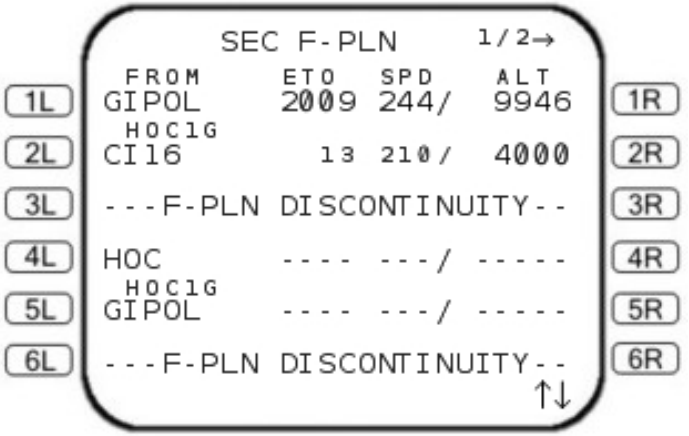
2. Push the 1R LSK



STEP: Push the 3R LSK

STEP: Push the 5R LSK to select the ILS14 approach





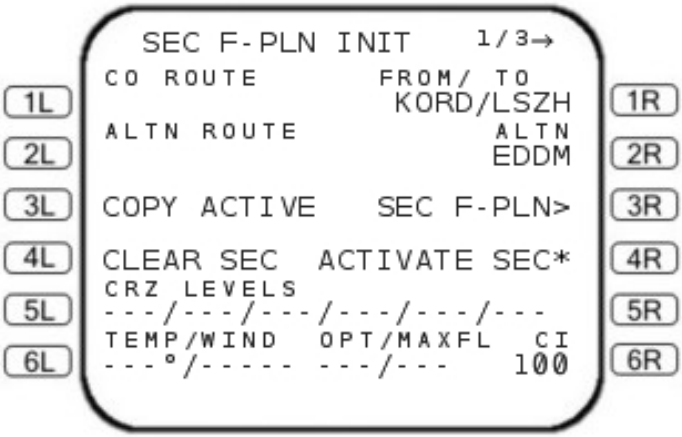
The HOC1G STAR and ILS to RWY 14 have been inserted after CI16 waypoint in the SEC F-PLN. It would not be desirable to fly from CI16 back to HOC and through the STAR again, so HOC, GIPOL and the DISCONTINUITY must be cleared to become a usable SEC F-PLN.

The pilot can now continue to use the FMS until the runway change is announced by ATC. The runway changed SEC F-PLN may be

activated by accessing the SEC F-PLN INIT page and selecting ACTIVATE SEC as shown in the following screen.

STEPS: 1. Push the SEC F-PLN prompt

2. Push the 4R LSK



Go Around

Go around causes changes to thrust limits FMS phases of flight, PROF and NAV guidance. Those items will be discussed as well as performing a DIR TO to set up another ILS approach.

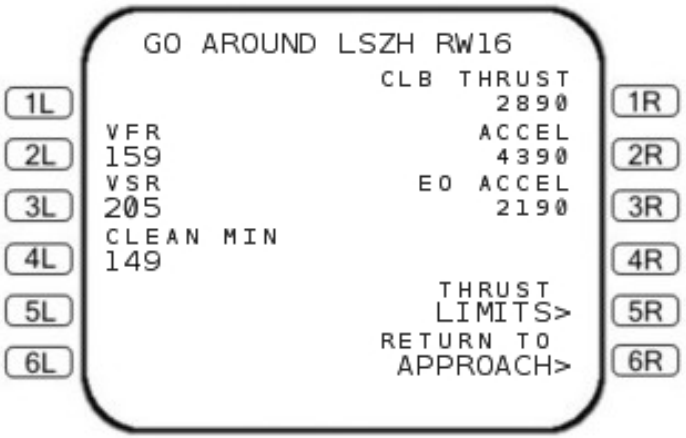
Missed Approach

Pushing the GA switch below 2500 feet with 5 degrees or more flaps will initiate automatic go-around. If aircraft altitude is below the go-around thrust reduction altitude, the thrust limit selected is go-around mode. If altitude is above the go-around thrust reduction altitude, thrust limit mode will be CLB.

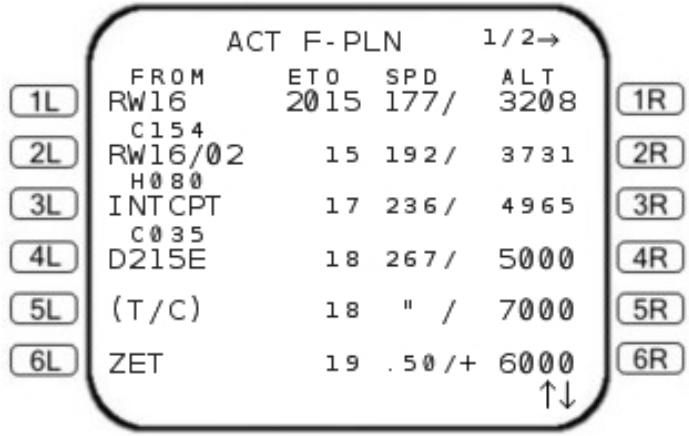
During go around, the FMS transitions to TAKEOFF or CLB phases depending on use of the GA switch. sequencing the destination runway, valid CRZ FL or CLR ALT. If the go around is initiated via the

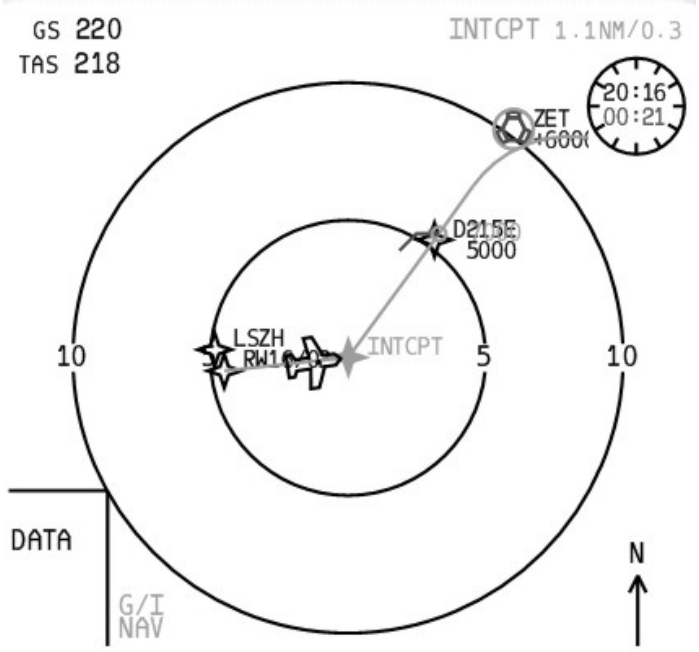
GA switch before sequencing the destination and the pilot enters a valid CRZ FL the FMS transitions to TAKEOFF. As the aircraft sequences the destination, the FMS transitions to CLB. With a manual increase in engine power, the FMS transitions to CLB after sequencing the destination.

NOTE: Commanded airspeed during climb will be VMIN + 5 for configuration (FLAP 28) or indicated airspeed when the GA switch was pushed, whichever was higher. The commanded speed is displayed in the speed window on the PFD but will not be displayed on the MCDU GO AROUND page.



Laterally, as the destination is sequenced, the missed approach is activated. Predictions are calculated for each waypoint (see screen below) and the CRZ ALT is established as the highest of CRZ ALT, CLR ALT, or 10,000 feet above the destination altitude. With PROF and NAV engaged, the aircraft automatically flies the missed approach (see screen below).





NOTE: Once that final waypoint is passed, PPOS becomes the FROM waypoint followed by an active leg F-PLN

DISCON and then the END OF F-PLN marker. After a missed approach or go-around if the pilot clears the to waypoint or the to waypoint sequences to a DISCONTINUITY, it is possible that one or several waypoints may sequence if they are within 10 NM of aircraft position. If this occurs, it may be necessary to enter a DIR TO or new waypoint, then the subsequent approach.

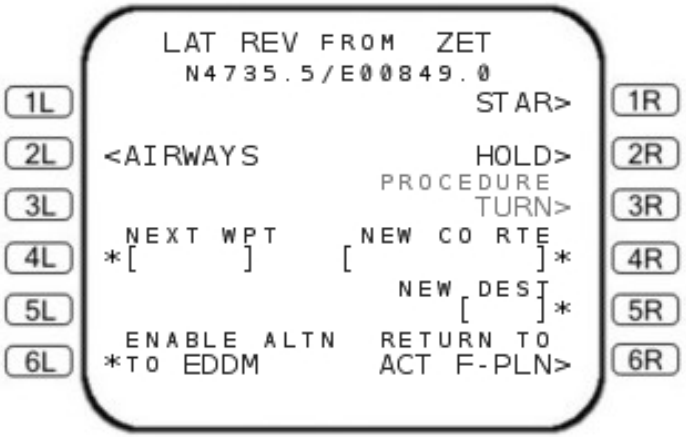
After executing an FMS missed approach, it will be necessary to string a new approach before sequencing through the loaded flight plan. If the flight plan is sequenced and destination is lost, it will be necessary to string a new flight plan with a new destination.

Second ILS Approach

Planning for a second approach (ILS, VOR, VFR etc.) could be accomplished in the secondary flight plan just like the landing runway change. It may also be accomplished in the following manner.

STEPS: 1. Push the 6L LSK to perform a LAT REV at ZET

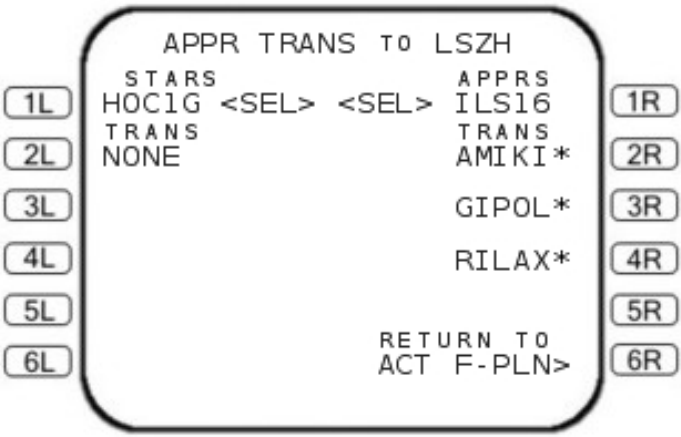
2. Push the 1R LSK



STEP: Push the 6L *INSERT

The *INSERT prompt is available from the previous selection or will be available after changing the approach selection. Pushing insert automatically displays the APPROACH TRANSITION (see following screen) page where the transition is chosen and STAR APPR waypoints are inserted into the F-PLN.

STEP: Push the 2R LSK

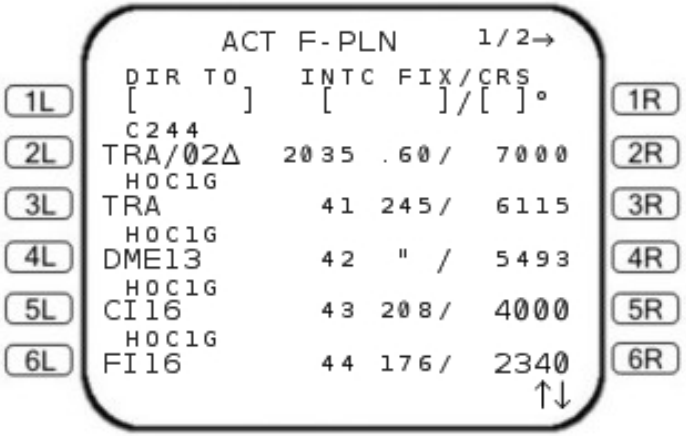


The entire HOC 1G STAR is probably not the ATC or pilot desired routing. A simple way to establish the assigned routing is by performing a DIR TO the appropriate waypoint.

Direct to Waypoint

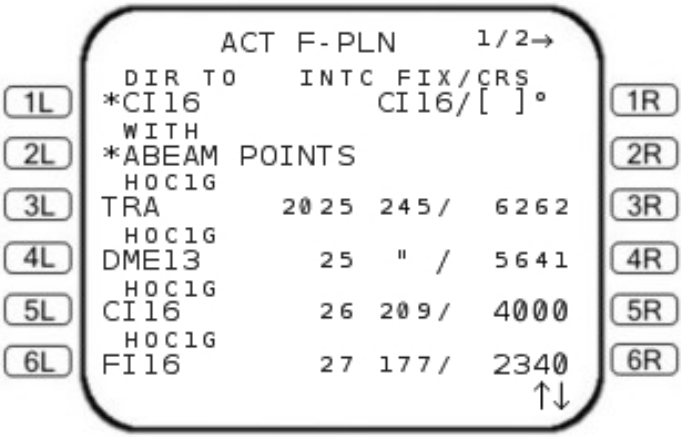
Pushing the DIR INTC key displays the modified F-PLN page.

STEP: Push the DIR INTC key

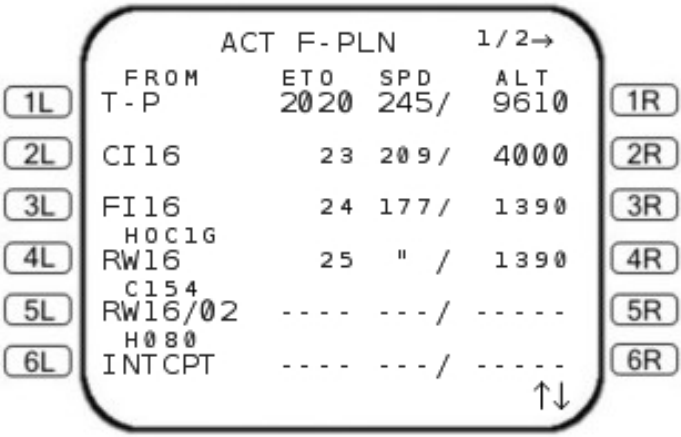


ATC has instructed PMDG01 to proceed direct to CL16 at 4000 feet for the ILS approach to RW16. In the following screens, routing is established. Altitude is controlled by the FCP as selected altitude.

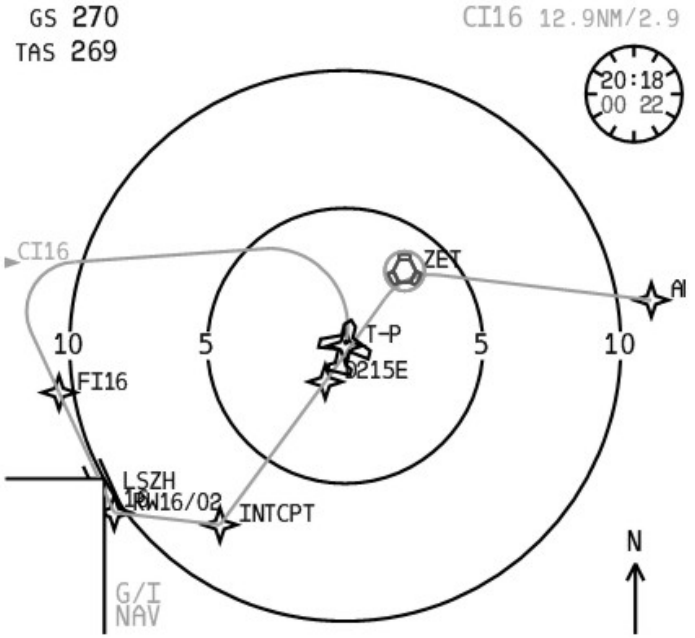
STEP: Push the 5L LSK



STEP: Push the 1L LSK



Navigation Display:



Alternate Diversion

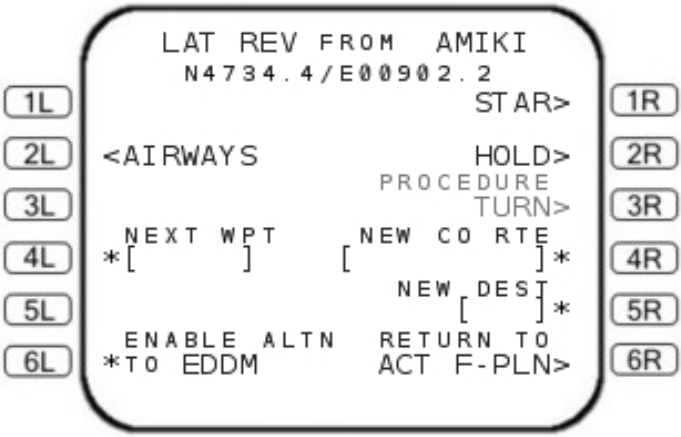
After sequencing the destination and during missed approach, alternate diversion may be accomplished by ENABLE ALTN TO, NEW DEST, or performing a DIR TO the alternate airport. Those F-PLN modifications will be discussed in this section.

ENABLE ALTN TO - From a revise waypoint LAT REV page, pushing 6L deletes all waypoints from the revise point to the destination and enters the alternate F-PLN into the primary F-PLN. The alternate F-PLN includes the old destination as a F-PLN waypoint.

As an example, the alternate F-PLN is strung to include a transition waypoint (AMIKI) for STAR selection to EDDM. During missed approach a LAT REV to waypoint AMIKI is accomplished in the screen below. Selecting ENABLE ALTN TO EDDM 6L results in the flight plan shown in the following screens.

STEPS: 1. Push the LSK abeam AMIKI in the ACT F-PLN

2. Push the 6L LSK. (ENABLE ALTN *TO EDDM)

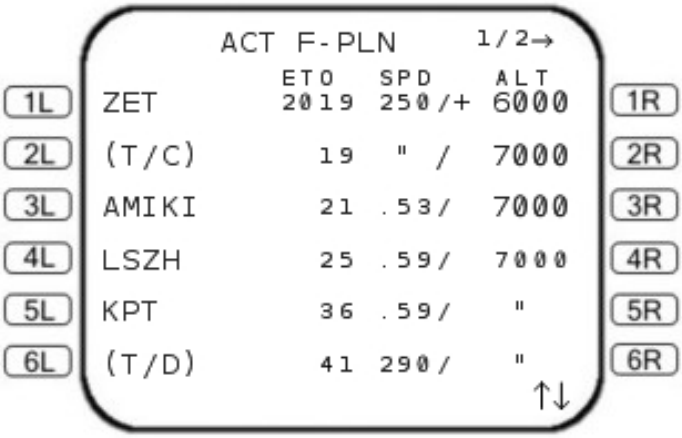


Next, clear the discontinuity in the route.

STEPS: 1. Push the CLR key

2. Push the 4L LSK to delete the discontinuity

Removing the discontinuity will cause the flight plan to continue beyond AMIKI, back to LSZH, then onward toward the alternate airport. This is not an efficient routing.

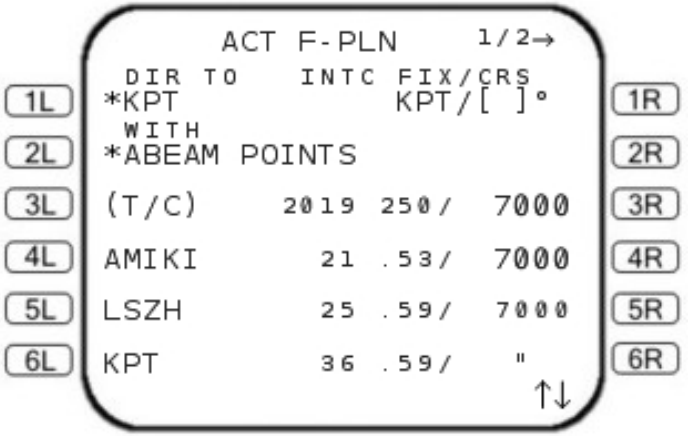


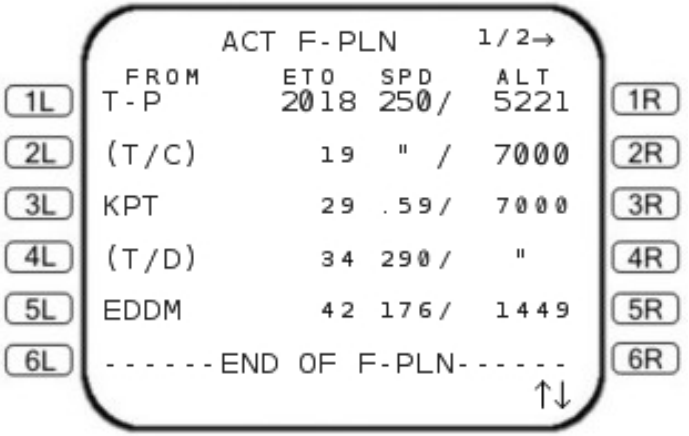
To make the route more efficient, perform a DIR TO KPT in order to eliminate the back-tracking over LSZH. Selecting the STAR for EDDM can be accomplished at the same time:

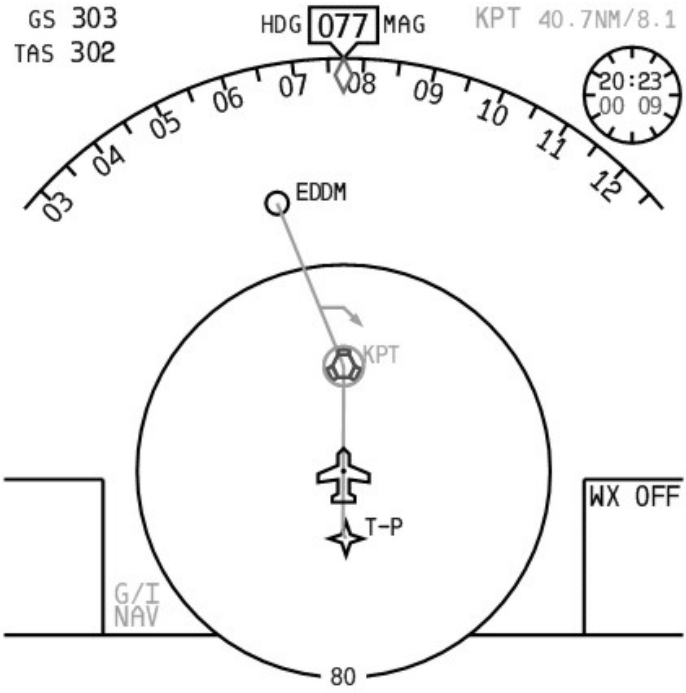
STEPS: 1. Push the DIR INTC key

2. Push the 6L LSK (abeam KPT)

3. Push the 1L LSK






GS 303
TAS 302
HDG 077 MAG
KPT 40.7NM/8.1
20:23
00 09
03
04
05
06
07
08
09
10
11
12
EDDM
KPT
T-P
WX OFF
G/I
NAV
80

Intentionally Left Blank

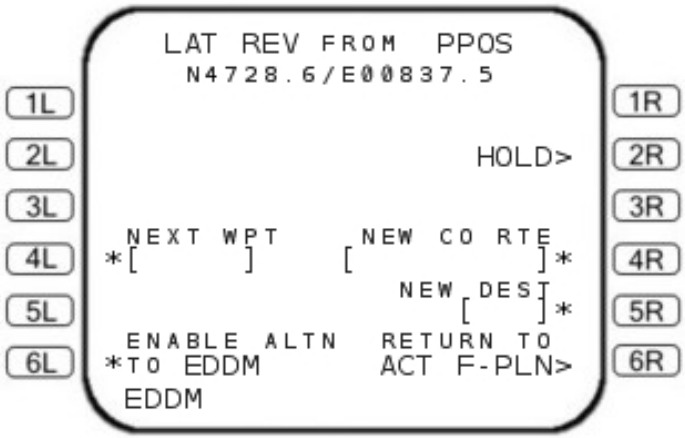
New Destination

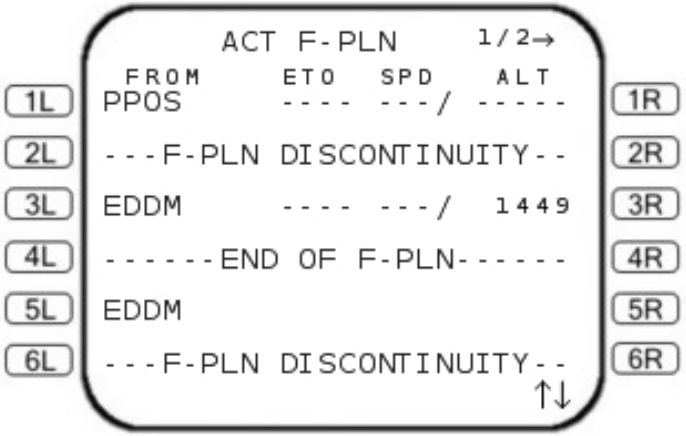
The purpose of the new destination function is to reroute the F-PLN from the selected waypoint to a new destination. The function is available for any selected fixed waypoint in the flight plan including the FROM waypoints and PPOS. The new destination may be any airport in the data base or a pilot-defined runway. When a new destination is entered, the following F-PLN events occur:

1. All waypoints beyond the selected fixed waypoint in the original F-PLN (including ALTN if it exists) are deleted.
2. A DISCONTINUITY is strung between to selected waypoint and the new destination.
3. A new destination is entered into the F-PLN.

To access the NEW DEST function a LAT REV is performed at the A/C present position. See screens below for a LAT REV at PPOS and EDDM entry.

STEPS: 1. Push the 1L LSK on the ACT F-PLN page
2. Enter EDDM into the scratch pad
3. Push the 5R LSK





Clearing the F-PLN DISCONTINUITY establishes a T-P and direct routing to EDDM. STAR selection cannot be accomplished from a T-P and if accomplished at EDDM creates, a routing from T-P to EDDM and then back to the STAR start waypoint, route, and approach to the destination runway. To keep the alternate diversion simple, a DIR TO can be accomplished to an enroute waypoint short of the destination where the STAR may be efficiently selected.

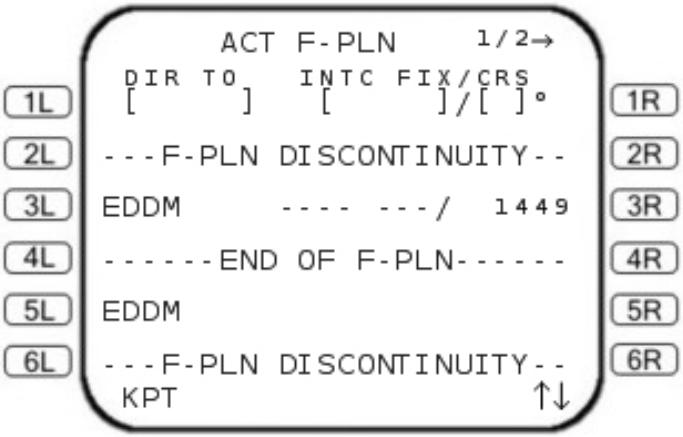
NOTE: The NEW DEST function can also be used to CLR a large string of waypoints at one time. By LAT REV at the last desired waypoint to be flown followed by a NEW DEST entry (i.e. same destination) all intervening waypoints would be cleared.

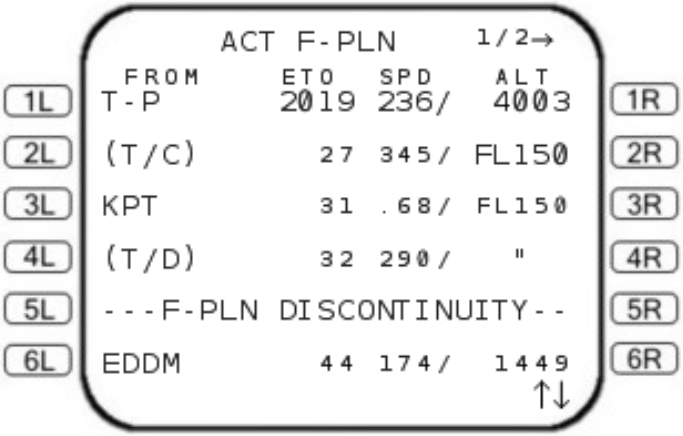
From either ATC instructions or pilot choice, Kempten (KPT) is chosen as an enroute point to perform a DIR TO. Typing KPT in the SP, pushing 1L for entry, and clearing the DISCON creates the routing.

STEPS: 1. Enter KPT in the scratch pad

2. Push the 1L LSK

3. Push the 1L LSK





From KPT a STAR and approach to Munich may be easily accomplished.

NOTE: A DIR TO EDDM could have been accomplished; however STAR and approach selection would have been inefficiently accomplished.

After Landing

The FMS transitions to a DONE mode when the aircraft has landed (< 80 KIAS) and either the INIT key on either MCDU is pushed or the engines are shut off for more than 5 seconds. When DONE is declared, the A/C STATUS page is displayed on the MCDU and all route and flight specific data relevant to the last flight is cleared and default values are recalled for later display and access. Pushing of any MCDU button after the DONE phase, transitions the FMS to PREFLIGHT.

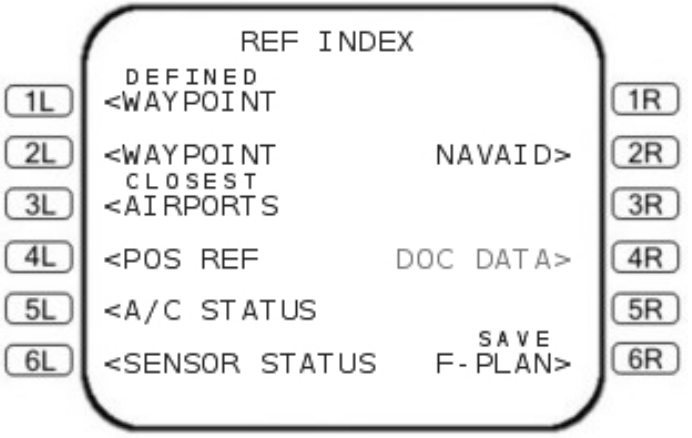
To retain a flight plan for immediate or future use after landing, the ACT F-PLN may be copied into the SEC F-PLN and the active leg altered to prevent SEC F-PLN leg sequencing. After landing, the SEC F-PLN is preserved and may be copied into the ACT F-PLN for immediate use. After landing and before the next takeoff, the IRU performance may be inspected on the IRS STATUS page.

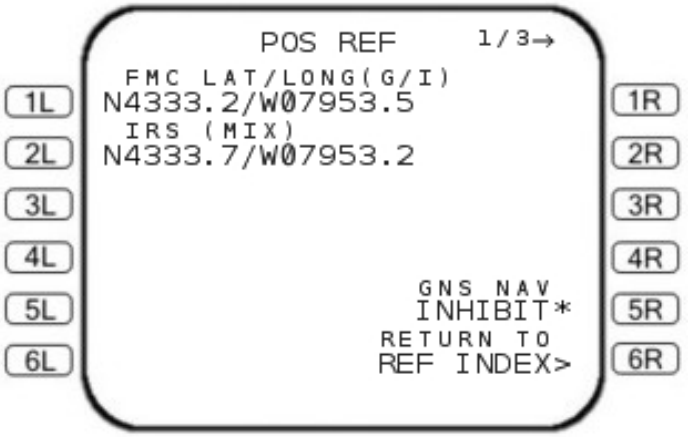
IRS STATUS Page

The IRS STATUS page provides IRU error rates and terminal GS reading at the end of a flight. The page may be accessed by pushing the REF key, 4L < POS REF and the PAGE key twice, as shown in the following sequence.

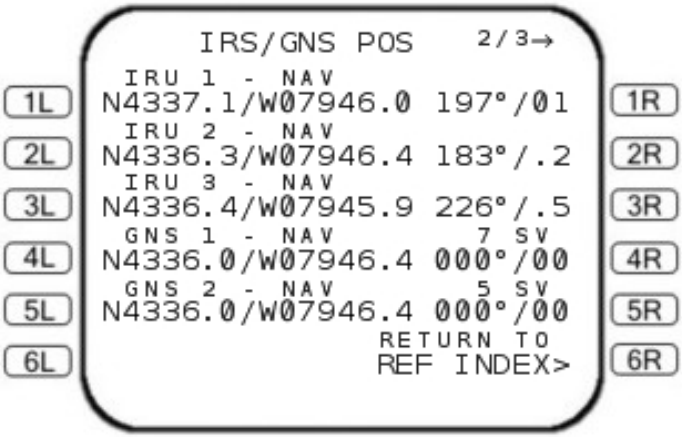
STEPS: 1. Push the REF key

2. Push the 4L LSK

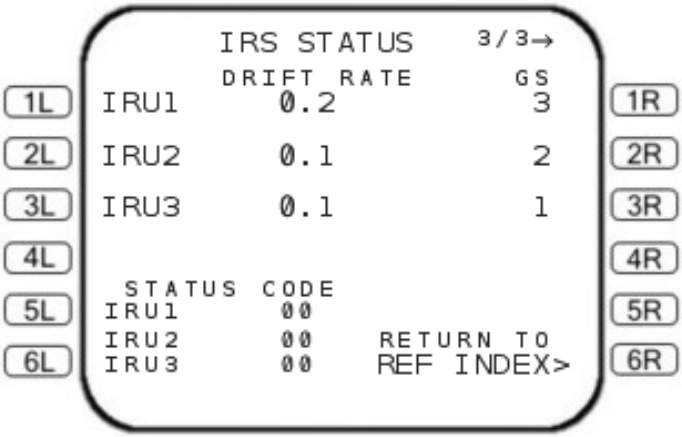




STEP: Push the PAGE key



STEP: Push the PAGE key



When the pilot advances the throttles for takeoff and the FMS transitions to takeoff (FMC position update occurs), the FMC stores the IRU position difference between itself and the update FMC position. Upon touchdown, the FMC is updated once again and the IRU difference is again stored. The change in these two different readings represents IRU drift during the flight from takeoff to landing.

Total drift divided by trip time provides the DRIFT RATE value displayed on the page. The GS column displays the IRU residual GS and is valid when the aircraft is stationary after landing and engines are shut down.

Advanced Flight Planning

In the advanced flight planning section, the creation of waypoints, their insertion in the flight plan, secondary flight plan creation and differences, and the insertion of procedure turns in the flight plan will be covered.

Waypoint Creation and F-PLN Entry

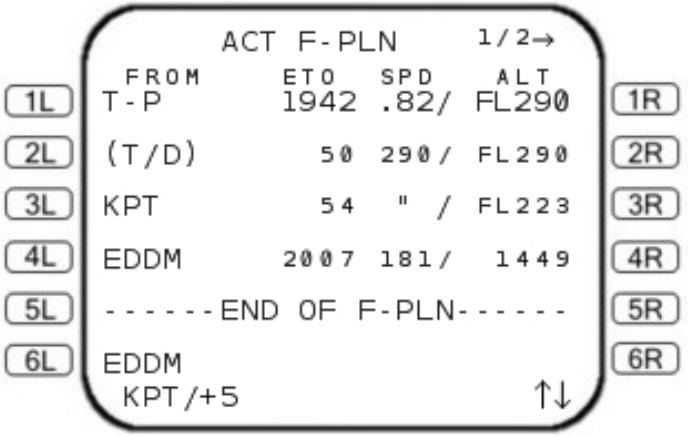
Waypoints may be created in a variety of ways. They may be entered into the F-PLN either directly or through the use of a LAT REV. Pilot-defined runways may be created and used in the F-PLN. Waypoint creation and pilot defined runway entry are the topics of this section.

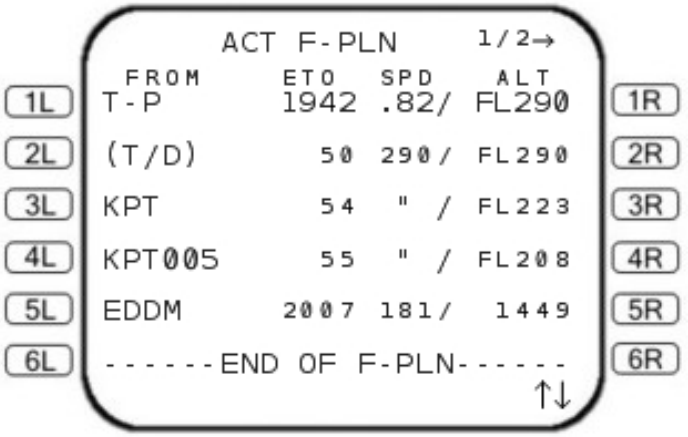
Along Track Offset (ATO) Waypoint

The along track offset waypoint, also known as the Place/Distance (PD) waypoint, is a pilot-defined point a given distance before or after an existing flight plan waypoint, and on the existing flight plan course. A new PD is located before the waypoint if a minus (-) is used and after the point if a (+) is used. The PD waypoint is given a flight plan name consisting of a waypoint three-letter identifier/three-digit distance. For example, typing KPT/ + 5 in the SP and pushing 2L in the screen below enters KPT005 into the F-PLN as a new waypoint. KPT005 becomes one of the 40 pilot definite waypoints.

STEPS: 1. Enter KPT/+5 in the scratch pad

2. Push 3L





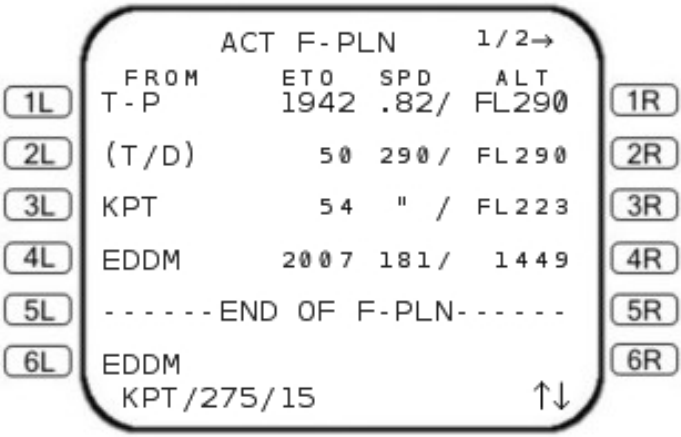
The referenced waypoint may not be the FROM waypoint. A discontinuity is never inserted since the point is along an established route. The PD point cannot be created closer than 1 NM to a point or less than 5 NM from the aircraft position.

Place/Bearing/Distance (PBD) Waypoint

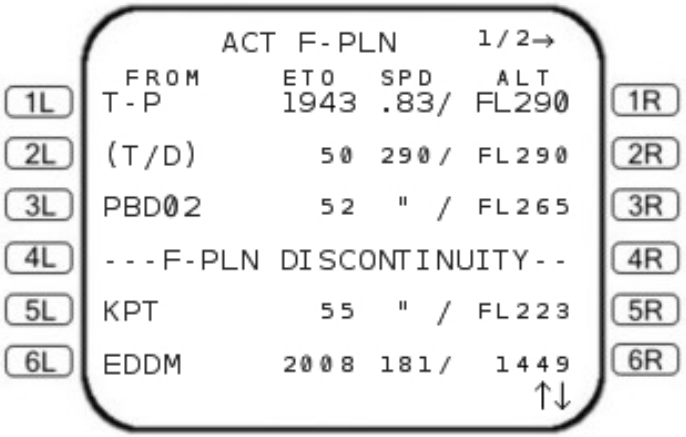
A Place/Bearing/Distance (PBD) waypoint may be pilot defined by specifying a waypoint three-letter ident/bearing/distance. The PBD becomes one of the 40 pilot definable waypoints and is labeled PBDXX where XX is the sequential number of the point the pilot creates. For example, a waypoint from KPT 275° radial 15 NM is created and entered into the F-PLN by typing KPT/275/15 in the SP and pushing 2L. See the following screens.

STEPS: 1. Enter KPT/275/15 into the scratchpad

2. Push 3L



RESULT:



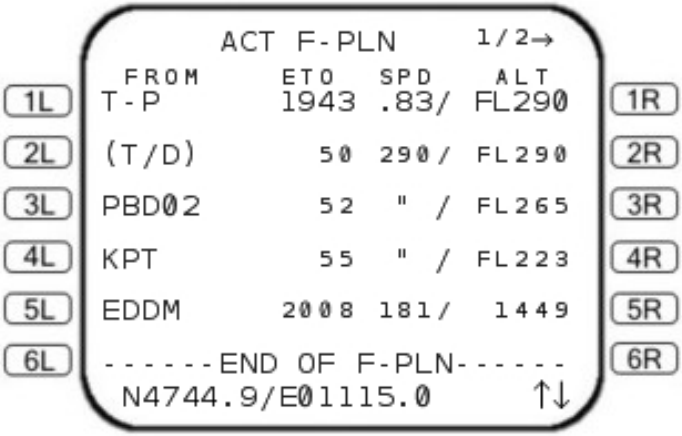
Notice that PBDO2 was created indicating that this waypoint is numbered 2 of the possible 40 pilot defined waypoints. The next pilot defined waypoint that is created will be numbered 3 of 40 but may be differently labeled in the F-PLN. The PBD waypoint entry by definition causes a break in the F-PLN and results in the entry of F-PLN DISCONTINUITY. APBD waypoint can be inserted as a DIR-TO waypoint.

Lat/Long Waypoint

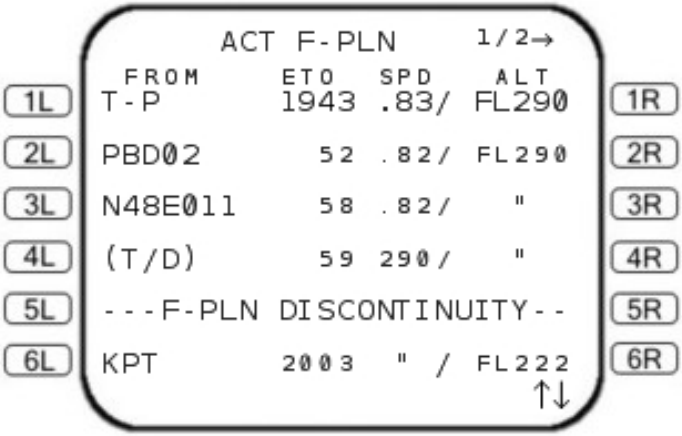
A lat/long waypoint may be generated by inserting latitude and longitude coordinates directly into the F-PLN. The entered waypoint is named with the cardinal directions and degrees portion of the coordinate such as N47EO11 As an example, N4744.9/E01115.0 is typed into the SP and entered by pushing 3L. Again, another DISCON is inserted into the F-PLN. A lat/long waypoint can be inserted as a DIR-TO waypoint.

STEPS: 1. Enter N4744.9/E0115.0 into the scratch pad

2. Push 4L

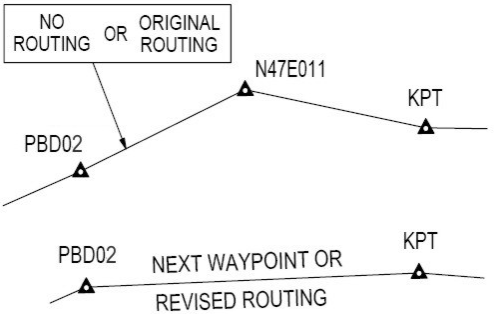


RESULT:



Lateral Revision Waypoint Entry

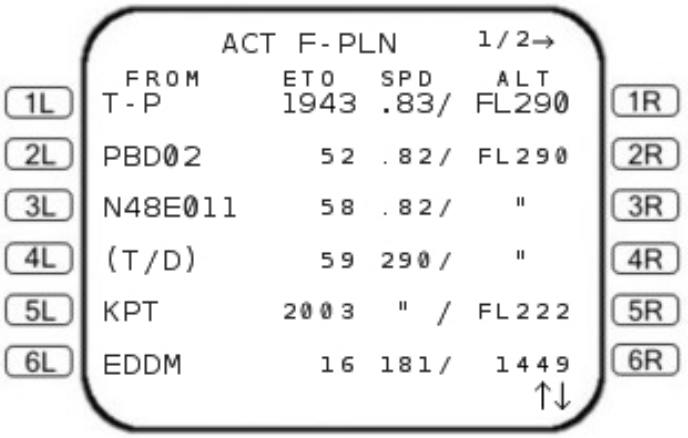
Waypoints may be entered into a F-PLN or the routing revised using the LAT REV to an existing waypoint. The new waypoint is inserted immediately following the revise point with a direct leg. If the new waypoint does not exist in the FPLN, a F-PLN DISCONTINUITY is inserted after the new waypoint. If the new waypoint is a waypoint already in the existing F-PLN, a single direct route is inserted with no discontinuity deleting all intervening waypoints. See the following figure for insertion of KPT after PBDO2.

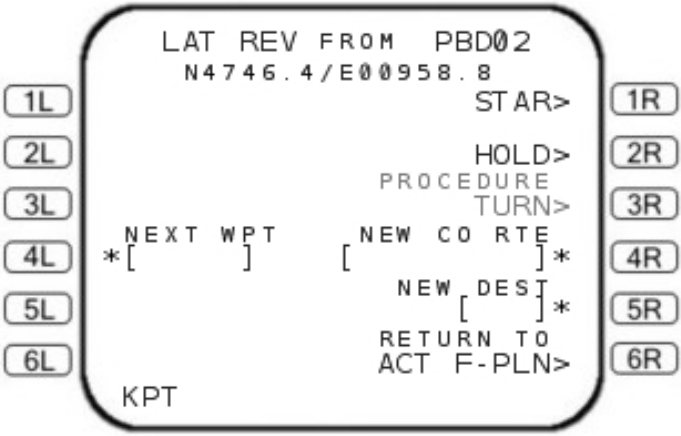


STEPS: 1. Push the 2L LSK

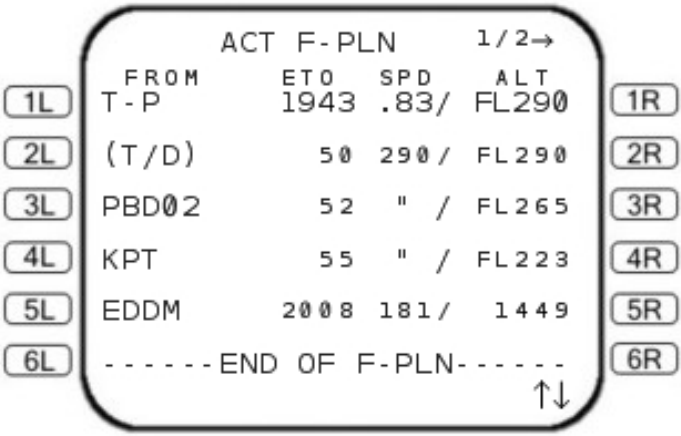
2. Enter KPT into the scratch pad

3. Push the 4L LSK




LAT REV FROM PBD02
N4746.4/E00958.8
STAR>
HOLD>
PROCEDURE
TURN>
NEXT WPT
NEW CO RTE
NEW DEST
RETURN TO
ACT F-PLN>
KPT
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R

RESULT:

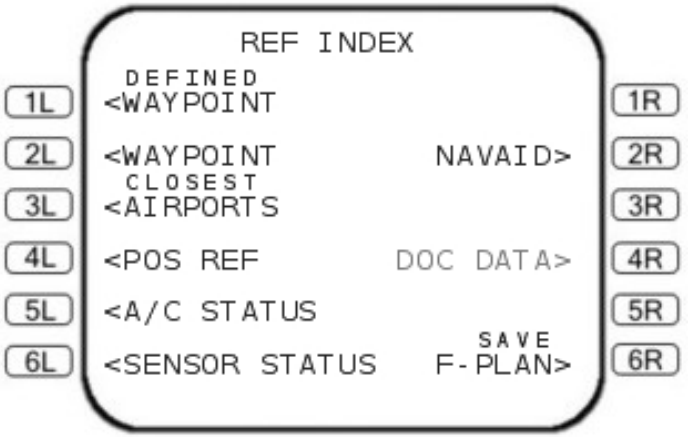

ACT F-PLN 1/2→
FROM ETO SPD ALT
T-P 1943 .83/ FL290
(T/D) 50 290/ FL290
PBD02 52 " / FL265
KPT 55 " / FL223
EDDM 2008 181/ 1449
------END OF F-PLN------
1L
2L
3L
4L
5L
6L
1R
2R
3R
4R
5R
6R

Defined Waypoint page

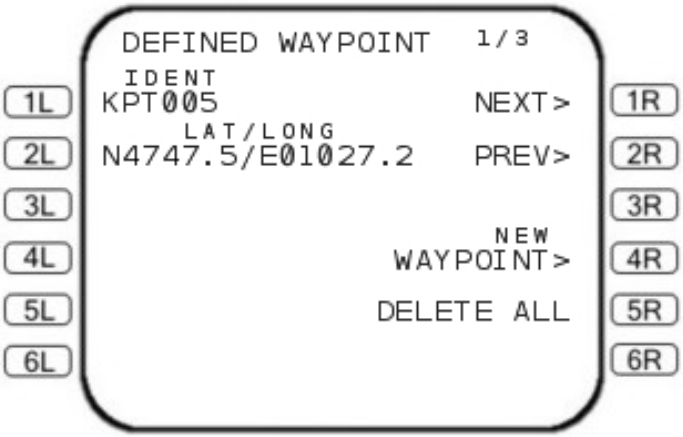
Accessing the REF key selects the display shown in the REF INDEX page. From the REF INDEX page, pushing 1L provides access to the DEFINED WAYPOINT page where pilot defined waypoints are displayed and may be deleted or created.

STEPS: 1. Push the REF key

2. Push the 1L LSK



RESULT:



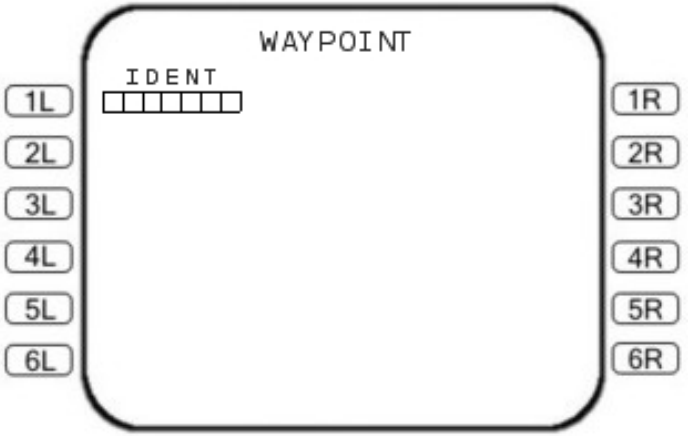
From the DEFINED WAYPOINT page, pushing DELETE ALL in 5R deletes all pilot-defined waypoints that are not either in the active, secondary flight plan page. Waypoints may be deleted singularly by use of the CLR key, SP, and individual DEFINED WAYPOINT pages as accessed by the NEXT 1R or PREV 2R keys. Defined waypoints presently being used in the ACT or SEC F-PLN cannot be deleted. When deletion of a pilot-defined waypoint in the flight plan is attempted, the MCDU SP message F-PLN WPT/NAV RETAINED is displayed. All DEFINED WAYPOINTS are deleted when the FMS transitions through DONE flight phase.

NOTE: Defined waypoints are not deleted from the SEC F-PLAN.

When the last waypoint is deleted, the WAYPOINT page is displayed. On this page, data on any NAV data base waypoint may be reviewed by entry into 1L. Alternate entry to this page is through the REF page and 2L WAYPOINT prompt.

STEPS: 1. Push the REF key

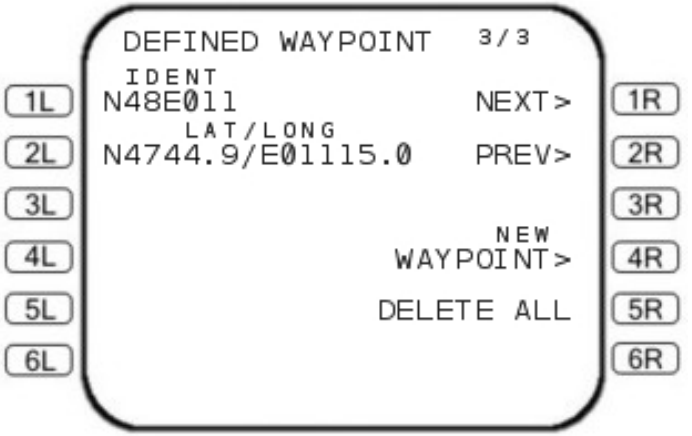
2. Push 2L



In the DEFINED WAYPOINT page, the DEFINED WAYPOINT is number 1/3 indicating that this is the first of three defined waypoints. The following screens show data on the next two pages.

STEPS: 1. On the DEFINED WAYPOINT page 1/3, Push 1R

2. Push 1R

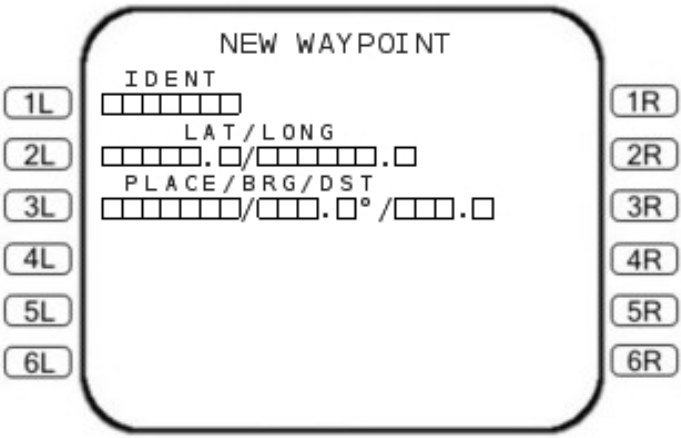


When 40 pilot-defined waypoints are created, the MCDU message LIST OF FORTY IN USE is displayed in the SP.

The NEW WAYPOINT page, accessed through 4R, enables entry of a new waypoint into the pilot-defined waypoint list.

New Waypoint

The NEW WAYPOINT page is shown below and is accessed by pushing 4R in screen above.



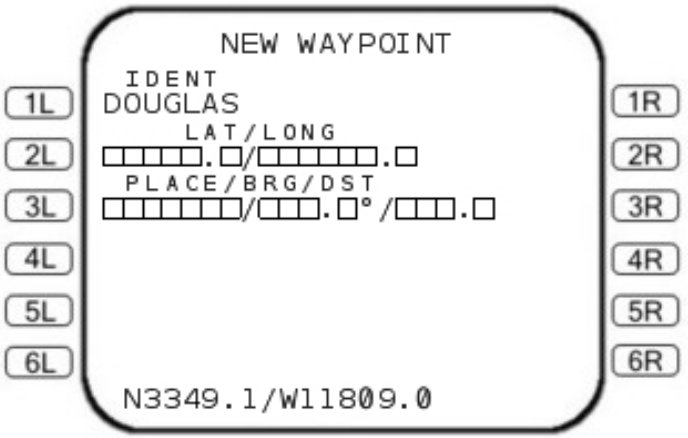
On this page, the pilot may name his defined waypoint with any combination of alphanumerics in data field 1L. For example, the waypoint DOUGLAS is created in the following screen. Entry of the point into the pilot defined waypoint list is via the ENTER prompt in 6R.

STEPS: 1. Type DOUGLAS into the scratch pad

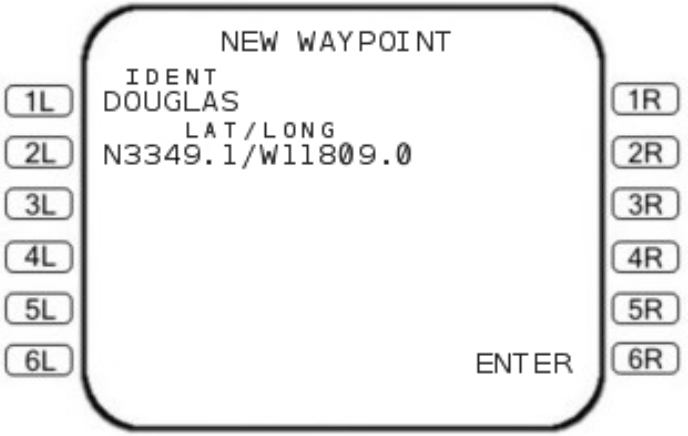
2. Push 1L

3. Enter N3349.1/W11809.0 into the scratch pad

4. Push 2L



STEP: Push 6R



If a Place Bearing Distance is entered into 3L, then the LAT/LONG is calculated and displayed in 2L above. If a duplicate name is

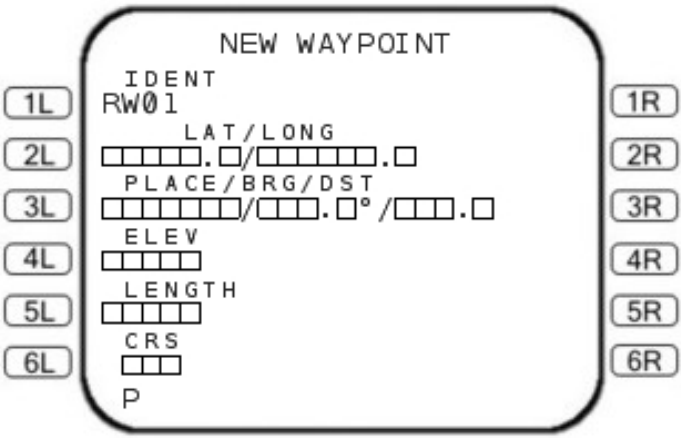
generated, the DUPLICATE NAMES page will be displayed when the point is next accessed.

Pilot-Defined Runway

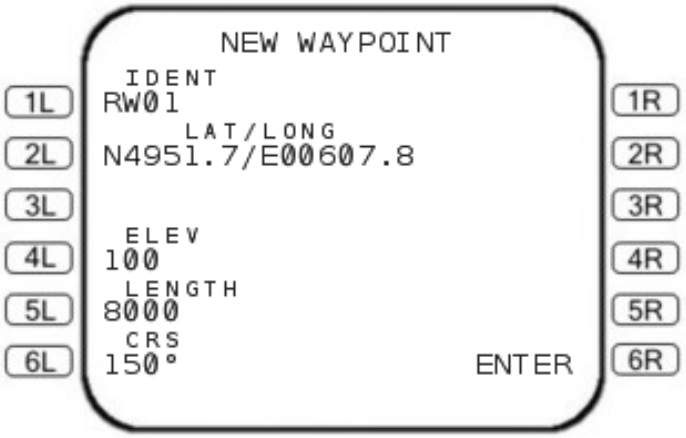
On the NEW WAYPOINT page of the previous section, a runway can be entered in 1L in the form of RW01 or RW14L. When entered, boxes associated with 4L (ELEV), 5L (LENGTH), and 6L (CRS) are displayed on the page. RW01 is entered into 1L. In the next screen, the remaining runway data is entered. Entry into the pilot-defined waypoint list is accomplished by pushing 6R (ENTER).

STEPS: 1. Type RW01 into the scratch pad

2. Push 1L



STEP: Enter remaining data



The defined runway may be used as an origin or destination, but there will not be any SIDs or STARs available for the runway. The associated LAT/LONG of the RW is assumed to be the runway threshold point. Defining a runway in this manner may be used to establish an airport not in the NAV data base for arrival and departure operations.

Duplicate Waypoints

If a non-unique identifier is entered through the MCDU, the DUPLICATE NAMES page will be automatically displayed for pilot review and waypoint selection. The LAT/LONG of the waypoint is displayed in whole degrees and, if a navaid, the frequency is also displayed. Pilot selection of the desired waypoint is made through the associated LSK whereupon the display reverts to the previously displayed page.

Duplicate waypoints will be displayed top to bottom in order of closest distance to the revised waypoint (for F-PLN entry) and/or aircraft position for other DUPLICATE NAMES pages.

NOTE: When a navaid is entered into the NAV RAD page, DUPLICATE NAMES page is not displayed (navaid

automatically selected) when only one navaid with the selected IDENT exists within 100 NM of the aircraft position.

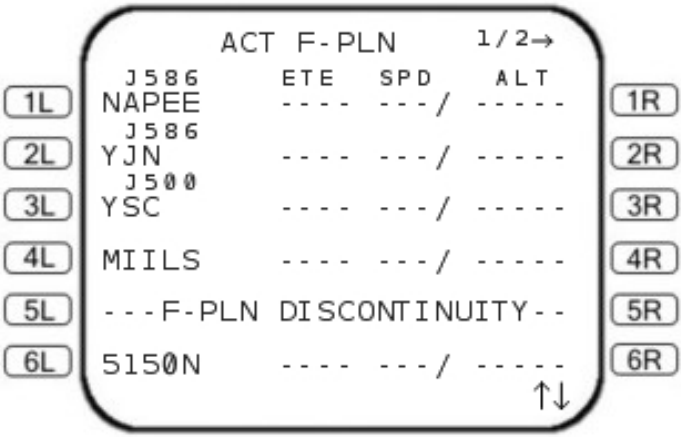
Routing after YSC is direct MIILS direct CL direct 5150N etc. Entering MIILS in the ACT F-PLN page shown in the following screen, and attempted entry of CL results in the display of the DUPLICATE NAMES page.

STEPS: 1. Type MIILS into the scratch pad

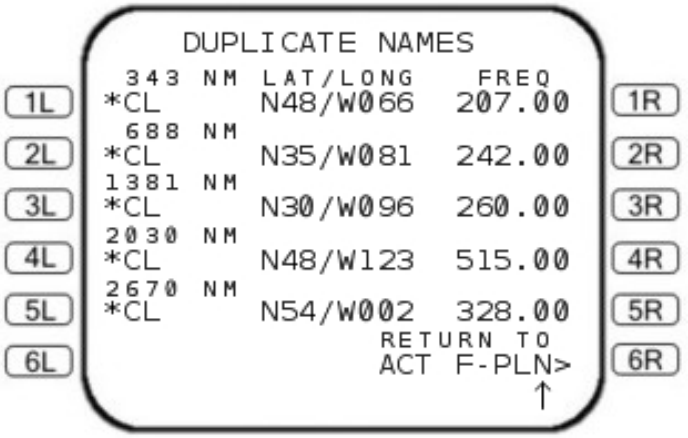
2. Push 3L

3. Enter CL into the scratch pad

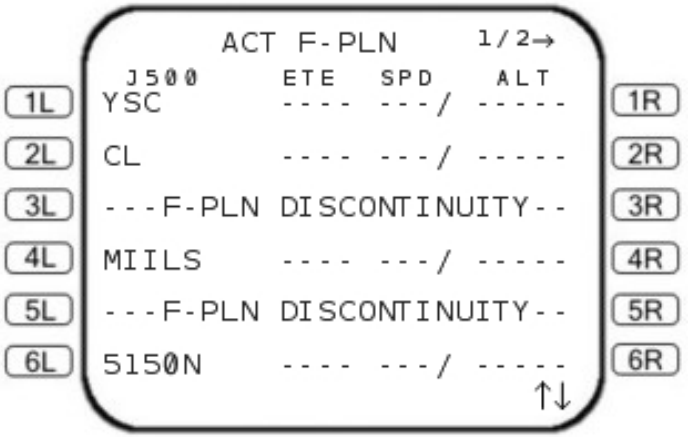
4. Push 3L



STEP: Push 3L



Choosing the correct CL waypoint by comparing LAT/LONGs and FREQ to the flight plan route yields CL at N48/W065 with a frequency of 207.0. To enter this navaid waypoint into the F-PLN as shown below.



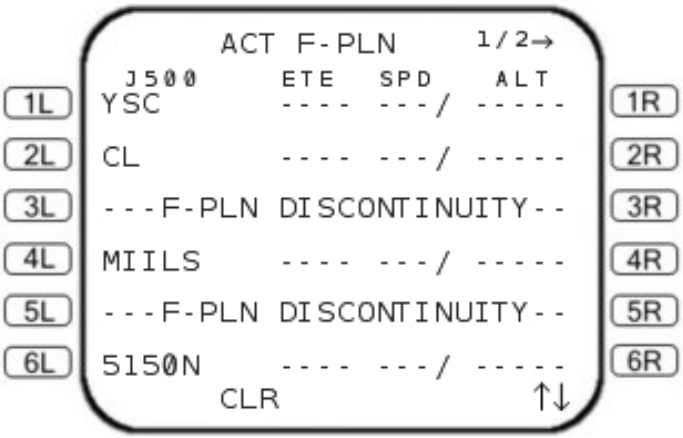
The author erred in pushing 3L on the ACT F-PLN page with CL in the SP. This commands CL entry before MIILS but sets the stage for Waypoint Deletion.

Waypoint Deletion

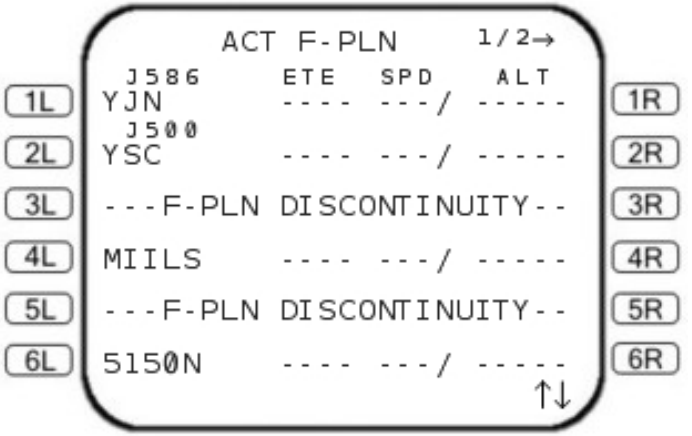
Waypoint deletions from the flight plan including F-PLN DISCONTINUITY are made using the SP and CLR key. The F-PLN DISCONTINUITY (DISCON) and waypoint routing are shown above. Actuation of the CLR key with the SP empty places the message CLR in the SP.

STEPS: 1. Push the CLR key

2. Push 2L

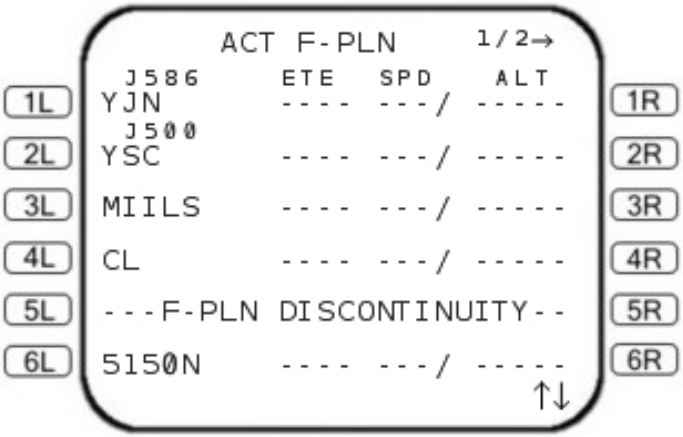


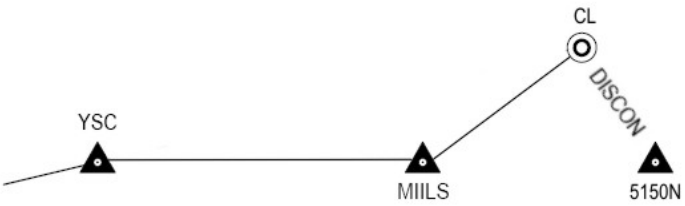
Actuation of the left LSK 2L abeam the waypoint to delete removes the waypoint from the flight plan and inserts another F-PLN DISCONTINUITY. Since the two discontinuities describe the same condition, only one is displayed on the MCDU. The revised F-PLN routing is shown below.



To create a continuous routing from YSC to MIILS, the pilot need only clear the F-PLN DISCONTINUITY located at 3L. Next, CL must be reentered as previously described. These steps and results are shown as follows. Note that when the F-PLN discontinuity of 3L is cleared, the F- PLN in 4L, 5L, and 6L are moved up one line.

STEPS:
1. **Push the CLR key**
2. **Push 3L**
3. **Enter CL in the scratch pad**
4. **Push 4L**
5. **Push 1L LSK (DUPLICATE NAMES page)**





NOTE: Clearing a FROM point is only possible when NAV is not engaged. This causes one leg sequence to occur.

If the aircraft position is invalid, the TO waypoint cannot be deleted.

Continuing the process of waypoint and airway entries and clearing of any F-PLN DISCONTINUITY completes the flight plan stringing process to the destination airport.

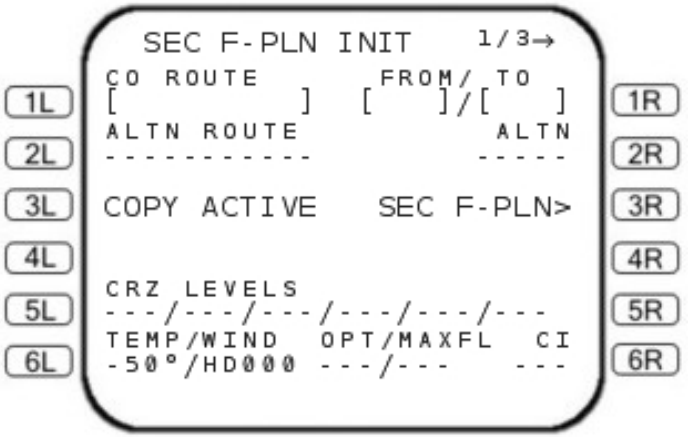
Secondary Flight Plan

The active F-PLN is used for active guidance and all performance planning functions while the secondary flight plan is used for planning changes and predictive purposes. The secondary F-PLN can be entirely different from the active flight plan or it can be a modified version of the active F-PLN. The secondary F-PLN may be activated during flight.

SEC F-PLN INIT Page

Pushing the SEC F-PLN key provides access to the SEC F-PLN INIT page and its related functions.

STEP: Push SEC F-PLN



1L CO ROUTE - Field defaults to entry prompts [ ] when no CO RTE number or FROM/TO is defined. If any modification to the CO ROUTE is made, this field is blanked. If the active flight plan is copied into the SEC F-PLN, then the CO ROUTE number is reflected here if it exists in the active F-PLN.

1R FROM/TO - Defined by copying active flight plan, entering origin/destination or defaults to entry prompts with no entry.

2L ALTN ROUTE - Alternate route designator entry automatically chooses routing to the alternate. The field is blanked if 2R is entered.

2R ALTN - Enables entry of the alternate airport ICAO identifier.

3L COPY ACTIVE - Copies the remaining portion of the active flight plan into the secondary flight plan.

3R SEC F-PLN - Accesses SEC F-PLN page.

4L CLEAR SEC - Displayed only if there is at least one waypoint in the SEC F-PLN. Clears the secondary flight plan and defaults to PPOS - END OF F-PLN -.

4R ACTIVATE SEC - Pushing 4R with the ACTIVATE SEC prompt displayed immediately activates the SEC F-PLN and the previously active flight plan becomes the new secondary flight plan.

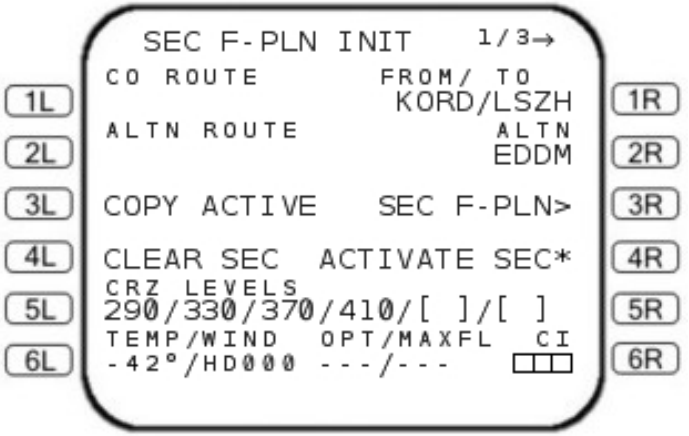
If NAV is engaged, the first leg of the SEC must be laterally identical to the active leg for the ACTIVATE SEC prompt to be displayed. If you wish to activate the SEC F-PLN and the ACTIVATE SEC prompt is not displayed, disengage NAV momentarily by going to heading hold - the prompt will now be displayed. Push 4R and, when the transfer is complete, reengage NAV. This feature prevents course changes due to accidental secondary activation.

5L CRZ LEVELS - Proposed SEC F-PLN CRZ FLs. If a SEC F-PLN CRZ FL lower than current aircraft CRZ ALT is entered, the lower CRZ FL will not transcribe to the active F-PLN. If the altitude is higher, it will become the new active cruise flight level, but the aircraft will not climb until the FCP CLR ALT is raised.

6L TEMP/WIND - Same as F-PLN INIT page. Pilot alterable.

6R CI - Cost Index. Same as F-PLN INFT page. Pilot alterable. Pushing 3L copies the ACT F-PLN to the secondary.

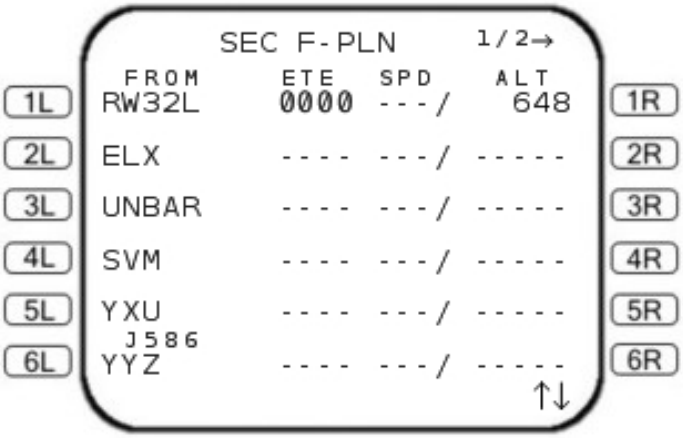
STEP: Push the 3L LSK



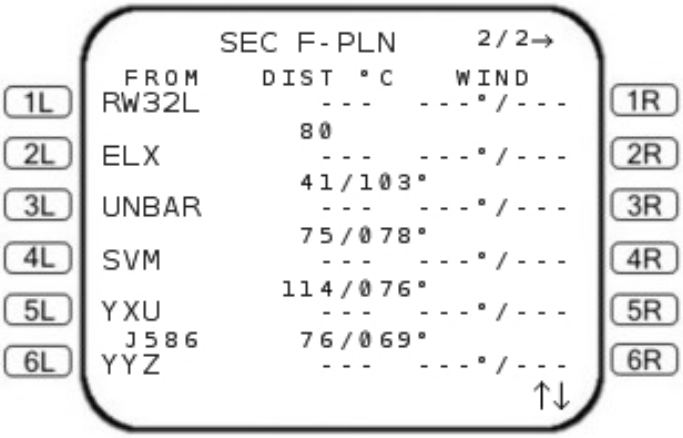
SEC F-PLN Pages 1 and 2

Pushing 3R accesses the SEC F-PLN page 1. These pages serve the same purpose as the ACT F-PLN pages and their format and data are identical with two exceptions. SEC replaces ACT in the title line and predictions are displayed only if the SEC was created by copying the ACTIVE and the first legs are identical.

STEP: Push 3R



STEP: Push the ->PAGE Key



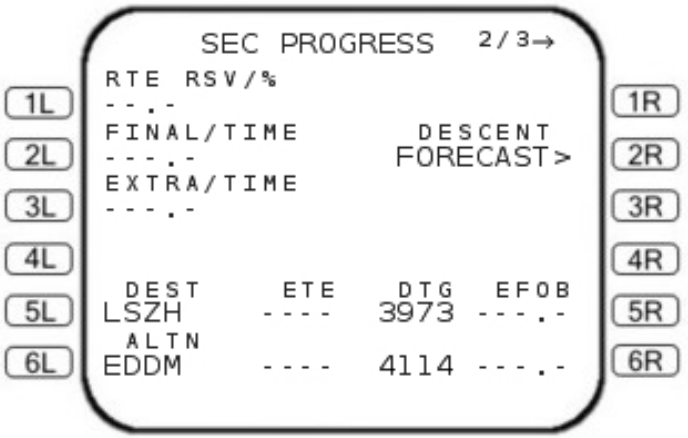
All LSKs function identically to the active F-PLN LSKs except EOSID is not available for selection and the asterisks (*) are not displayed. Some data items such as GW, UFOB, and PERF SPEED modes used in performance calculations are shared by both F-PLNS.

SEC F-PLN sequencing of the SEC F-PLN occurs at the same time as the ACT F-PLN if the active leg of the ACT FPLN is identical to the first leg of SEC F-PLN. If at any time after the copy is made, a flight plan revision occurs so that the active leg and the SEC F-PLN first leg are no longer the same, all SEC F-PLN leg sequencing ceases. If conditions for secondary flight plan sequencing exists at engine shutdown, the SEC F-PLN reverts to its initial default state of PPOS followed by a DISCON.

SEC PROGRESS

The SEC PROGESS page is accessed from the SEC F-PLN lNIT page by pushing PAGE key.

STEP: Push the -> PAGE key

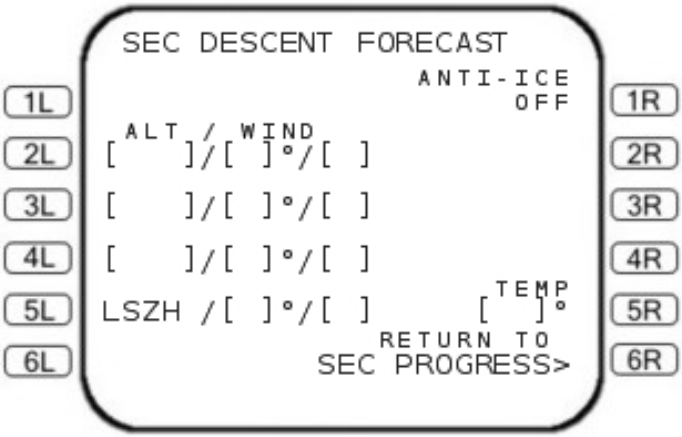


The information and data fields in 1L, 2L, and 3L are the same as the WEIGHT INIT page. Providing conditions for SEC F-PLN predictions are valid, lines 5 and 6 show the estimated time of arrival, distance to go and EFOB at the SEC destination and SEC alternate. Any SEC enroute waypoint may be entered in 6L. Note the page number 2/2 in the title line.

SEC DESCENT FORECAST

The SEC DESCENT FORECAST page may be accessed by pushing 2R in the screen above. This page is identical to the ACT F-PLN DESCENT FORECAST page.

STEP: Push the 2R LSK



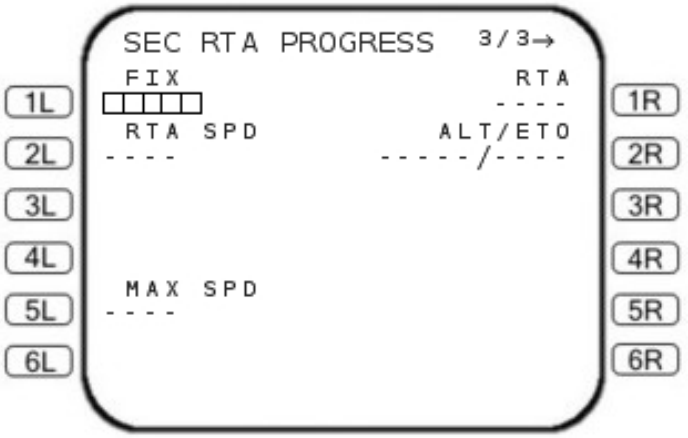
NOTE: If the primary destination waypoint is cleared or changed to other than a runway at the destination airport, all previous wind entries on this page are deleted.

Secondary F-PLN data is cleared during the DONE phase with the exception of a route strung using a CO ROUTE, FROM/TO entry, or non-sequencing SEC F-PLN. Those entries will be retained

SEC RTA PROGRESS

The SEC RTA PROGRESS page is accessed from the SEC PROGRESS page by pushing the PAGE key. The data fields on this page are similar to the RTA PROGRESS page for the primary flight plan.

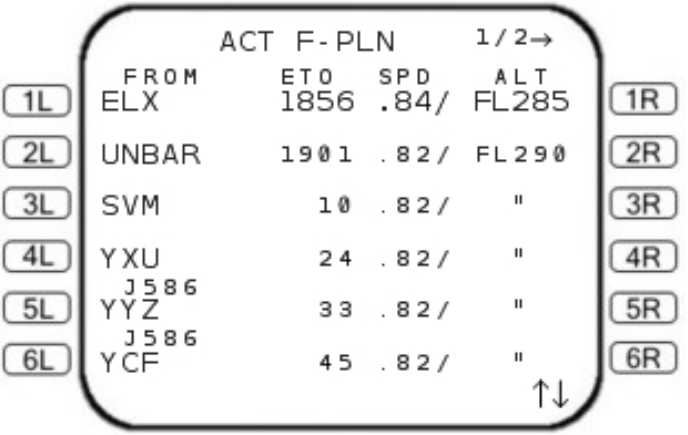
STEP: Push the -> PAGE key



Parallel Offset Nav

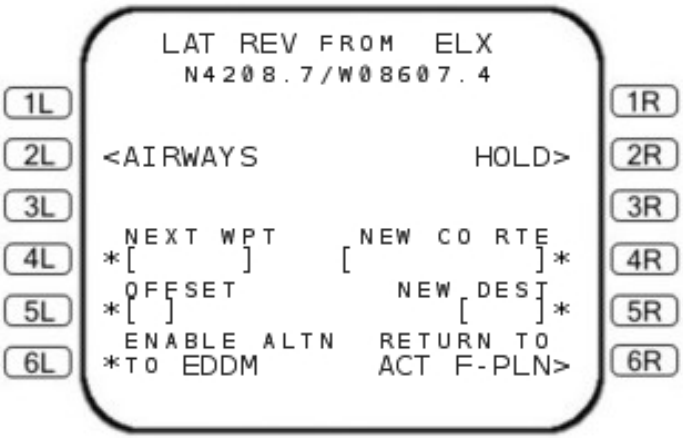
The parallel offset function enables the aircraft to fly parallel to the original flight plan, laterally offset by a pilot-entered distance. This F-PLN alternation can be accomplished by performing a LAT REV at the FROM waypoint and entering the offset distance measured in NMs into the OFFSET brackets of 5L of the second screen following.

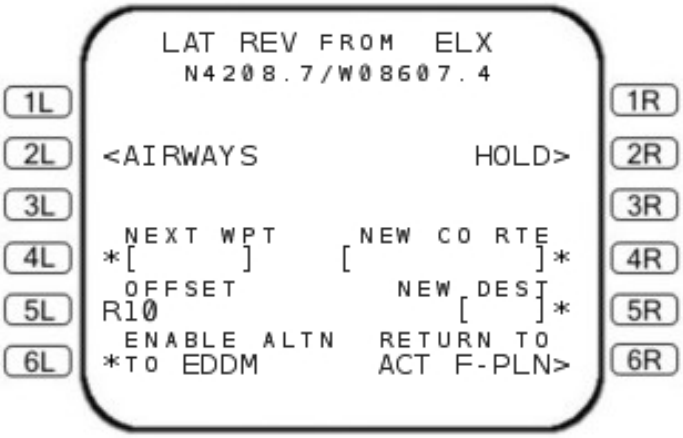
STEP: Push 1L



STEPS: 1. Enter 10R into the scratch pad

2. Push 5L





The parallel offset entry accepted by the FMC becomes active immediately after the offset distance is entered and the aircraft turns to intercept the parallel course using up to a 45 degree intercept. The above figure shows the ND display after the insert of a 10R offset.

Exit the offset mode by clearing the OFFSET on the LAT REV page or entering the direct TO on the DIR INTC page of the MCDU.

Alternate Diversion

There are three methods of accomplishing a flight plan modification for diversion to an alternate.

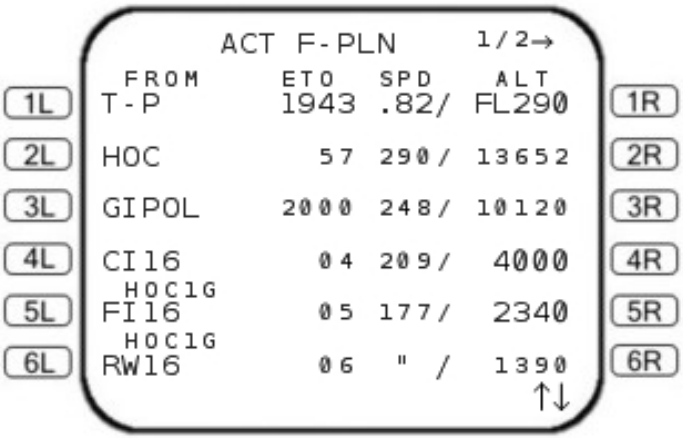
If an alternate was selected during preflight initialization, the alternate flight plan can be activated on the LAT REV page for the revision waypoint. Pushing 6L, the ENABLE ALTN TO function, inserts the alternate portion of the active F-PLN into the primary portion of the flight plan, thus activating it. The function is available for any fixed

waypoint in the primary F-PLN. When used, the active flight plan including speed, altitude, and time constraints will be deleted beyond the point from which the lateral revision is made. Routing becomes the revise point, F-PLN DISCONTINUITY, original destination as a flight plan waypoint, and alternate routing to the new destination. The new cruise altitude will be the ALTN cruise altitude which may be changed on the F-PLN INIT page. Normal F-PLN modifications may be made after the alternate F-PLN has been incorporated into the primary F-PLN.

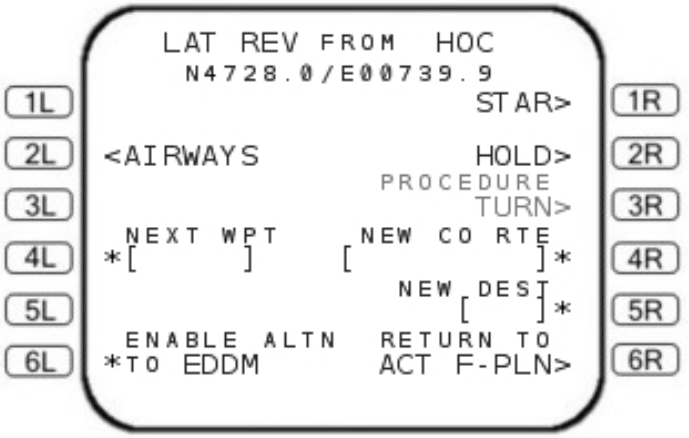
As an example, in the following screens, a LAT REV and ENABLE ALTN TO EDDM is accomplished after HOC.

STEPS: 1. Push F-PLN

2. Push 2L

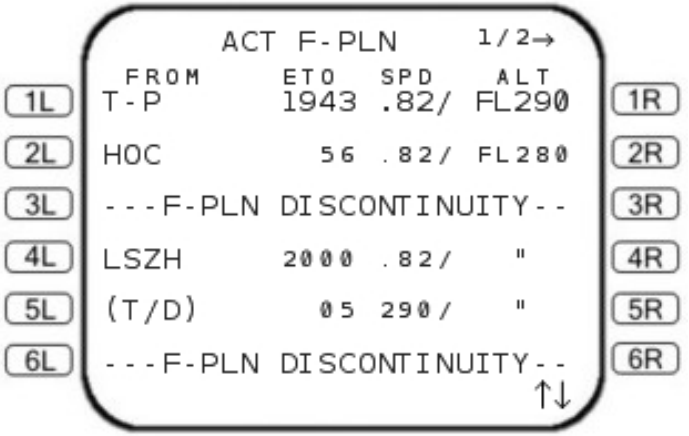


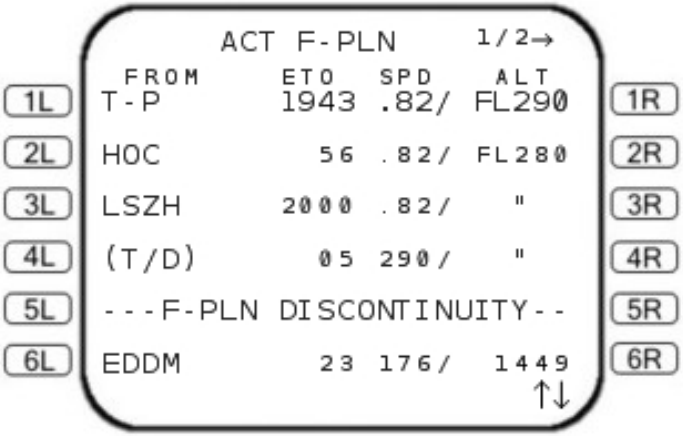
STEP: Push the 6L LSK



STEPS: 1. Push the CLR key

2. Push the 4L LSK





Entering a new destination will sequence the F-PLN from the selected waypoint to a new destination. The function is available for any selected fixed waypoint in the flight plan including the FROM waypoints and PPOS. The new destination may be any airport in the data base or a pilot-defined runway. When a new destination is selected the following events occur:

1. All waypoints beyond the selected fixed waypoint in the original F-PLN (including ALTN if it exists) are deleted.
2. A DISCONTINUITY is strung between the selected waypoint and the new destination.
3. A new destination is entered into the F-PLN.

Direct to may also be used to insert an alternate destination; however, a new destination must be entered to access PROF modes of operation. Direct to is defined in the CLIMB section.

Polar Navigation

When the aircraft is above 73° latitude, it is defined to be in the polar region. Above this latitude the IRU transitions to a true heading mode of operation. In this region, it is likely that radio navigation update will not be available and the FMS position calculation will become IRS ONLY NAVIGATION.

Above 85° latitude the FMS transitions to a calculated FMS true trackmode which is displayed in magenta color on the ND as FMS TRACK.

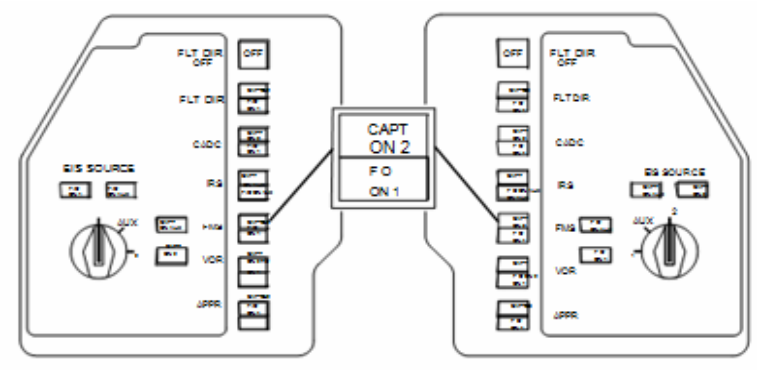
Within 2 NM prior to and 10 NM after the pole, the FMS transitions to a wings level mode of flight while it transitions the immediate polar region.

Abnormal Operations

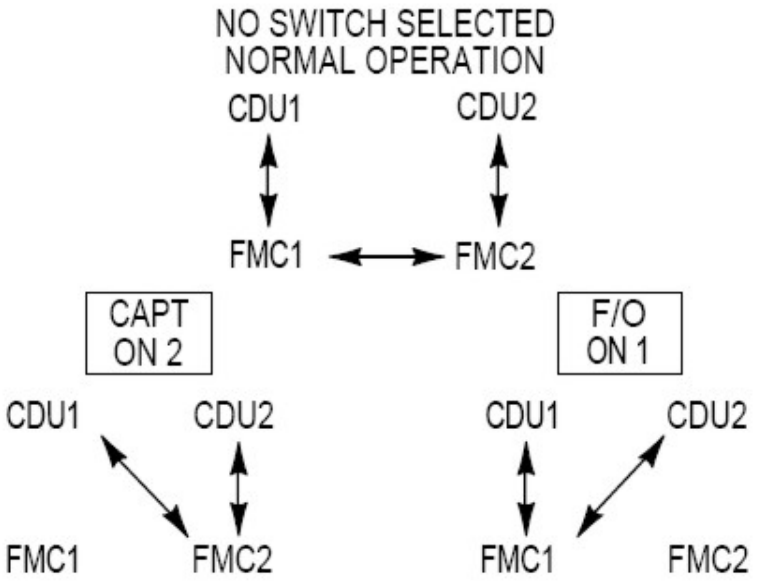
Dual and Independent Operation

The FMS is operable when electrical power is applied to the aircraft. Pilot entered data is retained during power transients through battery-powered memory in the FMC. The FMS supports DUAL, INDEPENDENT, and STANDBY operation modes.

Dual mode is the normal mode of the FMS. In Dual mode the two FMCs communicate with each other (cross talk) and continue operating in any FMS transfer switch configuration selected on the source input select panel (SISP). Refer to the following figure.



With neither FMS SISP switch selected, FMC1 will transmit page display to CDU1 and FMC2 will transmit to CDU2. This normal selection and other possible selections are shown in the following figure.



Dual mode operation involves both FMCs operating together with one acting as master and the other acting as slave.

After DUAL mode is established, both FCCs will select the FMC on the same side as the FCC in control. This FMC will then become the master. This selection process ensures that both flight directors will be controlled with the same steering commands.

NOTE: In the event of a FCC failure, the FMS will be affected as follows:

- *FMS SPD, NAV and PROF modes will disengage on the onside FMC with a master FCC failure.*
- *There should be no effects to the FMS if the slave FCC fails. All FMS modes should remain engaged. To correct the loss of FMS modes, the pilot should push the AUTOFLIGHT button on the GCP, then reselect FMS modes.*

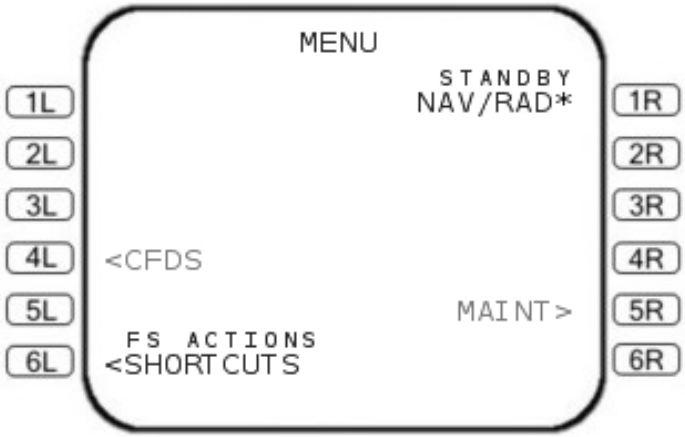
In DUAL mode operation, three parameters, aircraft position, gross weight, and active thrust limit shall be computed independently by each FMC. Individually computed data is compared with any significant errors annunciated with an MCDU message. If present positions differ by more than 5 NM, MCDU message FMCU POSITION MISMATCH is displayed. The message is automatically cancelled when difference is less than 3 NM.

When cross talk or resynchronization is attempted and fails, each FMC will revert to a completely INDEPENDENT mode of operation without cross talk.

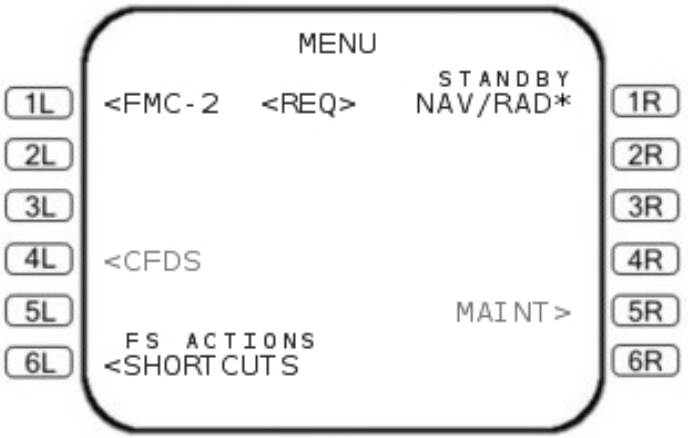
> *NOTE: Independent operation is not available in this simulation; except in the case of dual FMC failure when both MCDUs operate in Standby MCDU mode and are completely independent of each other.*

Single FMC Failure

If an FMC failure occurs, the respective MCDU MENU page will be displayed without the FMC1 or FMC2 prompt in the 1L data field. Also, STANDBY NAV/RAD* prompt will be displayed in the 1R data field and MAP FAIL will be displayed on the respective navigation display (ND).



If this condition is detected, the affected pilot can select the functioning FMC by pushing the FMS button on his SISP. In this event, CAPT ON 2 or F/O ON 1 will be illuminated on both SISPs. An FMC-2 (for CAPTs MCDU) or FMC-1 (on F/Os MCDU) prompt will be displayed on 1L and can be selected to regain MCDU functionality.



To display proper information on both NDs during a single FMC operation, the following mode and range selections must be made.

ACTIVE FMC SIDE	FAILED FMC SIDE
MAP	MAP (Same range selection as Active FMC
MAP	MAP (Same range selection as Active FMC
PLAN	PLAN (Same range selection as Active FMC)
MAP	VOR (Any selection range)
MAP	APP (Any selection range)

Either side can always display the VOR/APP mode at any time.

MAP FAIL will appear on the failed side when the active FMC is in the VOR, or APP, or PLAN mode and the failed FMC is in the MAP mode.

NO PLAN MODE will appear on the failed side when the active FMC is in VOR, APP, or MAP mode and the failed FMC is in the PLAN mode.

PMDG TIP
A single FMC failure (FMC-1 or FMC-2) can be selected from the MNDG Failures menu.

Standby MCDU Operation / Dual FMC Failure

If both FMCs fail, STANBBY operation must be selected on both MCDUs to gain access to navigation and NAV RADIO tuning. Also, if at any time the crew does not believe the FMCs are working properly, the MCDUs can be used in standby operation.

In the STANDBY mode only the MENU, F-PLN, PROG and NAV RAD MCDU keys are functional to select the related STANDBY pages.

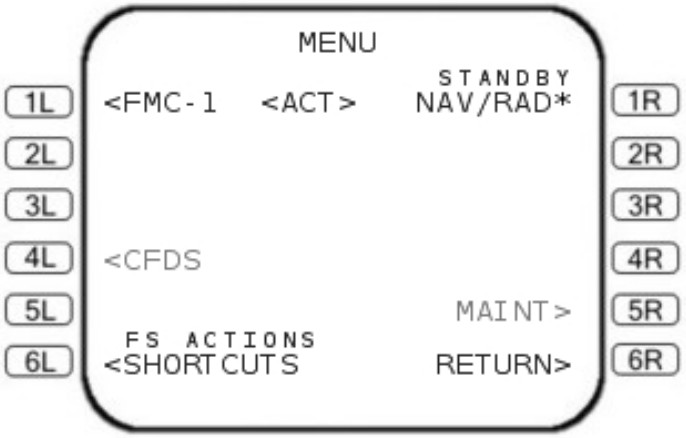
In this section, the MENU page, Standby MCDU Operation, STANDBY F-PLAN, Standby Progress and Standby Radio Tuning will be described.

PMDG TIP
A dual FMC can be set from the PMDG Failures menu by selecting both the FMC-1 and FMC-2 failures.

MENU Page

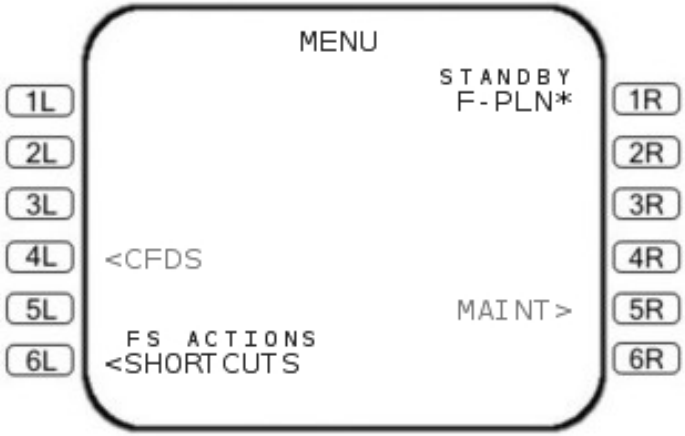
The MENU page provides the means to access specific sub systems which use the MCDU for display. Pushing the MENU function key displays the MENU page.

STEP: Push the MENU key

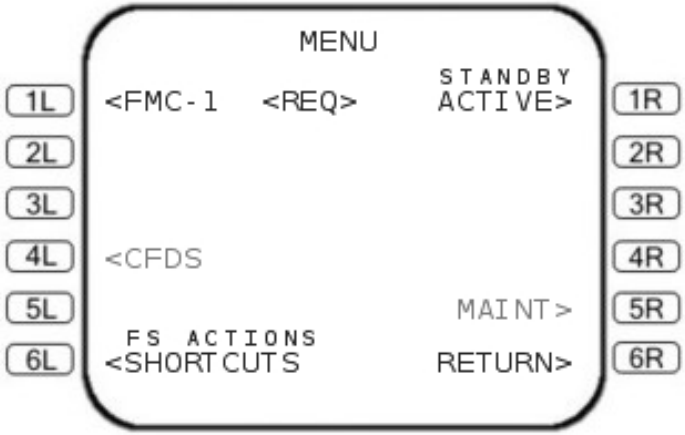


Pushing the LSK next to the subsystem name causes the subsystem menu or top level page to be displayed and activates the subsystem. Upon returning to the MCDU MENU page an ACT indicator is displayed next to the active subsystem as is shown in 1L for FMC-1 in screen above. Should a non active system make a request to send a message to the MCDU, the prompt REQ will be displayed next to the sub system.

The NAV/RAD* prompt is continuously displayed. MCDU Standby operation is available at any time. MCDU 3 will display F-PLN* in lieu of NAV/RAD*.

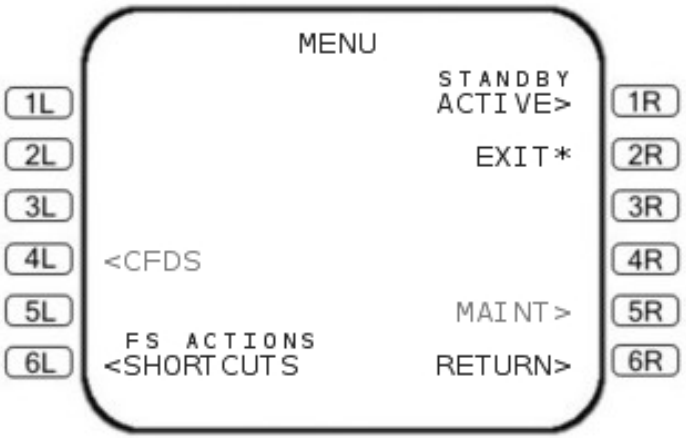


Pushing 1R on MCDU 1 or MCDU 2, activates MCDU Standby operation and causes the display to change to the STANDBY NAV/RAD page. If the MENU page is accessed during standby operation the NAV/RAD*, prompt (F-PLN* prompt on MCDU 3) is replaced by an ACTIVE> prompt in 1R.



The pilot may return to the active subsystem, or via pushing the LSK adjacent to the active subsystem, or via pushing 6R, the RETURN prompt. When returning to FMC1 or FMC2, the MCDU display last

shown before going to the MENU page will be redisplayed. If both FMCs are inoperative and FMC1 or FMC2 become operable, the A/C status page is accessed when returning to normal FMS operation. MCDU 3 has an EXIT* prompt in 2R to deactivate STDBY on MCDU 3.



Standby MCDU Operation

In the standby operational mode, the MCDU will provide navigation, radio frequencies, and lateral guidance data.

Navigation - During standby navigation, the MCDU will provide aircraft position and ground speed. The standby aircraft position shall consist of the aircraft's lateral position updated 5 times per second by using the present position inputs from the IRU. If Inertial Only position update is not active, then the aircraft lateral position shall not be computed. Standby ground speed is the ground speed input from the IRU updated at the same rate.

Radio Frequencies - Radio frequencies that were tuned by the FMC prior to failure will remain tuned until the pilot enters new frequencies into the STANDBY NAV RADIO page.

In standby operation the following data is available to other aircraft systems:

- Aircraft present position
- Current ground speed
- Navaid frequency (VOR, ADF, ILS) and course (VOR)
- ILS runway heading
- Distance to active waypoint
- Time to go (to the active waypoint)
- Active waypoint identifiers
- MAP display

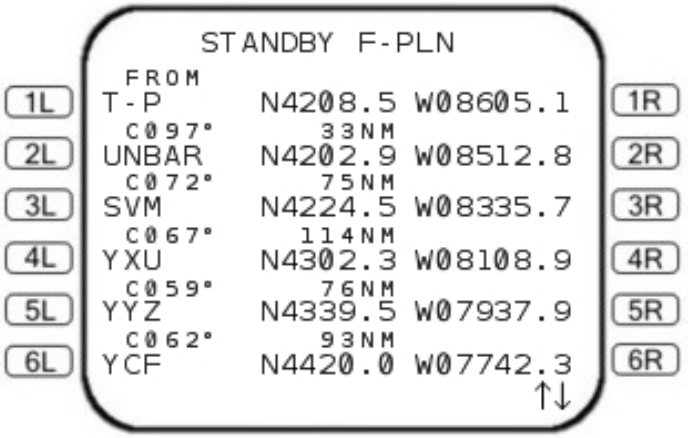
Lateral Guidance - The MCDU lateral guidance provides for horizontal control of the aircraft to the defined lateral flight plan. Roll rate and roll magnitude is limited appropriately for aircraft speed. The lateral guidance performs the following tasks:

- Lateral path construction
- Current path leg sequencing
- Steering command to the AFS (horizontal only)
- Crosstrack deviation (display by EIS)
- Active leg progress computations (time, distance, direction)

STANDBY F-PLN

Pushing the F-PLN key with Standby Active displays the STANDBY F-PLN page. The following screen shows a sample STANDBY F-PLN page just before reaching UNBAR and after a DIR TO UNBAR revision.

STEP: Push F-PLN



The purpose of this page is to display each leg of the active route, provide position information for each waypoint, computed course, and distance data for the connecting legs. The pilot can make waypoint entries using the left LSKs only. A valid waypoint entry should consist of an identifier/lat/long or lat/long only. The NAV database is not available. A lat/long entry will be assigned a name such as N51W050. Vertical scrolling is available to review and modify the F-PLN.

During normal flight, the MCDU is continually updating the STANDBY F-PLN to reflect the FMC flight plan. Consequently, on entering the standby mode of operation the MCDU is already initialized with the current F-PLN.

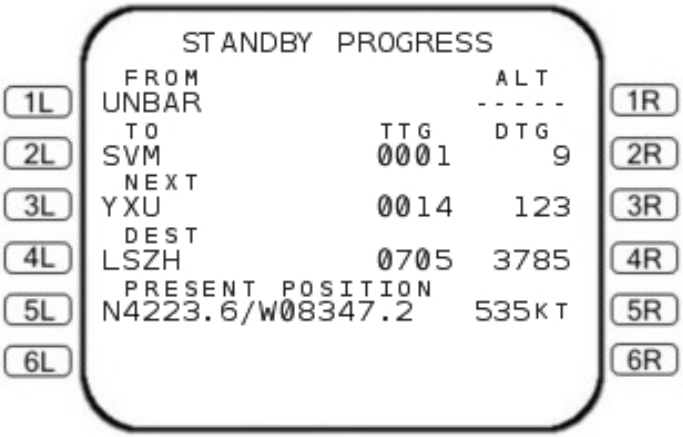
Basic F-PLN functions such as sequencing, waypoint entry and deletion, DISCONTINUITY insertion, DIR TO function, and PPOS and T-P generation are operable.

NOTE: The STANDBY F-PLN should be reviewed as only waypoints, tracks and distances are maintained in the MCDU. Discontinuities may be displayed where flight plan data has been lost.

Flight Progress

The standby progress page is accessed by the PROG mode key and displays dynamic information for the current flight.

STEP: Push the PROG key



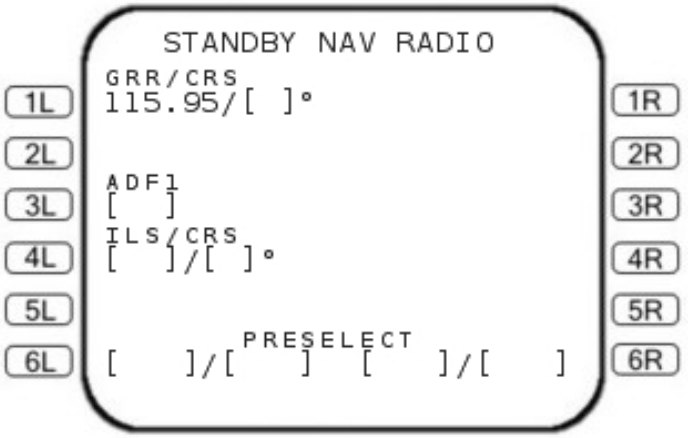
Line 1 displays the FROM waypoint identifier and altitude if available. Lines 2 thru 4 display the TO, NEXT, and DESTINATION waypoints along with the time to go, and the distance to go to each waypoint. The computed aircraft present position is displayed in 5L, with the current ground speed displayed in 5R. Entries are not allowed on this page.

Distance to go information on STANDBY PROGRESS page is IRU derived with no radio DME input. As such, it is to be considered only as accurate as the IRUs. It may not reflect accurate position.

Radio Tuning

The STANDBY NAV RADIO page provides tuning status display and control capability for the onside VOR, ADF, and the ILS. The left MCDU in standby mode of operation will control only the left radios as shown in the following screen.

STEP: Push the NAV RAD key



The pilot may tune the radios manually by entering the frequency (not ident) normally. The ILS runway heading is output to systems which use the information if entered. The capability to preselect navaid frequencies for later use is provided in line 6.

Clearing of GPS Softfault when FMS has rejected GPS data.

FMS may softfault the onside GPS due to receiving a corrupted or frozen latitude or longitude from the onside GPS and remain in that state, undetected by the GPS LRU. The FMS may softfault the offside GPS if the onside GPS is either hard faulted (I/O invalid) or not present. There will be no GNS softfault dedicated message annunciated in the cockpit.

NOTE: In normal operation the FMCs have the ability to tune and identify the navigational station corresponding to the flight plan. With no data base, it is additionally important to properly tune and identify radios to ensure the appropriate facility has been tuned.

FCC Failure

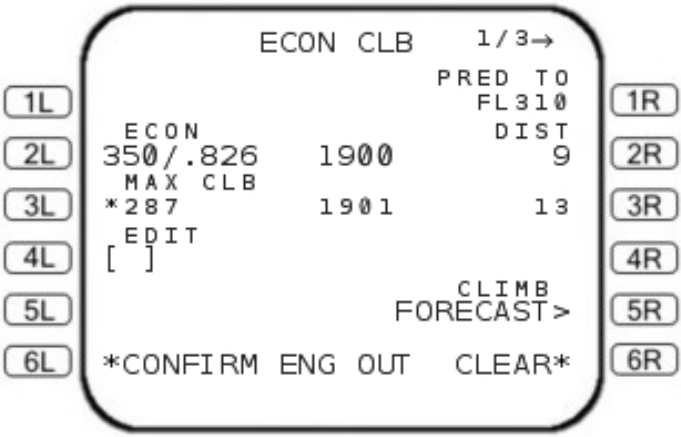
In the event of an FCC failure, the FMS will be affected as follows:

1. FMS SPD, NAV, and PROF modes will disengage on the onside FMS with a MASTER FCC failure.
2. There should be no effect to the FMS if the slave FCC fails. All FMS modes should remain engaged.

To correct the loss of FMS modes, the affected pilot should push the AUTOFLIGHT button on the GCP and then reselect FMS modes.

Engine Out Takeoff/Initial Climb

The FMS ENGINE OUT (EO) mode predicts one-engine out performance. When an EO condition is detected the *CONFIRM ENG OUT CLEAR* prompt will appear on the PERF page.



Pushing the ENG OUT key on the MCDU will also cause the *CONFIRM ENG OUT CLEAR* prompt to appear on the appropriate page as described above. Once displayed, pushing LSK 6L (*CONFIRM ENG OUT) activates computations that provide EO maximum altitude and new MAX CLB, MAX END, and ECON speed

targets. The climb/descent paths and fuel consumption predictions are also recomputed and displayed.

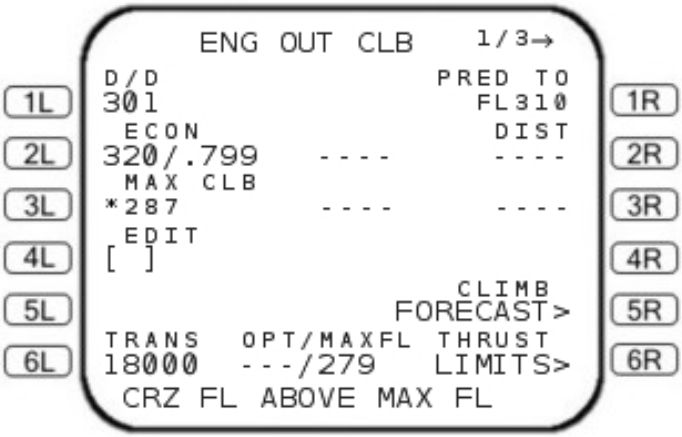
During takeoff the FMS engine out speed target is obtained at the time of engine out detection. Prior to reaching V2, the speed target will be V2. If the aircraft speed is between V2 and V2 + 10, the speed attained at engine loss will be maintained. If above V2 + 10, the speed will be reduced to V2 + 1- and maintained. In each of the three cases, the speed will be maintained until EO ACCEL altitude has been reached (FMS SPD engaged) or pulling the speed knob on the FCP to initiate acceleration (FMS SPD not engaged). At EO ACCEL altitude, the FMS speed target will be V3 until reaching all engine operating ACCEL altitude (if FMS SPD is not engaged V3 should be selected in the FCP SPD window). T/O or GA thrust will be maintained until all of the following conditions have been met:

1. Aircraft is at or above V3.
2. Slats have been retracted.
3. Three engine ACCEL altitude has been reached.

If PROF is not engaged, it will be necessary to pull level change to reduce thrust at all engine ACCEL altitude.

Engine Out in Climb

Confirming engine out results in the ENG OUT CLB page being displayed on the MCDU as displayed below.



Notice the message CRZ FL ABOVE MAXFL in the SP indicating the three engine CRZ FL was above the recomputed two-engine MAXFL.

Two-engine MAXFL is that altitude maintained with two engines operating at maximum continuous thrust with a 100 feet per minute climb rate available.

Automatic FCC EO detection or pilot-confirmed EO request results in selecting the MCT limit for the remaining two engines. The selection is a thrust limit and not engine out required thrust.

> *NOTE: An engine out condition will result in an automatic selection of AUTO MCT. The thrust climb limits will automatically revert from MCT to the appropriate thrust limit mode when the engine out condition is cleared.*

The engine out mode of operation cancels time constraints and the DECEL mode of operation.

To reselect a three-engine condition, the pilot must push the ENG OUT key to display the CONFIRM ENG OUT CLEAR prompts. Selecting CLEAR will cause the ENG OUT function to deactivate and performance predictions to revert to the three-engine condition.

FMS Engine Out Operation - Driftdown

The following procedure describes the FMS driftdown profile with PROF engaged. If PROF is not engaged, pilot should attempt to follow the described FMS profile.

If FCCs detect an engine failure, engine out confirmation must be made by the pilot through the MCDU.

NOTE: EO confirmation will not clear previously selected edit or max speeds.

Engine Out in Climb

If an engine out condition occurs in climb above the two-engine maximum altitude the aircraft will continue to climb with a speed target of driftdown and MCT power. When the aircraft can no longer climb at the driftdown speed, a natural level off will occur. The aircraft will remain in level flight until the driftdown speed is reached and the FCP altitude is lowered. At this time, a driftdown would be performed to the FCP altitude.

Engine Out in Cruise

When an engine out in cruise occurs and the pilot has confirmed the engine out, the current speed target will remain the active target. The thrust limit will transition to MCT; however, the engaged mode will remain in ALT-HOLD/SPD. When the speed target can no longer be maintained in ALT-HOLD/SPD, the mode will transition to ALT-HOLD/MAX thrust and the speed target will become the driftdown speed. The aircraft will remain in level flight until the driftdown speed is reached and the FCP altitude is dialed down.

The FCP altitude may be lowered to the two-engine maximum altitude (rounded down to the nearest 500 feet) or a lower altitude if desired; however, the aircraft will not descend until the aircraft speed has reached D/D speed and the FCP altitude is dialed down. When this occurs, the aircraft will enter a driftdown engine out descent mode and will descend to the FCP altitude with D/D speed as the target. Driftdown descent is accomplished with speed on pitch and throttles at MCT thrust. The D/D speed is displayed on all PERF pages adjacent to line 1L, as well as the Eng Out Econ speeds displayed in their appropriate positions.

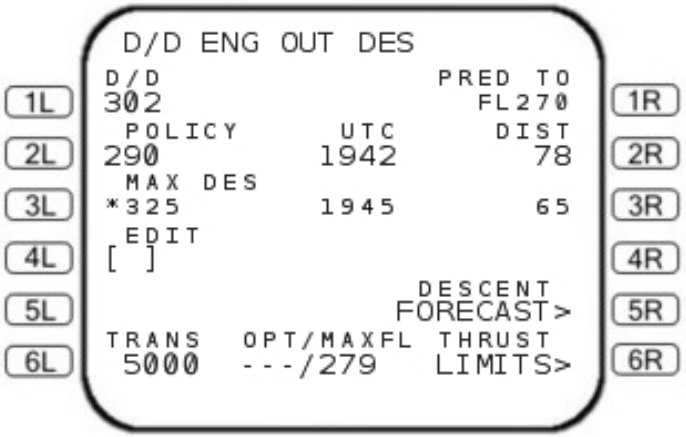
WARNING: **The aircraft will fly level in FMS PROF and FMS SPD and will not descend until the FCP altitude is lowered. The aircraft will not depart the clearance altitude with FMS modes engaged until the FCP altitude is dialed down; however, AFS speed protection is available. If decays below VMIN, FMS PROF and SPD will disengage. AFS speed protection will engage at VMIN - 10. The aircraft will depart the clearance altitude in order to maintain VMIN speed.**

When the descent rate reaches less than 100 fpm for 60 seconds, prior to reaching the two-engine maximum altitude, the FMS mode will change from driftdown to a vertical speed mode of -100 fpm. The V/S rate may be edited via the GCP and PROF may then be reengaged. The MCDU D/D ENG OUT DES page changes to ENG OUT DES. If the FCP altitude is dialed below the two-engine maximum altitude, the vertical speed will increase to -750 fpm. The FMS speed target shall remain VDD until one of the following occurs:

1. Aircraft achieves cruise level operation.
2. Aircraft captures the descent path.
3. Pilot performs any speed mode activity via the GCP or MCDU.

When the aircraft reaches the FCP altitude, the aircraft will level off. To transition from descent to cruise, it will be necessary to enter cruise flight on the INIT page. The speed target will then become the Eng Out Econ Cruise speed. Thrust limits will remain in auto MCT.

NOTE: When the aircraft transitions into ENG OUT CRZ, a top of descent may not be displayed on the MCDU flight plan page.The top of descent does not exist internally in the FMS, and once the FCP is dialed down and the top of descent is sequenced, the aircraft will descend into a normal FMS descent.



PROF disengagement shall not cause a speed target change. If air mass descent operation is initiated above the two-engine maximum altitude, the FMS speed target shall be VDD.

If an engine out is detected above two-engine maximum altitude while the aircraft is already in a descent, the thrust limit will go to MCT, but the aircraft will be flown with idle thrust down to the two-engine maximum altitude (or FCP altitude if higher). The aircraft will maintain the current speed target which was active at engine out confirmation. This will effectively yield a three-engine speed/profile. When the aircraft reaches the two-engine maximum altitude, it will then start flying with reference to the two-engine descent path, or a two-engine cruise if a new cruise flight level was entered on the INIT page with the EO speed as a target.

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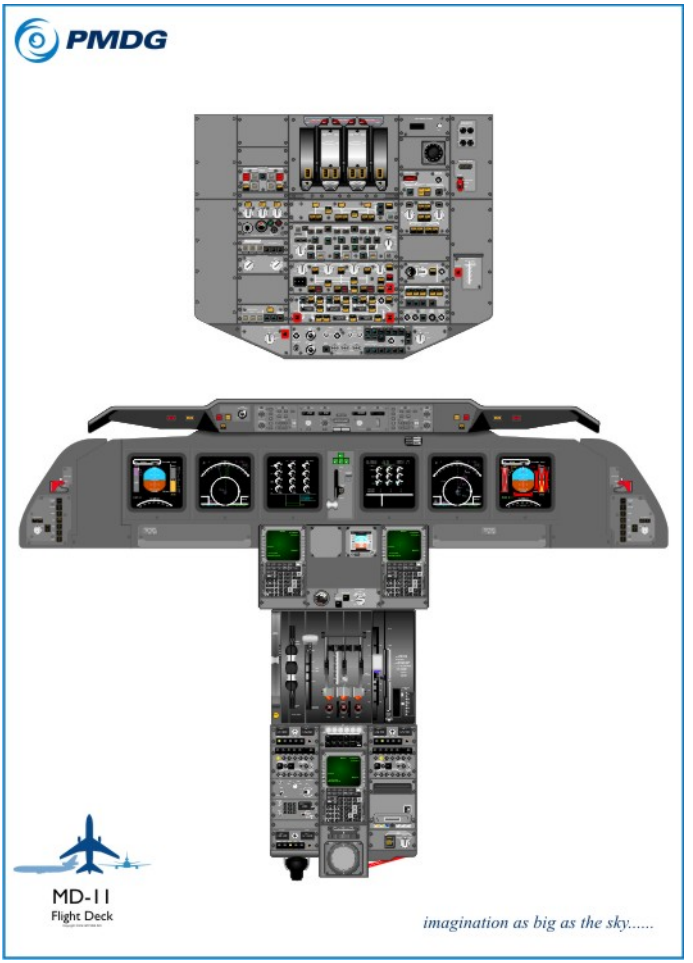

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