



A310/A300-600 Flight Management System Pilot's Guide

This manual is for use with
Microsoft® Flight Simulator 2002 ONLY!
Not for use in real flights

1. CDU OVERVIEW

The CDU is the primary pilot interface with the FMC, and is mainly used for long-term (strategic) actions such as flight plan construction, flight plan monitoring and revision, insertions of weights, temperature and wind entries, and performance data initialization. Short-term (tactical) actions, altitude steps, speed, selections, etc., are also entered on the CDU.

This interface allows the pilot to control the lateral and vertical elements of the flight plan.

LATERAL FUNCTIONS:

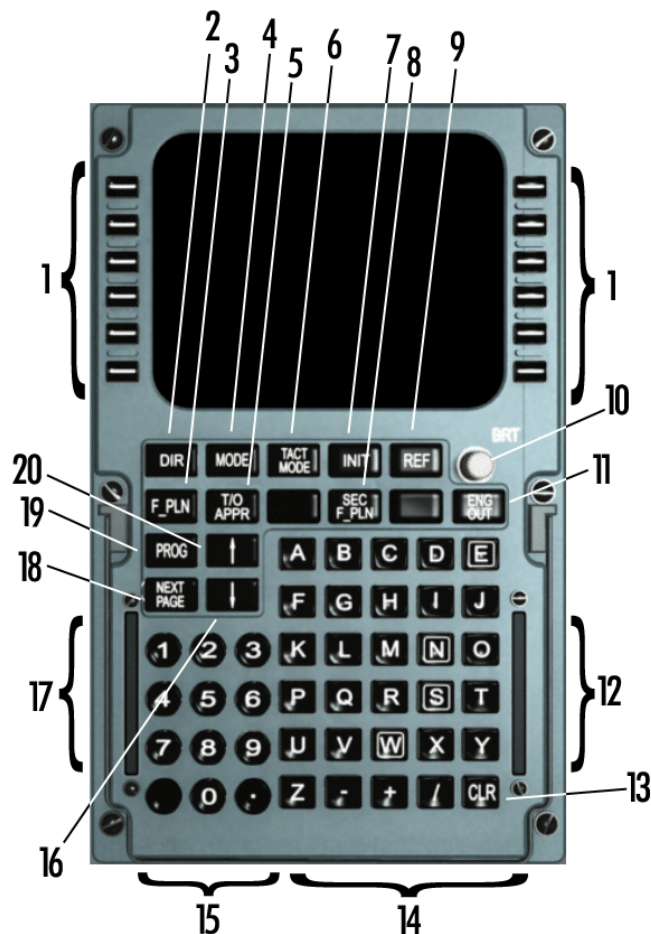
- NAV (aircraft position)
- NAVAID tuning (auto and manual)
- IRS alignment
- Flight plan initialization and modification
- Lateral flight plan display
- Lateral guidance

VERTICAL FUNCTIONS:

- Vertical profile
- Constraints (time, altitude, and speed)
- Wind and temperature revision
- Step climb/descent
- Predictions (fuel, time, altitudes)

1.1. CDU Keyboard

The CDU keyboard assembly provides a full alphanumeric keyboard combined with mode, function, data entry, slew switches, and advisory annunciators. Also, the keyboard assembly contains two integral light sensors and a manual knob to control display brightness. The general arrangement of the CDU is shown in Figure 1-1



- | | |
|------------------------------|---------------------------------|
| 1. LINE SELECT KEYS | 11. ENGINE OUT KEY |
| 2. DIRECT KEY | 12. ANNUNCIATOR-MESSAGE, OFFSET |
| 3. FLIGHT PLAN KEY | 13. CLEAR KEY |
| 4. MODE KEY | 14. ALPHA KEYS |
| 5. TAKEOFF/APPROACH KEY | 15. NUMERIC KEYS |
| 6. TACTICAL MODE KEY | 16. SLEW DOWN KEY |
| 7. INITIALIZATION KEY | 17. ANNUNCIATOR-DISPLAY, FAIL |
| 8. SECONDARY FLIGHT PLAN KEY | 18. NEXT PAGE KEY |
| 9. REFERENCE INDEX KEY | 19. PROGRESS KEY |
| 10. BRIGHTNESS KNOB | 20. SLEW UP KEY |

**Figure 1-1
CDU Keyboard**

1.1.1. Display

The CRT display screen has 14 lines with 24 characters per line. The page format is partitioned into four areas. See Figure 1-2.

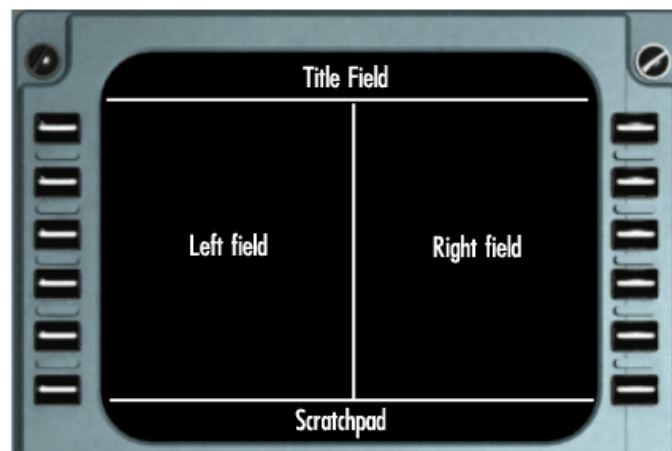
Title Field - This field is the top line of the display. It identifies the page in view and what additional pages of a set are available.

Left Field - This field comprises six pairs of lines, eleven characters per line. It extends from the left side of the screen to the center. The operator has access to one line of each pair through a Line Select Key (LSK) on the left side. A line pair comprises a label line and a data line.

Right Field - This field is similar to the left field, extending from the center of the screen to the right side. Operator access is available by a LSK on the right side.

Scratchpad - This field is the bottom line of the screen. Typed alphanumeric characters and FMC-generated messages are displayed on this line. The scratchpads for the two CDUs operate independently for data entry. The scratchpad accepts entries up to 22 characters. The last two character spaces are reserved for vertical slew indicators.

CRT DISPLAY SCREEN



**Figure 1-2
CRT Display Screen**

1.1.2 Line Select Keys (LSK)

These are six LSKs on each side of the CRT display. For reference, the left set of keys is identified **1L** through **6L**; the right set of keys is identified **1R** through **6R**. Each key provides operator access to one line of each pair of lines in the left and right data fields.

1.1.3 BRT Knob

The BRT knob allows the operator to manually increase or decrease the brightness of the CRT display. The brightness of the backlighted keys is controlled by a remote flight deck control. Annunciators are controlled by the master bright-dim-test system.

1.1.4 Function and Mode Keys (Rectangular)

This array consists of 15 keys, 2 of which are not used.

DIR**DIR Key**

Accesses the DIR TO page and allows the crew to initiate the DIRECT TO function by manual entry of a fixed waypoint, or line selection of a fixed waypoint in the ACTIVE PRIMARY F-PLN only.

MODE**MODE Key**

Allows access to the MODE page which displays the strategic performance modes. Changes made on this page affect performance in all the flight phases.

TACT MODE **TACT MODE Key**

Allows access to the current flight phase page (climb, cruise, etc). Changes made to the strategic modes on this page affect performance only in the current flight phase.

INIT**INIT Key**

Pressing this key will bring the INIT A page to the display on the ground only. The crew can define various initialization parameters including ACTIVE F-PLN data and IRS alignment.

REF**REF Key**

Accesses the REFERENCE INDEX page, which allows further access to reference pages pertaining to aircraft configuration, stored and defined waypoints, nav aids, maintenance, and other user systems.

F-PLN**F-PLN Key**

Provides access to a leg by leg description of the active route. The data includes a listing of real and pseudo waypoints, estimated times of arrival, airspeed/altitude constraints, distances between legs, and magnetic courses between legs.

TO/APPR**TO/APPR Key**

Accesses the TAKEOFF or APPROACH page, as appropriate, on which takeoff or approach parameters are displayed and/or inserted depending on the flight phase.

SEC F-PLN**SEC F-PLN Key**

When pressed, the SEC INDEX page is displayed. The SEC INDEX page allows access to, and functions related to, the secondary flight plan. These functions include copying into, deleting, and activating the secondary flight plan. The SEC INIT pages and all SEC PERF pages are accessible from this page.

ENG OUT**ENG OUT Key**

Has no specific page associated with it however, pressing it can cause display of an EOSID, if available, or display of the MODE page with EO prompts.

PROG**PROG Key**

Pressing the PROG key displays dynamic flight information about the active flight plan including: CRZ FL, present position, distance to destination, etc.

NEXT PAGE**NEXT PAGE Key**

Provides access to additional pages of a set when another page is required to complete display of data. This capability is indicated by a horizontal arrow on the title line. The NEXT PAGE function is closed loop; that is, it wraps around from the last page to the first page.

**VERTICAL SLEW Key**

For pages longer than the available space on the CRT vertical slewing is used to scroll the display up or down. These two keys are also used for incrementing (or decrementing) data (LAT-LONG) by a set amount in particular data fields. Vertical slew capability is indicated by arrows in the last two righthand spaces of the scratchpad. Simultaneous display of up and down arrows indicates upward and downward scroll capability.

1.1.5 Annunciators

There are four annunciators, two on each side.

DSPY (top left) - Illuminates when the flight plan has been slewed and/or the display does not indicate the active situation in the FMC.

FAIL (bottom left) - Indicates the CDU has failed. The screen is blank, except for the message, "FMC FAIL. "

MSG (top right) - Illuminates when a scratchpad message is being displayed or when a message is waiting in the queue.

OFST (bottom right) - Illuminates when a parallel offset is active.

1.1.6 Numeric Keys (Round)

These keys enable the operator to enter numerals into the scratchpad successively from left to right. Alpha and numeric keys may be entered together as required. The slash key (/) is included as part of the alpha keys and is used to separate pairs of entries in the same field; for example, airspeed and Mach (280/.720), wind direction and velocity (104/100), or airspeed and altitude (250/10000). The trailing entry of a pair is generally preceded by the slash if entered by itself. The leading entry may be followed by the slash but is not required if entered by itself.

1.1.7 Alpha Keys (Square)

These keys enable the operator to enter alphabetic characters into the scratchpad successively from left to right.

1.1.8 CLR Key

The **CLR** key is used to clear messages and data from the scratchpad or an individual data field. If alphanumeric characters have been entered into the scratchpad, a single, short press of the key will erase the last character entered. A longer press of the key erases the entire scratchpad. If the scratchpad is empty, operation of the **CLR** key enters the legend CLR into the scratchpad. This action may then be followed by pressing a LSK adjacent to the field to be cleared. If the cleared data field has a default or FMC-calculated value, the display reverts to this value. If the cleared data field is a leg in the flight plan, the leg is deleted from the flight plan. Pilot-entered data in a field that is normally blank cannot be cleared by the **CLR** key but may be changed via scratchpad entry. The CLR legend can be removed from the scratchpad by pressing the **CLR** key a second time or by entry of an alphanumeric character.

1.2 CDU PAGE FORMATS

Pertinent FMC data is displayed on the CRT of the CDU on pages that are selected by the function and mode keys. Two sizes of font are used on the display pages.

Page Title (LARGE Font) - Identifies selected page and type of data displayed below the title,

Next Page Prompts (→)- In upper right title field. Indicates that additional data is available for the page selected.

LARGE Font Display - Identifies pilot entered or data base derived data.

Box Prompts (□□□□□) - Indicate that data entry is required for minimum FMC operation. This data entry is performed through the use of the scratchpad and the corresponding LSK. Entry into a box prompt fine is displayed in LARGE font. Dashes in a data field indicate that data entry into that field is not allowed or that data is being calculated by FMC. The data appears automatically after a time interval and is in small font.

Bracket Prompts ([])- Indicate optional entry is possible in the applicable field.

Small Font Display - Represents predicted, default or FMC-calculated values. When adjacent to an LSK, the data can be changed by pilot entry, in which case, the font will be LARGE.

Scratchpad Line (Bottom Line of Display) - Displays FMS generated messages and keyboard entries.

Vertical Slew Prompts (↕)- As shown, the prompts indicate that the latitude or longitude value below the prompts can be incremented or decremented. The slew prompts can also appear to the extreme right of the scratchpad fine. This indicates that the lines of the display can be scrolled to move up or down one line at a time.

Label (Small Font) - Identifies the data displayed directly under the header.

Page Number (Small Font) - Indicates the page number of a data set and the number of pages in the set.

Waypoint (LARGE Font) - Waypoint is on the selected route.

Page Prompts (< or >) - Pressing the associated LSK accesses another CDU page but no function is performed.

Asterisk (*)- This symbol appears adjacent to an LSK if the actuation of the key will affect the active situation, e. g. - INSERT, CLEAR, ERASE, etc.

Airway (small Font) - Identifies the published airway between two waypoints.

Symbols (+ or -) - Mean at or above (+); or, at or below (-). For example, a + 5000 constraint indicates a crossing restriction at or above 5000.

Specified Turn Arrow (↩)- Appears next to the affected waypoint indicating a mandatory turn direction, e. g. - ABC↩, illustrates a left turn at ABC.

Dashes (- - -) - In a data line indicate that data is being computed, is not available, or data entry is not allowed.

Overfly (▲)- A triangle symbol next to a fixed waypoint indicates that waypoint will be overflowed before a course change is made.

1.3 CDU CONCEPT OF PAGING

CDU screen displays are referred to as pages. Each mode key, except the ENG OUT key, allows access to a specific page containing data pertaining to the page title.

The following foldouts are general diagrams of page sequencing and the data to be found on each page.

Notes regarding these diagrams are:

1. Pages which have vertical slew capability are indicated by opposing arrows at the bottom of the page - they may be slewed in either direction.



Figure 1-3

2. Horizontal slewing, or the ability to turn the page, is denoted by Next Page (N/P).
3. The page title is underlined, and beneath the title is listed the type of information found on that page.
4. The TACT MODE and TO/APPR keys display different pages when pressed, depending on the active flight phase.
5. Any page accessed automatically, or by pressing a Line Select Key (LSK), is shown in the following diagrams. If a page has no exit route, in the diagram, it means a mode key must be pressed to change pages.

2.1 PREFLIGHT

During this phase, the data base cycle is validated, weights are initialized, certain performance parameters are selected or modified, and flight planning is accomplished.

2.1.1 Powerup — Aircraft Status Page

The Aircraft Status page is normally displayed when the crew first enters the cockpit. (See Figure 2-2.) Display of this page results from any one of the following:

- Automatically when power is first applied to the FMCS.
- Automatically at shutdown of the second engine when fuel flow is below 440pph (200kg/h).
- Manually through the REF INDEX page. (See Section 5.2.)

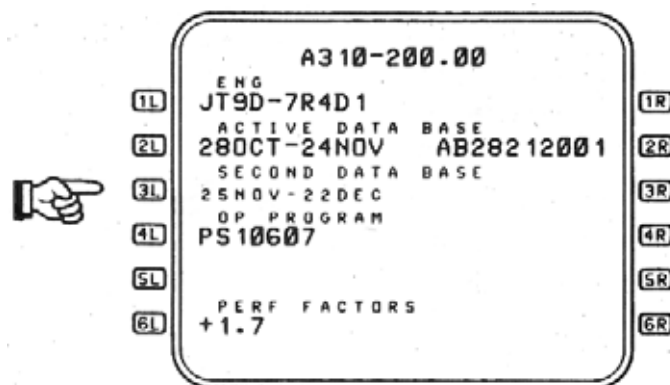


Figure 2-2

The purpose of the AIRCRAFT STATUS page is to display the performance and navigation data base parameters for which the particular FMCS is configured, including:

Title Line - Aircraft model and series

1L Engine type.

2L Effectivity period of the active data base.

2R Customer code, cycle date, and sequence number of the data base.

3L Effectivity period of the second data base.

4L FMC program reference number.

6L Performance Factor - a number with a range of + or — 9. 9, reflecting the A/C performance status, a measure of aircraft/engine efficiency from nominal, on which all FMC performance and prediction calculations are based. For example, a positive PERF FACTOR effectively decreases the entered cost index and increases the predicted fuel flow.

NOTE: Selection of an appropriate PERF FACTOR is a maintenance engineering function, and although this value may be modified by the crew, such practice is not recommended.

2.1.1.1 Data Base Selection

The second database may be activated by pressing LSK **3L** (Figure 2-2). This action causes the effectivity periods to change positions on the page. The active data base effectivity period is always displayed in large font.

CAUTION

Changing data bases, on the ground or in flight, erases all previously entered data including flight plans. In flight, depending on mode engagement, this action can also cause the A/P to disengage.

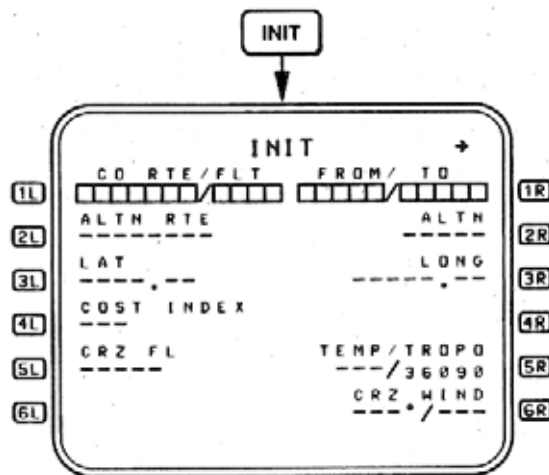
2.1.2 Initialization

There are two initialization pages, INIT A and INIT B. Both contain data which is pertinent to the flight and which must be inserted to allow the FMCS to function.

NOTE: INIT A and INIT B pages are available only in the PREFLIGHT and DONE flight phase - before second engine is started or after second engine is shutdown.

2.1.2.1 INIT A Page

The INIT A page is accessed by pressing the **INIT** mode key on the CDU. This page allows the crew to initialize cost index, define the origin/destination (or company route), cruise flight level, cruise wind, etc., and provides access to the INIT B page. If the INIT A page is displayed at engine start, the display reverts automatically to the F-PLN A page.


Figure 2-3

2.1.2.2 Company Route

1L **CO RTE/FLT** - Boxes are initially displayed indicating this data is mandatory. Either one, or both the CO RTE and flight number may be entered. The data is separated by a slash (/) when entered together, or when the flight number is entered alone it is preceded by a slash. The slash is omitted if the CO RTE is entered alone.

The CO RTE field is also filled when a CO RTE is selected on the ROUTE SELECTION page. (See Section 2.1.2.6.) Selection of a CO RTE completes the flight planning function except for selection of the departure and runway. (See Section 2.1.3.2.1, SID/RWY SELECTION, and Figure 2-10, FLIGHT PLANS.)

2.1.2.3 FROM/TO

1R **FROM/TO** - Entry of a FROM/TO airport pair only is allowed in this field. The FROM/TO field is filled automatically when a CO RTE is defined in **1L**, or manually from the scratchpad (SP), e.g., with LSGG/LGAT in the SP (Figure 2-4), pressing LSK **1R** inserts this airport pair into the boxes and the ROUTE SELECTION page is displayed. (See Section 2.1.2.6).

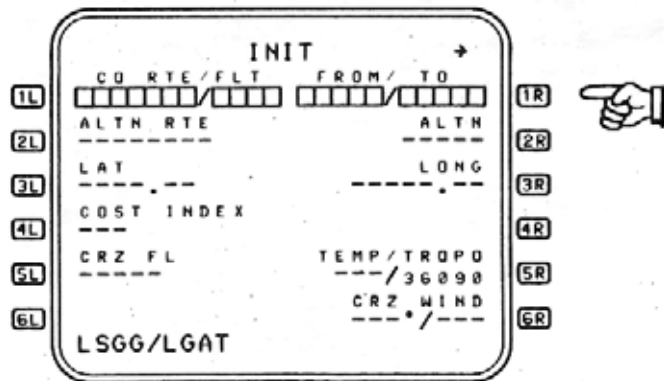


Figure 2-4

2.1.2.4 IRS/FM Position Verification

3L 3R **LAT** and **LONG** - With entry of a CO RTE or FROM/TO in line 1, the LAT/LONG of the origin (FROM) airport reference point is displayed in this line. This value may be incremented/decremented, at the pilots option, to actual gate position coordinates, as indicated by the slew symbols (↔) adjacent to LAT (see Figure 2-5). The slew keys of the CDU are used (↑ ↓), with each key press being equal to ±0.1 minute of LAT/LONG (holding the key depressed changes the value by 0.1 minute per second), to the maximum of 90 degree (LAT), and 180 degree (LONG). Only the magnitude may be changed in this way. The slew symbols may be moved from **3L** to **3R**, or vice versa, by pressing the LSK adjacent to the desired field. LAT/LONG may also be changed by typing the coordinates into the SP and transferring the data by pressing the LSK adjacent to the desired field.

NOTE: See Section 6.0, ISDU OPERATION, for manual position entry via the ISDU.

4L **COST INDEX** - The COST INDEX field is dashed until a CO RTE or FROM/TO entry is made, then boxes are displayed unless the CO RTE also has a cost index stored with it, in which case it is filled in with the other CO RTE data.

The COST INDEX reflects time cost relative to fuel cost, and a range of 0 to 999 is allowed. This value is usually established by each airline.

2.1.2.5 Align IRS

4R The **ALIGN IRS** prompt is displayed when any one, of the three IRS's is in the align mode, or the LAT or LONG is changed after the prompt is pressed.

Pressing LSK **4R** initiates IRS alignment to the position displayed on line 3. (See Figure 2-5.) The prompt does not reappear unless the position entered in line 3 is changed by the crew.

The SP message ALIGN IRS is present, when any page other than the INIT A page is displayed, with any IRS in the alignmode. See Figure 2-7.

5L **CRZ FL** - The cruise flight level is either taken from data base, with the CO RTE, or is manually entered by the crew. FL410 is the maximum value allowed in this field.

5R **TEMP/TROPO** - The cruise temperature and tropopause altitude may be entered or modified by the pilot. Dashes are displayed, and data entry is not allowed, until the CRZ FL is defined in **5L** Cruise temp, unless entered by the pilot is defaulted to ISA for the altitude defined in **5L**

TROPO altitude defaults to 36, 090 ft. MSL, but may be modified if desired.

6R **CRZ WIND** - Dashes are displayed in this field until the CRZ FL is defined in **5L** Default value is then 0/0 until the crew enters the cruise wind.

Figure 2-6 is an example of the completed INIT A page, for flight 1150 from LSGG to LGAT, with CO RTE #20441 entered.

Entry of data erases any previously selected CO RTE, and blanks **1L**.

NOTE: See Section 2.1. 3, **FLIGHT PLANNING**, for **manual flight planning using the FROM/TO rather than the CO RTE method.**

2L 2R **ALTN** and **ALTN RTE**

These fields are dashed until the primary destination is defined, then boxes are displayed, allowing entry of an alternate if desired. The ROUTE SELECTION page is displayed as soon as an alternate destination is specified in **2R**, unless no specific route exists.

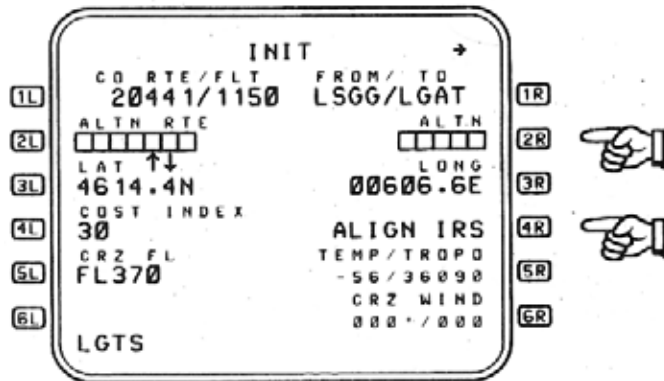


Figure 2-5

With the alternate, LGTS in the SP, pressing LSK **2R** places the data in the boxes (See Figure 2-5). No alternate route exists in the data base for this route, therefore the field in **2L** is blank. (See Figure 2-6.)

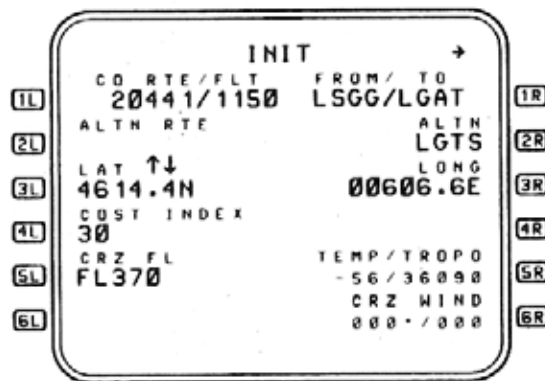


Figure 2-6

The data contained in **1L** or **1R**, **4L**, and **5L** of the INIT A page, is all mandatory — necessary to initialize the FMC.

2.1.2.6 Route Selection Page

This page is displayed automatically when a CO RTE, FROM/TO, or ALTN is specified on the INIT A page, for which there is more than one route. Page access may also be from the SEC INDEX page. (See Section 5.1.1, SEC INDEX.)

Figure 2-7 is an example of the route selection page.



Figure 2-7

The title line displays the Origin/Destination, LSGG/LGAT, and indicates that the route displayed is the second of two (2/2) CO RTE's available between these airports. Access to the other page is via the **NEXT PAGE** function key.

1L Displays the route alpha numeric, for example 20441, which corresponds to the CO RTE inserted on the INIT A page previously.

6L Pressing LSK **6L**, the INSERT prompt, enters the displayed route into the flight plan (either primary or secondary, depending on how the page was accessed), and the display reverts to the accessing page.

6R Pressing LSK **6R**, the RETURN prompt, reverts the display to the accessing page without inserting the route into the flight plan.

2.1.2.7 INIT B Page

Access to the INIT B page is from the INIT A page via the, **NEXT PAGE** function key on the CDU, as indicated by the NEXT PAGE prompt, →, in the top right corner of both pages. If INIT B is displayed, pressing the **NEXT PAGE** key causes INIT A page to be displayed. The INIT B page allows the crew to initialize performance related parameters, which in turn generate all performance predictions, (e. g., weights, CG, cruise altitudes, etc.)

2.1.2.7.1 Fuel Planning

Additionally, the crew may do fuel planning, in the appropriate fields, by changing and/or eliminating the displayed values, and noting the resulting fuel requirements as adjustment are made. (e.g., alternate fuel, holding fuel, required reserves, etc.)

The INIT B page cannot be accessed after the second engine is started. If the INIT B page is displayed at engine start, the display automatically switches to the FUEL PREDICTION page. (See Section 2.2.6.3.)

Figure 2-8 is an example of the INIT B page as it appears initially. Mandatory data fields display boxes — entry of data into these boxed fields and those of the INIT A Page causes the predictions to run.

Figure 2-8

1L TAXI - Taxi fuel is a data base derived default value, in tonnes or pounds, specified by the airline. This amount may be modified by the pilot to a maximum of .9 kgs. or 1984 lbs.

2.1.2.7.2 Fuel Weight Entry

1R BLOCK - Boxes are initially displayed indicating that this entry is mandatory. Value may either be calculated or pilot entered. (See NOTE below.)

FOB is the present fuel on board as calculated by the FMC. Dashes are displayed if data is invalid.

2L TRIP/TIME - The FMC calculated trip fuel and time to the primary destination is displayed and is not modifiable. Dashes are displayed if calculated data is not available.

2R ZFW - Boxes are initially displayed indicating that this data is mandatory. Value may either be calculated or pilot entered. (See NOTE below).

MZFW values appear only if the Zero Fuel Weight entered exceeds the maxima.

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3L RTE RSV/% - The trip reserves are expressed as actual fuel and the percentage of trip fuel. The percentage is a data base default value specified by the airline. Either value is pilot modifiable, one at a time, and the defining parameter - actual fuel or percentage - is displayed in large font. (See APPENDIX B, DATA FORMAT, page B-8).

3R TOGW - Boxes are initially displayed, indicating this entry is mandatory. Value may either be calculated or pilot entered. MTOGW is only displayed if the entered value exceeds the maxima.

NOTE: in fields **1R,2R** and **3R** data entry is only required in two of the fields. Entry of data into any two causes the remaining value to be calculated by the FMC.

4L ALTN - If an alternate destination has been specified on INIT A page, this field displays the fuel required to the alternate. If alternate fuel cannot be calculated, dashes are displayed.

Pilot entry into this field is only allowed if no alternate is specified.

4R LW - Landing weight at the primary destination is a calculated value of the difference between TOGW and trip fuel, and is not pilot modifiable.

MLW - is only displayed if the entered value exceeds the maxima.

5L FINAL/TIME - Represents the computed holding fuel/time at the alternate destination, at 1500' QFE and MAX ENDURANCE speed. Time initially is a data base derived default value. Either value is modifiable by the pilot, but one at a time. Changing one value causes the other to be recomputed.

5R CG - Center of gravity is displayed as a % of MAC with a default value of 25%. If a trim tank is not fitted the field displays the GW CG. With a trim tank the label line is ZFWCG, the initial default state of the label line is boxes, indicating entry of the ZFWCG is mandatory to initialize the trim tank computer. In either case the data is modifiable.

MAX FL - Is the calculated maximum altitude capability based on flight level. Dashes indicate a calculated value is unavailable.

6L EXTRA/TIME - This field displays the extra fuel/time above and beyond all required fuel, including reserves. The fuel value can be negative, in which case the time is dashed. Defaults to dashes to indicate calculated values are unavailable.

6R CRZ - Displays the CRZ altitude as defined on the INIT A page. Any data displayed in data field 5L, of INIT A page, (e. g., boxes, dashes, etc.), is duplicated in this field. Entry is allowed unless the field is dashed.

OPT FL - The present optimum altitude is displayed in this field. Dashes indicate calculated value is unavailable.

The three mandatory data lines on the INIT B page have been filled, initializing performance related parameters and causing predictions to be calculated, as indicated by the full data lines in Figure 2-9 below.

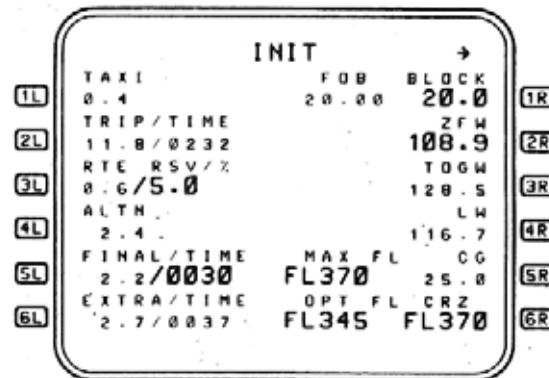


Figure 2-9

NOTE: In data lines **1R**, **2R**, and **3R**, when data is entered in any two lines by the pilot, the remaining line is calculated and filled by the FMC.

2.1.2.8 Pseudo Waypoints

As mentioned previously, in the INIT B page overview, initialization of weights causes the predictions to be calculated and displayed. As a result of these predictions, which affect the lateral and vertical elements of the flight plan, pseudo waypoints are generated, however, these pseudo waypoints do not cause any lateral path changes to the aircraft, nor are they ever the FROM waypoint in the flight plan.

A pseudo waypoint is a waypoint not fixed to a geographic location, which is inserted directly into the flight plan as an altitude and/or distance termination.

The primary purpose of these pseudo waypoints is to provide the pilot with EFIS and CDU display of the location, relative to the lateral flight plan, where a vertical event is predicted to occur. Pseudo waypoints are defined as follows:

(T/C) Top of Climb - The point where the prediction process intercepts the cruise altitude or the constructed descent/approach path, or the point at which the aircraft reaches the step altitude or the cruise altitude.

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(T/D) Top of Descent - The point where the prediction process intercepts the constructed descent/approach path, or the aircraft is predicted to descend from the cruise altitude.

NOTE: Short route segments with high CRZ ALT's can cause the (T/C) and (T/D) to be at the same point on the flight plan.

(S/C) Step Climb - The point at which the aircraft is predicted to begin a previously inserted step climb.

(S/D) Step Descent - The point at which the aircraft is predicted to begin the step descent previously inserted in the flight plan.

(LEVEL) Clearance Altitude - The point at which the aircraft is predicted to intercept the clearance altitude.

(SPD LIM) Speed Limit - The point at which the aircraft is predicted to reach the speed limit altitude in either the climb or descent flight phase.

(I/P) Intercept Descent Path - is the point at which the aircraft is predicted to reach the constructed descent/approach path under the following conditions:

1. IMMEDIATE DESCENT situational mode is active. (See Section 2.4.1.)
2. The clearance altitude is below the point at which the descent/approach path is intercepted.
3. The absence of an altitude constraint causes the predictions to level off before the descent path is intercepted.

(HHHHH) Altitude Intercept - is the point at which the aircraft is predicted to reach the PRED TO altitude when it is defined via the TACT MODE page, in the CLB or DES phase. This pseudo waypoint is not displayed if the altitude is the same as the CRZ ALT, SPD LIM ALT, or FCU ALT.

Any change in the active lateral or vertical situation may cause the predictions to restart, which in turn causes the pseudo waypoints to be recalculated.

2. 1. 3 Flight Planning

There are two active flight plan pages, F-PLN A and F-PLN B. Manual access to the F-PLN A page is via the **F-PLN** mode key on the CDU, from which access to the F-PLN B page is provided through the **NEXT PAGE** mode key.

The **F-PLN** key allows the crew to view the lateral and vertical elements of the flight plan in the order in which they occur, for planning purposes, and revision as desired.

Each F-PLN page is capable of displaying up to six waypoints or navaids. Additional waypoints/navaids may be brought into view by vertical slewing, until the closed loop flight plan returns to the origin airport.

NOTE: If both ACT and SEC F-PLN's are used, each may hold a maximum of approximately 65 waypoints. If only ACT is used, approximately 96 waypoints may be entered.

Both lateral (LAT REV) and vertical (VERT REV) revisions are made on the flight planning pages, with LAT REV's being made via the left six LSK's, and VERT REV's being made via the right six LSK's. This applies to the F-PLN A and F-PLN B pages only. Both are covered in detail in this section.

The planned route of flight is illustrated in Figure 2-10.

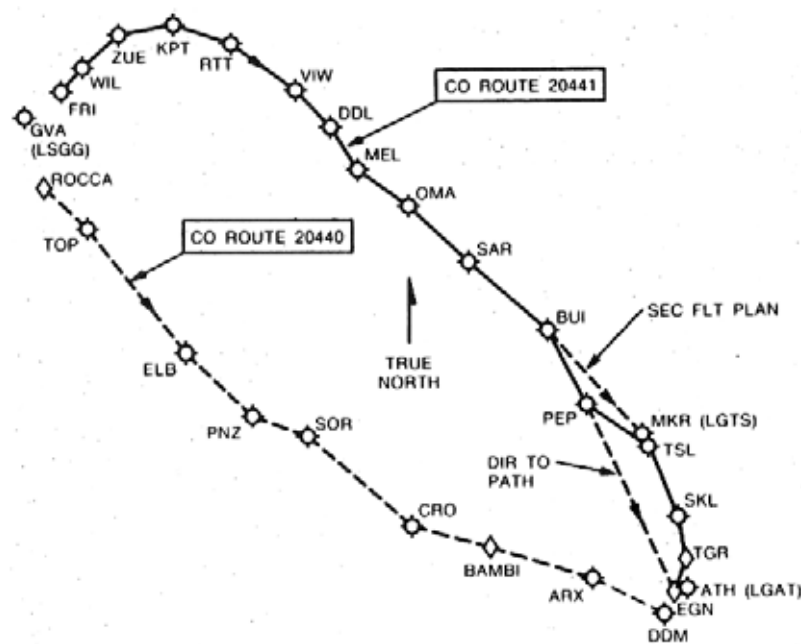


Figure 2-10

CO RTE 20441, the northerly track of the two flight plan routes, would have been inserted in its entirety had the CO RTE option been selected.

For the purpose of demonstration however, the same route is manually strung, waypoint by waypoint.

The initialization process has been completed and flight planning begins with pressing the **F-PLN** mode key. Figure 2-11 is an example of the F-PLN A page as it would appear with LSGG/LGAT defined.

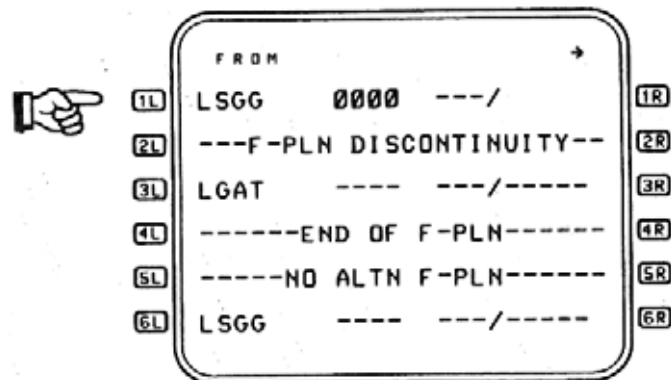


Figure 2-11

1L LSGG - The origin (FROM) airport.

2L F-PLN DISCONTINUITY - A flight plan marker displayed on the F-PLN, SEC F-PLN, and DIR TO pages only, indicating the lateral flight plan is not connected between these two waypoints/navaids.

3L LGAT - The destination (TO) airport.

4L END OF F-PLN - A flight plan marker indicating the end of the active or SEC F-PLN. Same display rules as F-PLN DISCONTINUITY.

5L NO ALTN F-PLN - A flight plan marker indicating that no alternate flight plan has been defined. Same display rules as F-PLN DISCONTINUITY.

6L LSGG - The FROM waypoint, is displayed again because the flight plan is a continuous loop (wraps around to the beginning), and no enroute waypoints have been defined as yet.

Waypoint stringing begins with a lateral revision at the origin airport, to select the departure SID by pressing LSK **1L**

2.1.3.1 Waypoint Stringing

Manual definition of a flight plan route, or waypoint stringing, is accomplished on the F-PLN pages directly, or from the F-PLN pages through the LAT REV function. (See Section 2.1.3.2, LATERAL REVISIONS.)

If no CO RTE exists for the desired route, the FROM/TO method is used to define the flight plan manually, waypoint by waypoint.

The pilot may enter ORIGIN/DESTINATION (FROM/TO) waypoints on the INIT A page for the active flight plan. (See Section 2.1.2.3, FROM/TO METHOD.)

The FROM/TO pair must be either airports listed in the data base or pilot defined runways. (See Section 5.2.1, DEFINED WAYPOINTS.)

NOTE: As a technique during manual flight planning, to prevent the unwanted scrolling of the flight plan waypoints as the pseudo waypoints are inserted by the FMC, it is recommended that waypoint stringing on the F-PLN pages be accomplished prior to initializing the weights on the INIT B page.

For the purpose of demonstration, assume a flight from Zurich to Athens (LSGG/LGAT), with Thesalonika (LGTS) as the alternate, for which there is no CO RTE.

2.1.3.2 Lateral Revisions

Lateral revisions are changes made in the lateral flight plan, from a specific point called the revise point, which may be any waypoint in, the flight plan, including the FROM waypoint (expressed as PPOS), and F-PLN DISCONTINUITY (expressed as DISCON). The lateral revision page is displayed automatically when any left LSK is pressed on a F-PLN page. The waypoint next to the pressed LSK forms the title of the LAT REV page. Revisions made on these pages affect only the downpath flight plan - all flight plan legs which occur up to and including the revise point remain intact. Should the revise point become the FROM waypoint while a lateral revision is being defined, the lateral revision is erased and the display reverts to the F-PLN page. Lateral revisions cause all predictions to be recalculated -dashes are displayed while new values are calculated.

There are five general categories of lateral revisions:

1. Waypoint insertion/deletion directly on F-PLN A and B pages. (See Section 2.1.3.2.6, WAYPOINT INSERTION/F-PLN A and B pages.)
2. From the flight plan pages through the LAT REV function. (See Section 2.1.3.2.2, WPT/NAVAID ENTRY, and Section 2.1.3.2.3, NEW WAYPOINT FUNCTION.)
3. The DIRECT TO function on the flight plan pages, via the DIR key. (See Section 2.3.4, DIRECT TO NAV.)
4. The Parallel Offset function for the active flight plan, from the PROG page. (See Section 2.4.4, PARALLEL OFFSETS.)

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5. The Along Track Offset waypoint entered on the F-PLN pages, using the PLACE/DIST function. (See Section 2.5.3, ALONG TRACK OFFSETS, and Section 2.5.3.1, ATO WAYPOINTS.)

SID revisions are normally done only at the ORIGIN waypoint, and STAR revisions done only at the last enroute waypoint.

Pressing LSK **1L**, next to LSGG, the ORIGIN waypoint (see Figure 2-11), causes display of the "LAT REV from LSGG" page.

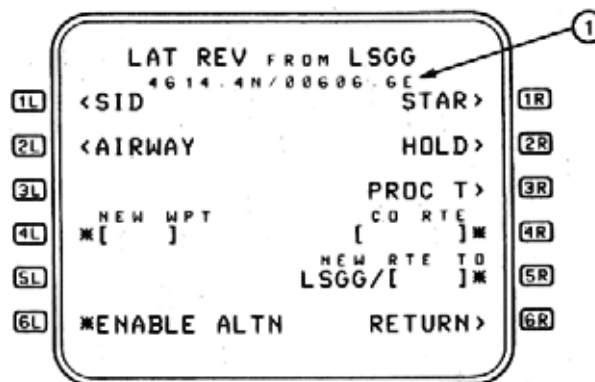


Figure 2-12

Notice that the LAT/LONG coordinates of the revise point, LSGG, are just below the title line **(1)**. This is true in all cases, except when the revise point is defined by PLACE/BEARING/DISTANCE, or it is a F-PLN DISCONTINUITY.

1L SID - Displays the SID page when pressed. This prompt is only displayed when the flight phase is PREFLIGHT, the origin airport is defined in the flight plan, and the revise point is the origin airport. This prompt is not displayed if the origin waypoint is a pilot defined runway or the origin for the alternate flight plan. (See Figure 2-12.)

1R STAR - Provides access to the STAR page. This prompt is displayed whenever a destination airport has been defined, and the revise point is any waypoint other than the FROM waypoint. (See Section 2.4.6, RWY/STAR SELECTION.)

2L AIRWAY - When pressed access is provided to the AIRWAY page, to allow selection of any airway segment comprising multiple waypoints, to facilitate manual flight planning. This prompt is displayed when the revise point is a fixed waypoint, except when it is a pilot defined waypoint, navaid, runway, or airport. (See Section 2.1.3.2.4, AIRWAYS PAGE.)

2R HOLD - This function is used to insert a holding pattern with a manual termination leg into the flight plan, or modify the parameters of an already existing holding pattern. (See Section 2.5.4 HOLDING.)

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3R PROC T - Provides access to the procedure turn page. This prompt is displayed only if the revise point is a fixed waypoint, or is the manual termination of a procedure turn leg which is not active. This prompt is not displayed if the revise point is the FROM waypoint, or the manual termination point of an active procedure turn leg. (See Section 2.6.3, PROCEDURE TURN.)

4L NEW WPT - is used to insert a fixed waypoint directly into the flight plan. The waypoint may be defined by its identifier, LAT/LONG, or PLACE/BEARING/DISTANCE.

When the LSK adjacent to the bracket prompt is pressed, with the desired identifier in the SP, the new waypoint is strung directly into the flight plan and display reverts to the F-PLN page. If the revise point is the FROM waypoint, it becomes PPOS, and a F-PLN DISCONTINUITY is strung between PPOS and the new waypoint. If the NEW WPT is a part of the downpath route, a DIR TO leg will be constructed, and all intervening waypoints will be deleted. (See 3.1.3.2.6, WAYPOINT INSERTION/F-PLN A and B. PAGES.)

4R CO RTE - This function allows a flight plan revision by designating a pre-stored company route from an enroute revise point. The desired CO RTE number is inserted in this field, causing all downpath waypoints, from the revise point, to be deleted and the new route to be inserted. (See Section 2.1.3.2.5 CO RTE.)

NOT IMPLEMENTED

5R NEW RTE TO - This function is used to define a new destination for the FMC. The destination must either be an airport stored in the data base, or a runway created by the defined waypoints function (See DEFINED WAYPOINTS, 7. 2. 1). Function is most often used for an emergency return to the origin airport or a diversion to a previously undefined destination after a missed approach at the primary destination. (See Section 2.3.2.2 NEW ROUTE TO.)

6L ENABLE ALTERNATE - Used to activate the alternate flight plan if an alternate destination has been specified on the INIT A page. All primary flight plan waypoints and constraints are deleted downpath of the revise point, and the alternate route is strung from the revise point with a F-PLN DISCONTINUITY between it and the first waypoint.

6R RETURN - Prompt returns the display to the F-PLN page, or the accessing page.

2.1.3.2.1 SID/RWY Selection

Referring back to Figure 2-12, pressing LSK **1L**, adjacent to the SID prompt, accesses the SID page. In this case, the title line is, "SID from LSGG", and a list of available SIDS and RWYS is displayed.

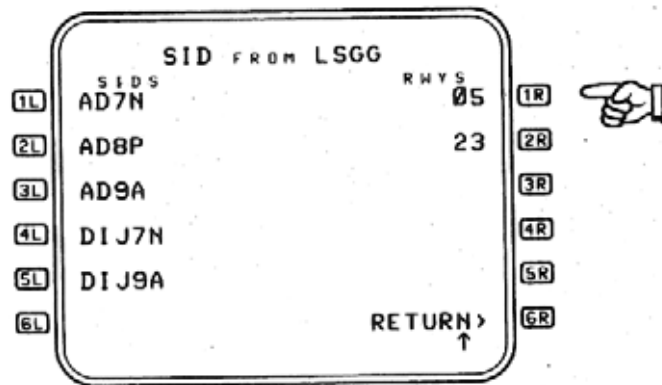


Figure 2-13

Either the SID or the RWY may be selected first. Assuming this flight has been cleared for a FRI8N departure, pressing LSK 1R selects RWY 05 for departure, and changes the display to that shown in Figure 2-14.

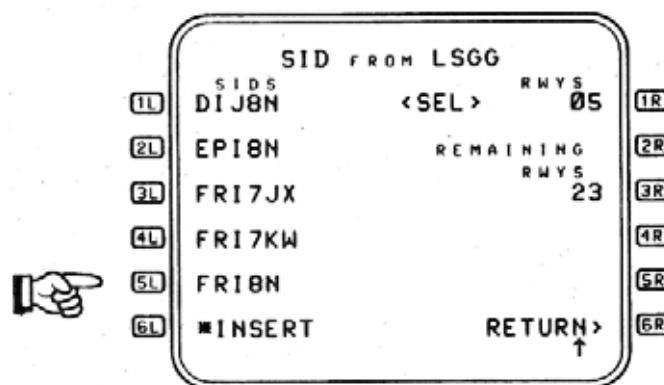


Figure 2-14

The selected runway is indicated by the < SEL > 05 in line 1R. If necessary, the scroll function may be used to view the entire list of SIDS compatible with RWY 05. Pressing LSK 5L in Figure 2-14 selects the FRI8N SID and displays Figure 2-15.

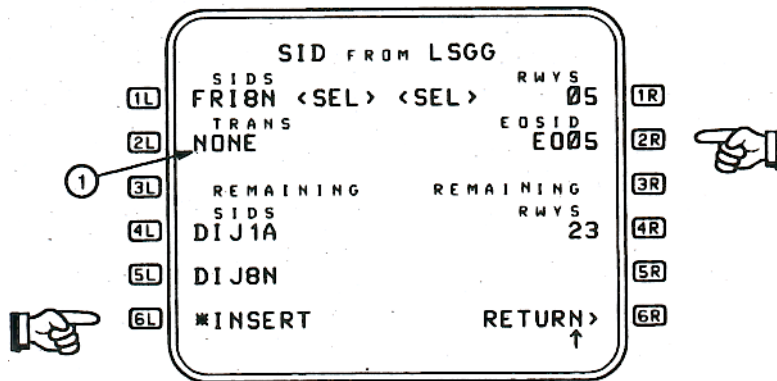


Figure 2-15

The SID selected is now indicated by the FRI8N < SEL > in line 1L. Departure transitions (TRANS), if any, are listed above the REMAINING SIDS label prior to selection. Only the TRANS selected is displayed after one is selected from the list. If no TRANS exist for the SID selected, NONE is displayed in the field (1). Other SIDS and RWYS are listed under REMAINING SIDS or REMAINING RWYS. These may be viewed through use of the slew keys on the CDU.

Notice the ENGINE OUT SID (EOSID) in line 2R, Figure 2-15. There is only one in the database for each runway, and it is automatically displayed when the runway is selected. Pressing 2R selects <SEL> the displayed EOSID.

NOTE: If the SID page was accessed from the SEC or ALTN F-PLN pages, no SID prompt is displayed.

Pressing the *INSERT prompt, 6L, results in the selected departure being strung into the flight plan, and the display returning to the accessing F-PLN page.

2.1.3.2.2 WPT/NAVAID ENTRY

Figure 2-16 shows the SID as far as Fribourge (FRI), the end point of this departure, followed by a F-PLN DISCONTINUITY because the route has not been defined beyond this point.

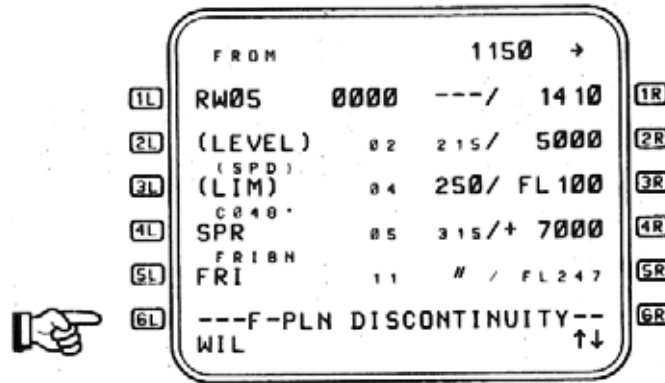


Figure 2-16

With Willisau (WIL), the next waypoint along the route of flight, typed in the scratchpad, pressing LSK **6L** strings it into the flight plan and move the F-PLN DISCONTINUITY down one data line.

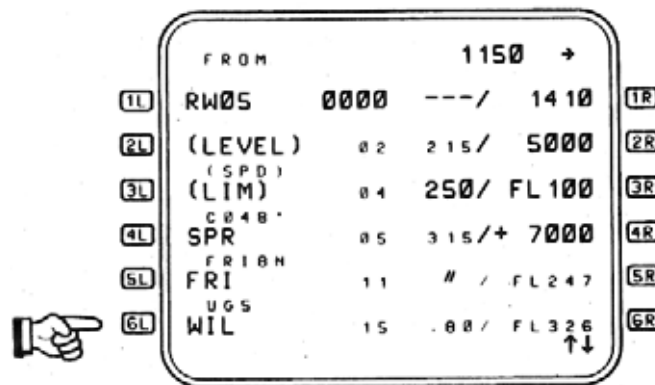


Figure 2-17

An entire route may be constructed in this manner, however, there are other options to accomplish the same result.

2.1.3.2.3 NEW WAYPOINT Function

The NEW WAYPOINT function is accessed from the LAT REV page. When manually stringing a flight plan, the revise point would be the last waypoint defined. Using this function, the new waypoint is strung in the flight plan after the revise point, with a DIRECT TO leg, and is followed with a F-PLN DISCONTINUITY, providing no downpath waypoints exist.

Pressing LSK **6L**, next to WIL, Figure 2-17, accesses the LAT REV from WIL page.

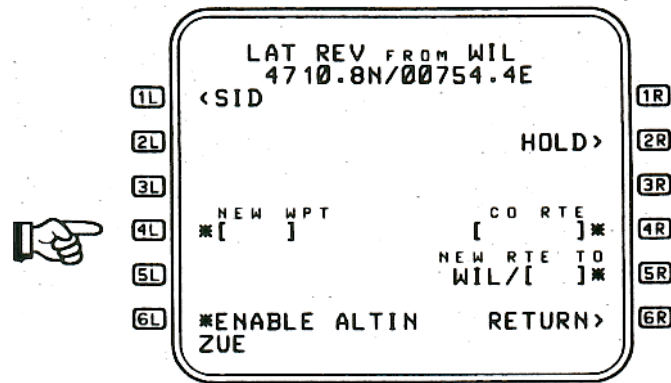


Figure 2-18

Type the desired waypoint in the SP - ZUE is the next waypoint along the planned route of flight - and press LSK **4L**

F-PLN A page is displayed with the new waypoint strung in the flight plan.

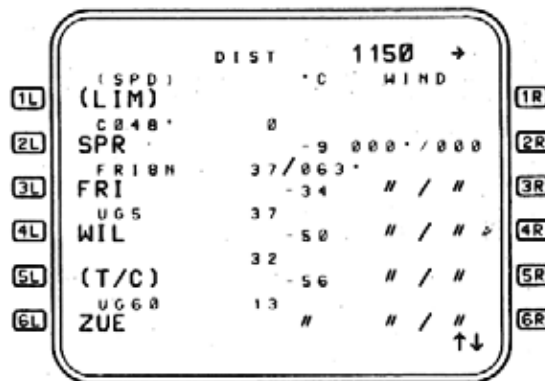


Figure 2-19

Either of the preceding two methods may be used to string the flight plan all the way to the destination.

A faster method would be to select an end point along the flight plan route, and string all the waypoints between PPOS and the end point on that airway segment.

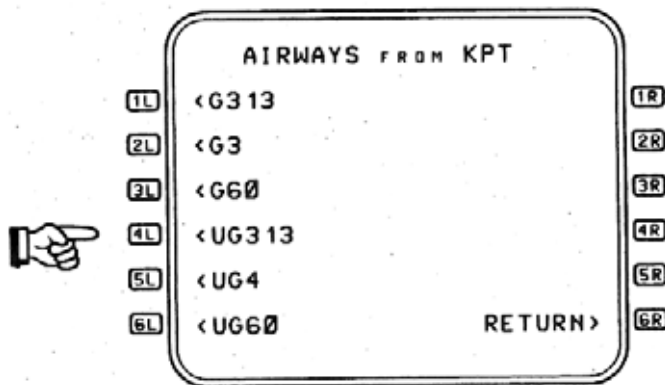
2.1.3.2.4 AIRWAYS Page

Accessed from LAT REV page, the AIRWAYS page may be used to string an entire airway segment along the route of flight. (See Figure 2-12, and Section 2.1.3.2, LATERAL REVISIONS.)

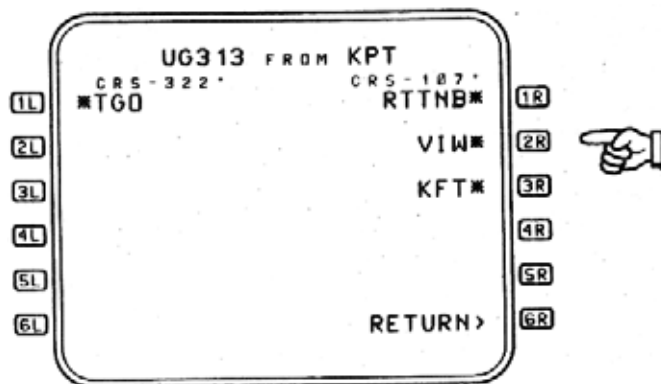
Referring to the route of flight (Figure 2-10), Kempten (KPT) is the next waypoint. The Airway from KPT to Villach (VIW) is UG313.

After entering KPT into the flight plan, the desired revise point for a LAT REV to continue the manual stringing process will become KPT.

A LAT REV from KPT is done, and the AIRWAYS page is accessed by pressing LSK **2L**, Figure 2-12.


Figure 2-20

The airways page lists all airways defined by the Kempten VOR, including Low Altitude. Select UG313 by pressing LSK **4L**. Figure 2-21 lists the end points associated with UG313 from KPT - notice the title line.


Figure 2-21

The airway courses FROM KPT are at the top of each list. Pressing VIW*, the desired end point, LSK **2R**, strings this airway segment in the flight plan.

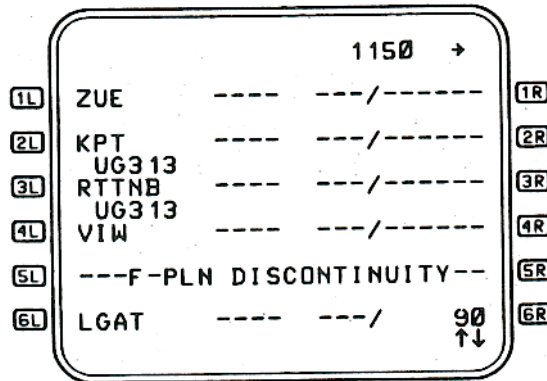


Figure 2-22

Notice the label line above **3L** and **4L**, UG313, and the route of flight to VIW, to confirm the previous action.

A LAT REV from VIW produces an airway list which includes UB1. Selection of this airway would allow completion of the flight plan to destination.

2.1.3.2.5 CO RTE



Referring back to Figure 2-12, the CO RTE option, in **4R**, represents yet another method to define a flight plan from the desired revise point through the LAT REV function.

Assume a manually defined flight plan route intersects a CO RTE to the same destination, (e. g., at Dolsko DOL, VOR, CO RTE 20441). If desired, CO RTE 20441 (numerics only), could be entered into data field **4R**. This one action would string the remainder of the route, from DOL to LGAT into the flight plan.

2.1.3.2.6 Waypoint Insertion/F-PLN A and B Pages

Waypoints are inserted into the flight plan by first typing the alpha numerics in the scratchpad, and then inserting the data into the desired field by pressing the adjacent LSK. (See APPENDIX B, DATA FORMATS, for the correct format.)

NOTE: Incorrect data format is indicated by the SP message, "FORMAT ERROR". A data entry attempt into the wrong field generates the SP message, "NOT ALLOWED".

Waypoints may be inserted directly into the flight plan, from the SP, at any point other than the FROM waypoint, by any of the following methods:

- By its identifier, if it is contained in the data base, as was previously demonstrated.
- By its identifier, if it has been pilot defined on the NEW WAYPOINT page (not in data base).
- By its LAT/LONG, (e. g., LL01 would be the first LAT/LONG waypoint, and would be displayed on the ND as LLO1.)
- By its PLACE/BEARING/DISTANCE, (e. g., ZUE/225/15 would be displayed on the ND 15NM from ZUE on a bearing of 225 deg). PBDO1 would be the first PLACE/BEARING/DISTANCE waypoint, and would be displayed on the ND as PBDO1.
- By its PLACE/DISTANCE, (e. g., ZUE/15 would be displayed on the ND, on the route of flight, 15NM after ZUE, ZUE/-15 would occur 15NM before ZUE). PDO1 would be the first PLACE/DISTANCE waypoint, and would be displayed on the ND as PDO1.
- By an airport identifier, (e. g., LSGG.)
- By a runway threshold identifier, (e. g., LSGGO5.)

NOTE: The FMC stores a total of 20 pilot defined waypoints of all types.

(See also Section 5.2.1, DEFINED WAYPOINTS, and Section 5.2.5, DEFINED NAVAIDS.)

2.1.3.2.7 Waypoint Deletion on F-PLN A and B Pages

Waypoints are deleted from the active flight plan, on either F-PLN A or B pages, by first insuring the SP is clear of data, and then pressing the **CLR** function key on the CDU keyboard. CLR is written in the SP, and may then be transferred to the desired waypoint field by pressing the adjacent LSK.

Referring to Figure 2-23, pressing LSK **4L** deletes WIL from the flight plan and the display changes to that shown in Figure 2-24.

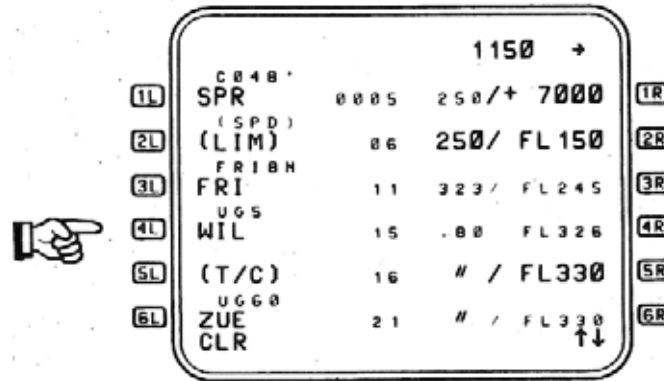


Figure 2-23

WIL is replaced by a F-PLN DISCONTINUITY, Figure 2-24, which may be deleted in the same manner the waypoint was. (See Section 2.1.3.2.8, F-PLN DISCONTINUITY - PURPOSE/CLEARING.

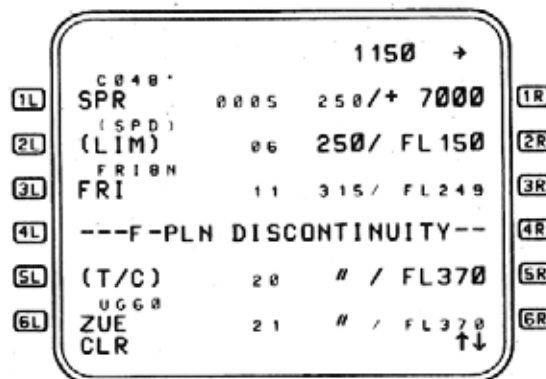


Figure 2-24

Depending on the type of the waypoint cleared, the results of this action are as follows:

- Clearing a downpath waypoint deletes the selected leg from the flight plan, and replaces it with a F-PLN DISCONTINUITY.
- Clearing the TO waypoint deletes that leg from the flight plan, causes T-P (TURNING POINT) to become the FROM waypoint, and strings a direct leg to the next fixed waypoint. If the TO waypoint becomes a F-PLN DISCONTINUITY, or is followed by one, the FROM waypoint becomes PPOS (PRESENT POSITION).
- Clearing the TO waypoint is not allowed, if aircraft position is invalid. See paragraph 8.6.
- Clearing FROM waypoint generates a new active leg. Clearing the FROM waypoint is not allowed if NAV is engaged. SP message, "NOT ALLOWED" is displayed in both cases.

- Clearing the origin or destination waypoint is not allowed. SP message, "NOT ALLOWED" is generated if the attempt is made.

2.1.3.2.8 F-PLN Discontinuity - Purpose/Clearing

Discontinuities, or flight plan gaps, may occur as part of a data base stored CO RTE, SID, STAR, or result from a lateral flight plan revision. A discontinuity may exist within a primary route leg between way points, and is normally encountered when no stored route exists between two waypoints, or the route requires manual definition by the pilot.

Whenever the FMC creates a discontinuity in the flight plan, the first leg following the discontinuity will be an initial fix (IF). All legs are deleted from the beginning of the discontinuity up to the first leg containing a fixed waypoint termination, and this waypoint is then converted to an initial fix.

Discontinuities are indicated by the flight plan marker. F-PLN DISCONTINUITY, displayed across the entire width of the CDU in a data line. Clearing a discontinuity results in the two waypoints being reconnected on the F-PLN page as well as on the ND.

Referring back to Figure 2-24, with CLR in the SP, the F-PLN DISCONTINUITY is cleared by pressing LSK **4L**. Additionally, a waypoint may be inserted on top of the F-PLN DISCONTINUITY, as in manual flight planning, causing it to move down one data line, to be cleared after the flight plan is strung. (See Section 2. 1. 3. 1, WAYPOINT STRINGING, and Section 2. 1. 3. 2, LATERAL REVISIONS.)

2.1.3.3 F-PLN A Page

Lateral and vertical elements of both flight plan pages are listed in the time sequence of their occurrence. The purpose of the F-PLN pages is to display these elements in a waypoint by waypoint format which includes the time, speed, and altitude of each segment of the route, with selection capability for situational modes where available. (See Section 2. 4. 1, SITUATIONAL MODES.)

- The F-PLN A page is accessed manually by:
- The **F-PLN** mode key on the CDU.
- The **NEXT PAGE** function key from the F-PLN B page.

The F-PLN A page is displayed automatically:

- When a fixed waypoint is entered on the DIR TO page.
- When a revision page, accessed from the F-PLN A page, is inserted in the flight plan.
- From the INIT A or RTE SELECTION page when the flight phase transitions from PREFLIGHT or DONE to an active in-flight phase.
- From a MAINTENANCE page when the flight phase transitions from PREFLIGHT or DONE to an active in-flight phase.


NOT IMPLEMENTED

FROM		1150 →		
1L	RW05	0000	--- / 1410	1R
2L	(LEVEL)	02	215 / 5000	2R
3L	(SPD)	04	250 / FL100	3R
4L	SPR	05	315 / + 7000	4R
5L	FRI	11	# / FL247	5R
6L	WIL	15	.80 / FL326	6R

Figure 2-25

Figure 2-25, is an example of the F-PLN A page as it would appear with LSGG/LGAT defined.

Vertically in columns, from left to right, the page contains the following data:

Title Line - The flight number, as entered on the INIT A page (field blank if no flight number is entered), appears on the right side of the page, followed by the NEXT PAGE arrow  **NOT IMPLEMENTED**

1L 6L Waypoints, pseudo waypoints; flight plan markers (F-PLN DISCONTINUITY, END OF F-PLN, etc.), with leg type information is displayed in the first vertical column; the FROM waypoint is always at the top of the column in line 1, followed by the TO waypoint in line 2, unless separated by a pseudo waypoint. In this case, the pseudo waypoints (LEVEL) and (SPD LIM) occur before SPR, the TO waypoint.

The time, speed, and altitude for the FROM waypoint (in line 1) are memorized parameters, not predicted, and are displayed in large font. If PPOS is the FROM waypoint, dashes are displayed in all three fields. If the FROM waypoint is also the ORIGIN waypoint, TIME is as stated under NOTE below, SPEED is V1 as defined on the TAKEOFF page (dashes if not defined), and the ALTITUDE is the origin field elevation or the runway elevation rounded to the nearest 10 feet.

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Time enroute for each leg is displayed in the second vertical column. For predicted times the hour is not included on successive lines unless it changes, with the exception of line 1, where it is always displayed. Hours are always be displayed with a time constraint.

NOTE: Prior to takeoff the times are ETE; after takeoff the time in line 1 changes from zeroes to the time airborne, and the times for each leg become ETAs at the waypoint/navaid.


1R 6R Speed and altitude for each leg (large font indicates a constrained value, small font indicates a computed value) is displayed on the right half of the screen for each waypoint, both geographic and pseudo. A ditto symbol ("") in the speed/altitude column indicates the predicted values do not change for that segment. Constrained speed/altitude values are always presented.

Speed is normally FMC generated (small font) and is a predicted value at the waypoint, unless a pilot entered speed constraint is displayed (large font).

In cruise flight, if the Mach is less than .65, the corresponding CAS is displayed.

Above the crossover altitude Mach is displayed unless it is below .65 (see above). Below the crossover altitude CAS is always displayed. The crossover altitude is defined as the altitude where CAS and Mach represent the same value of TAS.

A (+) or (-) next to the waypoint altitude means a crossing restriction at that waypoint of the value indicated, (e. g., line **4R** , + 7000, indicates that SPR must be crossed at or above 7000 MSL.) The baro corrected altitude is displayed in feet (rounded to the nearest 100) below the TRANS ALT and FL (QNE) above the TRANS ALT. Prior to T/C the origin TRANS ALT is used, after T/C the destination TRANS ALT is used (from database unless changed by the pilot).

The vertical scroll symbol , in the right side of the SP,

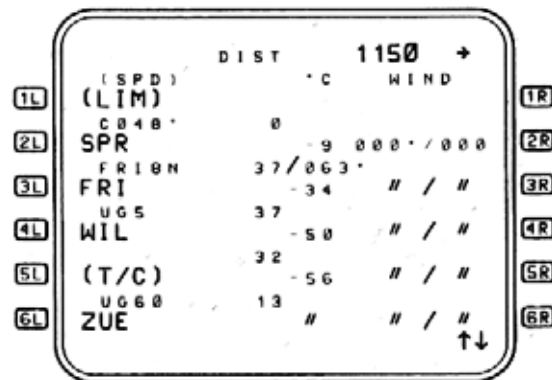
indicates the flight plan may be scrolled up or down through use of the scroll up or scroll down function keys. Each key press scrolls the display one data line.

  (See Section 2.1.3.5. VERTICAL REVISIONS - CONSTRAINTS.)

2.1.3.4 F-PLN B Page

The F-PLN B page format is identical to the F-PLN A page insofar as display of the flight plan is concerned. In addition to the display of flight plan route, the right half of the F-PLN B page displays the leg distance, temperature, and wind for each waypoint. The F-PLN B page is accessed:

- Manually via the **NEXT PAGE** function key from the F-PLN A page.
- Automatically from any revise page accessed from the F-PLN B page.



	DIST	°C	WIND
(SPD)	1150		
(LIM)			
CR4B	0	-9	000 / 000
SPR			
FR10H	37	063	
FRI		-34	# / #
UG5	37		
WIL		-50	# / #
(T/C)	32	-56	# / #
UG60	13		
ZUE		#	# / #

Figure 2-26

With reference to Figure 2-26, the F-PLN B page displays, from left to right in vertical columns:

- 1L 6L** Waypoints, pseudo waypoints, flight plan markers (F-PLN DISCONTINUITY, END OF F-PLN), with track to the next waypoint, is identical to the F-PLN A page.
- 1R 6R** The DIST, is the enroute distance between waypoints, to a maximum value of 4096NM. The distance to the TO waypoint is along track distance to go. For pseudo waypoints in the TO position (second data line), the distance is the along track distance from PPOS to the predicted LAT/LONG of the pseudo waypoint. Distance is not displayed for all leg types.

The forecast temperature, in degrees Celsius, is displayed for each waypoint, except the FROM waypoint where the temperature is the actual memorized value for that position. If the FROM waypoint is PPOS, dashes (----) are displayed in the temperature field. Temperature is displayed in both large (pilot entered) or small (predicted or default) font. Temperature is displayed at the T/C or T/D, but not at any other pseudo waypoints.

The forecast wind direction/velocity, based on pilot entries is displayed for each waypoint, except the FROM waypoint where the actual forecast wind for that waypoint is displayed. If the FROM waypoint is PPOS, dashes (----) are displayed. Wind direction is referenced to True North. Wind values are displayed in both large (pilot entered) and small (default or predicted) font. Wind is displayed at T/C and T/D, but not at any other pseudo waypoint.

Other page data and symbology is identical to the F-PLN A page.

2.1.3.5 VERTICAL Revisions

Vertical revisions are changes made to the flight plan which have an immediate or downpath (future) affect on the active flight plan vertical profile. This vertical profile represents the desired aircraft trajectory, thrust settings, and speeds along the vertical path of the flight plan.

The two vertical revision pages are accessed from F-PLN A and F-PLN B pages and are displayed automatically when a right LSK is pressed adjacent to the desired waypoint on either flight plan page.

Vertical revisions to the flight plan can be made at any point along the route of flight. The displayed page corresponds to the accessing page; (i. e., F-PLN A page allows access to VERT REV A page, F-PLN B page/VERT REV B page).

The following revisions to the vertical profile may be changed or revised on these two pages:

- Speed limits and climb, cruise, or descent speeds
- Altitude and time constraints
- Altitude steps
- Temperature and wind revisions

Entry of a vertical revision causes a complete recalculation of the vertical flight plan profile and invalidates all performance predictions - dashes are displayed in the data fields until the data is recalculated.

Vertical revisions may be made to the primary, secondary, and alternate flight plans. The method to accomplish these revisions is identical in all three cases, however, changes which may affect the active situation are not allowed in either the secondary or alternate flight plans. (See Section 5, ADDITIONAL FEATURES, for specific data on secondary and alternate flight plans.)

If the vertical revision does not meet certain criteria, it is rejected by the FMC, and the SP message, "NOT ALLOWED", is displayed.

NOTE: Any pilot entered or procedure specified vertical flight plan constraint is displayed in large font.

2.1.3.5.1 Time Constraint Entry

A time constraint is defined as a time requirement (ETD, ETA), to be met at a specified waypoint in the lateral flight plan. Based on the performance predictions of the vertical profile, the FMC adjusts the vertical guidance speed target during the cruise flight phase to meet the desired time constraint.

Time constraints may be entered at any fixed waypoint in the flight plan, from the vertical revision page, except under the following conditions:

- ENG OUT mode is active.
- No valid clock data.
- Active lateral leg is a holding pattern or procedure turn.
- A STEP is in the primary flight plan.
- A destination is not defined in the primary flight plan.
- A EOSID or missed approach is being flown.
- Entry is attempted on a leg not in the primary flight plan.

The SP message, "NOT ALLOWED", is displayed if any of the above conditions exist when an entry attempt is made.

Time constraints are automatically deleted from the flight plan for the following:

- Activation of the EO mode.
- Loss of valid clock data.
- When the aircraft transitions to airborne.
- When a second time constraint is entered into the flight plan.
- The active leg has a manual termination.

The SP message, "TIME CSTR REMOVED", is displayed whenever a time constraint is automatically deleted from the flight plan.

A time constraint may be thought of as being a pilot defined ETA for a specified waypoint or destination.

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With reference to Figure 2-27, assume a destination ETA of 1114 is desired for RW33R at LGAT.

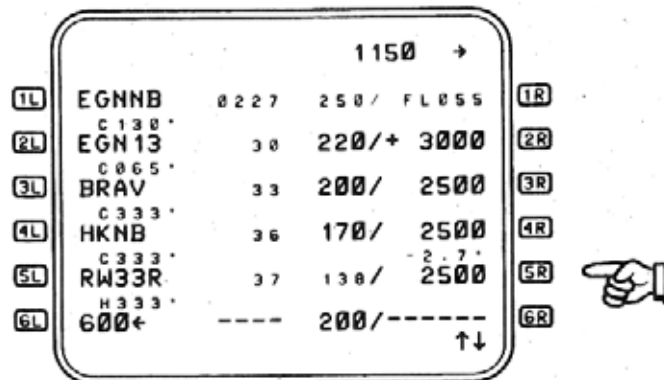


Figure 2-27

Pressing LSK **5R**, adjacent to RW33R, causes display of the VERT REV A page. The revise point is RW33R, as indicated by the title of the CDU page in Figure 2-28, VERT REV AT RW33R.

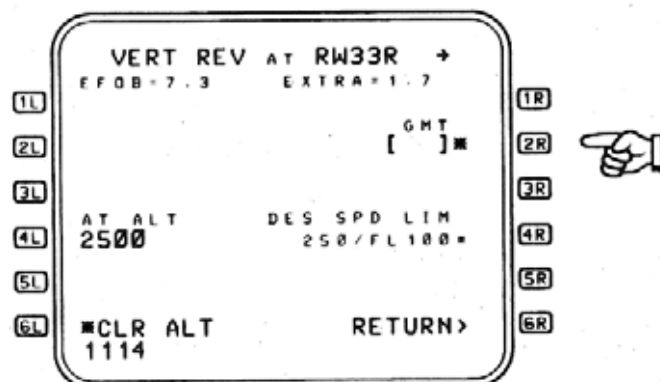


Figure 2-28

Type the desired ETA in the SP, 1114, and insert it into the field labeled, "GMT", by pressing LSK **2R**. This action results in the automatic display of the accessing page, F-PLN A page in this case.

Notice that the desired ETA is now displayed next to RW33R in line 5, **1**, and in large font to indicate that it is pilot entered data (See Figure 2-29A). Scrolling the flight plan back to the origin waypoint, RW05 at LSGG, it may be seen that in order to make good the ETA of 1114 at LGAT, using the current strategic mode, the takeoff from LSGG must be at 0837, **2** (See Figure 2-29B)

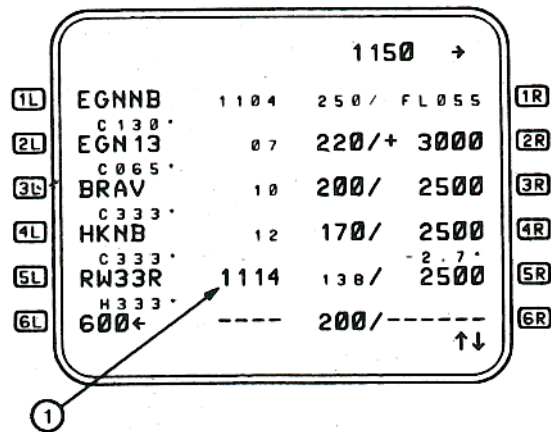


Figure 2-29A

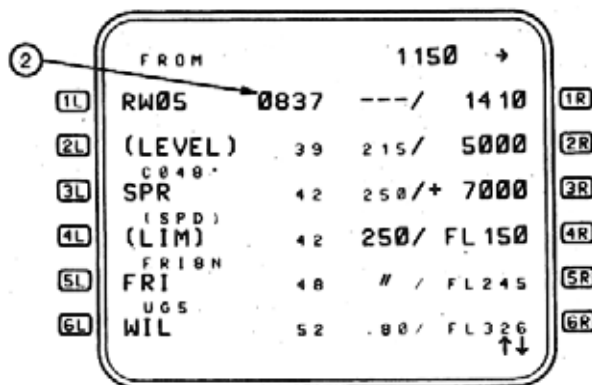
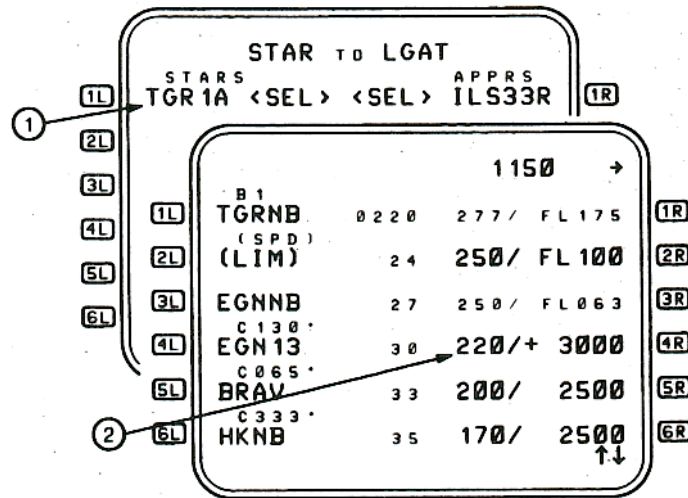


Figure 2-29B


Figure 2-30

2.1.3.5.2 Speed Constraint Entry

Speed constraints restrict the IAS of the aircraft at a specified waypoint along the lateral flight plan. During the takeoff, climb, and cruise flight phases IAS is confined to a value equal to, or less than the specified constraint, until the waypoint specifying the constraint has been sequenced.

In the descent and approach flight phases, IAS is also confined to a value equal to, or less than the specified constraint, however, the constraint is active until the flight phase transitions to a flight phase other than descent or approach.

Speed constraints may be entered manually or specified by procedure from the data base; (e.g., a specified speed at a STAR waypoint). In the latter case the constraint would be automatically inserted in the F-PLN when the approach procedure is selected from the STAR list.

With reference to Figure 2-30, the TGR1A STAR to RW33R at Athens has been selected **1**, and after the 'INSERT' prompt is pressed a speed constraint of 220 KIAS at waypoint EGN13 is automatically included with the selected procedure **2**. (See Figure 2-30)

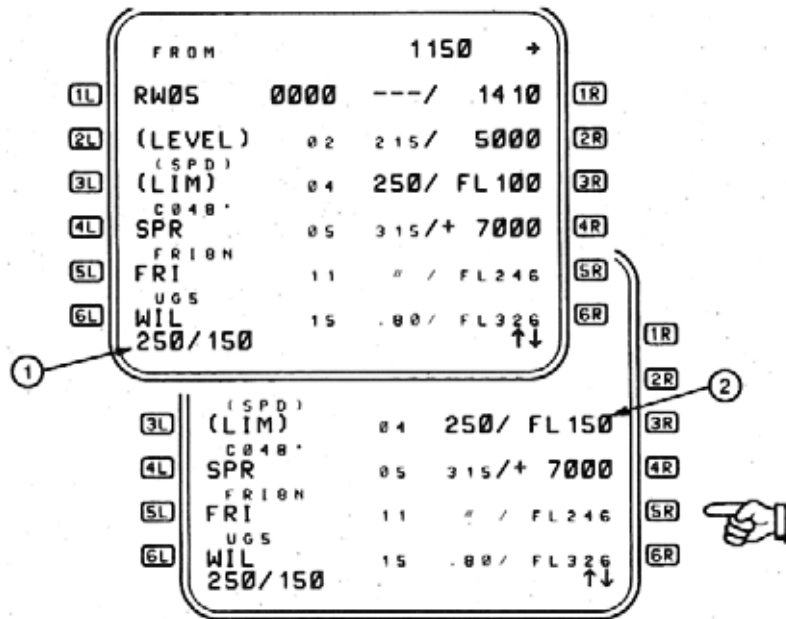


Figure 2-31

For example, with 250/150 in the SP (see Figure 2-31), **(1)** pressing LSK **3R** changes the SPD LIM pseudo waypoint values from 250/10000 to 250/15000 **(2)**

Another method would be a vertical revision at a downpath waypoint, FRI for example. Pressing LSK **5R**, (see Figure 2-31), causes display of the VERT REV at FRI page, (see Figure 2-32). The CLB SPD LIM data field, adjacent to **4R**, may be modified by writing the desired values in the SP **(1)**, and pressing LSK **4R**. This action changes the SPD LIM at FRI to 250/15000 **(2)**, and displays the new constraint in large font to indicate it has been modified by the pilot. (See Section 2.1.3.5.2.2, SPEED LIMIT, for more on the subject.)

Both methods work equally well, however, the first method, insertion directly into the desired data line, is the most expeditious.

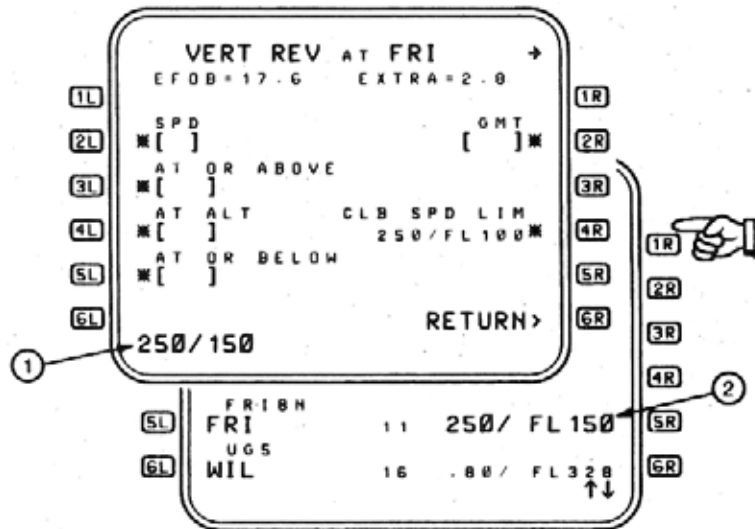


Figure 2-32

NOTE: To change back to the default value of 250/10000, press the **CLR** key, with the SP empty, and transfer CLR into the SPD LIM data field by pressing LSK **4R**

2.1.3.5.2.1 Vertical Revision Pages A & B

As previously stated these pages are accessed from F-PLN page A, and F-PLN page B respectively. Once accessed, the **NEXT PAGE** key allows access to the other page of the pair.

Figure 2-33 is an example of VERTICAL REVISION page A, on which the pilot may insert speed, altitude, and time constraints.

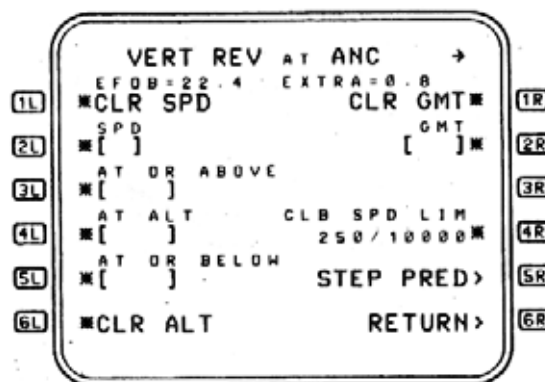


Figure 2-33

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NOTE: For the purpose of demonstration all label and data lines are included, however, they are not always displayed at the same time.

The title line displays the revise point, VERT REV at FRI. Line 2 displays the Estimated Fuel On Board (EFOB) and the EXTRA fuel predicted by the FMC at FRI. Fuel predictions are only displayed in this field if the revise point is a waypoint in the lateral flight plan.

1L CLR SPD - Displayed if a speed is defined at the revise point and inserted in data line **2L**. Pressing this LSK clears the speed in data line **2L** and return the display to F-PLN page A.

2L SPD - Entry of a speed in this field creates a speed constraint at the revise point and return the display to F-PLN page A. SPD prompt is not displayed if the revise point is a pseudo waypoint *CLB and *DESC prompts are displayed in line 6 when a SPD constraint is defined.

3L 5L Entry of an altitude or flight level in any of these data fields creates an altitude constraint at the point and return the display to F-PLN page revise A. The constraint AT, AT OR ABOVE, or AT OR BELOW, depending upon which data line the entry is made on. Line **4L** is only displayed when the revise point is the T/C. Lines **3L** and **5L** are displayed at geographic waypoints.

*CLB or *DES prompts are displayed in line 6 when an altitude constraint is defined.

6L CLR ALT - This prompt is only displayed if there is an altitude constraint at the revise point. Pressing the adjacent LSK clears the altitude constraint and return the display to F-PLN page A.

1R CLR GMT - Pressing this LSK clears the time constraint at the revise point and return the display to F-PLN page A. Prompt is only displayed if a time constraint has been entered at the revise point.

2R GMT - This prompt is only displayed if the revise point is a geographic waypoint in the primary flight plan; not including missed approach legs. Entry of a time in this field creates a time constraint at the revise point, and return the display to F-PLN page A.

4R SPD LIM - The default speed limit, 250/10000, is displayed in this field, and may be modified by the pilot. The label line displays CLB SPD LIM prior to and including the climb phase, and DES SPD LIM during and after the cruise phase. If the display criteria is not met within the FMC, **4R** is blank. Any attempt to enter a value into the blank field generates the SP message, "NOT ALLOWED". Brackets, indicating data insertion is allowed, are displayed providing the default value had been previously deleted by the pilot.

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The CLR function may be used to delete any pilot entered value. This action causes the display to revert to the default SPD LIM.

Entry of SPD LIM into this field must be in the format SPD/ALT. After data entry, a SPD LIM is created for the CLB or DES phase, and the display reverts to F-PLN page A.

5R STEP PRED - The STEP PRED > prompt is displayed in this data line whenever an altitude step may be made. Pressing this prompt causes display of the STEP PRED page. (See Section 2.1.3.5.3.1, STEP ALTITUDE PREDICTION PAGE.)

6R RETURN - Pressing the RETURN > prompt reverts the display to F- PLN page A.

NOTE: If the pilot entered speed or altitude constraint cannot be automatically assigned the correct flight phase, due to FMC internal revision requirements not being met, data line 6, (see Figure 2-34), displays the *CLB or *DES prompts whenever a constraint has been entered at the revise point, to allow manual selection of the desired flight phase.

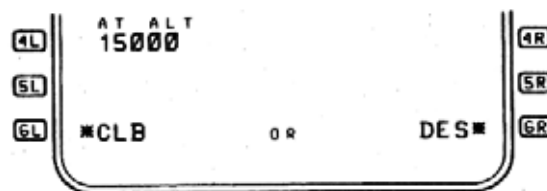


Figure 2-34

VERT REV page B, may be accessed by the following:

- Pressing the **NEXT PAGE** key when on F-PLN page A or SEC F-PLN page A.
- A VERT REV when on F-PLN page B or SEC F-PLN page.

The VERT REV B page allows the crew to enter or modify temperature and wind values at any waypoint on the flight plan. Figure 2-35 is an example of the page as it would appear when accessed - data brackets empty.

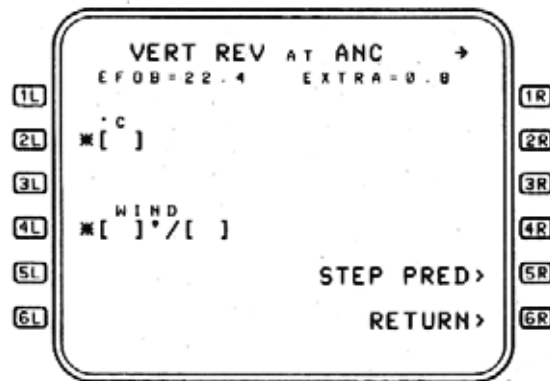


Figure 2-35

2L TEMP - The pilot may insert Static Air Temperature (SAT) at any flight plan waypoint, in deg. C.

4L WIND - A PPOS true wind value may be inserted in this field to update the current wind model.

5R STEP PRED - Accesses the STEP PRED page when displayed.

6R RETURN - Pressing this prompt returns the display to F- PLN page B.

If a temperature or wind was previously entered at the revise point, it is displayed here in large font.

NOTE: If a temperature or wind is entered at the T/C pseudo waypoint, the FMC regards it as a CRZ WIND/CRZ TEMP revision to INIT page A or the FUEL PRED page and changes the values on these pages correspondingly.

2.1.3.5.2.2 Speed Limit

SPEED LIMIT is an altitude related restriction on aircraft IAS, (e.g., 250/10000, see Figures 2-31 and 2-32). The vertical guidance speed target is determined at or below the specified altitude and is limited to the maximum defined speed.

As is always the case, a pilot entered value is displayed in large font.

Different SPEED LIMITS may be specified for the CLIMB and DESCENT flight phases.

With PROFILE engaged and the aircraft below the SPEED LIMIT altitude, the CDU SP message, "SPD LIM EXCEEDED", is displayed if the IAS exceeds the specified limit by more than 15 kts. The message automatically clears when the speed returns to within 5 kts. of that specified.

Manual clearing via the CLR key on the CDU is available at any time. This action would cause the speed limit to revert to the default value specified in the data base, and the displayed value would be in small font.

NOTES: **1. Autopilot vertical guidance initiates control to a new target speed within two seconds of any SPEED LIMIT revision/deletion affecting the vertical profile.**

2. Both speed and altitude must be entered in the correct format, (e. g., 250/10000), to be accepted by the FMC, however, either may be modified individually providing the other has already been specified.

2.1.3.5.2.3 Thrust Reduction Altitude

In addition to being the lowest altitude at which the vertical flight path, or PROFILE mode, may be engaged, the THRUST REDUCTION ALTITUDE defines the vertical location at which the FMS commands the TCC to reduce the maximum thrust limit from the pilot defined Takeoff/Flex Takeoff thrust limit to the FMS thrust limit.

If the A/THR mode is SPEED or SPEED ON THROTTLE, the thrust reduction altitude has a direct impact on IAS while still in the confines of the airport traffic area.

2.1.3.5.2.4 Acceleration Altitude

The ACCELERATION ALTITUDE defines the vertical location at which the FMS can command an acceleration to the desired climb speed, (e.g., 250 KIAS below 10000 MSL).

NOTE: **Both THRUST REDUCTION ALTITUDE and ACCELERATION ALTITUDE may be modified to comply with any desired speed schedule, however, changes to either may only be accomplished on the TAKEOFF page. They cannot be changed on the F-PLN page or a VERT REV page. (See Section 2.2.1.2, TRANS/THR RED/ACC ALTITUDES.)**

2.1.3.5.3 Altitude Constraint Entry

As previously mentioned there are three types of altitude constraints which may be entered into the flight plan:

- AT
- AT OR BELOW
- AT OR ABOVE

All may be manually entered by the pilot, or procedure specified from data base.

As a general rule of thumb, altitude constraints must be:

- Above the origin airport for CLB PHASE
- Above the present altitude for a climb constraint
- Below the present altitude for a descent constraint
- Above the destination airport for DES and APPR phase.

If the altitude constraint does not conform to required criteria, it is rejected by the FMC, and a suitable SP message is generated; (e.g., INITIALIZE CRZ FL, NEW CRZ ALT-HHHH, etc.)

As with SPD and TIME constraints, altitude constraints may either be inserted directly into the flight plan by writing the data in the SP for transfer into the desired data field, or by vertical revision at the desired waypoint.

Examples of both methods may be seen in Figure 2-31 (direct into F-PLN), and Figure 2-32 (via VERT REV page A).

Figure 2-36, is an example of an AT OR ABOVE altitude constraint at a geographical waypoint.

	FROM		1150	→	
1L	RW05	0000	---/	1410	1R
2L	(LEVEL)	02	215/	5000	2R
3L	(SPD)				
3L	(LIM)	04	250/	FL100	3R
4L	C040*				
4L	SPR	05	315/+	7000	4R
5L	FRI	11	" /	FL246	5R
6L	UGS				
6L	WIL	15	.80/	FL326	6R
	250/150			↑↓	

Figure 2-36

In this case the vertical profile is modified by the FMS to cross SPR AT OR ABOVE 7000. The + 7000 (1) specifies the AT OR ABOVE, while AT OR BELOW would be entered as a - 7000.

An altitude constraint entry at the T/C pseudo waypoint redefines the CRZ ALT in the FMC in the same way as entry of a new CRZ ALT on the PROG PAGE. In this case the new altitude is not a constraint, but rather a new cruise altitude. (See Section 2.2.6, PROG PAGE, and Section 2.4.2, CRZ ALT CHANGE.)

In like manner, an altitude constraint entry higher than the CRZ ALT defined in the FMC, causes the CRZ ALT to be redefined to the new altitude. The SP message, NEW CRZ ALT-HHHH, with "H" being the altitude or FL, is displayed to advise the crew of the cruise altitude change in the FMC.

2.1.3.5.3.1 Step Altitude/Prediction Page

A downpath altitude step may be thought of as being a form of altitude constraint, to either satisfy an ATC request, or as a normal part of the flight plan to conserve fuel during the cruise phase, or position the aircraft vertically for an anticipated STAR. There are of course, two possibilities along the vertical profile for altitude steps, STEP CLB and STEP DES. The STEP CLB segment is active when the following conditions exist:

1. Profile is engaged.
2. CRZ is the active flight phase.
3. The STEP CLB pseudo waypoint is a part of the active F-PLN.
4. The STEP point has been sequenced on the lateral F-PLN.
5. Actual aircraft altitude is below the FCU clearance altitude.
6. EO Driftdown Situational Mode is not active.

The STEP DES segment is active when the following conditions exist:

1. Profile is engaged.
2. The STEP DES pseudo waypoint is a part of the active F-PLN.
3. The STEP point has been sequenced on the lateral F-PLN.
4. Actual aircraft altitude is above the FCU clearance altitude.
5. EO Driftdown Situational Mode is not active

In both STEP CLB and STEP DES the AFS commands the vertical guidance path target, speed target, vertical speed target, thrust target, and control mode, with

PROFILE engaged, as follows:

1. The CRZ FL is the vertical guidance path target.
2. Speed target is defined according to the following priority:
 - If TACT SPD mode is active the speed target is the defined tactical speed entry, (e. g., ECON).
 - If a Hold is active or is to become active within 3 minutes, with a heading leg to a manual termination (HM), (e. g., IMM EXIT), the speed target is the pilot entered Hold Speed. If a pilot entered Hold Speed has not been specified, target is the MAX END speed.
 - The speed target is the PERF MODE CRZ SPD for the STEP CRZ FL.
3. The vertical speed target is —1000 ft/min or the pilot defined vertical speed on the FCU, until the IAS reaches the limiting speed as defined on the TACT MODE page.
4. The vertical guidance thrust target is maximum climb thrust in climb and idle thrust in descent.
5. The vertical guidance control mode is speed on thrust or speed on elevator, or combinations of each, to maintain the selected IAS or vertical speed.

In climb or descent the FMC commands a vertical rate commensurate with IAS as defined on the MODE or TACT MODE pages (see Section 2.1.3.5.5, PERF MODES). Once the speed target is reached, speed is maintained on elevator or thrust as necessary, modifying vertical speed in compliance with whichever parameter is active - IAS/Vertical Speed. In descent a — 1000 ft/min vertical rate is commanded, or the vertical rate selected by the pilot, until the speed target is reached, then vertical speed is modified by the FMC to maintain the descent speed restriction.

Vertical guidance commands are apportioned according to the active situation, with approximately 70 percent devoted to the active parameter and 30 percent to the inactive parameter.

For example, with vertical rate active, 70 percent of the available energy would be devoted to the commanded vertical rate and 30 percent to the commanded IAS, until the speed target is reached, then the 70 percent shifts to maintaining speed and the remaining 30 percent goes to vertical rate.

This division of available energy is most apparent climbing through 10, 000 feet when IAS target increases to the selected climb speed. Vertical speed drops off as 70 percent of available energy is devoted to the new target speed.

The pilot has the option of overriding this automatic vertical guidance by selecting the desired vertical rate in the V/S window of the FCU and pulling the set knob, engaging the AFS in the V/S mode. Vertical speed then is only restricted by VMAX and VMIN for the configuration. This option is available to comply with ATC requests to expedite altitude changes or when higher than FMC commanded rates are desired.

The point along the lateral flight plan at which the climb or descent is to occur, called the STEP point, is the point at which the vertical flight plan changes from one cruise altitude to another cruise altitude. The STEP point is indicated on the F-PLN pages and the ND by the pseudo waypoints S/C (STEP CLB) and S/D (STEP DES).

Prior to executing an altitude step the crew has the option to view the predictions associated with it on the STEP PRED page, to determine if such action is warranted as far as fuel savings are concerned.

An altitude step is available when the following conditions exist:

- The flight plan is either:
 - The active primary
 - The secondary with performance predictions enabled
- A cruise flight level has been defined.
- A step altitude is not active.
- A time constraint has not been defined.
- The revise point is a fixed geographical waypoint, or the FROM waypoint, except PPOS.
- The flight phase is not descent or approach.

If the above criteria are not met, the field is blank and data entry is not allowed.

NOTE: The STEP PRED prompt is also displayed on VERT REV page B under the same criteria as that stated for VERT REV page A, above.

As previously mentioned, access to the STEP PRED page begins on either F-PLN page with a VERT REV. Regardless of the accessing page, however, the resulting displays are identical. Figure 2-37 is an example of a VERT REV from F-PLN page A at MELNB.

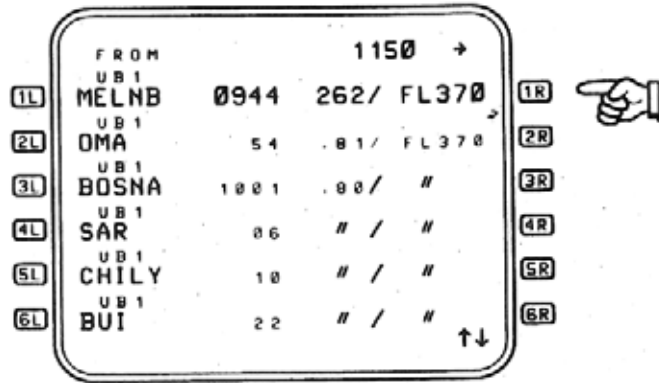


Figure 2-37

Pressing LSK **1R** results in display of the VERT REV at MELNB page.

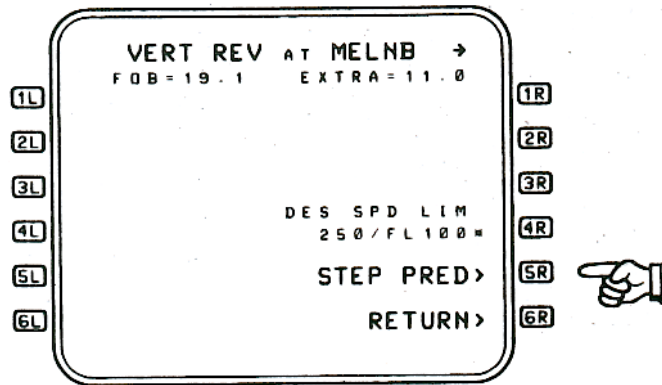


Figure 2-38

In this case the display criteria have been met and the STEP PRED > prompt is displayed. If the prompt is not displayed, a step altitude is not available.

Pressing LSK **5R** accesses the STEP PRED page.

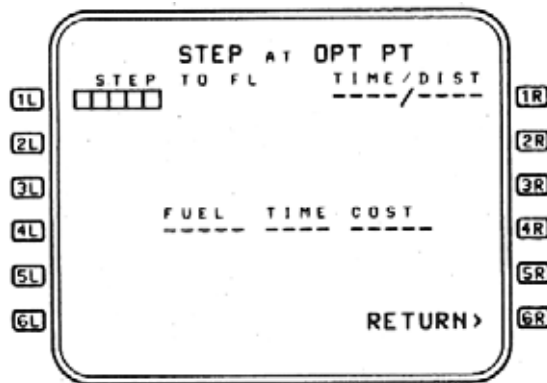


Figure 2-39

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The title line is the point at which the step takes place. There are two possibilities for the title line, depending on whether the revise point is the FROM waypoint or a downpath waypoint. In this example, MELNB is the FROM waypoint. When the FROM waypoint is the revise point, the title line on the STEP PRED page is STEP at OPTIMUM POINT.

All this means is that the step point is calculated by the FMC rather than specified by the pilot to commence at a downpath waypoint.

If MELNB, the revise point, was a downpath waypoint, the title line would be STEP at MELNB.

Operationally speaking, the STEP at OPTIMUM POINT would most often be used for fuel planning purposes or to comply with an altitude change in real time; while a STEP at a downpath waypoint might be to comply with an ATC request.

In both cases the label and data lines are identical.

1L STEP TO FL - The desired step altitude is written in the SP and transferred into the boxes. The FMC makes the determination between a STEP CLB and STEP DES based on whether the altitude specified by the pilot is above or below the CRZ ALT. Step altitude must be within 8000 ft of CRZ ALT. In the case of a STEP CLB, the specified altitude must be above the highest altitude constraint or the SP message, "ENTRY OUT OF RANGE", is displayed, and entry of the step will not be allowed. Entry of an altitude into this field causes the display to revert to Figure 2-40.

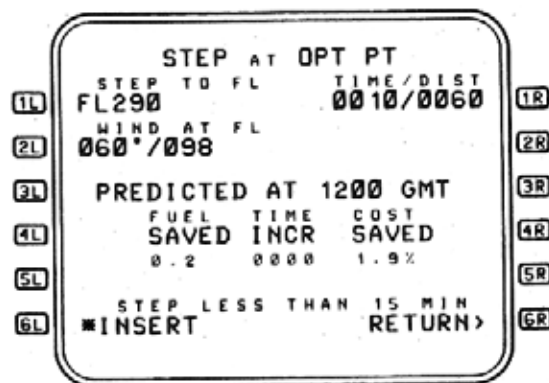


Figure 2-40

The altitude step is now specified in the FMC and after a short pause the prediction fields are filled.

1R TIME/DIST - The time, in hours and minutes, and the distance in nautical miles, from PPOS to the STEP start point, is displayed in this field. Dashes are displayed if predictions are invalid.

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2L **WIND at FL** - The wind at the STEP TO altitude is entered using the direction/velocity format. If no wind is entered the STEP is optimized using FMC wind predictions. Brackets are displayed until wind entry is made. The wind is displayed in small font if calculated by the FMC, and large font if entered by the crew.

4L **4R SAVINGS** - The predicted fuel savings is displayed as fuel in tonnes, time saved in HHMM(HOURS-MINUTES), and percentage of overall fuel cost saved. If the STEP results in a fuel savings, the word SAVED is displayed in **4L** – **4R**. If the STEP results in a fuel loss the word INCR(INCREASE) is displayed.

5L **5R** This data line may display one of the following three messages, depending on the FMC STEP predictions:

1- **STEP; LESS THAN 5 MINUTES** - The CRZ segment at the step altitude is predicted to be less than 5 minutes. If this message is displayed as a result of an optimum step point calculation, insertion of the step is not allowed.

2- **STEP LESS THEN 15 MINUTES** - The CRZ segment at the step altitude is predicted to be greater than 5 minutes but less than 15 minutes. Insertion of the step is allowed under these conditions.

3- **STEP POINT IN DISCON** - An optimum step point has been determined to lie within a discontinuity. Insertion of the STEP is not allowed.

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6R RETURN - Pressing this LSK returns the display to the accessing page, (e.g., VERT REV page A). If the RETURN > prompt is pressed prior to the *INSERT prompt, all pilot entered data on the STEP PRED page is erased.

6L INSERT - Pressing this LSK inserts the STEP into the flight plan and returns the display to the accessing F-PLN page. This prompt is only displayed when an altitude has been entered in the STEP TO FL field (1L).

The *INSERT prompt is not displayed if the SP messages, STEP LESS THAN 5 MINUTES, or STEP POINT IN DISCON are displayed.

NOTES: 1. After the step altitude is inserted into the F-PLN, the FCU must be changed in accordance with the new CRZ ALT to affect the desired altitude change when the step point is reached.

Thirty seconds prior to the STEP point, providing the FCU and the STEP ALT are the same, P-CLB will flash on the PFD FMA indicating to the pilot that a STEP occurs at the STEP point without any further action.

2. After a STEP has been inserted into the F-PLN and the FCU has been changed accordingly, should the FCU be repositioned to the present CRZ ALT prior to the STEP point, the STEP is automatically canceled and the CRZ ALT reverts to the present altitude.

If the FCU was not changed in accordance with the altitude STEP, upon reaching the STEP point the STEP is automatically deleted and the SP message, CHECK ALTITUDES, is displayed.

It is important to remember that the FCU altitude window, under normal conditions, is the master as far as the altitude to be maintained is concerned. An exception would be GS intercept with LAND engaged. Level change can only occur automatically at the STEP point if the FCU has been changed in accordance with the altitude STEP.

With ALT* the engaged mode in the FMA, changing the FCU altitude to the altitude STEP has no affect on aircraft altitude until the STEP point is reached. At that time level change occurs as P-CLB or P-DES modes engage.

2.1.3.5.3.1.1 IMM CLB/IMM DES

Two vertical guidance situational modes exist to facilitate an immediate climb (**IMM CLB***) or immediate descent (**IMM DES***) rather than waiting for the aircraft to sequence the STEP point.

They appear on the F-PLN pages in data line **1R**, and are displayed only when PROF is engaged. They occupy this position until the STEP point is sequenced, and then are deleted. Scrolling the flight plan has no effect on the situational mode display.

Figure 2-41 is an example of the IMM DES prompt.

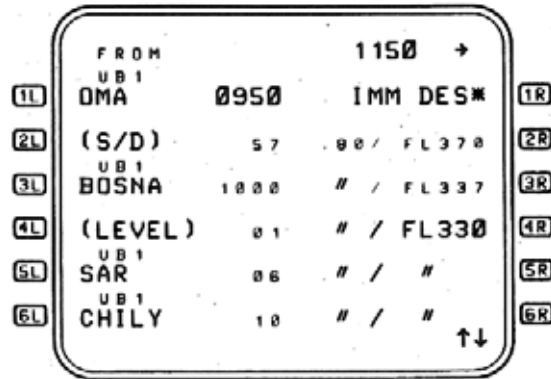


Figure 2-41

Pressing LSK **1R**, in this case causes the aircraft to begin a descent at 1000 ft/min. As soon as the P/B is pressed, initiating the IMM DES, the display changes to reflect the rate of descent as indicated in Figure 2-42.

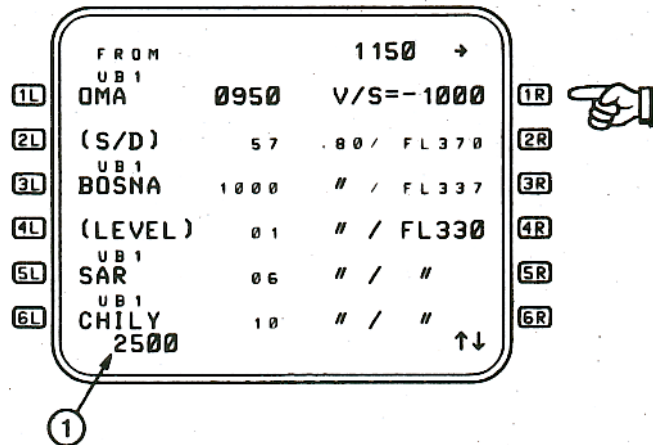


Figure 2-42

This initial rate may be changed, at the pilot's option, by input of the desired vertical rate into the V/S window of the FCU. or with PROFILE engaged, by writing the desired rate in the SP **1**, and pressing LSK **1R**. See Section 2.4.1.1, IMM DES MODE and Section 2.4.1.3, IMM CLB MODE.

2.1.3.5.4 Wind/Temperature Entry

Wind/Temperature computations along the route of flight are based on pilot input and actual winds/temps from the FMC at PPOS. Wind input is used for groundspeed and optimum wind calculations. Temperature input is used to calculate TAS, thrust settings, optimum altitudes, etc.

The FMC places the winds/temps into three categories:

1. Entered - Winds/temps entered by the pilot
2. Forecast - Are winds/temps based on linear interpolation between wind/temp entries
3. Predicted - Winds/temps are a combination of the forecast and actual wind/temp at PPOS.

The pilot entered wind value format is Direction/Velocity and is referenced to true north. Entry may be made on any one of five CDU pages:

1. INIT A - Enter the forecast T/C wind in the cruise wind field. Figure 2-3, **6R**
2. F-PLN B - Enter the forecast winds for each route segment at every waypoint along the route of flight. It is important to realize that if wind alone is inserted, without the temperature, the wind data must be preceded by a slash (/) to meet the format criteria for this data field. See Figure 2-26, **1R – 6R**
3. VERT REV B - Entry is the same as F-PLN B above. Figure 2-35, **4L**
4. STEP PRED - Enter PPOS wind at the STEP altitude on the STEP PRED page. Figure 2-40, **2L**
5. DES FORECAST - Enter winds on an altitude basis for the descent flight phase, and enter the destination surface wind from ATIS. Entry of the destination wind allows the FMC to furnish predicted wind values for the descent phase without further pilot input. See Figure 2-115, **2L 5L**

The climb wind forecast is divided into two segments as follows:

- Below 10000 MSL the vertical profile forecasts are determined by linear interpolation between the origin wind at the origin airport and the T/C wind at 10000 MSL
- Above 10000 MSL the vertical profile forecasts are determined by the constant value of the T/C wind.

If T/C wind and the origin wind are not entered by the pilot, the values default to zero, and wind values at all waypoints along the route of flight correspond to the T/C wind value derived from the FMC.

Enroute flight planning changes, which cause recalculation of the predictions, also cause a new wind profile to be calculated using the actual wind at aircraft PPOS as though it were the T/C wind and projecting the profile forward from that position to the destination.

The descent wind forecast profile is dependent on whether a wind entry has been made on the DES FORECAST page. If no wind entry is made the descent forecast profile consists of the following:

- Above 10000 MSL the wind forecast is a constant value equal to the wind at the T/D.
- Below 10000 MSL the wind forecast is determined by linear interpolation between the cruise wind at 10000 MSL and the destination airport surface wind.

If a destination wind is not entered the default values at destination is the same wind direction as the T/D at zero velocity. Temperature along the route of flight is entered in degrees centigrade and this input is used to modify ISA values to correspond with actual conditions. Temperature entries may be made on the following CDU pages:

1. **INIT A** - Enter a T/C temperature in the cruise temperature field. Figure 2-3, **5R**
2. **F-PLN B** - Enter forecast temperatures at origin, destination, all enroute waypoints, T/C, and T/D pseudo waypoints. Figure 2-26, **1R 6R**
3. **VERT REV B** - Entries are the same as for F-PLN B page above.

2.1.3.5.5 Performance Modes

Two performance modes are available for selection at the option of the pilot. The strategic mode allows modification of performance parameters for all remaining flight phases, while the tactical mode impacts only the current flight phase.

If no changes are made on either page, the FMC assumes the ECON performance mode.

2.1.3.5.5.1 Strategic Mode

The purpose of the STRATEGIC MODE page is to allow selection of performance modes affecting the entire flight as opposed to making the selections on each leg of the flight.

Three options are available:

1. **ECON** - Economy is the default state of the FMC. It is based on the CI defined by the airline or specified by the pilot, and represents the optimization of minimum fuel and minimum time.

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2. **MIN FUEL** - Minimum fuel mode corresponds to a CI of zero, and computes the optimum speeds required for minimum fuel consumption for the route to be flown.
3. **MIN TIME** - The minimum time mode corresponds to a CI of 999, and provides the maximum speed possible within the confines of the flight envelope, except below 10000 MSL where 250 KIAS is the maximum possible.

The optimization calculations for ECON and MIN FUEL, in both the cruise and descent flight phases, are based on pilot entries of CRZ WIND, TEMP, and CRZ ALT. In the cruise flight phase the optimum mach is updated automatically as a function of weight, winds, temperature, and CG. A fixed MACH/CAS is provided for the descent phase based on cruise mach and computed CAS as a function of aircraft weight and wind component at the end of the cruise phase. In all strategic modes the target speeds are limited to VFTO (GREEN DOT) in the clean configuration or maneuvering for the flap setting for the lowest speed, and VMO -20/MMO (-.02), whichever is lowest, for the highest speed.

Pilot inputs necessary for this calculation are CRZ ALT and CI. Access to the STRATEGIC MODE page is gained by pressing the **MODE** key on the CDU.

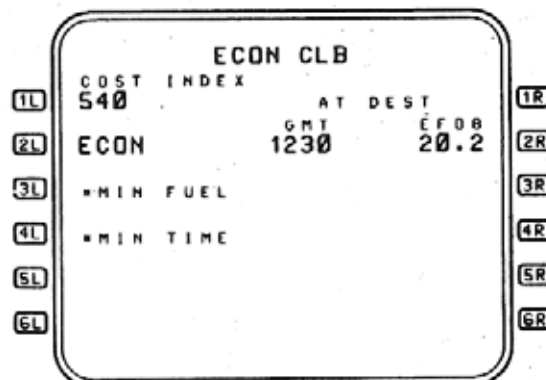


Figure 2-43

The title line is identical to the PROG page and reflects the active performance mode current flight phase (e.g., ECON CLB in Figure 2-43). It is important to realize that the mode displayed in the title may differ from that displayed in large font in **2L** through **4L** for the active mode. This is because the title can contain tactical and situational modes, while **2L** through **4L** can only display the strategic modes.

1L **COST INDEX** - This field is identical to the CI field on INIT A page, and may be modified or cleared by the pilot.

2L 3L 4L 2R 3R 4R

The active strategic mode is displayed in large font, without the * prompt, and the same data line contains the predicted time and fuel remaining at destination. Predictions fields for the non-selected modes are blank until they are selected by the pilot. Pressing the LSK adjacent to the desired mode activates it and the display reverts to large font. After a short delay predictions pertaining to this mode are displayed. Time predictions

airborne are ETA in GMT, and ETE when on the ground.

2.1.3.5.5.2 Tactical Mode Page

The purpose of the TACTICAL MODE page is to allow activation of the selected strategic mode or one of the available tactical modes, and to display predicted time and distance to a predetermined altitude for the active mode and the MAX CLB mode. Selection of a mode on the TACT MODE page impacts only the current flight phase. The FMCS reverts to the selected strategic mode once the current flight phase is passed.

Access to the TACT MODE page is by pressing the **TACT MODE** key on the CDU.

Three different CDU pages are available depending on the active flight phase:

1. **CLB page** - Is displayed when in the DONE, PREFLIGHT, TAKEOFF, or CLB flight phases; or when another TACT MODE page is displayed and the flight phase changes to DONE, PREFLIGHT, TAKEOFF, or CLB. Available selections are ECON CLB, MAX CLB, and SPD TACT MODES.
2. **CRZ page** - Is displayed when the **TACT MODE** key is pressed when in the CRZ flight phase, or when another TACT MODE page is displayed and the flight phase changes to CRZ. Available selections are ECON CRZ, MAX END, and SPD TACT MODES.
3. **DES page** - Is displayed when the **TACT MODE** key is pressed when in the DES or APPR flight phases, or when another TACT MODE page is displayed and the flight phase changes to DES or APPR. Available selections are ECON DES, MAX DES, and SPD TACT MODES.

The TACT MODE pages title lines differ from the strategic MODE title lines in that the active mode is not displayed with the flight phase. Additionally, the CI cannot be changed on any TACT MODE page. It is important to note these differences to preclude confusing the two performance mode pages.

Selection of the desired mode is accomplished by pressing the LSK adjacent to the *prompt.

Figure 2-44 is an example of a typical TACT MODE page for the CLB flight phase.

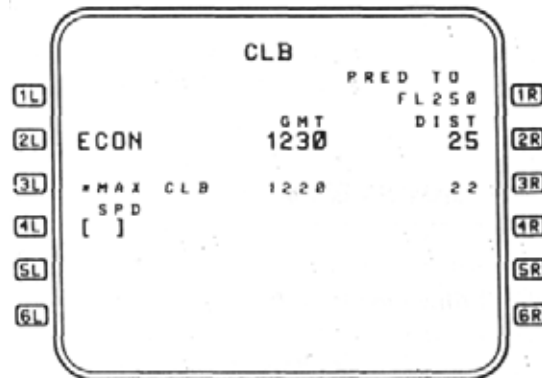
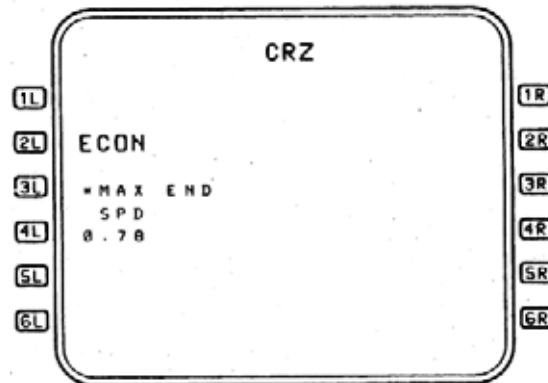


Figure 2-44

- 1R** **PRED TO** - The altitude to which the predictions shown are referenced, is displayed in this field. The displayed value defaults to the FCU altitude in feet MSL (NNNNN) below the origin transition level, and to Flight Level (FLNNN) above the origin transition level (e. g., transition level 18000 MSL).
- 2L** **2R** **ECON** - Displays the selected strategic MODE in large font and the predicted time and distance to the altitude displayed in **1R** . If a TACT MODE is subsequently selected, it is displayed in large font and the prediction fields for the strategic MODE are blanked.
- 3L** **MAX CLB** - Pressing this LSK activates the MAX CLB TACT MODE, displaying MAX CLB and the associated predictions in large font. Predicted time and distance are always displayed for the MAX CLB mode, regardless of whether it is active or not.
- 4L** **SPD** - The SPD MODE cannot be activated until speed has been entered in the brackets. Entry of a speed causes display of the associated Mach in the CLB and DES flight phases, and the appearance of an asterisk * prompt. Pressing the LSK adjacent to the prompt activates the SPD Mode.

Figure 2-45 is an example of the TACT MODE CRZ page.


Figure 2-45

Access to this page is gained by pressing the **TACT MODE** key when in the CRZ flight phase, or by the flight phase changing to CRZ while another TACT MODE page is displayed.

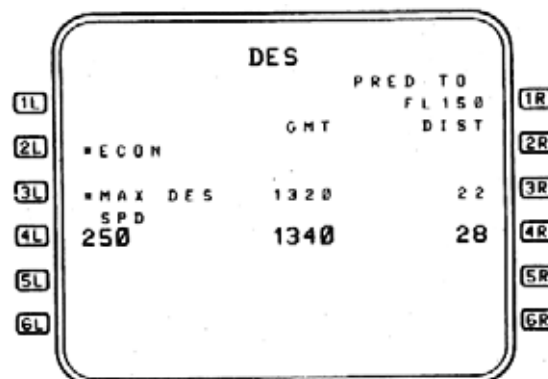
The title line displays the active flight phase. No predictions are displayed on the TACT MODE CRZ page.

2L ECON - Displays the active TACT MODE in large font and is the same as CLB page.

3L MAX END - The MAX END (MAXIMUM ENDURANCE) TACT MODE is activated by pressing LSK **3L**, and is displayed in large font when active. MAX END equates to LRC (LONG RANGE CRUISE).

4L SPD - Display logic is the same as SPD on the CLB page, but is limited to entry of either a SPD or a MACH rather than both. Entry into this field on the CRZ page does not affect the CLB or DES pages.

The DES TACT MODE page, Figure 2-46, is essentially the same as the CLB TACT MODE page.


Figure 2-46

Access is gained by pressing the **TACT MODE** key, on the CDU, when in the DES or APPR flight phases, or when the flight phase changes to DES. or APPR while another TACT MODE is being displayed. The title line displays the active TACT MODE.

1R PRED TO - This field displays the altitude to which the predictions shown are referenced, and uses the same display logic as the CLB page. The pilot may enter altitude values into this field for the purpose of descent planning. Entered values are used in the calculation of the Altitude intercept pseudo waypoint (I/P), (see Section 2.1.2.8, PSEUDO WAYPOINTS). An entry into this field has no affect on CLB page.

2L 2R ECON - Mode selection and active mode prediction fields are the same as CLB page.

3L MAX DES - Pressing this LSK activates the Max Descent Tactical Mode. Predictions are always displayed for this mode, however, when the mode is activated the font size changes to large to indicate it is active.

4L 4R SPD - Mode selection and active mode prediction fields are the same as the CLB page. Data entry may either be speed, Mach, or both (MACH/SPD). An entry into this field has no affect on the CLB or CRZ pages.

2.1.3.6 Flight Plan Check

The distance and course of each leg of the flight plan is checked against the computer flight plan or enroute chart, to verify that the displayed flight plan is identical to that which was filed with ATC. F-PLN page B, accessed via the **NEXT PAGE** key when F-PLN page A is displayed, and the EFIS ND in the PLAN mode, are used together to perform the necessary verification.

	FROM	DIST	1150 →	
1L	RW05		12 000' / 000	1R
2L	(LEVEL)	6		2R
3L	SPD	0		3R
	(LIM)			
4L	CRZ	8		4R
	SPR		-9 000' / 000	
5L	FRI 8H	37	-34 # / #	5R
	FRI			
6L	UGS	37	-50 # / #	6R
	WIL			
			↑↓	

Figure 2-47

Figure 2-47, a sample of F-PLN page B as it might appear from the departure runway at LSGG through the FRI8N SID, can be verified by comparing it with the graphic lateral depiction of the flight plan route as it would be displayed on the EFIS ND, Figure 2-48.

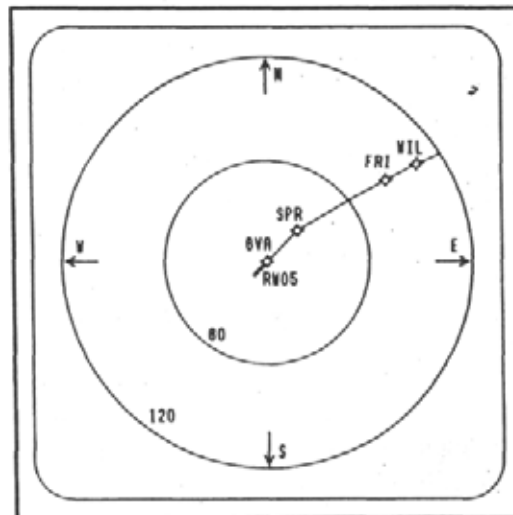


Figure 2-48

In the PLAN mode, the ND display is a depiction of the lateral flight plan in a North up orientation, regardless of aircraft heading, with the TO waypoint as the center reference point of the CDU.

The scale of the geographic coverage is determined by the range selected on the EFIS Control Panel (Figure 2-49), (e. g., at a scale of 120 NM, the ND map presents an image with a radius of 60 NM).

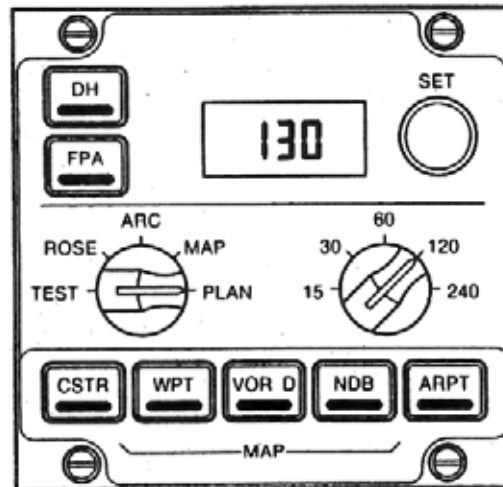


Figure 2-49

Checking the F-PLN is accomplished by pressing the slew arrows on the CDU, in the desired direction, slewing the flight plan through each waypoint. As the flight plan is slewed, the ND display changes to reflect the same waypoint positioning as that reflected on F-PLN page B. Each button push changes the center reference point from the TO waypoint to the FROM waypoint. In this way the center reference point of the CDU is always the TO waypoint as the flight plan is scrolled through each leg. As each leg is sequenced by pressing the slew arrow, the FROM waypoint, in the top line of the F-PLN page changes correspondingly.

The range scale, Figure 2-49, must be constantly changed to display the desired geographical area as the F-PLN is scrolled through each leg to the destination.

NOTE: It is important to realize the North up orientation of the ND occurs only in the PLAN mode - other ND modes are orientated to aircraft heading. Additionally, the PLAN mode offers the only capability to view the route of flight both ahead and behind the aircraft PPOS. This is due to the TO waypoint being the center reference point of the CDU rather than at the bottom portion of the CDU as is the case with all other ND modes.

2.1.3.7 Copy Active

With flight planning completed it is recommended that a copy of the active primary flight plan be made to preclude the loss of portions of the flight plan either inadvertently or as a result of certain functions (e.g., DIR TO). This is only possible if the SEC F-PLN function has not been utilized.

The COPY ACTIVE function may be found on the SEC INDEX page, accessed by pressing the SEC F-PLN button on the CDU keyboard. Pressing LSK **3L** copies the active primary flight plan into the SEC F-PLN (Figure 2-50).

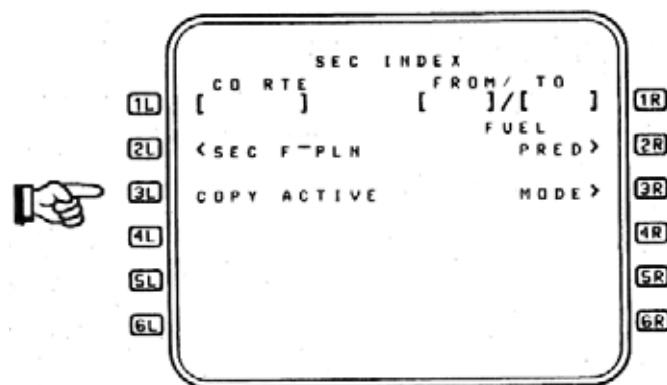


Figure 2-50

See section 5.1.1 COPY ACTIVE, for a more complete description of this function.

2.1.4 Transition to Takeoff Phase

FMS transition from the PREFLIGHT flight phase to the TAKEOFF flight phase occurs:

1. When the aircraft is not airborne.
2. Valid groundspeed is being received and is greater than 100Kts.
3. Either throttle is advanced above a prescribed threshold.

2. 2 TAKEOFF

The TAKEOFF and CLIMB flight phases of the vertical profile are airmass related (i. e., control of IAS, V/S, and thrust are defined relative to factors representative of the airmass the aircraft is in). The ascending trajectory of the aircraft, as predicted by the performance mode selected, and controlled by the vertical guidance function, is determined by the following factors:

1. Altitude targets
2. Speed targets
3. Thrust targets
4. Aircraft dynamics
5. Control strategy

The vertical profile for this phase is defined by climb target altitudes which limit the ascending trajectory of the aircraft, and the performance mode speed target limited by the climb speed restrictions and the climb speed limit.

Taxi and before takeoff checklists are completed prior to the beginning of the TAKEOFF flight phase. Should the need arise to change the GW, CG, or ZFWCG, during the taxi phase, the updates may be made on the FUEL PRED page (see Section 2.2.6.1, FUEL PRED PAGE). While a CG update is not necessary on the A310-200, a ZFWCG update is mandatory on aircraft equipped with a trim tank (A310-300, A300-600) for the proper operation of the CGCC (CG Control Computer).

GW update is necessary when the ZFW changes as a result of last minute cargo or baggage, and is the sum of the new ZFW and the total FOB as indicated on the left ECAM (**1**), Figure 2-51).

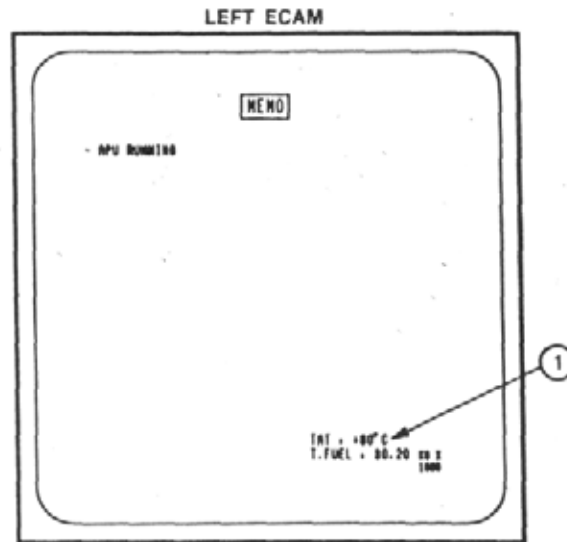


Figure 2-51

2.2.1 TAKEOFF Page

The TAKEOFF page may be accessed when the aircraft is in the DONE, PREFLIGHT, or TAKEOFF flight phases, by pressing the **TO/APPR** mode key of the CDU (Figure 2-52). Access is also allowed in flight before flap/slat retraction and before VFTO (GREEN DOT) is reached.

Page access is normally done during the PREFLIGHT phase after the weights are received. V1 and V2 are usually the only data inserted, however, other options exist on this page and are discussed in the following paragraphs.

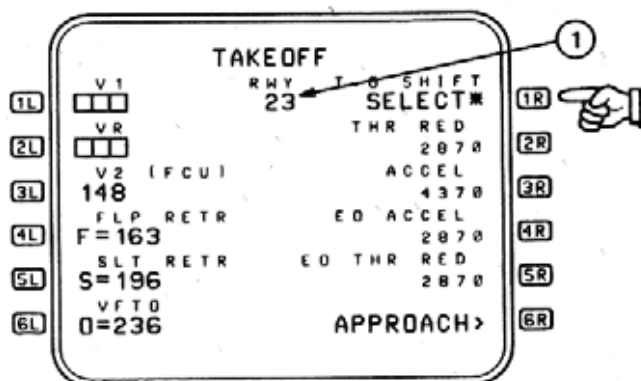


Figure 2-52

- 3L V2** - Data is displayed for reference only, and comes from the value entered by the pilot on the FCU. This value cannot be modified after the flight phase transitions from PREFLIGHT to TAKEOFF or CLB.
- 4L FLP RETR** - The flap retraction speed is calculated by the FMC and displayed for reference. It is always displayed in large font and may be modified by the pilot. It corresponds to a value of 1.25 Vs, slats 15 deg/flaps 0 deg, and is represented by a GREEN - F symbol moving along the SRS of the PFD. Displayed 5 seconds after liftoff and only with the flap/slat handle in the 15/15 or 15/20 position. (See **1**, Figure 2-55.)
- 5L SLT RETR** - The slat retraction speed is calculated by the FMC and displayed for reference. Same display and entry rules as FLP RETR above. It corresponds to 1.25 Vs, clean configuration, and is represented by a GREEN - S moving along the SRS of the PFD. Displayed 5 seconds after liftoff and only with the slat/flap handle in 15/0 position, after the flaps are retracted. (See **2**, Figure 2-55.)
- 6L VFTO** - Velocity final takeoff is calculated by the FMC but may be changed by the pilot. It is always displayed in large font. It corresponds to the best lift over drag speed in the clean configuration, and is represented by a GREEN dot (o), or small circle, moving along the SRS of the PFD. GREEN dot is displayed only with the slat/flap handle in the clean, 0/0 position. (See **3**, Figure 2-55.)

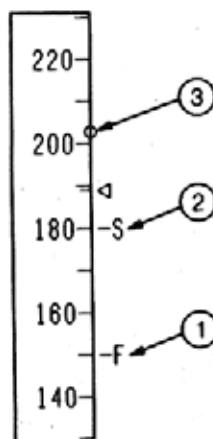

Figure 2-55

Figure 2-55 is offered as an example only. The F, S, and O speeds are not displayed on the SRS of the PFD at the same time, each being a function of a different slat/flap configuration.

NOTE: Data lines **4L** **6L** represent the minimum speeds for flap (FLP RETR) and slat (SLAT RETR) retraction, based on present aircraft weight as calculated by the FMC, as well as the minimum clean maneuvering speed (VFTO). These speeds may also be referred to as F (flaps), S (slats), and O (VFTO or GREEN DOT).

1R TO SHIFT - This field is blank until an origin runway has been defined (**1L** Figure 2-52), which is normally done when the SID is selected on the origin LAT REV Page (see Section 2.1.3.2.1, SID/RWY SELECTION). Entry attempts before definition of the takeoff runway result in display of the SP message, "NOT ALLOWED". After runway definition, the SELECT* prompt is displayed in Figure 2-52. Pressing LSK **1R**, when SELECT is displayed, activates the TO SHIFT function. ACTIVE is displayed in data line **1R** as long as the function is active. TO SHIFT may be canceled by the **CLR** function manually, or automatically when a new runway is defined.

NOTE: TO SHIFT, when active, causes the FMC to update the FMC position, when the go levers are toggled at takeoff, to a point 970 meters (3182 ft.) down the departure runway rather than at the runway threshold. This option covers the eventuality of a displaced runway threshold.

2R THR RED - The THRUST REDUCTION ALTITUDE, as defined in the data base, can only be changed in this field while the flight phase is PREFLIGHT. See THR RED ALT, Appendix B, page B-10.

3R ACCEL - The Acceleration Altitude (ACCEL ALT) as defined in the data base. Same display and modification rules as THR RED above. See ACCEL ALT, Appendix B, Page B-1.

4R EO ACCEL - The Engine Out Acceleration Altitude as defined in the data base. Same display and modification rules as THR RED above. See EO ACCEL ALT, Appendix B, Page B-4.

5R EO THR RED - The Engine Out Thrust Reduction Altitude as defined in the data base. Same display and modification rules as THR RED above. See EO THR RED ALT, Appendix B, Page B-4.

6R APPROACH - APPROACH > prompt is only displayed if a primary destination has been defined in the active F-PLN. Pressing LSK **6R**, with the APPROACH > displayed, accesses the APPROACH page. See APPROACH PAGE, Section 2.6.1.

NOT IMPLEMENTED

NOTE: Data fields **2R** **5R** display dashes until the default values from data base are calculated, or a pilot entry is made. This is one of the few cases where pilot entry is allowed in a dashed data field. Entries are allowed only in the PREFLIGHT phase. Attempts at any other time result in the display of, "NOT ALLOWED", in the SP.

2.2.1.1 TAKEOFF PAGE - ACARS Uplink

The FMC with an ACARS interface presents a slightly different TAKEOFF page than that covered previously. Other ACARS TAKEOFF Page information is available in Section 5.2.6.2.

Three conditions can cause new Vspeeds to be displayed automatically:

1. An automatic change in the takeoff control mode of the TCC.
2. A pilot entry of a runway in data field 1R.
3. Receipt of an ACARS uplink.

Under conditions 1 and 2 above, previous data is erased and boxes are displayed in the data fields. Condition 3 causes new data to be displayed in the appropriate field providing conditions 1 and 2 are compatible with the new data, otherwise boxes are displayed requiring manual entry of the correct data.

Referring to Figure 2-56, only the differences will be detailed. Data lines not covered in this section are identical to those presented in 2.2.1, TAKEOFF PAGE

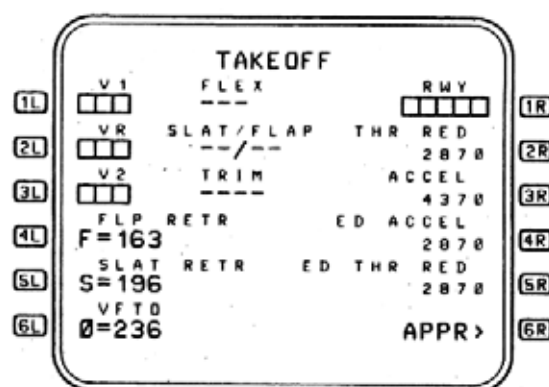


Figure 2-56

IL 3L - Input by the pilot or received in an ACARS uplink. V2 is not manually set on the FCU, rather the value in data line **3L** is repeated in the speed window of the FCU.

1C FLEX - The FLEX TEMP selected on the TRP is displayed here when FLEX TO is active (Figure 2-57), and an ACARS uplinked FLEX TEMP was received for the runway entered in **1R**

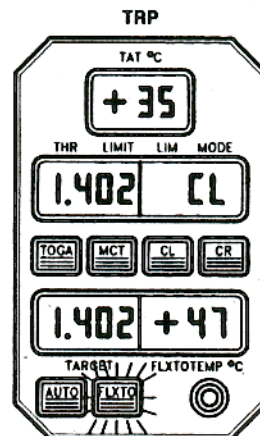


Figure 2-57

If a FLEX TEMP is available for the specified runway, but FLEX TO has not been selected on the TRP, AVAIL (Available) is displayed. If no FLEX TEMP is available, NONE is displayed. If no runway is specified in line **1R**, dashes are displayed. The SP message, SET XXdeg. C IN TRP, is displayed if a runway is specified, FLEX TO is active on the TRP, and no FLEX TEMP has been entered in the TRP.

2C SLAT/FLAP - Slat/Flap settings commensurate with aircraft weight and the specified runway, are uplinked by ACARS and displayed in this data line. If Slat/Flap settings are not received, a runway is not specified in **1R**, or the FLEX TO mode has been selected and FLEX TO data has not been received for the specified runway, dashes are displayed.

3C TRIM - Trim settings are displayed when ACARS uplinked data is available for the specified runway. If a trim setting is not received, or FLEX TO is not selected and FLEX data has been received for the specified runway, dashes are displayed.

1R RWY - Boxes are displayed in this field until an ACARS uplink is received or a runway is specified by the pilot. If an uplink has been received and no runway had previously been entered, the first runway on the uplink list is displayed, as well as all other data pertaining to that runway. In this case it may not be the runway desired for departure, underscoring the importance of selecting the departure runway before ACARS uplink data is expected.

Figure 2-58 is an example of the TAKEOFF page, after receipt of ACARS uplink, with all data lines filled.

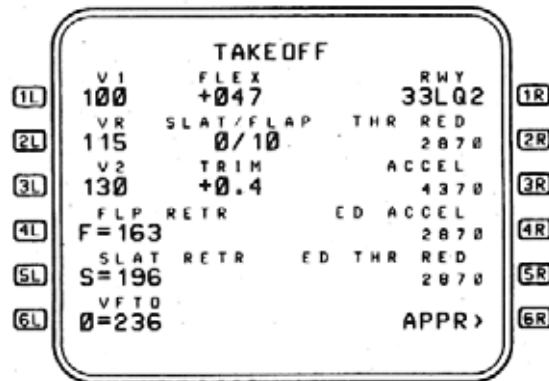


Figure 2-58

2.2.1.2 THR RED/ACCEL Altitudes

The THR RED and ACCEL ALT normally come from the data base, however, they may be modified by the pilot on the TAKEOFF page only. See Section 2.2.1, TAKEOFF PAGE.

THR RED ALT is defined as:

The thrust reduction altitude is the vertical location at which the FMS commands the TCC to reduce the maximum thrust limit from the pilot defined Takeoff/FLEX TO Thrust Limit to the FMS Thrust Limit, (e. g., CLB Thrust). THR RED ALT is also one of the lowest altitudes at which the PROF mode may be engaged.

THR RED ALT applies to two engine operation only. Single engine operation is indicated by EO THR RED ALT and is activated after EO is selected by the pilot.

ACCEL is defined as:

The acceleration altitude is the vertical location, after takeoff, at which the FMS can command an acceleration to the desired climb speed, (e. g., 250/10000).

ACCEL applies to two engine operation only. Single engine operation is indicated by EO ACCEL and is activated after EO is selected by the pilot.

2.2.2 Departure Runway Change

There are two ways to accommodate a change of departure runway. Although they both deal with the same SID page, the method is somewhat different.

The first method is a repeat of the SID selection during flight planning (2.1.3.2.1 SID/RWY SELECTION) beginning with a lateral revision at the departure airport, LSGG. On the LAT REV from LSGG page, press LSK **1L** adjacent to the < SID prompt (Figure 2-59).

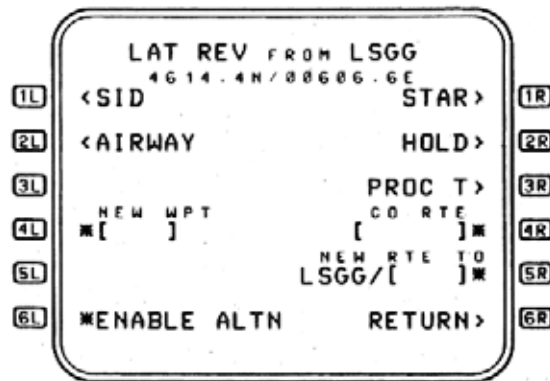


Figure 2-59

The SID from LSGG page is displayed, with RWY05 selected. The only runway remaining, RWY 23, may be selected by pressing LSK **4R** (Figure 2-60).

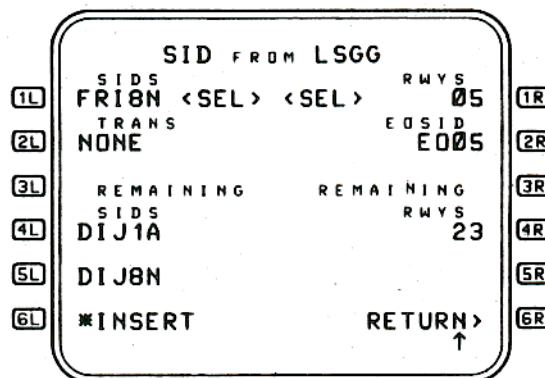


Figure 2-60

Pressing the *INSERT prompt, LSK **6L**, changes the departure runway to RWY 23 and returns the display to the accessing F-PLN page.

The other method to affect a change of departure runway is offered as an operational technique that could be employed. runway change is anticipated.

Recall Section 2.1.3.7, COPY ACTIVE when, again as an operational technique, it was suggested that a copy of the active primary F-PLN be made after it is completed? Assuming this was done, if a departure runway change is anticipated, it can already be selected on the copy of the active primary F-PLN waiting in the SEC F-PLN. The process of runway selection in the SEC F-PLN is identical to that already detailed for the active primary F-PLN (see Section 5.1, SEC F-PLN). All that remains is to activate the SEC F-PLN - make the SEC the active primary F-PLN (see Section 5.1.1, ACT SEC).

Pressing the **SEC F-PLN** key of the CDU accesses the SEC INDEX page (see Section 5.1.1, SEC INDEX).

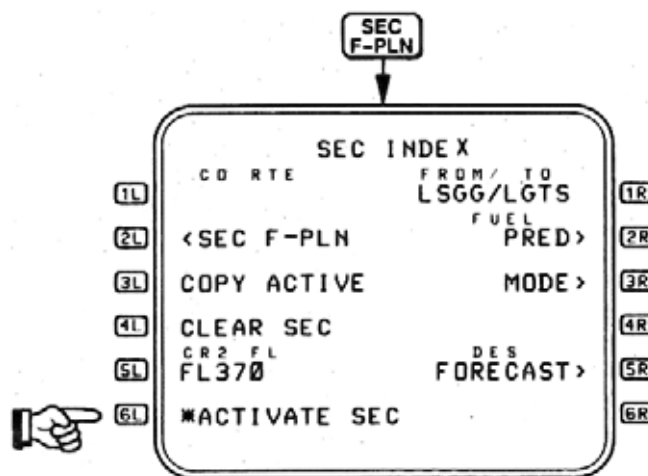


Figure 2-61

At the bottom left of the CDU is the *ACTIVATE SEC prompt. Pressing this LSK activates the SEC F-PLN, making it the active primary F-PLN, and returning the display to the active primary F-PLN page. With two button pushes, a runway change has been affected. Certainly faster than the first method, providing the impending runway change was anticipated and planned for.

Prudence now should dictate a COPY ACTIVE of the new active primary F-PLN.

2.2.3 Speed Changes

Changes to the planned departure speed schedule, to accommodate last minute ATC requests, can be accomplished by doing a VERT REV at the desired waypoint, (e.g., FRI, Figure 2-62).

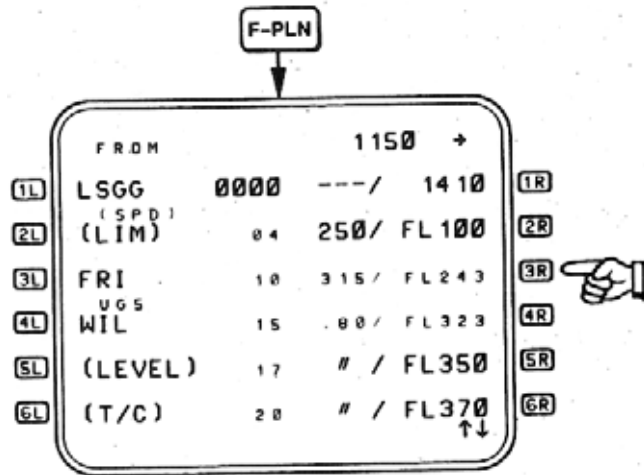


Figure 2-62

Assume climb speed between FRI and WIL has been changed to, "Maintain 280 kts. " The normal climb speed in this segment is calculated by the FMC to be 315 kts. By reference to Figure 2-63, a speed constraint may be created between these waypoints by writing 280 in the SP and pressing LSK **2L**

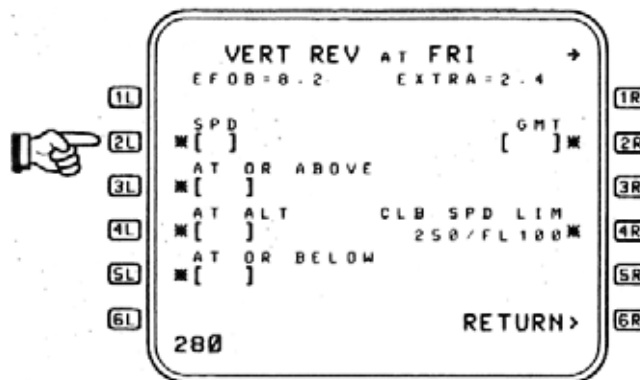


Figure 2-63

The speed for the route segment in question would change from 315 kts. to 280 kts. The speed schedule would automatically return to normal, Mach. 80 at WIL, as indicated by reference to Figure 2-62. This speed change would only occur automatically with PROFILE engaged. If PROFILE was not engaged the same change could be affected manually, directly in the SPEED window of the FCU.

2.2.4 GW and CG Update

After engine start INIT page B is no longer available, therefore, revisions to GW and CG, made just prior to takeoff, must be accommodated on the FUEL PRED page (Figure 2-64).

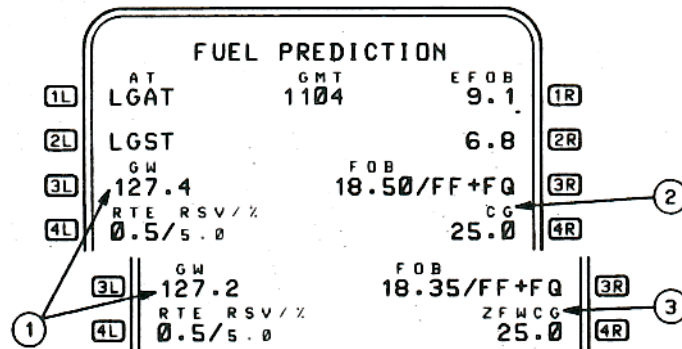


Figure 2-64

The GW field is displayed **1** (Figure 2-64) whenever the ZFW has been initialized on INIT page B. An update to GW made during taxi should be the sum of the ZFW and the present FOB as displayed on the bottom portion of the left ECAM.

It is important to realize that both the CG **2** (Figure 2-64) and ZFWCG **3** (Figure 2-64) fields in **4R** are only displayed in the PREFLIGHT phase.

ZFWCG is mandatory data for the CGCC to function on A310-300 and A300-600 aircraft. CG data is not mandatory on A310-200 aircraft as they have no trim tank. After transition to the TAKEOFF phase, the fields are blank.

See Section 2.2.6.3, FUEL PREDICTION PAGE, for a complete description of page access and details of each data line.

2.2.5 Manual NAV Radio Tuning

Prior to departure, consideration should be given to the PNF manually tuning the first leg of the departure route to provide a raw data crosscheck of course information as it is presented on the ND. The following procedure is offered as a technique only.

By reference to F-PLN page A, Figure 2-36, it may be seen that the course to SPR, the first waypoint in the FRI8N SID, is 048 deg. Manual tuning of a VOR frequency is enabled by first placing the selector switch of the VOR/NAV/ILS SWITCH PANEL **1** (Figure 2-65), located on the COMPLEMENTARY EFIS CONTROL PANEL, in the VOR position, and then manually channeling the desired frequency and course in the VOR/ILS CONTROL PANEL **2** (Figure 2-65).

VOR/NAV/ILS SELECTOR/CONTROL PANELS

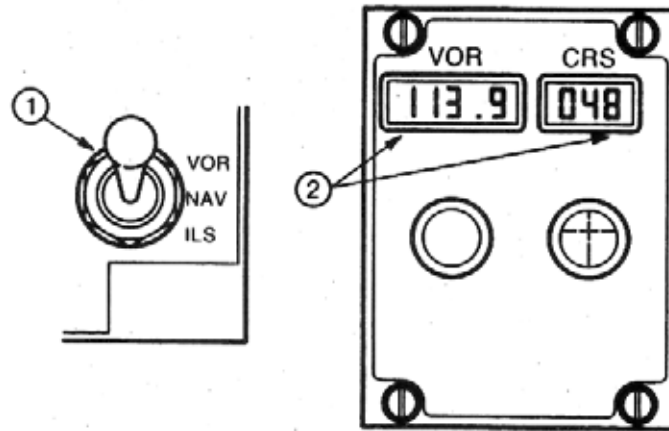


Figure 2-65

Course intercept is reflected in a conventional manner on both the onside (manually tuned) RMI **1**, and ND **2**, when the latter is operating in either the ROSE or ARC mode. (See Figure 2-66.)

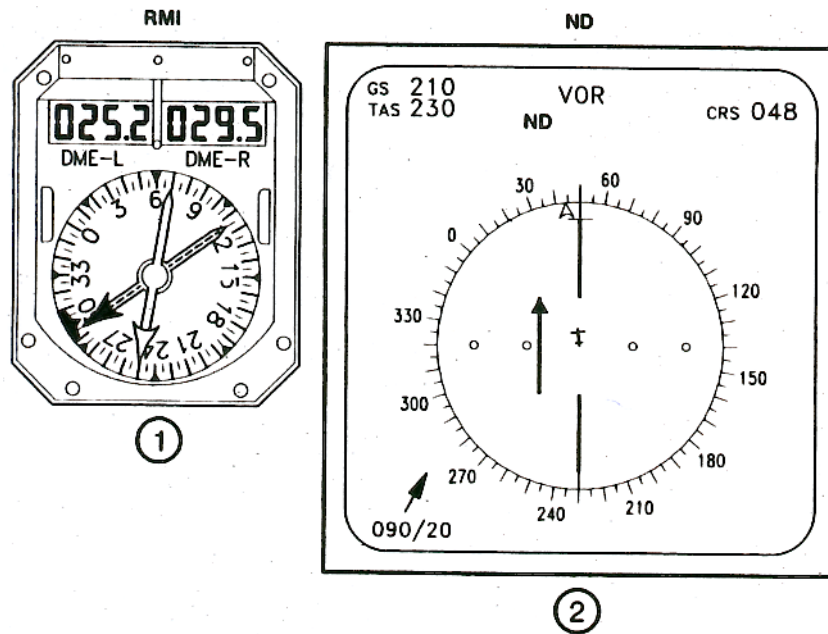


Figure 2-66

Additionally, the manually tuned navaid is indicated on the PROG page by the letter M, for MANUAL, adjacent to the frequency for SPR **1**. (See Figure 2-67.)

NOT IMPLEMENTED

NOTE: After raw data verification of course intercept, the PNF may return to autotuning by placing the VOR/NAV/ILS SELECTOR SWITCH to the NAV position.

2.2.6 PROG Page

The PROGRESS PAGE displays dynamic flight information concerning the active primary F-PLN.

Access to the PROG page is gained by pressing the **PROG** key on the CDU.

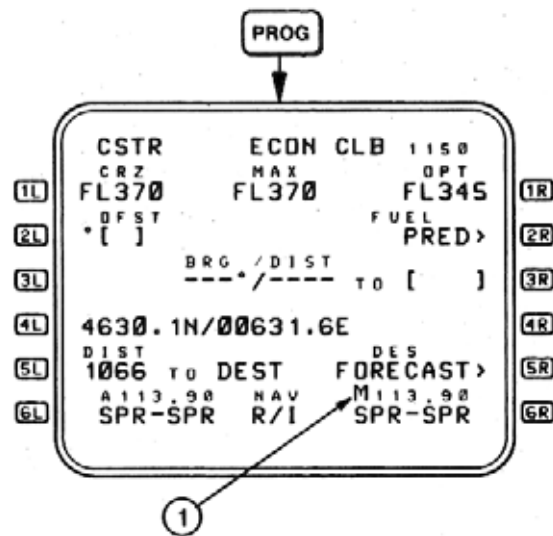


Figure 2-67

TITLE LINE - The title line displays the performance submode (CSTR), performance mode (ECON), vertical phase (CLB), and the flight number (1150). If no flight number was entered on INIT page A, the field is blank.

There are three vertical phases:

1. **CLB** - is displayed if the aircraft is in PREFLIGHT, TAKEOFF, CLB, or DONE flight phase.
2. **CRZ** - is displayed when the aircraft is in the CRZ flight phase.
3. **DES** - is displayed when the aircraft is in the DES or APPR flight phase.

Performance modes associated with these vertical phases are as follows:

ECON

MIN TIME

MIN FUEL

MAX CLB (CLB phase only)

MAX END (CRZ phase only)

MAX DES (DES phase only)

SPD

ENG OUT

Performance submodes, having a direct bearing on the manner in which the performance mode is executed, are:

CSTR - Indicates the FMS has deviated from the active performance mode IAS in order to meet a time constraint.

S/C - Indicates a STEP CLIMB is in progress. **S/D** - Indicates a STEP DESCENT is in progress.

??? - Indicates the aircraft is between the FMC target altitude and the FCU altitude, and a conflict exists.

D/D - Indicates a driftdown procedure is in progress.

In addition, three Situational modes exist to cover specific flight phase situations:

IMM DES (CRZ and DES phase)

IMM CLB (CRZ phase only)

DECEL (DES or APPR phase)

IL CRZ - The cruise flight level is displayed to the nearest 100 feet, but may not exceed the maximum certificated altitude of 41000 feet. Pilot entry is allowed, and follows the same format and display rules as INIT page A, except entry is also allowed in the dashed field displayed when the FMC transitions to the DES phase.

1R OPT - The FMC calculated optimum (OPT) and maximum (MAX) flight levels, based on current performance and atmospheric criteria, is displayed in **1R** and **1L**, and follows the same format and display rules as INIT page B. If the DES or APPR phase is active, the OPT field is replaced by the vertical deviation of the aircraft from the predicted descent path, to a maximum ± 9900 feet, rounded to the nearest 10 feet (1).

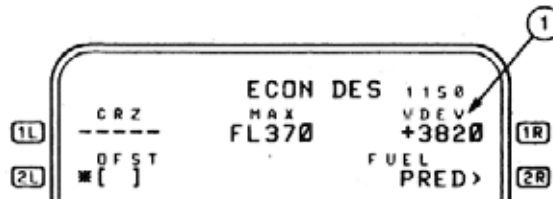


Figure 2-68

A positive vertical deviation (+) indicates the aircraft is above the predicted descent path, and a negative vertical deviation (—) indicates the aircraft is below the predicted descent path.

2L OFST - A parallel offset, left or right of the active flight path, may be entered here when the bracket prompt (* []) is displayed. Bracket prompts are only displayed when the course being flown is to an active flight plan waypoint or navaid, and the termination waypoint of that leg is not a destination runway in the active primary F-PLN. (See PARALLEL OFFSETS.)

2.2.6.1 FMC Position Update



Aircraft PPOS is displayed in this field as LAT/LONG **4R** (Figure 2-67). Pressing LSK **4L**, with the SP empty, freezes the LAT/LONG values at the then current position, and changes the display to include the label line, "POS FROZEN". (See Figure 2-69.)

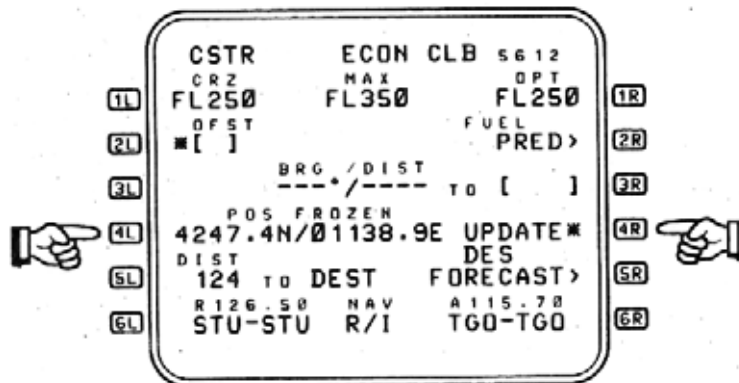


Figure 2-69

Section 2
Flight Phases

Pressing LSK **4L** a second time unfreezes the display and allows the LAT/LONG field to reflect PPOS. Aircraft PPOS may also be updated via this field. The FMC may be updated to an actual known position by entry, directly into **4L**, of any of the following:

1. LAT/LONG
2. WAYPOINT IDENT
3. NAVAID IDENT.
4. PLACE/BRG/DIST

Entry of any of this data into the **4L** field causes display of an UPDATE* prompt in **4R** after any necessary LAT/LONG calculations are completed by the FMC. Pressing the UPDATE* prompt **4R**, as the aircraft overflies the update position, reinitializes the FMC to this position, and the display reverts to the new PPOS. If the UPDATE* prompt is cleared via the **CLR** key, before the UPDATE* prompt is pressed, the data line is cleared of all entered data and the LAT/LONG display reverts to the previous values. If aircraft PPOS is invalid when an update is attempted, the SP message, "NOT ALLOWED", is displayed.

The update function impacts the FMCs only and has no affect on inertial position.

NOTE: The update function should only be attempted when automatic FMC position updates do not occur due to a lack of radio position inputs, and then only with extreme care. It is possible to induce a considerable error into the FMC should the UPDATE* prompt be pressed at the wrong time.

5L DIST - Aircraft Distance to Destination, along the active primary F-PLN route, is displayed here in large font. Dashes are displayed when no active primary destination exists, or when data is not available.

2.2.6.2 NAVAID Tuning

6L 6R This data line contains the tuned nav aids; the two stations chosen for display on the RMIs, the frequency and identifier of each, and the method used to tune the station. There are three methods of tuning the NAV radios:

1. Automatically (A) by the FMC. See Section 4.3, AUTOMATIC TUNING.
2. Manually (M) through the VOR/ILS CONTROL PANELS. See Sections 2.2.5, MANUAL NAV RADIO TUNING, and 4.4, MANUAL TUNING.
3. Remote (R) by entry of the nav aid identifier, (e.g., STU; Figure 2-69) into the nav aid field by pressing LSK **6L**. The nav aid frequency is preceded by an "R" when it is remotely tuned, (e.g., R126.50; Figure 2-69). Although the nav aid is manually specified, by insertion of the identifier into **6L**, the FMC still automatically tunes the station - no further pilot action is required. It is important to realize that data entry into **6L** is for FMC 1 and data entry into **6R** is for FMC 2.

NOT IMPLEMENTED

NOTE: In the case of Manual (M) and Remote (R) tuning, the VOR/NAV/ILS SELECTOR SWITCH, on the COMPLEMENTARY EFIS CONTROL PANEL, must be in the VOR or ILS position, otherwise the desired frequency cannot be channeled on the VOR/ILS CONTROL PANEL or inserted in the identifier field of the PROG page. In the latter case the SP message, "NOT ALLOWED", is displayed when an attempt is made.

2R **FUEL PRED** - Pressing LSK **2R** accesses the FUEL PRED page. The prompt is only displayed after the second engine is started and before the last engine is shutdown. See Section 2.2.6.3, FUEL PREDICTION PAGE, for a complete description of all data lines.

3R **BRG/DIST TO** - The FMC calculates the bearing and distance to the inserted waypoint, in whole digits, from aircraft PPOS. Entry of a specific format is allowed for a waypoint, navaid, runway, airport identifier, LAT/LONG, or PLACE/BRG/DIST. The BRG/DIST calculation is updated every 3 seconds, and is displayed in degrees and nautical miles. In the case of LAT/LONG and P/B/D, which may not have an identifier, the word, "ENTRY", in large font, is displayed in the bracket field. Waypoints defined in this manner have no impact on the allowable list of pilot defined waypoints. See Appendix B, for acceptable formats.

5R **DES FORECAST** - This LSK allows access to the DESCENT FORECAST page. The prompt is only displayed if an active primary destination has been defined. See Section 2.4.6.3.1, DES FORECAST PAGE, for a complete description of all data lines.

2.2.6.3 Fuel Prediction Page

The FUEL PREDICTION PAGE displays fuel and time information pertaining to the active primary F-PLN. (See Figure 2-70.)

Manual access is from the PROG page via LSK **2R** (Figure 2-69), with automatic switching after the second engine is started if INIT page B was displayed.

Much of the data on the FUEL PRED page is identical to that found in INIT page B. The stated purpose of the FUEL PRED page then, is to provide fuel planning capability beyond the PREFLIGHT flight phase, after which INIT page B is no longer available.

FUEL PREDICTION				
1L	AT LGAT	GMT 1235	EFOB 12.2	1R
2L	LGTH	1315	5.2	2R
3L	GW	110.4	23.25 /FF+FQ	3R
4L	RTE RSV / %	1.1 / 5.0	ZFWCG 25.0	4R
5L	FINAL TIME	10.2 / 0030	TEMP / TROPO -34 / 36000	5R
6L	EXTRA TIME	0.0 / 0010	CRZ WIND 000 / 000	6R

Figure 2-70

- 1L 2R** Data line contains predictions for time and fuel at the primary destination, LGAT. When on the ground, the time label is TIME and the predictions are ETE and EFOB at the primary destination. Airborne the time label is GMT and the predictions are ETA and EFOB at the primary destination. If no primary destination has been specified, NONE is displayed in **1L** and the prediction fields are dashed.
- 2L 2R** The alternate destination is displayed in **2L** with the EFOB in **2R**. If no ALTN has been specified, NONE is displayed in and the prediction field in **2R** is dashed.
- 3L GW** - Gross Weight is displayed in thousands of kgs., or pounds as the case may be. The field displays dashes and entry is not allowed if FOB is not being calculated, and boxes if FOB is being calculated but ZFW has not been initialized. Entry of a current GW into the boxes causes the FMC to calculate the ZFW, the re by initializing the system exactly as it is on INIT page B. If the GW revision results in the computation of ZFW beyond the max allowable, the SP message, "AAAAA OUT OF RANGE", is displayed. The AAAAA of the message can be ZFW, BLOCK, GW, or TOGW.
- 3R FOB** - Present FOB is displayed, in pounds or tonnes. When both FF and FQ sensors are used in the FOB computations by the FMC, they are both displayed, as in Figure 2-70. Either one may be selected alone by preceding the choice with a slash /. Sensor status is indicated by the SP message, "SENSOR IS INVALID". Entry of CLR into the field, when one sensor is displayed, causes both to be displayed again, providing both sensors are valid. Dashes are displayed when both sensors are invalid. FOB may be reinitialized by entry of a value into **3R**. The FQ sensor is automatically deleted when the FOB is manually entered, providing the FF sensor is valid. If not, the entry is rejected and the SP message, "SENSOR IS INVALID", is displayed. If the new value is above the max allowable, the SP message, "AAAAA OUT OF RANGE", is displayed.
- 4L 6L** RTE RSV/%, FINAL/TIME, and EXTRA/TIME, are the same as INIT page B. See Section 2.1.2.7, INIT B PAGE.

4R ZFWCG - This field may either be CG (aircraft without a trim tank), or ZFWCG (aircraft with a trim tank). When the latter case is true, ZFWCG is a mandatory entry or the CGCC will not function on aircraft so equipped. In both cases the field is only displayed in the PREFLIGHT flight phase, and data and format are identical to that displayed on INIT page B. See **5R**, INIT B PAGE.

5R 6R TEMP/TROPO and **CRZ WIND** fields are the same as that displayed on INIT page A. See **5R** and **6R**, INIT A PAGE. TEMP and CRZ WIND are displayed in the CLB phase only.

2.2.6.4 Bearing/Distance To

As a technique, during the takeoff and initial climb portions of the flight, or anytime during the flight, it may be useful to utilize the BRG/DIST TO function, on the PROG page, to provide continuous BRG/DIST readouts to almost any desired geographical point. It is recommended that the PROG page be displayed by the PNF whenever possible, so as to have available the dynamic flight plan data contained thereon. (See Section 2.2.6, PROG PAGE.)

2.2.7 Takeoff Roll

Up to this point, the altitudes, speeds, weights, functions, and modes, have been selected or loaded into the FMC for one purpose; to initialize the system for flight.

2.2.7.1 Position Update

After initial thrust lever movement, as the takeoff roll begins, the Go Levers are toggled. At that moment the FMC position updates to the threshold of the departure runway (See Section 4.1.2, FMC POSITION), LSGG 05 in this case, the little airplane representing PPOS begins moving down the runway depicted on the ND, and the parameters initialized in the FMC define aircraft control about the pitch, roll, and yaw axis.

2.2.7.2 FMA Indications

The FMC is coupled to the AFS when NAV and PROFILE are engaged on the FCU, and AUTO engages on the TRP. During the takeoff roll, and the climb portion of flight to the THR RED ALT, the following displays will appear on the FMA of the PFD as the Go Levers are toggled

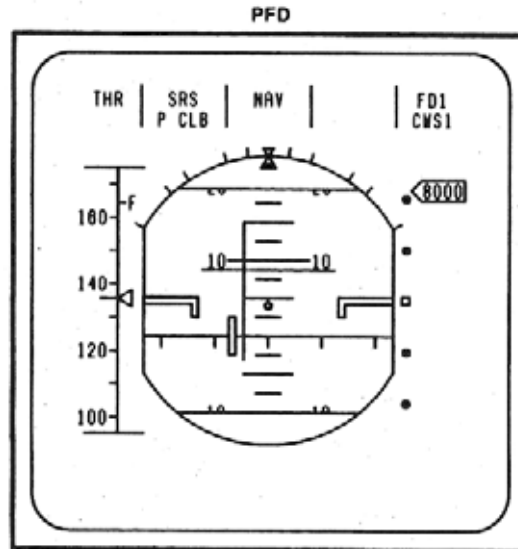


Figure 2-71

assuming the LSGG RWY 05 ILS frequency and course have been selected in the ILS CONTROL PANEL, either TO or *FLEX TO* is selected on the TRP (Figure 2-72), and one A/P paddle is in the ON position.

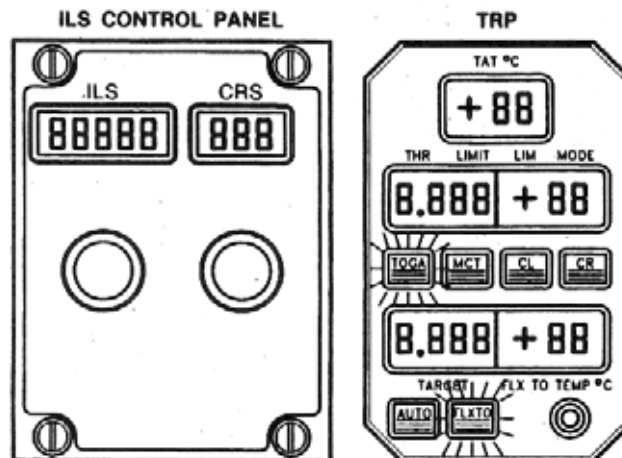


Figure 2-72

By reference to Figure 2-71, it may be seen that:

The ATS control mod is:

THR - The A/THR system is engaged in the THR mode. THR is the normal engaged mode until the THR RED ALT, when PROF engagement is annunciated by P THR changing from the BLUE of the armed status to the GREEN of the engaged status.

The LONGITUDINAL control mode is:

SRS - The speed set on the FCU, V2 + 10 kts for 2 engine operation. SRS disengages at THR RED ALT if PROF is armed; or upon manual PROF engagement; or selection of another LONGITUDINAL control mode.

The LATERAL control mode is:

RWY - The PFD ROLL BAR is replaced by the YAW BAR. The course commanded by the YAW BAR is localizer center to 30 feet AGL, then RWY disengages automatically and the LATERAL control mode engages in NAV if selected, or HDG if NAV is not selected.

In Figure 2-71, the armed modes are P CLB and NAV, so both engage at the appropriate time, and the A/P is engaged in CWS. After lift off, the A/P may be engaged in CMD by activation of the CMD P/B on the FCU.

2.2.7.3 NAV Engagement

At 30 feet RA altitude, AFS disengages and NAV engages providing the NAV P/B on the FCU has been pressed - GREEN bars in P/B illuminated, and NAV BLUE is annunciated on the second line of the PFD LATERAL mode window. (See Figure 2-73.)

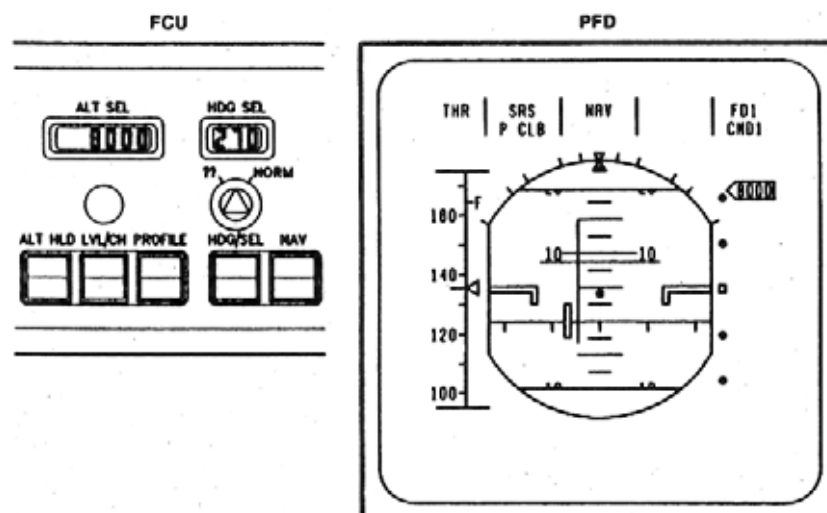


Figure 2-73

At THR RED ALT, PROFILE engages (providing it was armed), and the TRP engages in AUTO with CLB selected. The FMA and TRP displays then approximate Figure 2-74.

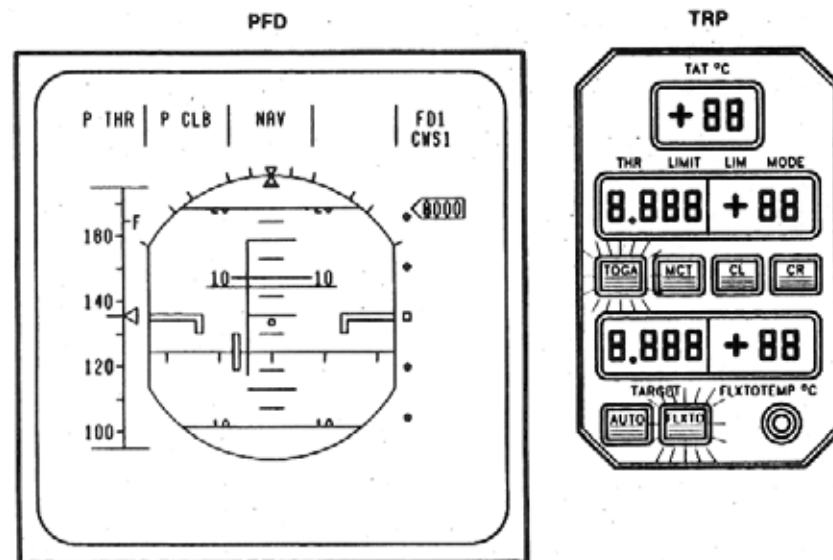


Figure 2-74

It is important to realize that without NAV engagement, the lateral F-PLN, as specified in data base or manually defined by the pilot (left side of the active primary F-PLN), **is not flown** as depicted on the ND.

2.2.7.4 Profile Engagement

In similar fashion, if PROFILE is not engaged, the speed and altitude constraints specified in data base or manually defined by the pilot **are not flown** as depicted in the vertical profile of the F-PLN (right half of active primary F-PLN).

NOTE: The AFS is coupled to the FMC by the arming and subsequent engagement of three modes:

1. NAV
2. PROFILE
3. AUTO - on TRP

Without the engagement of these three modes, auto flight **does not** occur.

2.2.8 Transition to CLIMB Phase

FMS transition from the TAKEOFF flight phase to the CLIMB flight phase occurs when:

1. The aircraft is airborne (oleo strut extended)
2. Groundspeed is > 100 kts
 In addition:
 Two - Engine Operation:
 1. Aircraft altitude is above the THR RED ALT
 Engine - Out Operation:
 1. An EO condition exists
 2. Aircraft altitude is > EO THR RED ALT
3. CAS from the ADC > VFTO (GREEN Dot)

2.3 CLIMB

Like TAKEOFF, the CLIMB flight phase is airmass related, i. e., control of IAS, V/S, and thrust, are defined by the FMS relative to factors representative of the airmass the aircraft is in. (See Section 2.2 TAKEOFF.)

During this phase the pilot defined or database derived THR RED and ACCEL altitudes are sequenced as the aircraft is cleaned up, NAV and PROFILE modes engage, and aircraft climb performance is governed by the parameters selected or defined during PREFLIGHT.

For the purpose of demonstration, assume the departure clearance from LSGG was changed by the tower to, "Honeywell 1150, runway 05, cleared for takeoff, after departure turn left heading 010 for departure vector, maintain FL100." Figure 2-75 is an example of the FCU as it might appear to conform to this clearance.

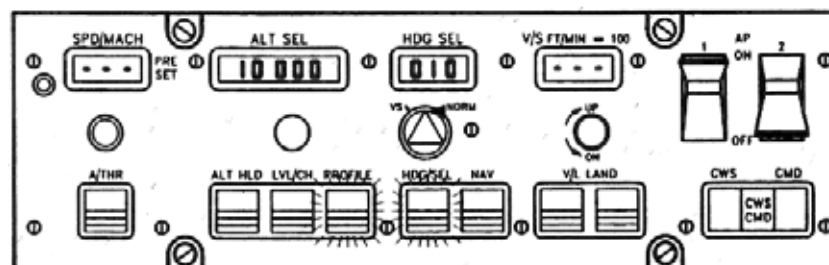


Figure 2-75

The engaged longitudinal mode is PROFILE, the engaged lateral mode is HDG SEL, and A/P 1 is in CMD. The SPD/MACH and V/S windows, of the FCU, are dashed because PROFILE is engaged and speed is held on elevator to conform to the previously selected active TACTICAL or STRATEGIC mode.

The TRP goes from TOGA or FLEX TO to AUTO, as indicated by Figure 2-76, and the TRP TARGET window changes to dashes to indicate thrust commands are coming from the FMC.

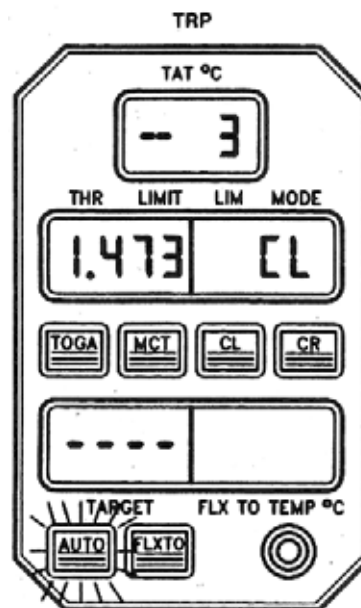


Figure 2-76

In this situation a clearance on course and climb to CRZ ALT may be implemented by simply pressing the NAV P/B on the FCU, dialing the desired CRZ ALT (37000) in the ALT SEL window and pulling the knob to activate a longitudinal mode.

The following lateral and vertical changes occur in aircraft attitude:

- The engaged lateral mode changes from HDG SEL to NAV
- The A/P turns the aircraft to intercept the flight planned route
- PROFILE is the engaged lateral mode and is active when the ALT SEL knob is pulled
- A climb to the previously selected CRZ ALT is initiated

The FMA of the PFD approximates Figure 2-77, under this scenario, as the aircraft climbs to the selected CRZ ALT.

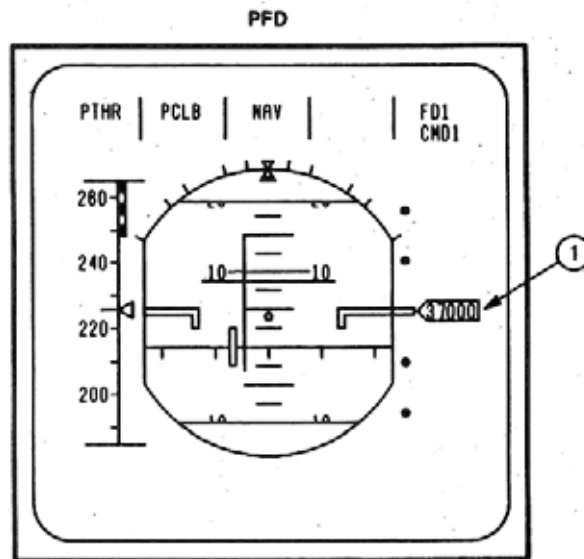


Figure 2-77

The FMA indicates the engaged ATS mode is P THR (PROFILE THRUST), and the engaged AP/FD longitudinal mode is P CLB (PROFILE CLIMB). NAV is the engaged AP/FD lateral mode. The altitude selected altitude index **1**, in the color BLUE. All engaged modes, on the FMA, are displayed in the color GREEN.

The FCU configuration, to affect the aforementioned climb to CRZ ALT, is displayed in Figure 2-78.

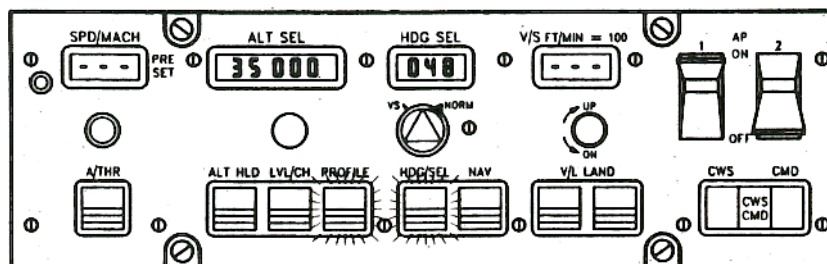
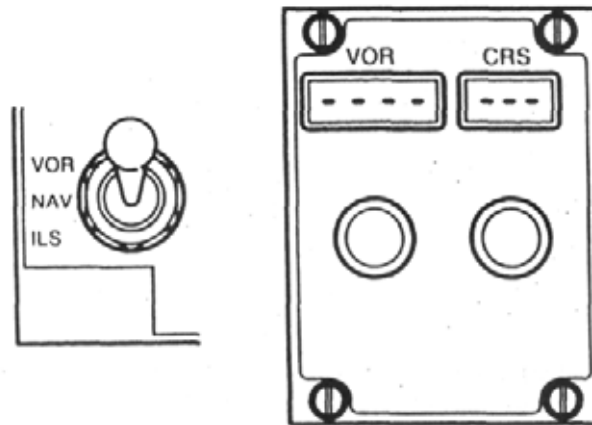


Figure 2-78

Dashes are displayed in the SPD/MACH and V/S windows, and 37000, the desired CRZ ALT, is displayed in the ALT SEL window. After a turn on course, assuming a crosswind component of zero, pressing the HDG SEL knob slews the heading to course, 048 deg. to SPR, the next waypoint along the route of flight.

2.3.1 Return To Autotuning

After verification of raw data course intercept by the PNF, as detailed previously (see Section 2.2.5, Manual NAV Radio Tuning), a return to autotuning of the NAV radios may be implemented by placing the VOR/NAV/ILS SELECTOR SWITCH in the NAV position on the affected side, as in Figure 2-79.



VOR/NAV/ILS SELECTOR/CONTROL PANELS

Figure 2-79

Autotuning is also indicated on the VOR/NAV/ILS CONTROL PANEL by the display of dashes in both the frequency and course windows (see Figure 2-79), and on the PROG page by the letter "A" preceding the NAV frequency (see Figure 2-80).

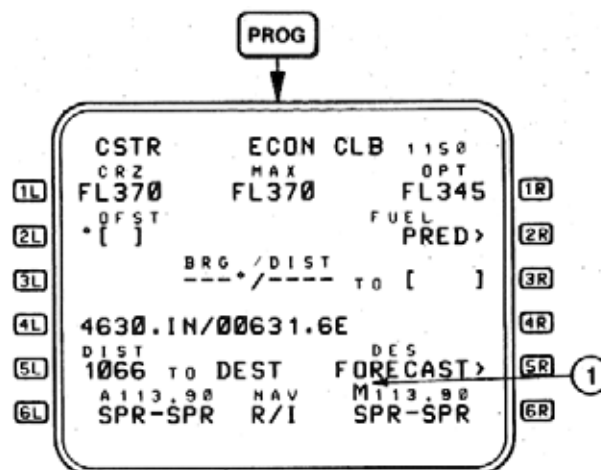


Figure 2-80

The "M", preceding the FMC 2 NAV frequency, **(1)**, would be replaced by an "A" when the VOR/NAV/ILS SELECTOR SWITCH is moved to the NAV position, returning the affected side to autotuning.

2.3.2 Emergency Return - New Destination Defined

The FMC is programmed, during PREFLIGHT, to fly from the origin airport to the destination airport. Any deviation from the active F-PLN relating to a destination other than that specified must be accommodated by redefining the destination. If this is not done, no STARS are available for the new airport, no predictions are available, and the F-PLN page display of the active lateral and vertical situation has no bearing on the current circumstance.

For the purpose of demonstrating the steps required of the pilot in a situation requiring a departure from the active primary F-PLN, two examples are given. The first example, an engine loss prior to the diversion point and an immediate return to the origin airport. In the second example, an enroute diversion is accommodated, and a new destination is specified.

2.3.2.1 Engine Out Page



2.3.2.2 New Route To

As mentioned at the beginning of this chapter, when operational considerations dictate an enroute diversion or a change of destination different than what has already been defined in the FMC, the new destination must be specified. The reasons, from a purely operational viewpoint, are:

1. None of the waypoints in the active Primary F-PLN are associated with the diversion airport until that airport is specified as a new destination.
2. No STARS can be selected at the diversion airport - the STAR prompt is not even displayed on the LAT REV page for the reason stated in #1 above.
3. Predictions are not available - both lateral and vertical profiles are for the original destination only.

Numerous SP messages are generated as a result of the diversion from the original F-PLN, until a new destination is specified.

Normally any diversion from the original F-PLN is due to an emergency of some kind and a turn to the new course is desired as soon as clearance is received.

With that thought in mind, the LAT REV page, which displays most of the change options available to the lateral flight plan, are accessed from PPOS rather than a fixed geographic waypoint. The waypoint chosen is immaterial, as the end result is the same. One pilot always has the active primary F-PLN displayed, normally the PF. Figure 2-88 is an example of F-PLN page A as it might appear between BOSNA and SAR on UB1.

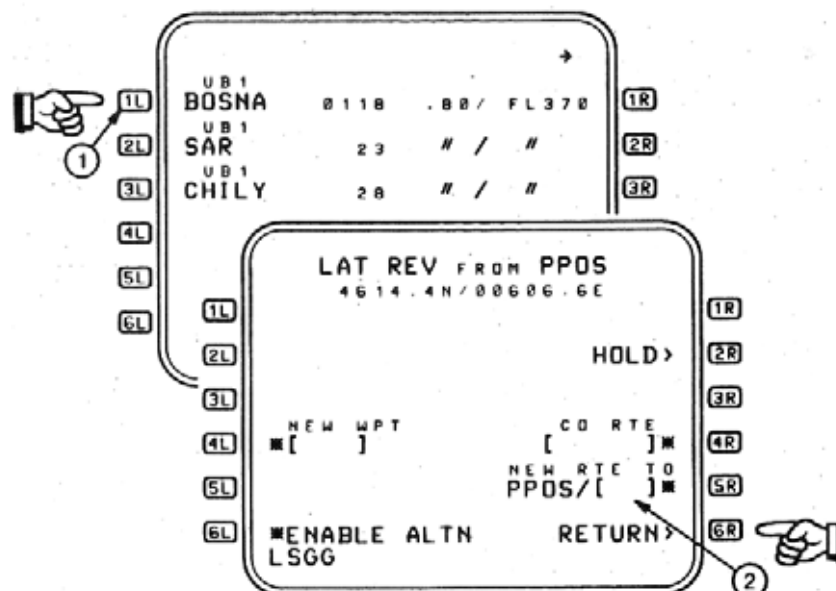


Figure 2-88

Section 2**Flight Phases**

To do a LAT REV from PPOS the LSK adjacent to the FROM waypoint, BOSNA, is pressed **(1)**, resulting in the display of the LAT REV from PPOS page.

Notice the label line for **5R** NEW RTE TO. Since the LAT REV was from PPOS, PPOS/[] is in the data line **(2)**.

With the desired new destination in the SP, LSGG for demonstration pin poses, and pressing LSK **5R**, the following occurs:

1. The new destination is defined in the FMC
2. All downpath way points from PPOS are erased
3. F-PLN page A is displayed with a direct leg from PPOS to LSGG, separated by a F-PLN DISCONTINUITY
4. Predictions are calculated for the destination.

The aircraft does not turn until the F-PLN DISCONTINUITY is removed between PROS and LSGG - the A/P disengages when a DISCONTINUITY is entered, and NAV is engaged - the AP/FD lateral control mode becomes HDG when the new destination is defined and aircraft present heading is maintained until changed by the pilot.

As the direct to leg is flown to LSGG, a new route complete with a STAR to the active runway can be built directly on the active primary F-PLN page. (See Section 2.1.2.3, FROM/TO Method.)

As an option the route can also be built on the SEC F-PLN page, by the PNF, without the necessity of disturbing the PF. When complete, the SEC may be activated and the new route flown back to LSGG. (See Sections 7.1, SEC F-PLN, and 7.1.1, ACTIVATE SEC F-PLN.)

2.3.3 Climb Performance Change

As mentioned previously, in the discussion of PERF MODES, once the current flight phase is entered, changes to the PERF MODE impact only that flight phase, e.g., CLB, when the changes are made on the TACT MODE pages. (See Section 2.1.3.5.5, PERFORMANCE MODES.)

2.3.3.1 Tactical Mode

For the purpose of demonstration, assume ATC requests, "Honeywell 1150 expedite climb through FL220". Compliance with this request, a change to the TACTICAL SITUATION, can either be:

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Flight Phases

- Manually - by deselecting PROFILE on the FCU (the AP/FD system engages in V/S automatically), turning the vertical rate knob to a rate of climb compatible with the urgency of the situation, and then pulling the knob to engage the AP/FD in the V/S mode. The pitch bar of the PFD reflects the selected V/S when the knob has been pulled.

Figure 2-89 is an example of this action on the FCU (1), with the change in the longitudinal engaged mode indicated on the FMA (2). Notice also that the ATS engages in SPD (3) when the longitudinal engaged mode is V/S.

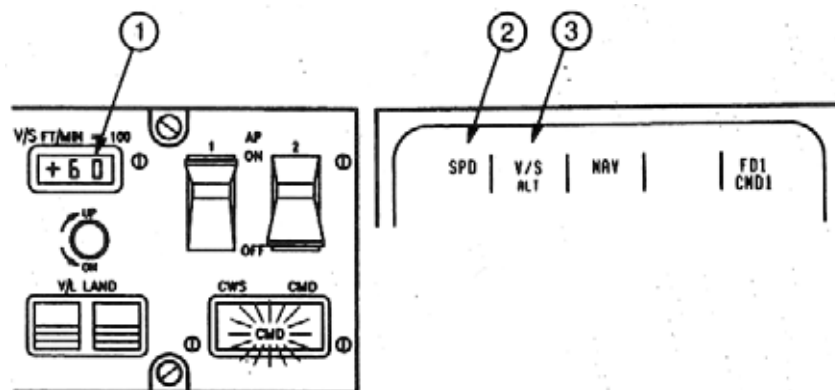


Figure 2-89

In this situation priority is given to V/S - remember the 70% vs 30% mentioned earlier in Section 2.1.3.5.3.1.

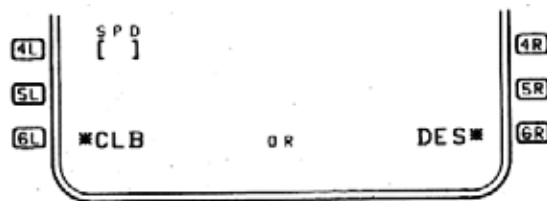
NOTE: If the situation calls for the absolute maximum possible vertical rate over the short-term, the ATS may be disengaged by pressing either throttle button. MAN THR AMBER is then displayed in the ATS mode window of the FMA, and throttle control reverts to the pilot.

Under normal conditions IAS would have to be manually held on elevator, requiring almost constant attention from the PF. The manual method always allows for the maximum possible rate and angle of climb in the short-term, because IAS can be traded for altitude.

OR

- Automatically - by pressing the **TACTMODE** key on the CDU, and selecting the MAX CLB TACT MODE by pressing LSK 3L. Control of the vertical profile is then automatic, requiring no further pilot input, and the rate of climb is maximized over the long-term, or as long as MAX CLB is active.

Figure 2-90 is an example of the steps required to affect a change in the TACT MODE.


Figure 2-90

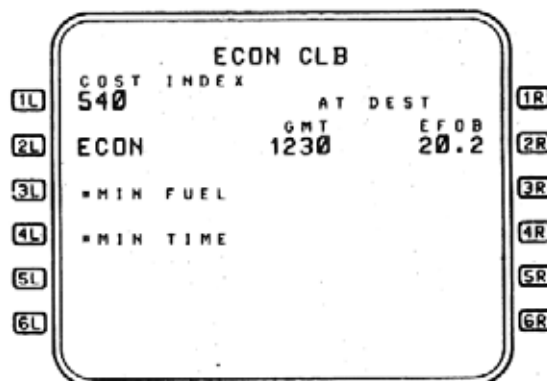
Two button pushes are all that's required: 1 **TACTMODE** key, 2 - MAX CLB prompt.

Reversion back to the ECON STRATEGIC mode may be affected by pressing LSK **2L**.

A complete discussion of this page may be found under Section 2.1.3.5.5.2, TACTICAL MODE PAGE.

2.3.3.2 Strategic Mode

The STRATEGIC mode may also be changed at any time on the STRATEGIC mode page, by pressing the **MODE** key on the CDU. By reference to Figure 2-91 it may be seen that ECON is the active mode, with options on MIN FUEL and MIN TIME.


Figure 2-91

The active mode makes up part of the title line on the STRATEGIC mode page, and is displayed in large font on data lines **2L** through **4L** respectively.

A complete discussion of this page may be found under Section 2.1.3.5.5.1, STRATEGIC MODE PAGE, page 3-66.

2.3.4 Direct to NAV

DIR TO is a lateral navigation function by which the pilot may proceed from PPOS to a selected fixed waypoint by a direct flight path.

The affect this action has on the downpath waypoints of the active primary flight plan is determined by the DIR TO waypoints relationship to the flight plan.

There are two possibilities:

1. If the DIR TO waypoint is a part of the active primary flight plan, including the FROM waypoint, a DIR TO leg is strung from PROS to that waypoint when the DIR TO function is invoked. All original flight plan waypoints, between PPOS and the DIR TO waypoint, are deleted from the flight plan. T-P (TURNING POINT) becomes the FROM waypoint, followed by a DIR TO leg, and the F-PLN page and ND display the new lateral navigation situation.
2. If the DIR TO waypoint is not a part of the active primary flight plan, a DIR TO leg is strung from PPOS to that waypoint when the DIR TO function is invoked. The DIR TO waypoint is followed by a F-PLN DISCONTINUITY, followed by the original flight plan in its entirety. None of the waypoints are deleted. T-P becomes the FROM waypoint, followed by a DIR TO leg, the F-PLN page and ND display the new lateral navigation situation.

Access to the DIR TO function is gained by pressing the **DIR** mode key on the CDU. This access is only allowed if the aircraft position is valid. The SP message, "NOT ALLOWED", would be displayed were position not valid.

When a left LSK is pressed, adjacent to any fixed waypoint, with the SP empty, a soft DIR TO is executed. An additional press of the left LSK causes an immediate DIR TO maneuver by the aircraft to that waypoint. This action selects, or inserts, the desired waypoint in the brackets, they disappear, and F-PLN page A is displayed. If an attempt is made to select a pseudo waypoint, F-PLN marker, or any waypoint other than a fixed waypoint, the SP message, "NOT ALLOWED", is displayed and the DIR TO is not initiated.

NOTE: It is important to realize that no data modification, insertion, or horizontal slewing (there is no NEXT PAGE) is allowed on the DIR TO page. Additionally, access to both LATERAL and VERTICAL revision pages is not allowed. Initiation of the DIR TO function is all that is allowed.

Figure 2-92 is an example of the DIR TO page.

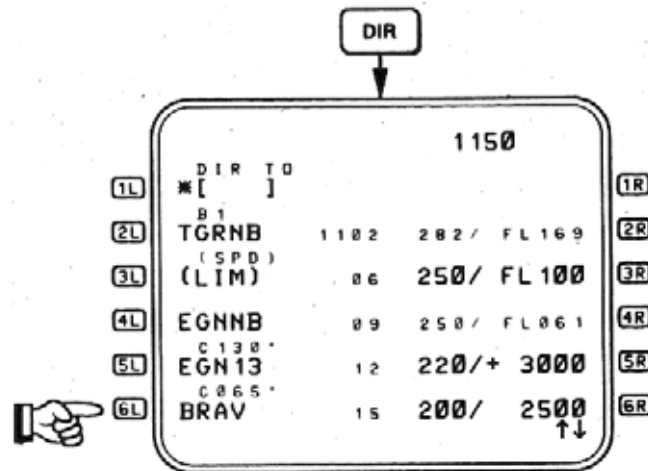


Figure 2-92

Although it is referred to as the DIR TO page it is identical in appearance to the F-PLN page, with a few differences which are covered in this section.

The most apparent difference from the F-PLN page is the DIR TO bracket prompt in data line **1L**.

1L DIR TO - The bracket prompt (*[]) allows selection of the desired fixed waypoint. This fixed waypoint may be selected from the active primary flight plan by pressing the adjacent left LSK if the SP is empty, or it may be manually entered into **1L** from the SP. Vertical slewing may be used to scroll to the desired waypoint in the active primary flight plan, however, the DIR TO prompt remains in data line **1L** until activated, cleared, or another page is accessed without activating the function. In cases where the waypoint is manually entered and is not part of the flight plan, it may be specified by ident., LAT/LONG, P/B/D, etc., as with any waypoint. (See Section 2.1.3.2.6, WAYPOINT INSERTION/F-PLN A and B PAGES.)

2L 6L These data lines are identical to F-PLN page A.

Referring back to Figure 2-92, an example of selecting a DIR TO waypoint from the active primary flight plan is illustrated. Pressing LSK **1L**, initiates an immediate DIR TO EGNNB, and the display changes to Figure 2-93, F-PLN page A with the DIR TO leg inserted in the flight plan.

	FROM		1150	+	
(1L)	T-P	1032	255/	FL370	(1R)
(2L)	(T/D)	49	.00/	FL370	(2R)
(3L)	(LIM)	1103	250/	FL100	(3R)
(4L)	EGNNB	06	250/	FL060	(4R)
(5L)	EGN13	09	220/+	3000	(5R)
(6L)	BRAV	12	200/	2500	(6R)

Figure 2-93

Notice the FROM waypoint is T-P, TGRNB has been deleted because it is positioned between PPOS and the DIR TO point, and EGNNB is the TO waypoint.

As mentioned previously, a DIR TO a waypoint not contained in the active primary flight plan, entails the same steps as a DIR TO a flight plan waypoint except the DIR TO point is followed by a F-PLN DISCONTINUITY.

Figure 2-94 is an example of a DIR TO a waypoint not in the active primary flight plan.

	FROM		1150	+	
(1L)	T-P	0220	277/	FL175	(1R)
(2L)	(T/D)	21	# /	FL110	(2R)
(3L)	(LIM)	22	250/	FL100	(3R)
(4L)	PBD01	30	220/	3000	(4R)
(5L)	--F-PLN DISCONTINUITY--				
(6L)	EGNNB	35	170/	2500	(6R)

① CLR

Figure 2-94

In this case a P/B/D waypoint was defined in the SP, e.g., ARX/125/30, and inserted into the brackets on the DIP TO page by pressing LSK **11**. The FMC names the waypoint PBD01 (the first pilot defined waypoint) and it is followed by a F-PLN DISCONTINUITY because it is not along the flight plan route.

The F-PLN DISCONTINUITY is deleted with the CLR function **(1)** Figure 2-94), the flight plan is now reconnected, and the aircraft flies from PPOS (T-P) to PBD01, to EGNNB, and is

back on the original route of flight.

NOTE: The discontinuity must be cleared prior to sequencing PBD01 or the A/P disconnects. A F-PLN DISCONTINUITY is readily apparent on the ND and is represented as a gap in the GREEN course line between PBD01 and EGNNB in this case.

2.3.5 Transition to Cruise Phase

FMS transition from the CLIMB PHASE to the CRUISE PHASE occurs when:

1. Actual aircraft altitude equals the CRZ FL defined in the FMC + or -50 ft.
2. The CRZ FL defined in the FMC equals the altitude set in the FCU + or -50 ft.

NOTE: If the aircraft is leveled off at an intermediate altitude prior to the CRZ FL specified in the FMC, and the specified CRZ FL is never reached, for whatever reason, the FMC does not transition to the CRUISE PHASE.

2.4 CRUISE

That phase of flight from the T/C to the T/D is referred to as the CRZ phase. As mentioned previously, the CRZ ALT defined in the FMC during PREFLIGHT must have been reached, or redefined in accordance with the present altitude, otherwise the FMC does not transition into the CRZ phase. The CRZ phase is active then, when the aircraft reaches the CRZ ALT defined in the FMC.

During the CRZ phase, the vertical profile comprises elements of level, ascending, and descending flight path segments. Aircraft performance in these segments is based on altitude, speed, and thrust targets defined prior to entry into the CRZ phase, or modifications made to accommodate current changes in the tactical situation.

Functions not covered previously, which are likely to be encountered in cruise, are discussed in this section.

2.4.1 Situational Modes

Situational modes allow the pilot to deviate from the vertical profile without affecting a vertical flight plan change. Situational modes are usually invoked to respond to a temporary situation with the intent to later return to the defined vertical profile, e.g., descent from the CRZ ALT immediately, in compliance with an ATC request, rather than wait for the flight plan to intercept the defined vertical profile T/D point.

There are four Situational modes which may be encountered in the CRZ flight phase. These modes may either be manually selected or automatically engaged.

2.4.1.1 IMM DES Mode

The Immediate Descent Mode provides a constant rate of descent (1000 fpm), until the defined vertical profile is intercepted, at the selected Strategic or Tactical Performance mode speed. Vertical guidance initiates descent within 2 seconds of mode activation. IMM DES is displayed and may be activated when the following conditions exist:

1. PROFILE is engaged.
2. CRZ flight phase is active and vertical guidance has acquired or captured the defined CRZ FL.
3. The FCU altitude is at least 250 ft. below the defined CRZ FL.
4. A STEP DES or destination exists in the flight plan.

NOTE: It is important to realize that the IMM DES* is only displayed when #3 and

STEP DES or a destination) above are accomplished.

Manual Engagement - occurs when the IMM DES* , LSK **IR** on the F-PLN page, is pressed.

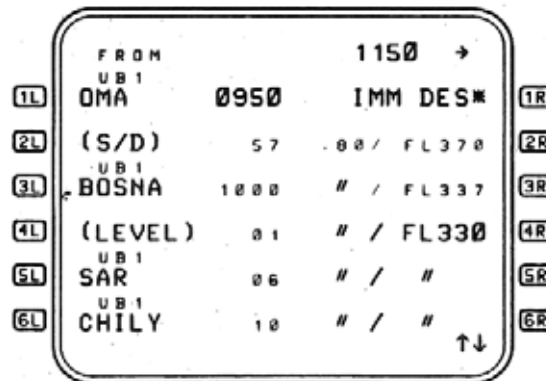


Figure 2-95

Automatic Engagement - by the FMS occurs when all the following conditions are met:

1. Aircraft altitude above CRZ FL.
2. Vertical guidance is not actively capturing the FCU altitude.
3. Maximum Descent Tactical Mode is not engaged.

Automatic Disengagement - by the FMS occurs when the following conditions are met:

1. Maximum Descent Tactical Mode is engaged. See Section 3.5.2.1, MAX DES TACTICAL MODE.
2. PROFILE is not engaged.
3. Vertical guidance has acquired or captured the FCU or FMS defined CRZ FL to which the aircraft has been descending.
4. DES or APPR flight phase is active and the vertical guidance descent state is above-path or on-path. (See Section 2.5, DESCENT.)
5. CRZ phase is active and STEP DES is not active.
6. EO D/D Situational Mode is active. (See Section 2.3.2.1.3, EO DRIFTDOWN SITUATIONAL MODE.)
7. A HOLD leg with a manual termination (HM) is active or next in the F-PLN, and TTG is < 3 minutes. (See Section 2.5.4, HOLDING.)

2.4.1.2 Decel Mode

The Deceleration Mode provides for a decrease in IAS from present speed to minimum

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Flight Phases

speed (Vmin), limited by the FAC to maneuvering speed for the configuration (VFTO - GREEN DOT). Vertical guidance initiates speed control to the new target speed two seconds after mode selection. DECEL Mode is manually selectable only, no auto engagement by the FMC is provided.

DECEL* is displayed adjacent to LSK **1R** on the F-PLN page (Figure 2-96) under the following conditions:

1. PROFILE is engaged.
2. Vertical guidance has acquired or captured the FCU selected altitude.
3. DESCENT or APPROACH flight phase is active.
4. Vertical guidance descent state is above path.
5. Tactical SPD mode is not active.
6. A HOLD leg with a manual termination (HM) is active or next in the F-PLN. and TTG is < 3 minutes. (See Section 2.5.4, HOLDING.)

DECEL mode is selected by pressing LSK **1R** when the DECEL* prompt is displayed.

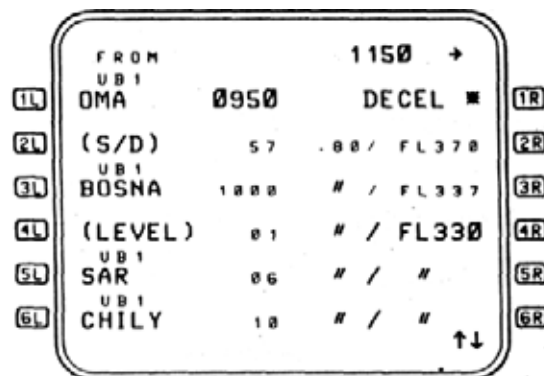


Figure 2-96

After the DECEL* prompt is pressed, it disappears and the display reverts to the F-PLN page.

The DECEL mode disengages automatically under the following conditions:

1. PROFILE is not engaged.
2. DESCENT or APPROACH phase is not active/
3. Tactical SPD mode is engaged.

4. Strategic MODE is changed.
5. The vertical guidance descent state is on-path or below-path.
6. An EO condition has been detected by the TCC.
7. Vertical guidance descent state is above-path; or the descent/approach path is considered invalid by the FMC and the actual aircraft altitude is above the FCU selected altitude.

DECEL* prompt is displayed when the aircraft has overflown the T/D pseudo waypoint on the F-PLN page, usually as a result of the descent altitude not having been selected in the ALT SEL window of the FCU. If the descent altitude is not set in the FCU ALT SEL window, with PROFILE engaged, the automatic descent does not occur. If PROFILE is not engaged, it is necessary to pull the altitude set to engage LVL CHANGE to begin descent - in this case the DECEL* prompt is not displayed.

The DECEL function is intended to allow the AFS to re-intercept the vertical profile after the T/D point has been passed.

2.4.1.3 IMM CLB Mode

After a STEP CLB has been entered into the vertical F-PLN, the Immediate Climb Situational Mode enables climb to a new CRZ FL prior to sequencing the defined STEP point in the lateral F-PLN. Vertical guidance initiates a climb two seconds after mode selection, at the defined cruise target speed. Climb IAS may be modified on the TACT MODE or Strategic MODE page. (See Sections 3.1.3.5.3.1, STEP ALTITUDE/PREDICTION PAGE, and 3.3.3, CLIMB PERFORMANCE CHANGE.)

The IMM CLB« prompt is displayed on the F-PLN page under the following conditions:

1. PROFILE is engaged.
2. CRUISE flight phase is active.
3. The FCU selected altitude is more than 250 ft. above the current CRZ FL.
4. A HOLD leg with a manual termination (HM) is not active or next in the F-PLN, and TTG is not <3 minutes. (See Section 2.5.4, HOLDING.)

The IMM CLB mode is engaged by pressing LSK **IR**, IMM CLB*.

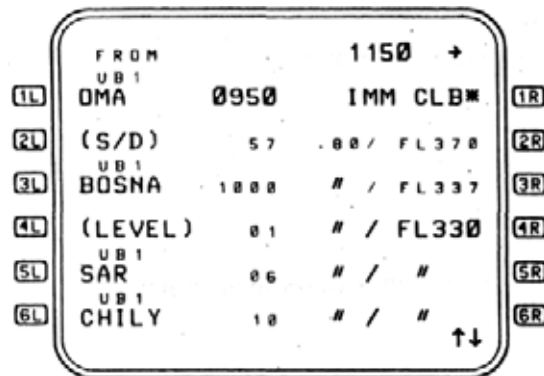


Figure 2-97

A climb is initiated within two seconds of mode selection, the IMM CLB* prompt disappears, and the display reverts to the F-PLN page.

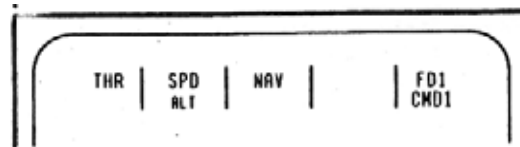
The IMM CLB mode automatically disengages when:

1. PROFILE is not engaged.
2. An EO is detected by the TCC.
3. The STEP CLB is deleted from the vertical F-PLN.

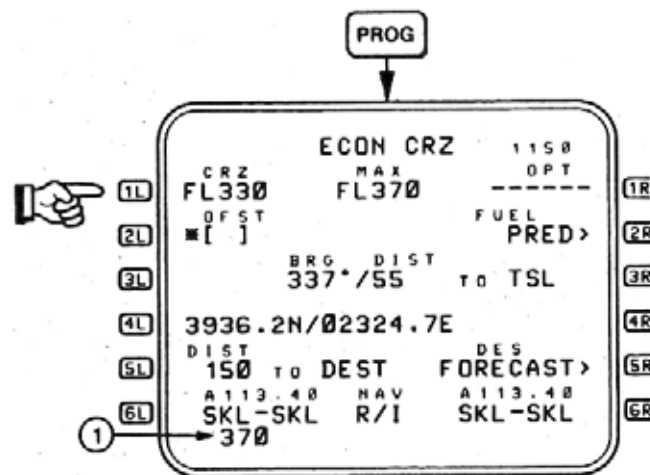
2.4.2 CRZ ALT Changes

There are three methods of affecting an altitude change while the A/P is engaged:

1. Manually - through the FCU, an immediate climb/descent is initiated by selecting the desired altitude in the ALT SEL window, and either pulling the set knob or pressing the LVL/CH P/B to engage the LVL CHANGE mode. Pressing the LVL/CH P/B also disengages PROFILE, however, if PROFILE is engaged, pulling the set knob does not disengage it, rather it initiates an immediate climb/descent to the altitude selected on the FCU, except in cases where a STEP CLIMB is in the vertical profile, or if aircraft PPOS is before the T/D point - pulling the set knob in these cases arms P CLB or P DES BLUE. V/S mode may also be utilized, and may be more desirable if the altitude change is only 1000 to 3000 feet. Regardless of the mode selection, e.g., in a climb, either PROFILE, LVL CHANGE, or V/S engages, CL is annunciated on the TRP - climb power is applied by the ATS, THR/SPD/NAV GREEN and ALT BLUE is displayed on the FMA, if LVL CHANGE was engaged (see Figure 2-98), and the A/P initiates a climb to the new altitude selected in the FCU. If PROFILE is engaged, the ATS and Longitudinal engaged modes in the FMA are preceded by a P, e.g., P THR and P SPD. With PROFILE engaged, pulling the set knob also causes display of the Situational Modes IMM CLB/IMM DES, depending on the flight phase, on the F-PLN page, allowing the pilot to initiate an immediate descent if desired.


Figure 2-98

2. Manually - via the PROG page, by changing the CRZ altitude in data line **1** (see Figure 2-99). For demonstration purposes, assume level at FL330, and a climb to FL370 is desired at PPOS.


Figure 2-99

A manual climb to FL370, utilizing the PROG page to input data to the FMC, is affected in the following manner:

- Write 370, or FL370, in the SP (**1**, Figure 2-99)
- Press LSK **1L**
- Select 370 in the ALT SEL window of the FCU

NOTE: With or without PROFILE engaged, the climb is immediately initiated when the set knob is pulled, except in cases involving a STEP CLIMB or a PROFILE descent when aircraft PPOS is prior to the T/D point.

3 Automatically-through use of the STEP CLIMB function. (See Section 2.1.3.5.3.1, STEP ALTITUDE/PREDICTION PAGE.)

2.4.3 Cruise Performance Change

Modifications to the defined cruise target speed may be accommodated on either the TACT Mode page, affecting the current flight phase only, or the Strategic Mode page, affecting all the remaining flight phases.

In flight, the TACT MODE page is the more useful of the two, because changes in target speed are very likely involve a choice between ECON or an IAS dictated by a tactical situation, such as the need to reduce to turbulent air penetration speed, or an increase/decrease specified by ATC.

Access to the TACT MODE page is gained by pressing the **TACTMODE** key on the CDU (see Figure 2-100).

Assume ATC requests, "Honeywell 1150, can you increase speed to Mach .82 for spacing?"

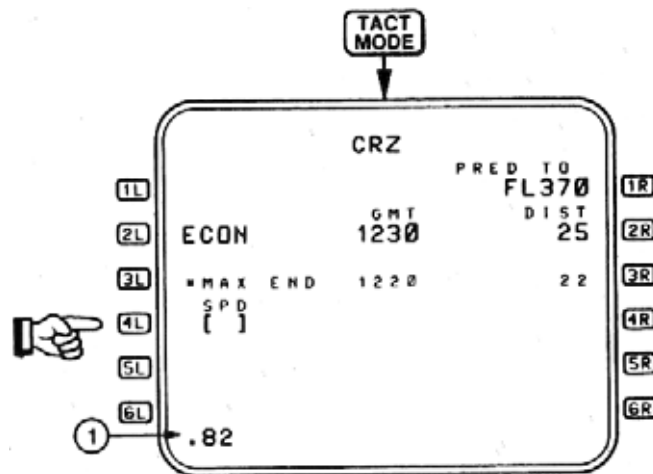


Figure 2-100

Writing .82 in the SP and pressing LSK **4L** twice (first entry small font with asterisk) is all that is required to implement this request.

The return to normal cruise target speed is accomplished by pressing the *ECON prompt in **2L**. (See Section 2.1.3.5.5.2, TACTICAL MODE PAGE.)

Cruise target speed may also be modified on the Strategic Mode page. Pressing the CDU **MODE** key causes display of this page.

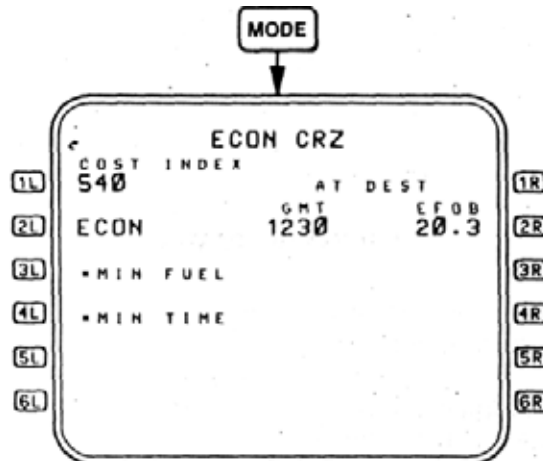


Figure 2-101

Three choices are available, affecting the remainder of the flight phases:

1. ECON - The current selected performance mode.
2. MIN FUEL
3. MIN TIME

Normal cruise target speed is achieved with the ECON mode. MINIMUM FUEL represents a speed reduction from ECON, and MINIMUM TIME a speed increase. These modes are available at anytime. (See Section 2.1.3.5.5.1, STRATEGIC MODE PAGE.) Manual speed selection is always available on the FCU. Figure 2-102, a portion of the FCU, demonstrates the steps required to make a manual speed change on the FCU when PROFILE is engaged.

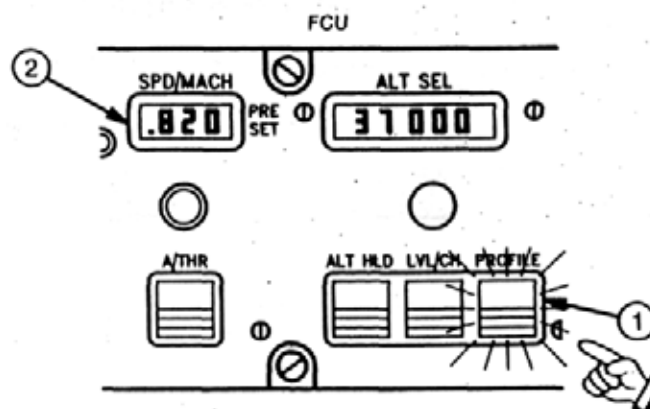


Figure 2-102

First disengage PROFILE by pressing the illuminated PROFILE P/B (1), then turn the SPD/MACH set knob to .820 Mach (2). The ATS increases power to acquire the new target speed.

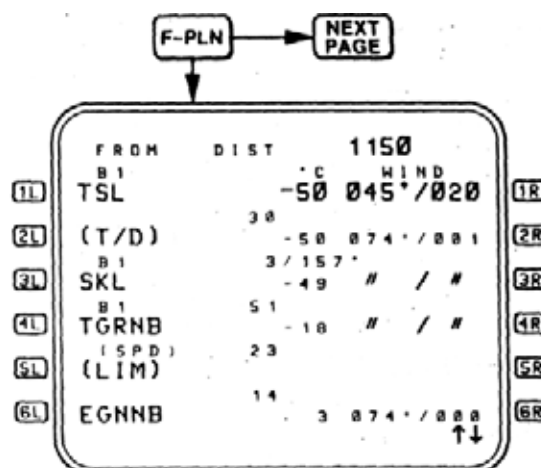
2.4.3.1 Wind Entry in Cruise

During PREFLIGHT the forecast CRZ WIND was entered on INIT page A. Actual wind at the CRZ FL, for each route segment, should also be entered to make the vertical profile, and the predictions based on that profile, as accurate as possible.

Temperature, and wind direction/velocity may be entered or revised on the following pages:

1. VERT REV page B. (See Section 2.1.3.5.2.1, VERT REV PAGES A & B.)
2. STEP PRED page. (See Section 2.1.3.5.3.1, STEP ALT/PRED PAGE.)
3. INIT page A (PREFLIGHT ONLY). (See 3.1.2.1, INIT A PAGE.) F-PLN page B. (See Section 2.1.3.4, F-PLN PAGE B.)
5. FUEL PRED PAGE. (See Section 2.2.6.3, FUEL PRED PAGE.)
6. DES FORECAST PAGE. (See Section 2.4.6.3, page 3-151.)

Figure 2-103 is an example of F-PLN page B with the actual wind at that position entered into data line 1R at TSL. Entry at the remaining F-PLN waypoints are made in like manner.


Figure 2-103

Pilot entered temperature and wind values are displayed in large font. Without pilot entered values, the temp/wind at the FROM waypoint is the actual memorized wind at that position. Wind entry on F-PLN page B cannot be made until the T/C and T/D point calculations have been completed. On long overwater flights, it is recommended that wind input be made at oceanic waypoints approximately one hour apart, so as to make the fuel predictions as accurate as possible. The CRUISE phase is the best time to perform the input of this wind data. The FMC uses a combination of the actual wind and pilot entered forecast wind, to arrive at a calculation of predicted wind, upon which the predictions are based.

Proper format for these entries may be found in APPENDIX B, pages B-10 and B-11. Basically, if wind alone is input, the value must be preceded by a slash /. PPOS wind values are available on the ND (1), Figure 2-104). and the ISDU (2), Figure 2-105). (See Section 3.1.3.5.4, WIND/TEMPERATURE ENTRY, page 3-64.)

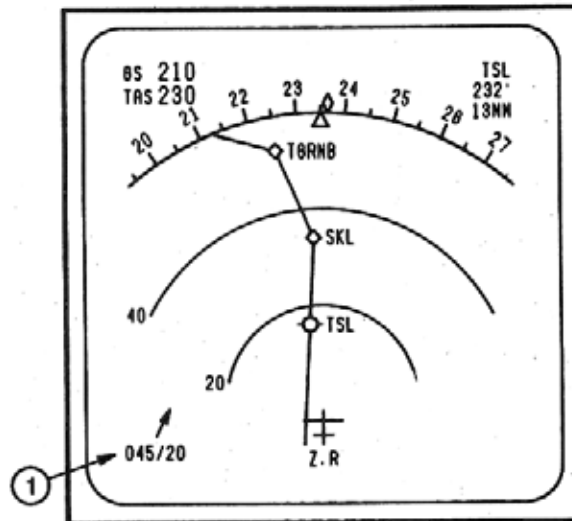


Figure 2-104

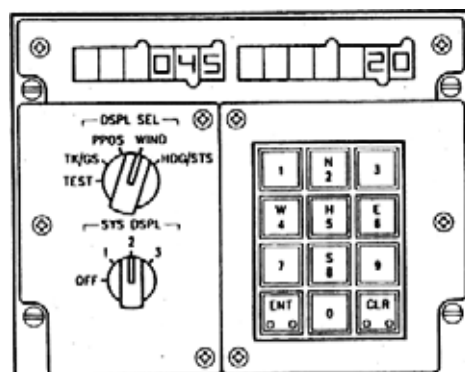


Figure 2-105

2.4.4 Parallel Offsets

A Parallel Offset, a lateral flight plan function, is a course exactly paralleling the active flight plan course, and offset to the left or right of that course a selectable distance up to and including 99 nautical miles. The function is especially useful to provide traffic separation subsequent to an ATC request, or when deviating around enroute thunderstorms.

Parallel Offsets are allowed on four F-PLN leg types:

1. CF - Course to a Fixed Waypoint is a great circle course from PPOS to a downpath waypoint.
2. TF - Fixed Waypoint to Fixed Waypoint is a great circle course between two fixed waypoints.
3. DF - Direct to a Fixed Waypoint is a combination of a great circle arc path from PPOS, tangent to and including a computed great circle course to the desired termination waypoint - a DIP TO leg.
4. FM - Course from a Fixed Waypoint with a Manual Termination is a great circle course starting at a fixed waypoint that is terminated by a flight plan revision.

Basically this means a Parallel Offset is allowed on all legs between fixed waypoints, courses to a fixed waypoint, and DIP TO legs to a fixed waypoint.

An Offset cannot be inserted on a short leg with a distance remaining below a prescribed minimum, or when the next waypoint is the destination. An Offset is automatically canceled when the leg type or next waypoint does not meet the above criteria. The SP message, "CANCELING OFFSET", is displayed, and indicates that the Offset is canceled at the next waypoint.

By reference to Figure 2-106, an Offset of 5NM right of course is desired.

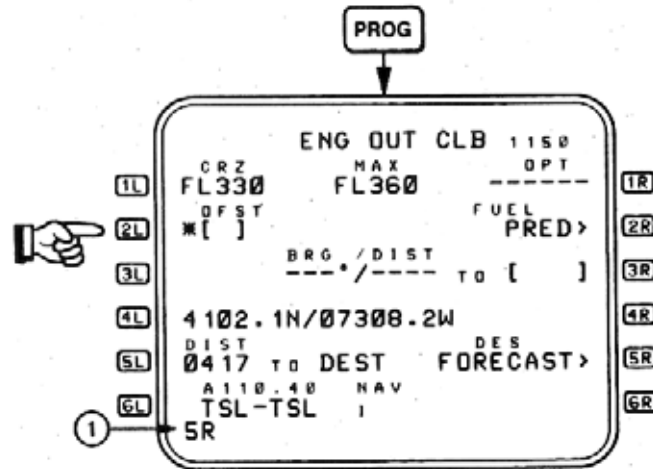


Figure 2-106

With 5R written in the SP **1**, pressing LSK **2L** inserts the Offset distance into the brackets and the Offset function is immediately activated. Figure 2-107 is an example of how the ND would appear after insertion of a 5R Offset, and before a turn to intercept is executed.

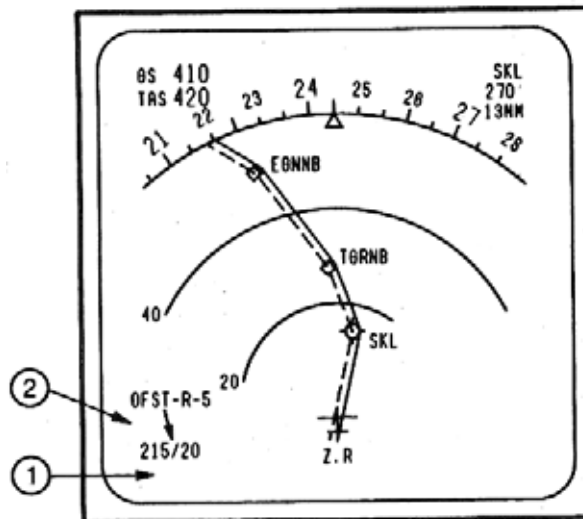
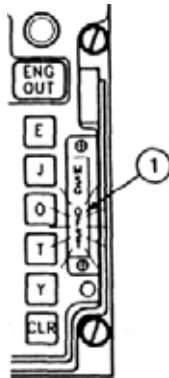


Figure 2-107

The original active primary flight plan course is represented by the dashed line, and the Offset course by the solid line. A 45 degree intercept would be flown to the new course, by the FMS, providing NAV is engaged. After interception of the Offset course, the NM displacement from the original course would be displayed in the lower left portion of the ND next to PROS wind **1**, and the Offset data field is displayed just above **2**. This data field is only displayed when an Offset is active. The OFST annunciator, on the right lower portion of both CDUs, is illuminated as long as the Offset function is active.

CDU


Figure 2-108

Clearing an Offset may be accomplished by:

1. A DIR TO a downpath waypoint.
2. By using the CLR function - write CLR in the SP by pressing the **CLR** key on the CDU and entering it into the **2L** data field - providing the SP is empty.

If the CLR function is used, the aircraft turns to a 45 degree intercept to reintercept the original course, providing NAV is engaged. If NAV is not engaged a manual intercept may be performed using the HDG bug.

2.4.5 Fuel Predictions

Cruise fuel predictions may be found on the FUEL PRED page, with access provided from the PROG page.

Referring back to Figure 2-106, a sample PROG page, notice the FUEL PRED > prompt in data field **2R**. Pressing LSK **2R** causes display of the FUEL PRED page (see Figure 2-109).

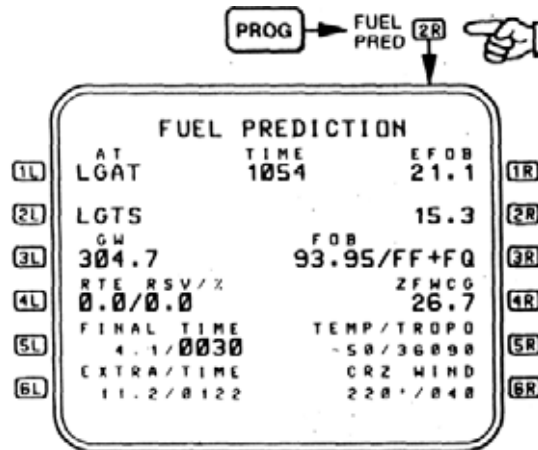


Figure 2-109

2.4.6 Descent Preparations

Just prior to the T/D the ATIS information is normally obtained, and the STAR and/or active runway are selected or modified, if a STAR/RWY was selected during PREFLIGHT, to reflect the expected approach.

2.4.6.1 RWY/STAR Selection

The mechanics of selecting a STAR are identical to the selection of a SID (see Section 2.1.3.2.1, SID/RWY SELECTION), and begins with a LAT REV at the destination or IAF. Figure 2-110 shows the LAT REV from EGNNB page. EGNNB is a IAF for LGAT.

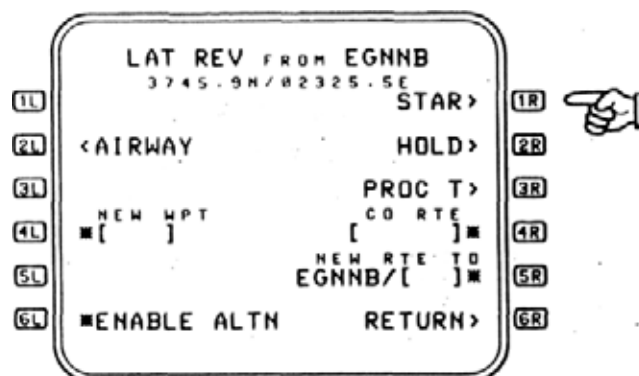


Figure 2-110

Pressing LSK **1R**, the STAR > prompt, results in the display of the STAR to LGAT page, Figure 2-111.

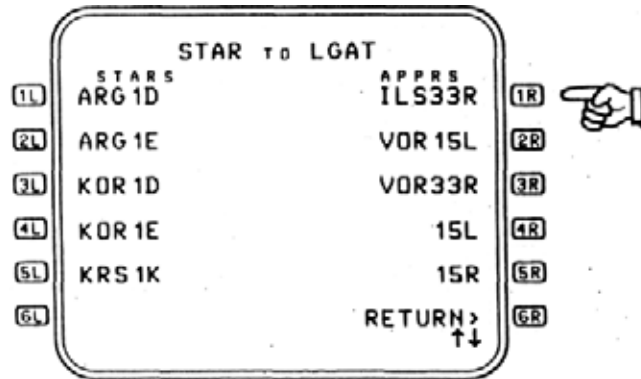



Figure 2-111

ILS approaches are in progress to RWY33R at LGAT, so pressing LSK **1R** selects RWY33R from the list. The display then changes to Figure 2-112, showing, <SEL>ILS33R **1**, and a list of compatible STARS to the left. The list of STARS may be scrolled, by pressing the scroll  key in a down direction, to reveal the desired arrival, in this case the TGR1A.

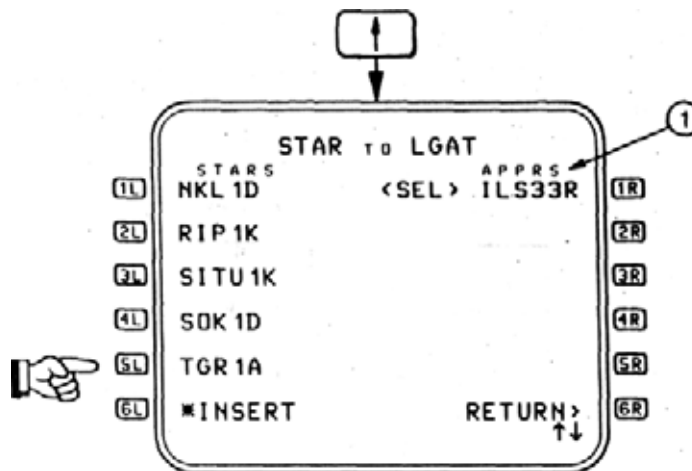


Figure 2-112

The process of selecting the arrival route and active runway is now complete, as indicated by Figure 2-113.

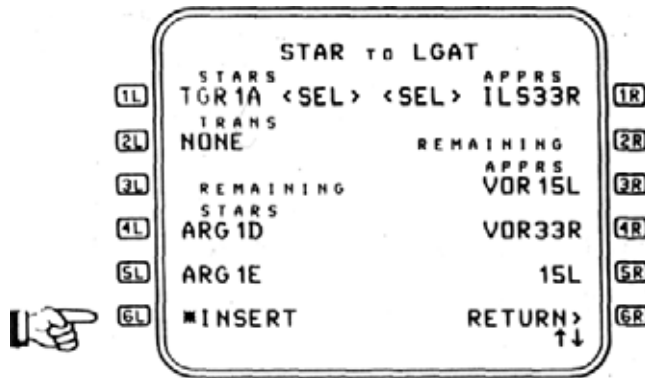



Figure 2-113

Pressing the * INSERT prompt is all that remains to insert the TGR1A STAR into the active primary flight plan.

As soon as the * INSERT prompt is pressed the display reverts to F-PLN page A,

Figure 2-114. Scrolling down , to the --END OF F-PLN--- marker, shows the arrival route and the missed approach route for RWY33R stojng in the F-PLN.

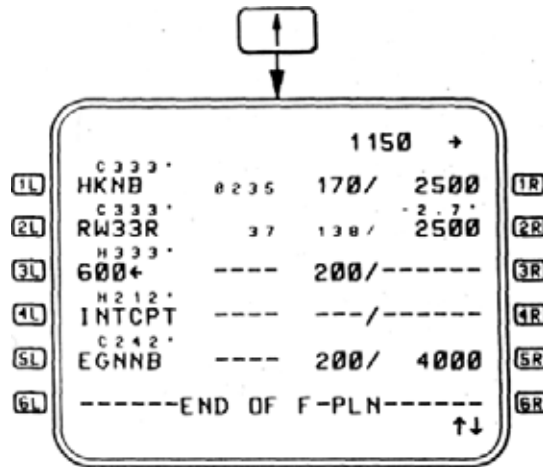


Figure 2-114

2.4.6.2 RWY Change Option

Many times an approach is programmed into the FMC only to change at the last minute. This is only possible, of course, at airports with more than one possible landing runway, given the surface wind condition. To preclude this eventuality from occurring it is suggested, as an operational technique, that the other possible approach runway be entered into the SEC F-PLN by the PNF.

The SEC F-PLN may be accessed from the SEC INDEX by pressing **SEC F-PLN** key on the CDU.

The display is a copy of the active primary flight plan and may be modified in any way desired without impacting the active primary flight plan. The process of selecting another approach runway on the SEC F-PLN is identical to that already detailed for the active primary flight plan.

Should it become necessary, during the initial approach, the SEC F-PLN can be activated, becoming the active primary flight plan with the runway change already inserted. (See Sections 6.1.2, SEC F-PLN A AND B, and 6.1.1, ACTIVATE SEC.)

2.4.6.3 DES Forecase Page

The DES FORECAST PAGE is accessed by pressing LSK **5R** on the PROG page. (See Figure 2-99.) This page should be accessed, and the destination wind inputs made prior to beginning descent so as to make the descent profile predictions as accurate as possible. Figure 2-115 is an example of the DES FORECAST page as it would appear initially, with the destination defined and before data input.

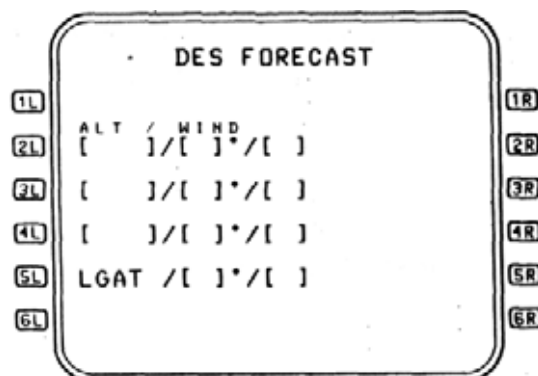


Figure 2-115

The purpose of this page is to allow the pilot to enter wind values for the DESCENT and APPROACH phases of the active primary flight plan.

2L WINDS - Pilot input in these data lines impact the FMC wind **4L** model. A maximum of three different altitude/wind combinations may be specified. The rules governing this data input are:

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- Altitude and wind data must be supplied as a single entry if the fields are blank, otherwise the SP message, "FORMAT ERROR", is displayed (see APPENDIX, ALT/WIND, page B-2).
- To replace existing data in either field, only the new value need be entered. For only a wind entry, the preceding slash is optional.

Once entered, the altitude values are sorted by altitude, by the FMC, and the resulting display is in a descending order, regardless of the order entered by the pilot, e.g., the lowest altitude specified is on the bottom.

5L WIND AT DESTINATION - The destination surface wind, from ATIS, is entered into this field. It is identical to the pilot entered wind values appearing on VERT REV page B and F-PLN page B. The destination airport, as defined on INIT page A during PREFLIGHT, is displayed first in the data line, followed by brackets allowing only the insertion of a wind value, i.e., direction/velocity. The destination specified cannot be cleared on this page - the entry of CLR into the data field clears only the wind value.

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

Figure 2-116 Is an example of the completed DES FORECAST page.

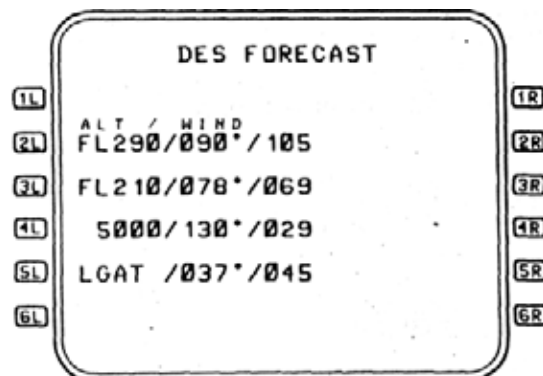


Figure 2-116

2.4.7 Transition to Descent Phase

FMS transition from the CRUISE phase to the DESCENT phase occurs when:

1. Aircraft altitude is more than 250 ft above the CRZ FL specified in

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the FMC, i.e., a lower CRZ FL has been specified in preparation for initial descent.

2. Aircraft altitude is more than 250 ft above the altitude set in the ALT SEL window of the FCU.

2.5 DESCENT

The DESCENT flight phase extends from the T/D to the beginning of the APPROACH phase, when slats/flaps are first extended. Although DESCENT and APPROACH are separate flight phases, as they relate to the FCU, both share a number of identical characteristics. These are covered in this section.

The vertical profile, in the DESCENT and APPROACH phases, is constructed of level and descending flight path segments. These flight path segments occur in a sequence allowing the aircraft to meet the vertical profile as it has been defined in the FMC.

With PROFILE engaged and descent unrestricted to the altitude set on the FCU, which seldom occurs in an operational environment, the vertical profile is exactly as computed by the FMC.

The ECON performance mode, with PROFILE engaged, produces an IAS of 250-265 kts at idle thrust, which saves approximately 500 pounds of fuel per descent.

2.5.1 Descent Vertical Profile Guidance

To monitor the aircraft progress on the vertical profile, while at the same time adhering to the selected speed, thrust, and altitude targets, the FMC considers three main vertical guidance descent states:

1. On-Path - When vertical guidance is actively capturing or maintaining the vertical profile descent/approach path.
2. Below-Path - When vertical guidance is not actively capturing or maintaining the vertical profile descent/approach path, and the aircraft altitude is less than the altitude associated with that path, at the current Distance to Destination of the aircraft.

Above-Path - When vertical guidance is not actively capturing or maintaining the vertical profile descent/approach path, and the aircraft altitude is greater than the altitude associated with that path, at the current Distance to Destination of the aircraft.

NOTE: Very often, the descent profile defined in the FMC cannot be flown because descent clearance is not received prior to the T/D. In this case, with profile engaged, an above-path state is identified by the FMC — it wants the aircraft to descend — but a descent cannot occur until a lower CRZ ALT is set on the FCU. When this above-path state occurs, under these conditions, the aircraft decelerates to VFTO/GREEN DOT as the FMS tries to capture the path. To preclude this from occurring, it is recommended that profile be disengaged until descent clearance is received. After clearance is received, a new CLR ALT can be defined, profile reengaged, and descent initiated.

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Once the descent begins, On-Path means the descent profile is on the vertical path defined in the FMC, and no action is required of the pilot, however, Below-Path and Above-Path cause changes in vertical rate and IAS that the pilot should be aware of.

Below Path - The FMC commands the AP/FD to level off the aircraft until the vertical path is recaptured. The level off maneuver is at a rate of change of .05g. Speed is maintained on thrust and equates to the value previously defined in the FMC. Once target speed is reached the thrust levers modulate toward idle in accordance with target IAS and vertical rate changes necessary to maintain target.

Above Path - The FMC commands the AP/FD to increase the vertical rate until the vertical profile is recaptured. This is accomplished by accelerating to the target descent speed + 20 kts., or 290 KIAS, whichever is higher, and increasing the vertical rate in an attempt to reintercept the descent path. If the aircraft is still above the descent path when this speed is reached, the message, "MORE DRAG", is displayed on the PFD (1, Figure 2-119). "MORE DRAG", indicates an over-speed condition exists and speedbrakes are required to maintain the existing speed schedule. The SP message, "LESS DRAG", directly associated with the deployment of the speedbrakes, indicates an under-speed condition exists as a result of the target speed decreasing 10 kts. below target.

In the following example (1, Figure 2-117), the FMC has computed the T/D between TSL and SKL

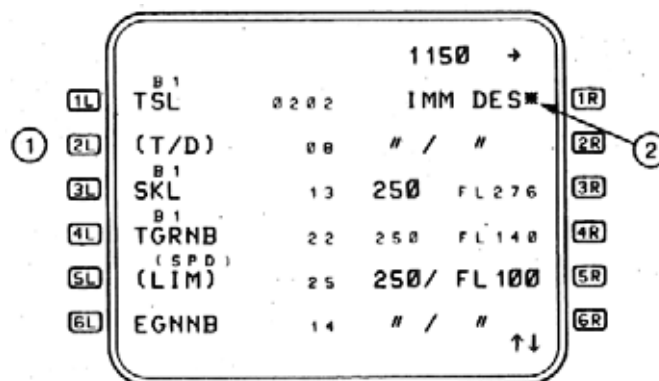


Figure 2-117

For demonstration purposes assume an ATC clearance to FL70:

1. 7000 is selected in the ALT SEL window on the FMC.
2. The altitude knob has been pulled.
3. PROFILE is engaged.

The IMM DES * prompt (2) is displayed after the ALT SEL knob has been pulled. If no further action is taken by the pilot, the aircraft automatically descends, to the altitude set on the FCU, when the T/D point is reached. If descent is desired prior to the T/D, the IMM

DES mode may be activated (see Section 2.4.1.1, IMM DES MODE).

On the FMA portion of the PFD, P DES is displayed in CYAN under P ALT, to indicate to the pilot that the AP/FD is armed to capture the vertical profile defined in the FMC (1), Figure 2-118).

PFD-FMA

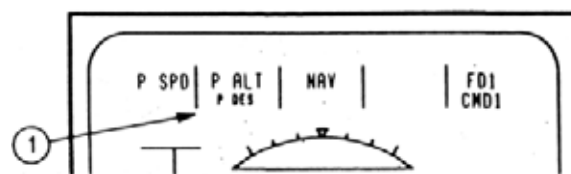


Figure 2-118

P DES CYAN begins to flash just prior to the T/D point, to alert the pilot to the impending descent.

NOTE: It is important to realize the difference between PROFILE and ALT HOLD insofar as the ALT SEL knob is concerned. If PROFILE is not engaged, the AP/FD begins an immediate descent when the ALT SEL knob is pulled - LVL CHG engages. IF PROFILE is engaged, however, the descent does not occur until the aircraft sequences the T/D point. In both cases the lower altitude must have been set in the ALT SEL window of the FCU.

The progress of the descent may be monitored on the PFD and PROG page. The displayed vertical deviation represents the difference between aircraft altitude and the altitude of the vertical profile descent/approach path.

Vertical deviations from the descent path are displayed on the PFD Vertical Deviation Scale (2), Figure 2-119),

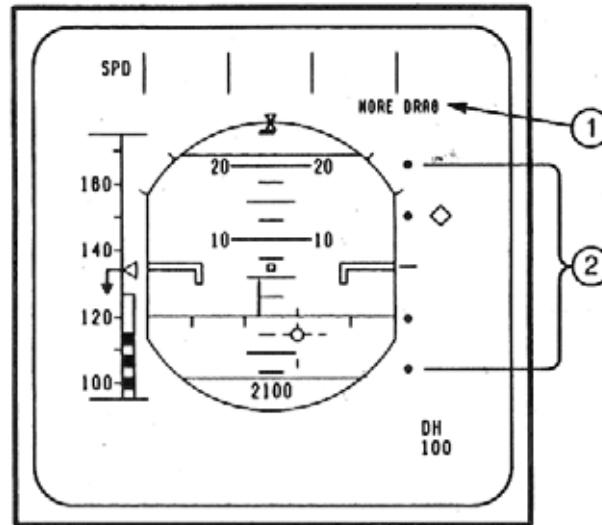


Figure 2-119

and the PROG page (1, Figure 2-120). Deviations over 1000 ft., are not displayed on the PFD.

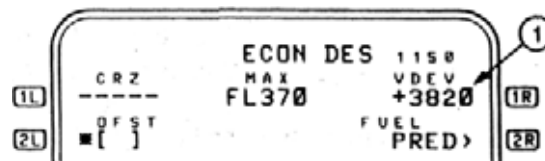


Figure 2-120

2.5.2 Descent Vertical Revisions

Speed changes are accommodated either via the FCU manually, or if PROFILE is engaged, on either the TACT MODE (see Section 2.1.3.5.5.2, TACTICAL MODE PAGE), or the strategic MODE page (see Section 2.1.3.5.5.1, STRATEGIC MODE PAGE).

Figure 2-121 is an example of the displayed page when the TACT MODE key is pressed on the CDU.

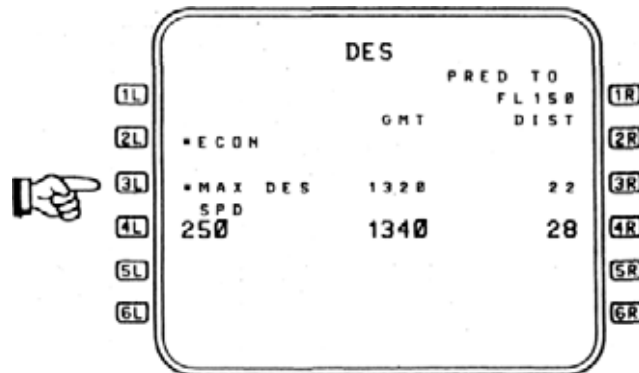


Figure 2-121

This page was covered in detail in the previous section, with the exception of the MAX DES mode.

2.5.2.1 MAX DES Tactical Mode

MAX DES is intended to allow the pilot to, "expedite descent", when requested by ATC, without having to disengage PROFILE. Pressing LSK **3L** activates the MAX DES mode, causing a pushover to attain MMO- .02 MACH, or VMO/325 KTS/ -10 KTS, whichever is lower. The vertical guidance thrust target is idle, however, speed is held with a combination of thrust and vertical rate. This maneuver results in the aircraft being considerably below the FMC calculated descent path. The exact amount of the vertical deviation, to a maximum of 9990 ft., is indicated on the PROG page. When MAX DES is deselected, by selecting another mode, the aircraft levels off until the descent path is reintercepted.

NOTE: When ATC requests cause significant deviation from the defined vertical profile, it is recommended that PROFILE be disengaged and the altitude and speed changes be accommodated manually on the FCU. If desired, after the change is initiated manually, the FMC data can be changed accordingly and PROFILE reengaged.

2.5.3 Along Track Offsets

The Along Track Offset (ATO) waypoint, is a pilot defined lateral navigation waypoint that may be entered directly into the active primary flight plan only on the F-PLAN pages. A waypoint defined as an ATO is included in the list of 20 possible pilot defined waypoints. Operationally this type of waypoint is especially useful when the clearance is received to

cross a point before or after a waypoint along the route of flight.

2.5.3.1 ATO Waypoints

An ATO waypoint, entered as a PLACE/DISTANCE (PD), is written in the SP to comply with an ATC crossing restriction which is not part of the selected STAR. During descent an ATC clearance is received to, "cross 10 north of TGRNB at or below FL120, maintain FL70". To enter this altitude constraint into the flight plan:

1. On either F-PLN page - write TGRNB/-10 in the SP (Display (A) **1**), Figure 2-122).

(A)

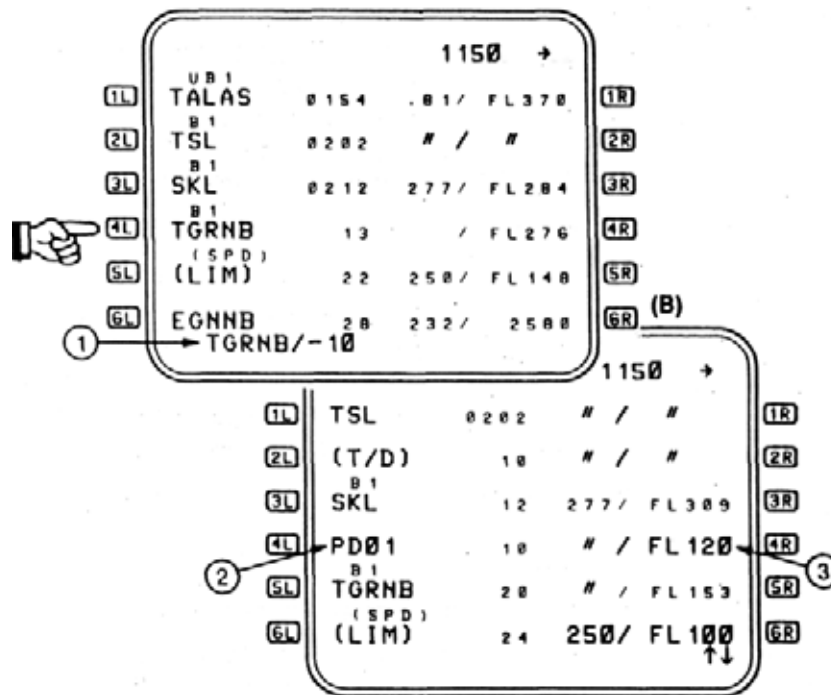


Figure 2-122

2. Press LSK **4L** - the crossing restriction is "northofTGRNB",so must occur before the waypoint identifying the crossing point. When entering ATO waypoints, press the LSK adjacent to the waypoint to which the crossing restriction or constraint is referenced. The FMC automatically places the ATO before, — sign, or after, + sign, the referenced waypoint, depending on which symbol was used to define it. In this case, TGRNB/-10, occurs before TGRNB, exactly where we want it. (Display (A)). See APPENDIX B, page B-7, for proper formats.
3. Write the altitude constraint, FL120, in the SP as, /120, and press LSK **4L**. (Display (B), (3)).

In (Display (B), Figure 2-122), the ATO waypoint is identified by the FMC as PD01, the first of 20 possible pilot defined waypoints. Notice the ATO occurs 10 NM before TGRNB, and the altitude constraint, FL120, is displayed in large font, to indicate it is a pilot entry and does not come from the FMC. If the ATC clearance also included a speed restriction at TGRNB, that could also be placed in data line **4R**, e.g. - 210/FL120 See 3.1.3.2.6 - WAYPOINT INSERTION/F-PLN A and B pages.

2.5.4 Holding

In practice, holding is a simple matter of flying a racetrack course over a prescribed waypoint or position while awaiting further clearance. The FMC, however, makes extremely complex computations to cause the AFS to fly this simple maneuver.

The need to understand the mechanics of the hold, as it is defined by the FMC, and to know what the FMS is doing, or will do when a hold has been entered in the flight plan, is very essential.

The path of all holding pattern legs, regardless of the type, is basically the same. The inbound course to the fix, turn direction, leg distance, or leg time, are all as they are defined in the flight plan. The leg time of an FMS hold, as for any hold, is for the inbound leg only, and conforms to existing regulations.

Holding pattern entries, flown by the FMS, are identical to the three accepted entries that any pilot is familiar with. The pilot has no choice of the entry maneuver - the correct entry is a matter of mathematical calculation within the FMC. NAV must be engaged for the FMS to fly any type hold.

2.5.4.1 Holding Pattern Types

There are three types of very different holding patterns used as legs in a flight plan. The main difference between them is in the manner in which they are terminated:

1. **Holding pattern to a fixed waypoint (HF):** A fixed waypoint hold terminates when the aircraft first sequences the holding fix after the hold becomes active. In other words, the aircraft makes one circuit in the hold, and then exit automatically along the route of flight.
2. **Holding pattern with an altitude termination (HA):** This hold termination is dependent on the altitude specified in the flight plan, and is most often used when terrain is a consideration during the CLIMB phase. If the aircraft reaches or exceeds the altitude specified in the flight plan before the HA leg is active, the aircraft does not

enter the hold. Lateral guidance sequences to the next leg and the aircraft continues along the route of flight. If the specified altitude is reached while in the hold, the hold is terminated when the aircraft next crosses the fix, and the flight plan route is continued.

- 3. Holding pattern with a manual termination (HM):** Is terminated manually whenever the IMM EXIT prompt is pressed. When the IMM EXIT function is active, the aircraft flies direct to the holding fix, regardless of the heading at the time of activation, and exists the hold along the flight plan route.

All this means to the pilot is:

- HF and HA holds are database derived are normally procedure specified or necessary due to flight conditions, and the pilot cannot enter them into the flight plan, although they may be deleted if desired. These two types of holds come from database, usually with a CO RTE, and are intended to cover departure or arrival contingencies for the defined origin/destination.
- HM holds are pilot entered or defined holding patterns, and are the type most often encountered. Manual holds may be done at any waypoint, except the TO waypoint, including PPOS, and are always followed by a F-PLN DISCONTINUITY, and is manually entered by a lateral flight plan change.

2.5.4.2 Hold Page

The HOLD page is accessed from the LAT REV page by pressing LSK **2R**. The point selected for the LAT REV becomes the revise point, or in the case of a Hold, the Holding Fix.

The title line is reflection of the revise point selected for the LAT REV. There are three possible title lines:

1. **DATABASE HOLD AT NNN** - Hold parameters are database derived, are a reflection of published or procedure specified parameters, and have not been changed by the pilot (Figure 2-124).
2. **COMPUTED HOLD AT NNN** - Indicates a published hold does not exist for NNN. The inbound course displayed is the actual aircraft course inbound to the fix (Figure 2-1 24).
3. **HOLD AT PPOS** - Hold page with system computed parameters which have been changed by the pilot (Figure 2-1 25).

The following three examples are generic HOLD pages, and are intended to demonstrate page contents that may be encountered.

To clarify the difference between a DATABASE and a COMPUTED HOLD, Figure 2-123

is a diagram of the holding fix showing the inbound radial and the DATABASE HOLD on the 300 deg. radial. The COMPUTED HOLD, being a Direct entry, is not shown.

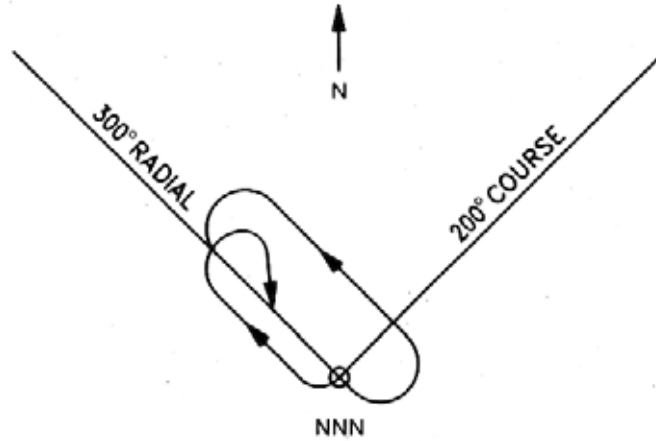


Figure 2-123

Assume the course inbound to the fix is the same in both cases, 200 deg. In the case of the DATABASE HOLD, the entry would be a Parallel Outbound on the non-holding side (Figure 2-123).

The COMPUTED HOLD however, is a Direct entry, because the holding radial is being tracked inbound to the holding fix.

Figure 2-124 is a combination of a DATABASE HOLD at NNN, and a COMPUTED HOLD at NNN pages.

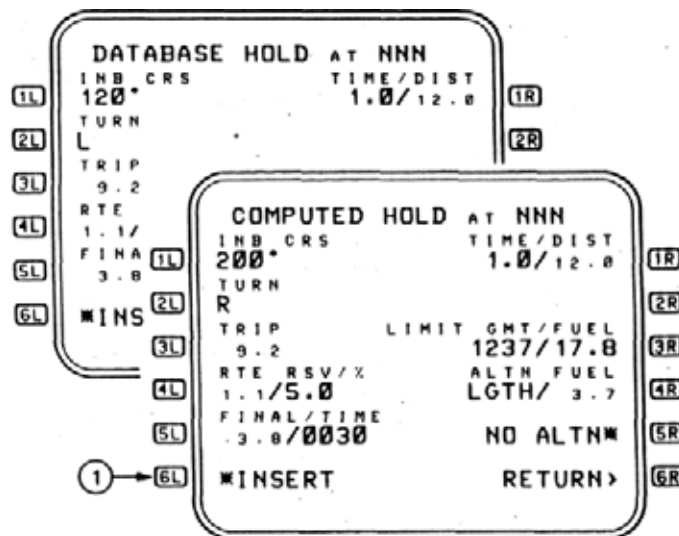


Figure 2-124

Section 2**Flight Phases**

Notice that the only difference in page content is the title, **1L**, and **2L**. Once again, a DATABASE HOLD is the published or procedure specified hold for the revise point, and the COMPUTED HOLD is when the revise point does not have a published holding procedure.

Title - DATABASE HOLD AT NNN/COMPUTED HOLD at NNN -The hold comes from the database or is computed for the fix.

1L INB CRS - The pilot can specify the inbound course. Default is course to the holding fix from the preceding waypoint. If the revise point is the FROM waypoint (meaning the hold is at present position), the present track is the default value of the inbound course. In the DATABASE hold, the parameters are published on the enroute or approach charts. The COMPUTED hold INB CRS is the actual aircraft heading inbound to the fix. If dashes are displayed, because present track is invalid, data entry is still allowed.

2L TURN - The turn direction of the hold, modifiable by the pilot. The DATABASE hold, in the example, is left (L) and the COMPUTED hold is the standard right (R) pattern. If changed by the pilot, the default turn direction is right (R).

3L TRIP - The FMC calculated fuel burnoff from the holding fix to the destination is displayed in this field.

4L RTE RSV/% - The route reserves expressed as actual fuel and percentage of trip fuel from the holding fix to the destination.

5L FINAL/TIME - Same as INIT page B.

6L INSERT - The *INSERT prompt inserts the holding pattern into the flight plan, and returns the display to the accessing F-PLN page. This prompt is displayed only when **1L**, **2L**, and **1R** have been completed and the hold is not an existing manual termination hold (HM) in the flight plan at the selected holding fix. If an HM is already in the flight plan, at the selected holding fix, pilot modification of **1L**, **2L**, **1R**, or **2R**, if it is displayed, is required before the prompt will be displayed. In other words, it cannot be inserted twice into the active primary flight plan at the same holding fix.

If the hold is at PPOS, the holding fix is the aircraft LAT/LONG at the moment the *INSERT prompt is pressed, and is labelled TURNING POINT (T-P) by the FMC.

If the hold page is left prior to activation of the *INSERT prompt, all entered data is erased. Prior to activation of the *INSERT prompt, any entered data can be cleared by the **CLR** function. (**1**, Figure 2-124).

1R TIME/DIST - The time in minutes and the distance in nautical miles, of the holding pattern leg. Time is the leg defining value, the distance is calculated accordingly, and may be modified by the pilot. The time field defaults to the ICAO value for the altitude, e.g., 1.0 minute at or below 14000 MSL, and 1.5 minutes above 14000

Section 2**Flight Phases**

MSL.

Instead of entering a time, a distance may be specified, for instance, a DME hold. In this case the distance becomes the leg defining value, and time is calculated for the leg distance. A distance entry must be preceded by a slash (/). A pilot entry of both time and distance causes display of the SP message, "FORMAT ERROR", and the entry is rejected.

If a default time cannot be calculated by the FMC because aircraft altitude is invalid, the TIME/DIST, field is dashed, however, entry is allowed.

The leg defining value of TIME/DIST is displayed in large font, the calculated value in small font. Any pilot entered value becomes the defining parameter, and is therefore displayed in large font.

2R REVERT TO - This field is displayed anytime a new holding leg is defined by the pilot. The **2R** data line is either COMPUTED or DATABASE depending on display logic.

The why is unimportant for this discussion, suffice to say, the appearance of this prompt indicates that the holding leg has been modified by pilot input. (See **1**, Figure 2-125.)

3R LIMIT GMT/FUEL - The time the hold should be exited, and the fuel remaining at that time, to arrive at the destination with planned reserved intact. These are calculated values, and pilot entry is not allowed.

4R ALTN/FUEL - The alternate destination is displayed in large font, unless no alternate is defined, and then NONE is displayed. The calculated fuel burnoff to the alternate is displayed in small font. Pilot entry of a value is allowed, if no alternate is defined, and is displayed in large font. An alternate destination cannot be defined on this page - INIT page A only -SP message, "NOT ALLOWED", is displayed if entry attempt is made.

5R NO ALTN - This prompt is only displayed if an alternate destination exists and the revise point (holding fix) is in the primary portion of the flight plan. Pressing LSK **5R**, when the NO ALTN* prompt is displayed, deletes the alternate legs, and the alternate fuel calculations. This is useful when additional holding fuel calculations are desirable, and alternative calculations are no longer necessary.

6R RETURN - Pressing this LSK returns the display to the accessing LAT REV page. If the RETURN > prompt is pressed before the*INSERT prompt, all entered data on the page is erased (**2**, Figure 2-124).

Figure 2-125 is an example of a PPOS hold in which the computed data is modified by the pilot.

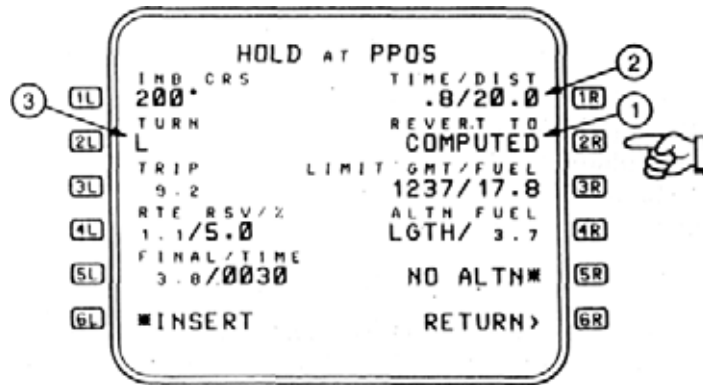


Figure 2-125

In this case a 20 mile DME leg is specified (2), and the turns are to the left (3) rather than the standard right pattern. When this type hold is inserted into the F-PLN, PPOS becomes TURNING POINT (T-P). See Figure 2-126.

Pressing LSK 2R, in Figure 2-125, would change the values back to the default state.

2.5.4.3 Holding Pattern Exit

As mentioned in the previous section, the F-PLN page is displayed when the *INSERT prompt is pressed, with the HOLD inserted. In the case of an HM hold, the holding fix is followed by a F-PLN DISCONTINUITY (Figure 2-126). The display remains unchanged as the aircraft flies to the holding fix. However, the moment the fix is sequenced, as the holding entry maneuver begins, the prompt IMM EXIT* appears in data line 1R.

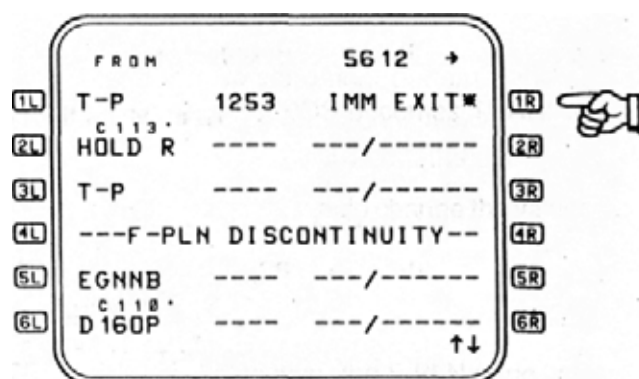


Figure 2-126

Pressing LSK 1R, when the IMM EXIT* prompt is displayed, causes the aircraft to immediately exit the hold by flying directly back to the holding fix, and continuing along the route of flight. In the case of an HM hold, if the F-PLN DISCONTINUITY is not cleared, the

A/P will disconnect when the aircraft crosses the holding fix into the DISCONTINUITY.

When the IMM EXIT* prompt is activated, it is replaced by a RESUME HOLD* prompt, which will be displayed until the aircraft leaves the holding fix. If the RESUME HOLD* prompt is pressed, anytime prior to leaving the holding fix, the hold defined in the F-PLN is re-entered the next time the aircraft crosses the holding fix.

NOTE: Any holding pattern may be exited by doing a DIR TO a downtrack waypoint. This action eliminates the hold fix and all waypoints between PROS and the DIR TO point.

2.5.5 Transition To Approach Phase

FMS transition from the DESCENT flight phase to the APPROACH flight phase occurs:

1. When a destination exists in the lateral flight plan.
2. When the active or next lateral flight plan leg is not an HM leg.
3. When the slat/flap configuration is not clean/zero.

2.6 APPROACH

The APPROACH phase extends from slat/flap extension to the touchdown point, and is composed of level and descending flight path segments, with lateral guidance responding to the selected STAR, or radar vectors from Approach Control.

The APPROACH phase includes the missed approach procedure applicable for the selected runway.

Lateral and vertical guidance control switches to the selected approach as NAV disengages at localizer intercept, and PROFILE disengages at glide slope intercept.

2.6.1 Approach Page

During, or just prior to the beginning of the APPROACH phase, the APPROACH page is accessed to review the approach parameters. Access to this page is gained by pressing the TO/APPR key on the CDU keyboard.

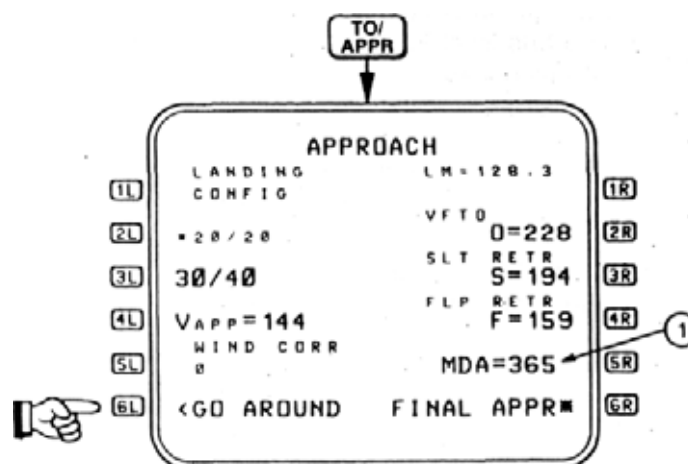


Figure 2-127

The APPROACH page is displayed when the **TO/APPR** key is pressed providing the flight phase is CLB, CRZ, DES, or APPR, otherwise the TAKEOFF page is displayed. In this case the APPROACH page access is via LSK from the TAKEOFF page. If there is no primary destination when the LSK is pressed, the SP message, "NO DESTINATION", is displayed instead of the APPROACH page. See Section 2.2.1, TAKEOFF PAGE.

The purpose of the APPROACH page is to allow selection of a landing configuration, MDA, display selected approach speeds, and provide access to the GO AROUND page.

Section 2**Flight Phases**

1L LANDING CONFIG - This data line is the title line for the landing configurations displayed in **2L** and **3L**. No data entry is allowed.

2L The landing configurations - slat/flap settings - available for **3L** selection are displayed on these two data lines. The selected configuration is displayed in large font. 30/40 is the default value.

NOTE: If Delayed Flap Approach (DFA) is armed or engaged, and the 20/20 configuration prompt is pressed, the selection is rejected and the CDU SP message, "NOT ALLOWED", is displayed. If 20/20 has been selected, and DFA is armed or engaged, the selected landing configuration automatically changes to 30/40, and the CDU SP message, "USING LOG CONFIG-30/40", is displayed. This has special significance during EO operations.

4L VAPP - The CAS final approach IAS, or VREF, is displayed here in large font. The value is calculated by the FMC and cannot be modified by the pilot.

5L WIND CORR - The wind correction defaults to zero and may be modified by the pilot. It is always displayed in large font, and the value is used to calculate VAPP.

6L GO AROUND - Provides access to the GO AROUND page when LSK **6L** is pressed. Prompt is not displayed unless the flight phase is CRUISE, DESCENT, or APPROACH. See Section 2.7, GO AROUND.

1R LW - The predicted landing weight is displayed in this label line. No pilot entry is allowed.

2R VFTO - Velocity Final Takeoff - GREEN DOT - "0" - Clean Maneuvering speed.

3R SLT RETR - "S" - SLAT RETRACTION speed.

4R FLP RETR - "F" - FLAP RETRACTION speed.

The values in data line **2R**, **3R**, and **4R**, are calculated by the FMC but may be modified by the pilot. Values are always displayed in large font. The default state is the FMC calculated value.

5R MDA - This data line is displayed and pilot entry is allowed under the following conditions:

1. The flight phase is DESCENT or APPROACH.
2. A Non-Precision approach is selected.
3. A destination runway is selected.
4. The destination runway is not preceded by a F-PLN DISCONTINUITY.

When all of these conditions are satisfied, MDA = [] is displayed in small font until a

numerical value is input and confirmed by pressing the FINAL APPR* prompt adjacent to LSK 6R. If above conditions are not met, the field is blank. If any of the above conditions occur after data is entered, the data field blanks - nothing is displayed. The FINAL APPR* prompt disappears after LSK 6R is pressed, the brackets disappear from data line 5R. the input value is displayed in large font (Figure 2-127, 1), and repeated on the EFIS. Use of the CLR function in this field deletes the input value and the display reverts to bracket prompts.

6R FINAL APPR - This prompt is displayed after data is input in data line 5R.

Pressing LSK 6R confirms the MDA input in data line 5R. the FINAL APPR* prompt disappears, the brackets disappear from around the MDA value, and the input value is sent to the EFIS.

2.6.2 FMA indications

Selection of the RWY/STAR, to LGAT 33R, was covered in Section 2.4.6.1. Aircraft PPOS on the STAR, for demonstration purposes, is between TGRNB, the FROM waypoint, and EGNNB, the TO waypoint (see Figure 2-128)

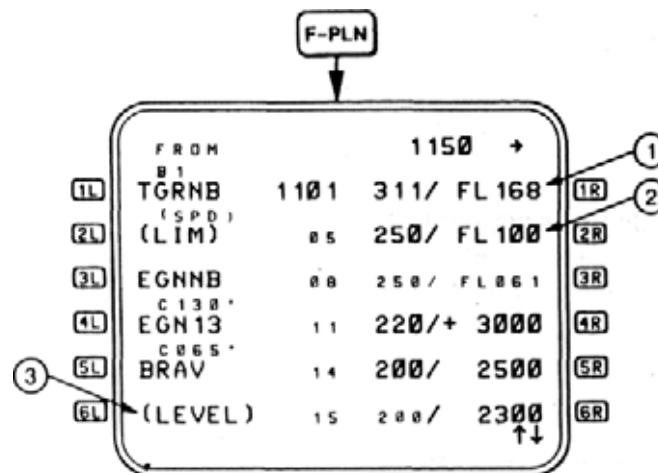


Figure 2-128

By reference to F-PLN page A it can be seen that the aircraft crossed TGRNB at 311 KIAS at 16800MSL 1, and a speed reduction to 250 kts. Is to occur at 10000 at 1105GMT 2. If necessary, speed can be further modified directly on this page, or manually on the FCU after PROFILE is disengaged.

LAND is armed on the FCU, allowing intercept of the LOG and G/S.

Data line 6L displays the (LEVEL) pseudo waypoint 3, indicating a level vertical segment for glide path intercept at 2300MSL. IAS is 200KIAS, at this point, and the

aircraft is being configured for landing.

Example EFIS FMA indications, at this point on approach, may be seen in Figure 2-129. The AFS is in the LOG TRACK mode, NAV has disengaged, and the G/S is armed for capture.

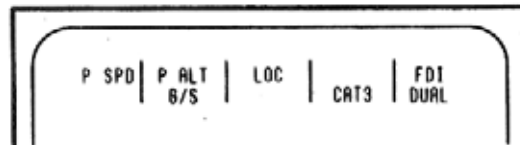


Figure 2-129

PROFILE is engaged, as indicated by P SPD and P ALT, and remains engaged until G/S CAPTURE.

Figure 2-130 is an example of G/S CAPTURE (A), PROFILE is disengaged, and G/S TRACK (B).

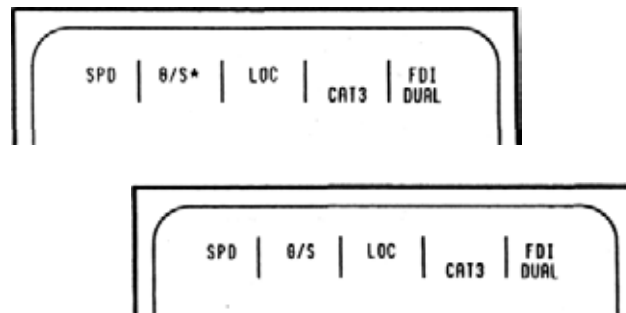


Figure 2-130

2.6.3 Procedure Turns

There are two types of procedure turns used as legs in a flight plan:

1. PROC T to intercept a course (PI) - The procedure comes from database when the approach runway is selected. It must be followed by a Course to Fix (CF) leg back to the PROC T fix, which is also the FAF in most cases. The inbound course for the CF leg is defined by the flight plan, and corresponds to the approach procedure specified PROC T for the landing runway.

2. PROC T with a Manual Termination (PM) - This procedure is manually defined by the pilot, and is always followed by a F-PLN DISCONTINUITY, which cannot be cleared from the flight plan by the **CLR** function.

The purpose of a PROC T is to accord the pilot the time to configure the aircraft for approach and landing, while performing a course reversal maneuver to align the aircraft on the final approach course. A PROC T is normally only flown in a non-radar environment.

Basically, the FMS flies a PROC T as a great circle course from the PROC T fix, or revise point, to the initial turn point. The FMS then makes a 180 degree circular arc turn back to a course parallel to the outbound course to affect an intercept to the final approach course inbound to the PROC T fix - a course reversal in simpler terms.

2.6.3.1 Procedure Specified PROC T

Figure 2-131 is an example of a PROC T specified by an approach procedure.

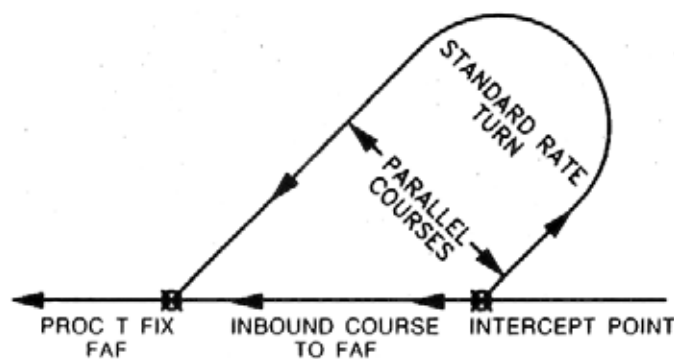


Figure 2-131

To fly a PROC T specified in a terminal area procedure, the FMC constructs a leg in the flight plan defining the outbound course, the position of the PROC T fix, the boundary distance, and the turn direction of the PROC T - the maneuvering side of the final approach course. If a procedure turn is not desired for the selected approach, it may be cleared from the F-PLN with the CLR function, at any time prior to beginning the approach procedure.

2.6.3.2 Manual Termination PROC T

A PROC T with a manual termination (PM) may be defined at any waypoint in the flight plan by first doing a LAT REV at the desired procedure turn fix. As with any LAT REV, this fix or point becomes the revise point. Figure 2-132 is the LAT REV from PBD01 page.

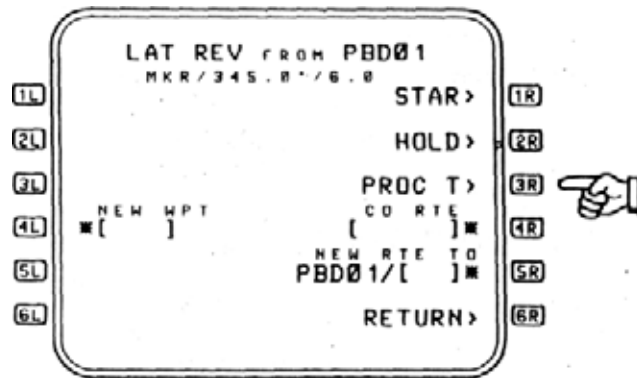


Figure 2-132

Pressing LSK **3R**, the PROC T > prompt, results in display of the PROC T at PBD01 page. Two possibilities exist for this page.

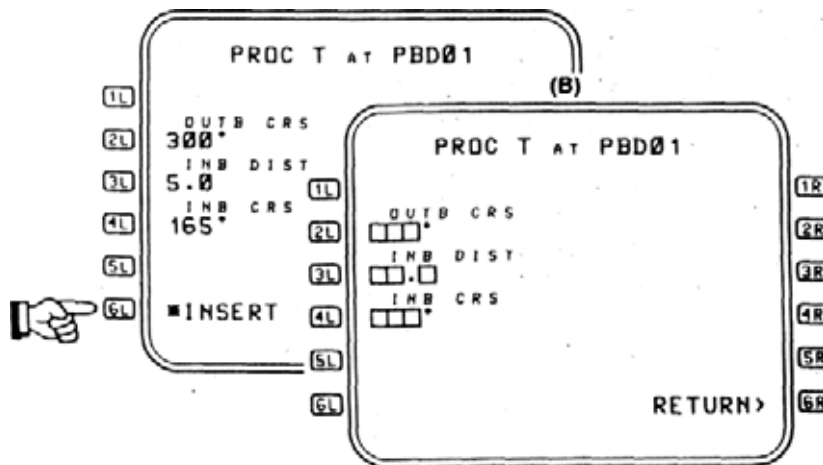


Figure 2-133

If a PROC T already exists for the revise point, data lines **2L**, **3L**, and **4L** contain the data pertaining to this defined PROC T ((A), Figure 2-133). If a PROC T does not already exist for the revise point, these same data lines display boxes ((B), Figure 2-133).

In the case of Display (A) above, any of the data is modifiable at the option of the pilot.

The purpose of the PROC T page is to allow the crew to insert or modify a procedure turn to a manual termination (PM), in the active primary flight plan, at the revise point.

Referring again to Figure 2-133, (A) and (B):

TITLE - Revise point, or PROC T fix, at which the procedure turn is inserted, in this case

PBD01.

2L OUTB CRS - Course flown from the revise point.

3L INB DIST - Distance, in nautical miles, of the inbound leg.

4L INB CRS - Course flown inbound to the revise point.

6L INSERT - Pressing LSK **6L**, inserts the PROC T into the active primary flight plan. This prompt is only displayed when data lines **2L**, **3L**, and **4L** contain data, and the PROC T does not already exist at the revise point. If the PROC T already exists at the specified revise point, any one of the three data lines must be modified before the *INSERT prompt is displayed. Once inserted, the display reverts to the accessing F-PLN page. If any other mode key is pressed before the *INSERT prompt, the newly entered data is erased.

6R RETURN - Pressing LSK **6R** returns the display to the LAT REV page.

NOTE: CDU SP message, "ENTRY OUT OF RANGE", is displayed if the geometry of the pilot entered PROC T cannot be flown. To insure that this does not occur, make certain that the Inbound and Outbound PROC T legs have an angular relationship of less than 90 degrees.

In addition to the maximum specified angle, the manual PROC T has a slightly different pattern than the procedure specified PROC T (see Figure 2-134).

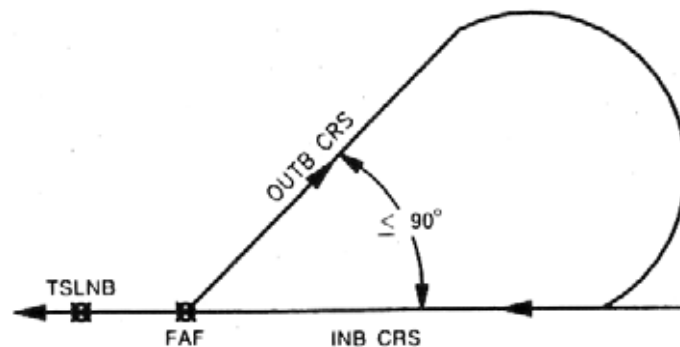
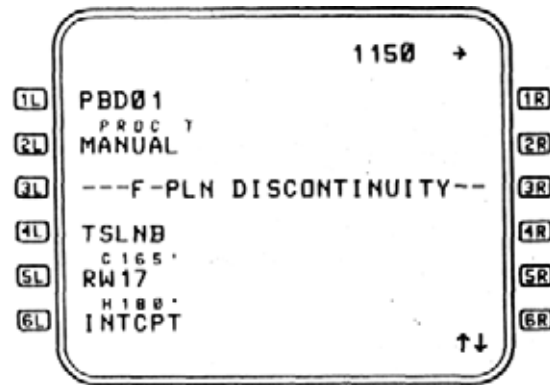


Figure 2-134

Notice there are no parallel Outbound and Inbound courses. The 180 degree change of direction, and the intercept of the course inbound to the revise point, is done in a constant turn. This is accomplished by having the inbound and outbound distance the same, allowing the radius of turn to remain constant for a given angular difference in the two legs.

When the desired parameters are input on the PROC T page, and the * INSERT prompt activated by pressing LSK **6L** (see Figure 2-133, (A)), the display reverts to the F-PLN page with the PROC T inserted, followed by a F-PLN DISCONTINUITY.


Figure 2-135

As mentioned previously, this DISCONTINUITY cannot be removed with the **CLR** function. In the example, a DIR TO TSLNB, after the inbound turn is completed, is the only way to remove the manual PROC T and the DISCONTINUITY from the flight plan. This is the "manual termination" of the PROC T that is required to exit this type procedure turn.

A normal complete procedure turn pattern is displayed on the EFIS ND provided:

1. The PROC T is part of the active or next leg of the active primary flight plan.
2. The ND range selected on the EFIS CONTROL PANEL is 15, 30, or 60NM.

Otherwise the PROC T is depicted on the ND as a curved arrow symbol, indicating the direction of turn of the PROC T only. Figure 2-136 displays an example of each for demonstration purposes - **(1)** a full PROC T pattern, **(2)** a curved arrow symbol.

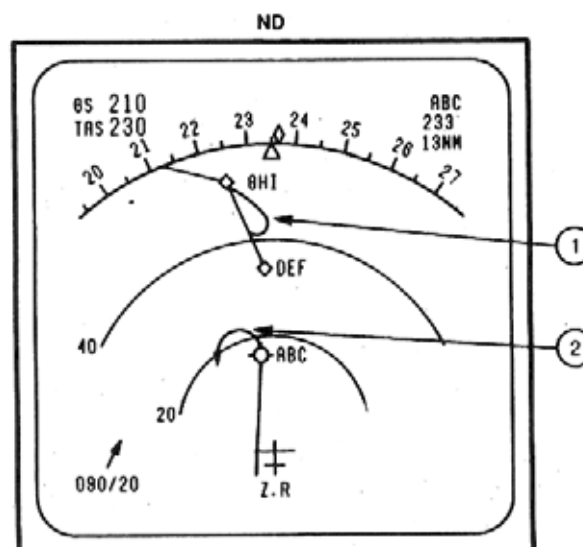


Figure 2-136

For clarity, both symbols are depicted larger than would be normal on this range scale.

The F-PLN DISCONTINUITY, following the ABC waypoint, indicates the PROC T displayed has a manual termination (PM) leg.

2.6.4 Transition To Go Around Phase

FMS transition from APPROACH flight phase to GO AROUND occurs:

1. When aircraft altitude is at least 250 ft below the altitude set in the FCU.
2. The active flight phase is APPROACH.
3. The GO LEVERS are toggled.

2.7 GO AROUND

Strictly speaking, GO AROUND is not one of the seven flight phases, however, for continuity, it is treated as such.

There is also no operational requirement to access the GO AROUND page prior to approach, although good technique dictates the data should be checked and/or modified if desired.

2.7.1 Go Around Page

In addition to the access provided by the < GO AROUND prompt on the APPROACH page, the GO AROUND page may be accessed under the following conditions:

1. The TO/APPR key when the flight phase is TAKEOFF due to a Go Around.
2. CLIMB following the sequencing of the destination, after a Go Around, and then only until a new destination is defined in the FMC.
3. LSK **6L**, on the APPROACH page, when the flight phase is CRUISE, DESCENT, or APPROACH.

NOTE: If the GO AROUND page is displayed when the flight phase transitions to CLIMB or CRUISE, the page does not automatically change to the APPROACH page.

Figure 2-137 is the GO AROUND page for RWY33R at LGAT, the primary destination for FLT 1150.

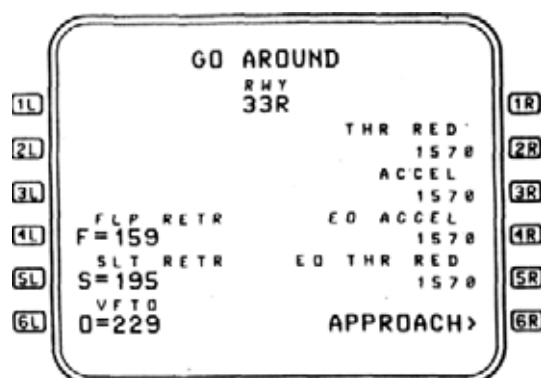


Figure 2-137

1L RWY - The selected approach runway is displayed in this data line under the page title. If no approach runway has been defined, dashes are displayed.

4L FLP RETR - Flap retraction speed. Same as APPROACH page.

- 5L** **SLT RETR** - Slat retraction speed. Same as APPROACH page.
- 6L** **VFTO** - Final Takeoff Velocity, GREEN Dot. Same as APPROACH page.
- 2R** **THR RED** - The thrust reduction altitude.
- 3R** **ACCEL** - The acceleration altitude.
- 4R** **EO ACCEL** - The engine out acceleration altitude.
- 5R** **EO THR RED** - The engine out thrust reduction altitude.
- 6R** **APPROACH** - Allows access to the APPROACH page. This prompt is only displayed if a primary destination is defined in the active primary flight plan.

Entries can only be made On the GO AROUND page if the flight phase is CRUISE, DESCENT, or APPROACH. Once the flight phase transitions to TAKEOFF or CLIMB, the SP message, "NOT ALLOWED", is displayed if an entry attempt is made, and the entry is rejected.

2.7.2 Missed Approach Route

The actual missed approaches a combination of the TAKEOFF and CLIMB phases as far as the FMS is concerned. To the pilot it is simply a planned and briefed procedure to follow when a missed approach is executed, for whatever reason. In many cases the published missed approach is not flown because the maneuver could put other arrival traffic in conflict. As soon as the pilot calls the missed approach, radar vectors and altitudes compatible with the active situation are usually provided. If ATC does not provide vectors however, the published missed approach is flown.

Figure 2-138, F-PLN page A, shows the published missed approach procedure for RWY33R at LGAT.

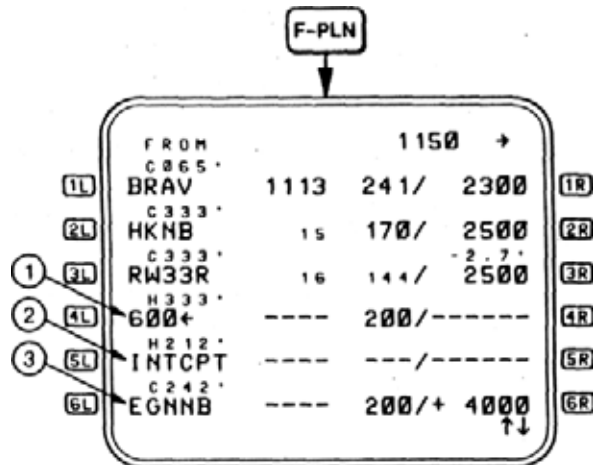


Figure 2-138

The procedure begins after the runway, with a climb to 600 ft on a heading of 333 degrees **1**, then, a left turn to a heading of 212 degrees **2**, to intercept a course of 242 degrees to EGNNB **3**

The 242 degree radial, in this case, happens to be the published holding radial for EGNNB. The FMS flies the aircraft to EGNNB, along the missed approach path, and executes the correct holding pattern entry, a Tear-drop, based on the angular relationship between aircraft heading and the holding radial (see Figure 2-141, **2**). The dashed line, in Figure 2-141, is the missed approach path and the hold at EGNNB. Referring back to Figure 2-138 **1**, the altitude of 600←, with the arrow, means the aircraft turns to a heading of 212 degrees after passing an altitude of 600 ft. The arrow is a Specified Turn arrow, in the direction of the turn - the point or altitude must be sequenced before the turn is executed. (See page 2-9.)

Most missed approaches include a Hold at the clearance limit, EGNNB in this case.

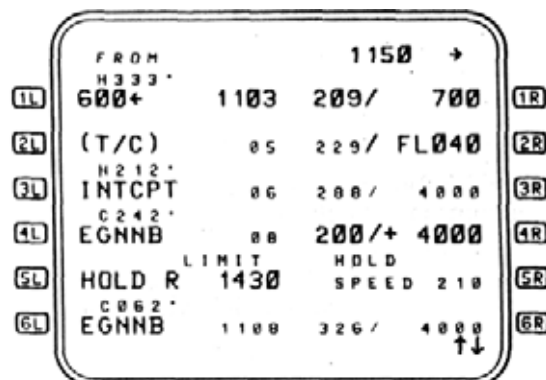



Figure 2-139

Scrolling down  two positions reveals the Hold is already a part of the missed approach procedure. If desired, the HQLD page could be accessed to make necessary changes.

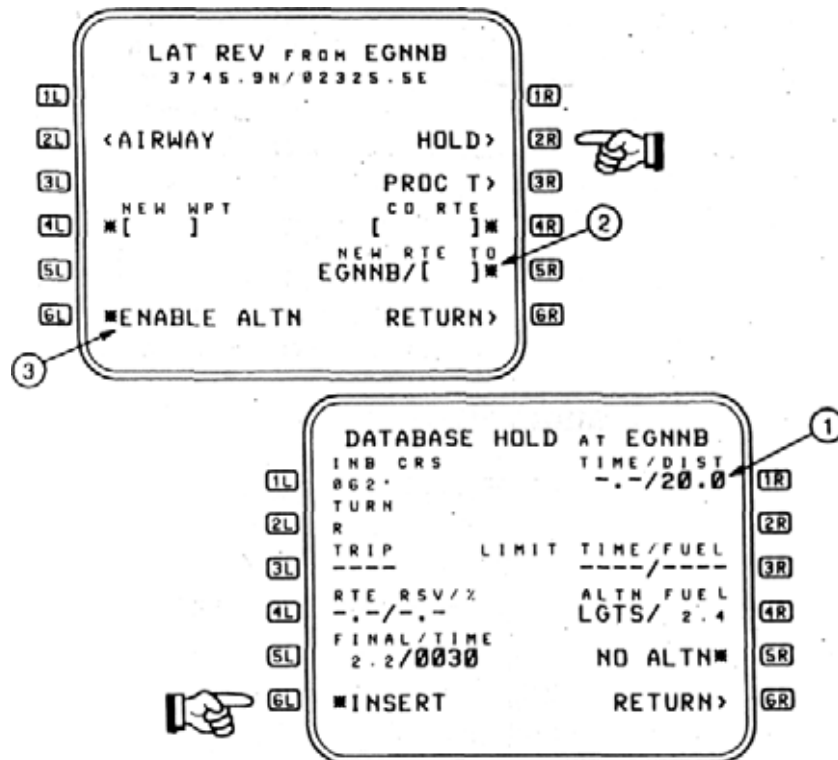


Figure 2-140

For example, 20NM legs have been requested and approved from ATC (1), Figure 2-140). Pressing LSK 6L, inserts the change into the flight plan. Notice also that the published hold for EGNNB is the 242 degree radial - INB CRS in the hold is 062 degree.

2.7.3 Second Approach To Destination

If another approach is flown to the primary destination, the primary destination needs to be redefined in the FMC, because it is no longer part of the remaining flight plan. An approach can be flown visually without the necessity of this step, however, to have the various approaches available for selection, the destination airport must be redefined in the FMC.

Referring back to Figure 2-140, (2), the NEW RTE TO field in data line 5R. The aircraft is presently holding at EGNNB. This field always reflects PPOS as the FROM point, therefore EGNNB/[] is displayed.

To redefine the primary destination, write LGAT in the SP and press LSK **5R**, LGAT is now part of the flight plan, the approach runway can be selected, and another approach can commence. LGAT, as the new destination, occurs in the flight plan after the EGNNB holding fix, so flight planning from that point can occur without impacting the hold.

The aircraft continues to hold at EGNNB until another approach clearance is received, and hold exit is performed in the normal manner - IMM EXIT or DIR TO.

2.7.4 Diversion To Alternate

If continued holding is impractical, from a fuel standpoint, or the definite possibility of another approach being unsuccessful exists, diversion to the alternate airport must be considered.

Figure 2-141 shows the primary destination of LGAT **①**, the hold at EGNNB **②**, and the alternate route to LGTS **③**, the alternate airport.

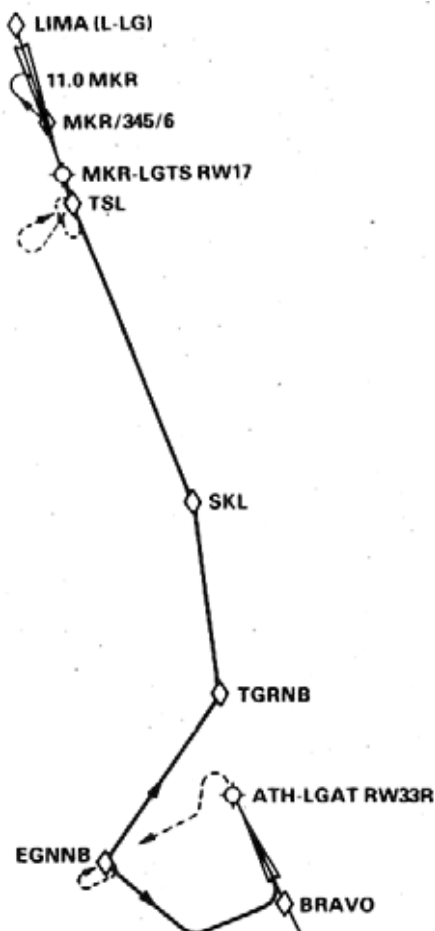


Figure 2-141

During PREFLIGHT, LOTS was selected at the alternate, however, no specific route was available from the database for this alternate (see page 3-6, INIT page A).

The process of flying to the alternate begins with a LAT REV at the point you wish to proceed FROM. In this case the LAT REV would be FROM EGNNB, the holding fix.

Referring back to Figure 2-140 , **(3)**, notice the prompt *ENABLE ALTN. This function is used to incorporate the alternate portion of the flight plan into the primary flight plan. See ENABLE ALTERNATE.

The rules governing the activation of the ENABLE ALTN function are as follows:

1. The flight plan must have an alternate destination, and the revise point must be part of the active primary flight plan.
2. When the ENABLE ALTN function is activated, all waypoints in the original primary flight plan, downpath of the revise point, are deleted, this includes the primary destination and the entire missed approach.
3. The alternate destination is redesignated the primary destination, and the former primary destination becomes the new alternate origin waypoint.
4. The alternate flight plan is strung into the primary flight plan with a DISCONTINUITY between the revise point and the first waypoint in the alternate route.
5. The FROM waypoint can be the revise point, in which case NAV disengages - The AP/FD engages in HDG.
6. All SPD and ALT descent constraints, as well as TIME constraints between PPOS and the former primary destination, including the former primary destination, are deleted.
7. The alternate CRZ FL, if one has been specified from a CO RTE, or specified during PREFLIGHT by the pilot, becomes the primary CRZ FL.

Since no alternate route was specified, during PREFLIGHT, when LSK **6L** is pressed, enabling the alternate, LGTS, the F-PLN page will contain the FROM waypoint, EGNNB, followed by a F-PLN DISCONTINUITY, and the new primary destination, LGTS.

Referring again to Figure 2-141, the route can be built by the PNF, using the enroute waypoints TGRNB, SKL, and TSL. At the same time the PF can establish the aircraft on an intercept to the route, with the FMS engaged in HDG, or do a DIR TO TGRNB, and then string the other two waypoints into the flight plan.

Within a few seconds after the flight plan is completed, predictions to the new primary destination are available.

2.7.5 Transition To the DONE Flight Phase

See Section 2.8, DONE PHASE.

2.8 DONE PHASE

The DONE phase indicates the completion of the flight for performance computations.

Transition to the DONE phase occurs under the following conditions:

1. The aircraft is not airborne.
2. After the second engine is shut down and fuel flow is less than 220 PPH for more than 15 seconds.

For the pilot, three things occur in the DONE phase which are worthy of note:

1. The FMC transitions to the PREFLIGHT phase when any CDU button is pushed, allowing access to all initialization and flight planning functions.
2. All data entered into the FMC for the previous flight is erased.
3. In the case of a through flight, a quick align of the IRUs is necessary, to level the platforms and zero the groundspeed values.

NOTE: For training flights, where another takeoff is planned, the previous flight plan is lost after touchdown, however, it is still in the SEC F-PLN and may be activated, making it unnecessary to go through the entire flight planning procedure before another takeoff can be accomplished.

3.0 ISDU OPERATION

This section describes the operation of the Inertial Reference System (IRS) through the use of the Inertial Systems Display Unit (ISDU) and the Mode Select Unit (MSU).

3.1 IRS DESCRIPTION

The components of the three-channel IRS are located as follows:

- The ISDU and three MSUs are mounted in the overhead panel.
- The three IRUs are located in the equipment bay.

3.1.1 Inertial Systems Display Unit (ISDU)

- Display:
 - Readout displays selected system data.
- SYS DSPL switch:
 - Allows pilot to select one of three systems or OFF.
- DSPL SEL switch:
 - Has four positions to select operation modes and one position to test lamps.
- Keyboard:
 - Used to input data.

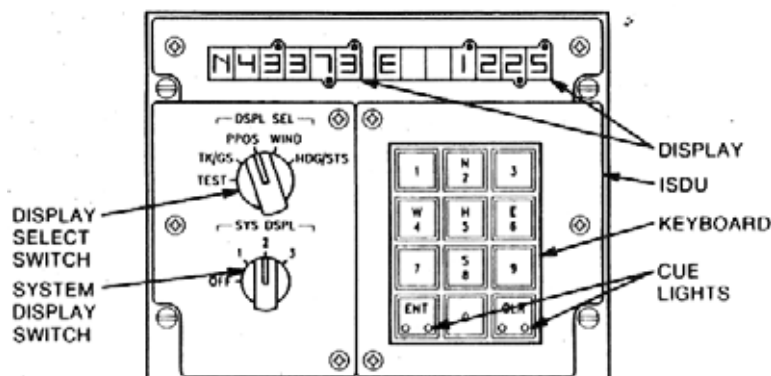


Figure 3-1 Inertial Systems Display Unit

3.1.2 Mode Select Unit (MSU)

- Mode select (OFF/NAV/ATT) switch: (switch has a detent in the NAV position)
 - OFF: System off position.
 - NAV: Navigation and system alignment position.
 - ATT: Attitude erection position. Heading may be entered or displayed.
- Annunciators:
 - Provide system function information.

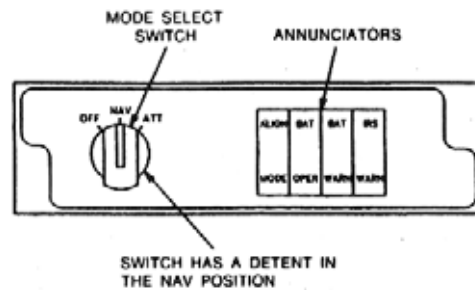


Figure 3-2

Mode Select Unit

3.1.3 On-the-Ground Displays

TK/GS: Displays ground track direction in degrees on the left display, and ground speed in knots on the right.

Displays true heading from 6.5 minutes into align until ground speed is greater than 50 knots. Then track angle is displayed.

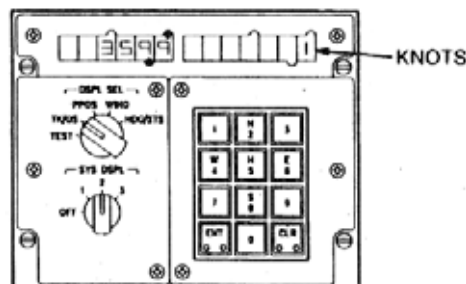


Figure 3-3

On-the-Ground Display

PPOS: Displays present position of the aircraft. Latitude on the left display and longitude on the right.

Displays the entered latitude and longitude during align. Displays the PROS (latitude and longitude) after align is completed.

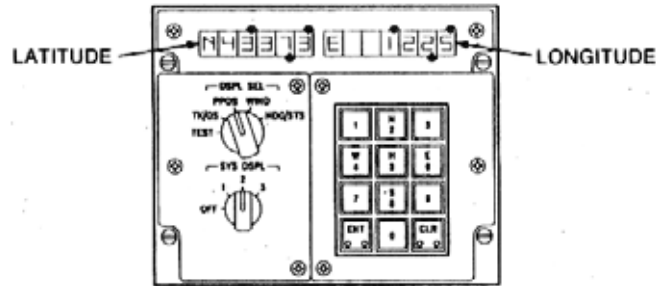


Figure 3-4

On-the-Ground Display

WIND: Displays wind speed in knots on the right and wind direction in degrees on the left.

NOTE: Display is blank if TAS < 100 knots.

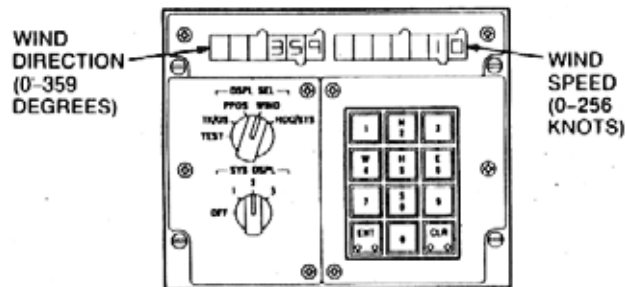


Figure 3-5

On-the-Ground Display

HDG/STS: Displays true heading after 6.5 minutes of align.

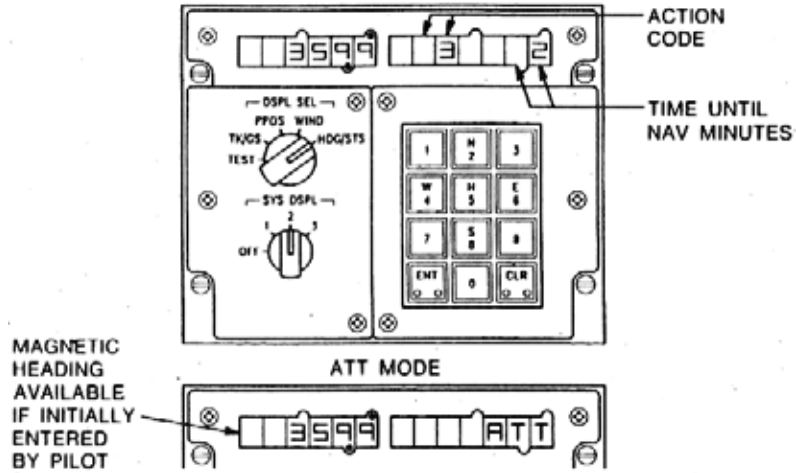


Figure 3-6 On-the-Ground Display

3.1.4 Action Codes

Action codes are used to inform pilot/maintenance of action desired.

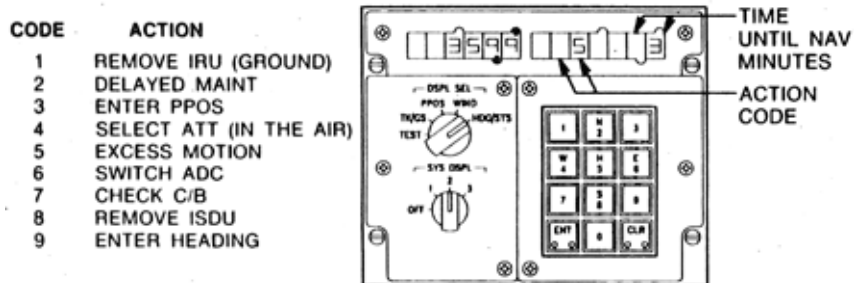


Figure 3-7 Action Codes

3.1.5 Flashing Annunciators

A flashing annunciator requires pilot action. During ALIGN

- ALIGN MODE flashing (action code = "3")
 - Enter PPOS.
- ALIGN MODE flashing (action code = "5")
 - Excess motion detected. Make sure aircraft is stationary. (A new alignment begins in 30 seconds.)
- IRS WARN flashing (action code = "1") and ALIGN MODE steady
 - Pilot and IRU disagree on latitude. Remove IRU.

During NAV

- IRS WARN flashing (action code = "4")
 - Select ATT mode.
- IRS WARN flashing (action code = "1")
 - Remove IRU.

3.2 OPERATING PROCEDURES

This procedure assumes that the IRS is turned off. To operate from the off condition, this procedure should be followed in the order presented (through the navigation [NAV] mode).

The three basic IRS modes that are used during operation are described below.

3.2.1 IRS Modes

- OFF: IRS off.
- NAV: Normal operation. Pilot enters present position (PPOS) during 10-minute alignment with aircraft stationary on ground.
- ATT: Reversionary attitude mode to provide aircraft attitude and heading information when the NAV mode has failed. Selected either on ground or in air. Pilot inserts reference heading.

The following paragraphs describe pilot action required to operate the IRS. Actions to be taken by the pilot are in bold lettering.

3.2.2 Navigation Mode - System Turn-On

Pilot Action:

Caution:

Do not move aircraft during align.

- 1) Set three MSU mode select switches to NAV (initiates a 10-minute align).
- 2) Set ISDU SYS DSPL switch to IRU channel 1, 2, or 3.

MSU: BAT OPER annunciator is lit for 5 seconds. Then ALIGN MODE annunciator is lit.

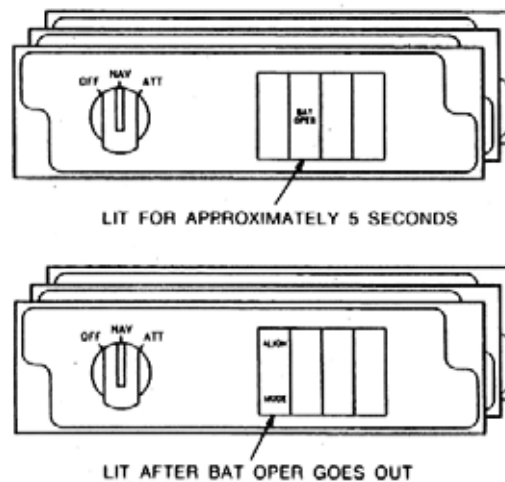


Figure 3-8

Inertial Reference System

ISDU: ISDU display data is controlled by the position of the SYS DSPL switch:

- Blank display indicates that the SYS DSPL switch is set to an unenergized channel.
- Set of six dashes, decimal points, and degree lights, indicate that channel is active, but valid data is not yet available.

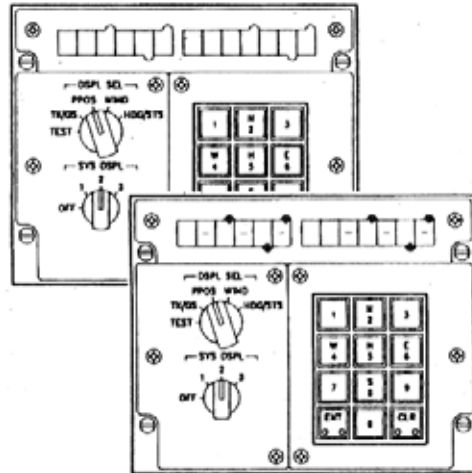


Figure 3-9

3.2.3 Test

Pilot Action:

- 3) Set and hold ISDU DSPL SEL switch to TEST (fully ccw). ISDU: Display lights and keyboard cue lights are energized (all segments).
- 4) Check all displays lights and cue lights to ensure that none are burned out.

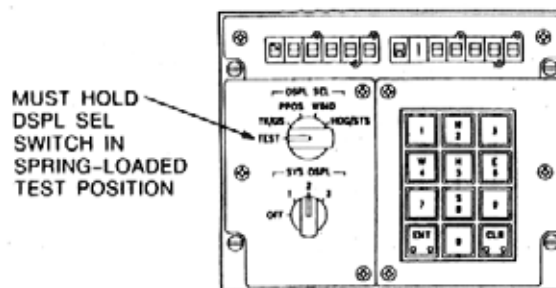


Figure 3-10

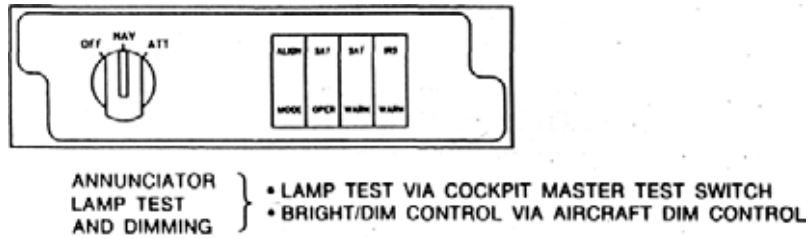


Figure 3-11

Pilot Action:

5) Activate cockpit master test switch. MSU: Annunciator lights are energized.

3.2.4 IRS Initialization

Pilot Action:

6) Set ISDU DSPL SEL switch to HDG/STS.

ISDU: After the 8-second power-up, the right display shows time until NAV and existing action codes. The left display shows three dashes.

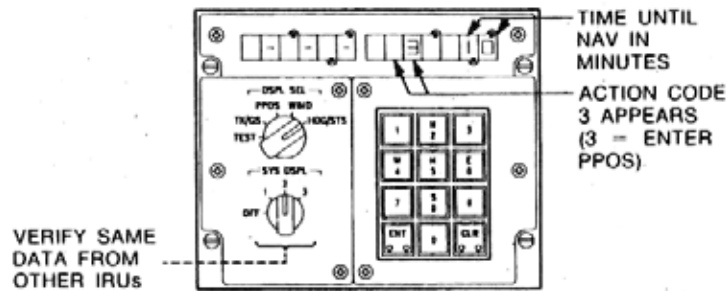


Figure 3-12

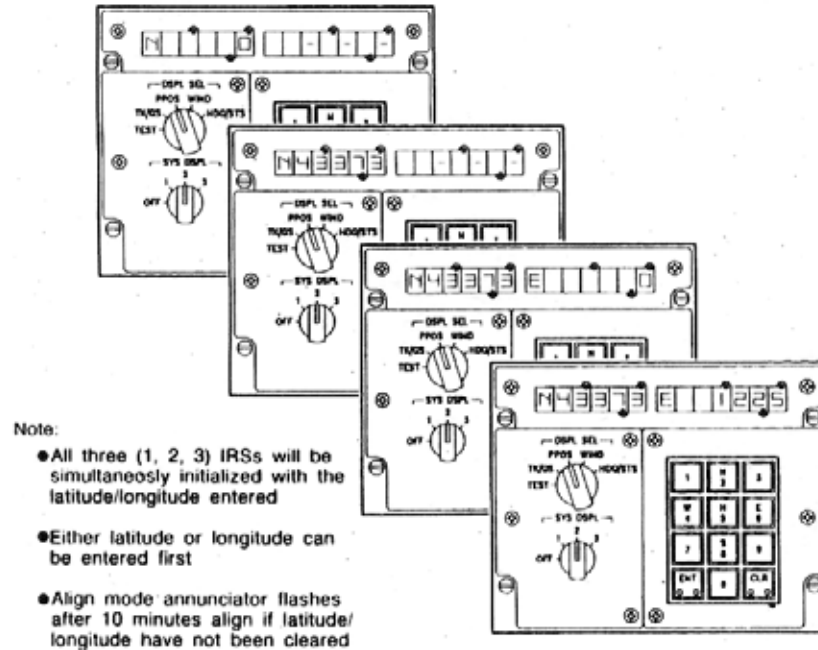


Figure 3-13

Pilot Action:

- 7) Set ISDU DSPL SEL switch to PPOS.
- 8) Enter present position latitude. (Press **N** or **S** key.)

ISDU: N or S, degree markers, decimal point, zero light, ENT, and CLR cue lights will light.

- 9) Press number keys to enter degrees, minutes, and tenths of minutes.

ISDU: Data appears on ISDU as it is entered.

- 10) Press **ENT** (enter) key to enter data, **CLR** (clear) key to change and reenter data.

- 11) Enter present position longitude. (Press E or W key.)

ISDU: E or W, degree markers, decimal point, zero light, ENT, and CLR cue lights will light.

- 12) Press number keys to enter degrees, minutes, and tenths of minutes.

- 13) Press **ENT** or **CLR** key as in Step 4, above.

ISDU: Displays present position latitude and longitude input data.

3.3 LATITUDE/LONGITUDE INSERTIONS PROBLEMS

Section 3
ISDU Operation

If ALIGN MODE annunciator flashes (action code "3"), reverify airport atitude/longitude. Reenter latitude/longitude.

Repeat procedure until ALIGN MODES annunciator ceases to flash or IRS WARN flashes (action code "1").

Pilot Action:

- 1) Set ISDU DSPL SEL switch to PPOS.
- 2) Set SYS SEL switch to positions 1, 2, and 3 to verify all three IRUs are initialized to the latitude/longitude entered.

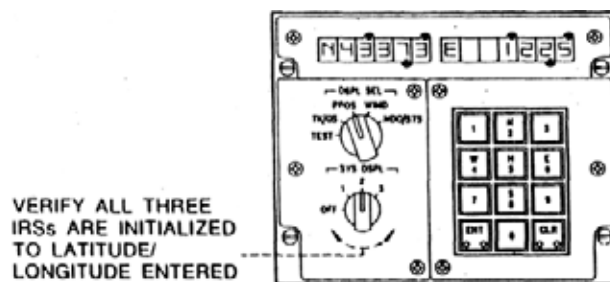


Figure 3-14

ISDU: Latitude/longitude data appears on display corresponding to system selected.

Pilot Action:

- 3) Set ISDU DSPL SEL switch to HDG/STS.
- 4) Set SYS SEL switch to positions 1,2, and 3 to verify respective IRU time until NAV.
- 5) Check MSUs to verify that all annunciators are off and the three IRUs are in NAV.

ISDU: ISDU displays time until NAV in minutes, in addition to aircraft true heading.

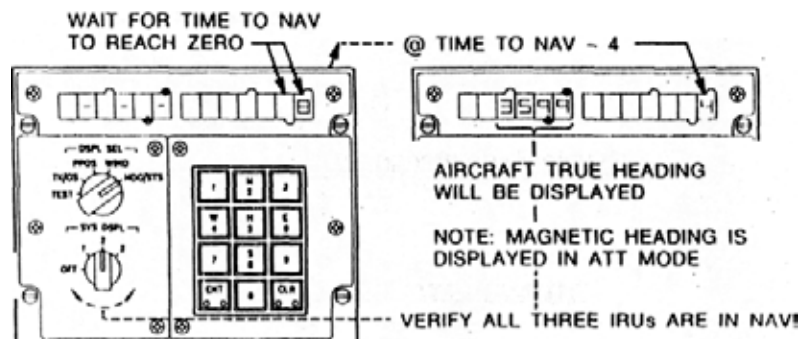


Figure 3-15

MSU: All annunciators are extinguished as the systems go into NAV.

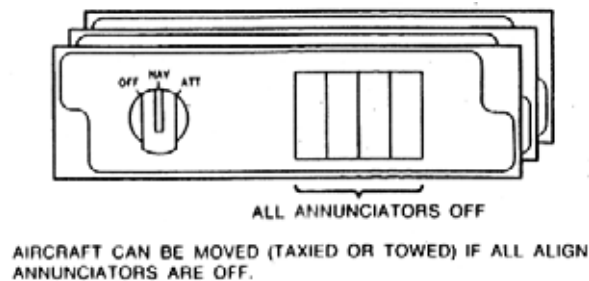


Figure 3-16

3.4 PROBLEMS AFTER LATITUDE/LONGITUDE HAVE BEEN ACCEPTED?

If ALIGN MODE annunciator flashes (action code == "5"), the IRU has detected aircraft motion. Make sure aircraft is stationary as a new alignment automatically begins in 30 seconds.

3.5 NAV MODE-3-MINUTE REALIGN OPTION

Pilot Action:

(Assuming IRU already operating in NAV mode)

1) Pull MSU mode select from detent before going from NAV to OFF, and back to NAV (within 5 seconds, each MSU).

MSU: ALIGN MODE annunciator is off during 5-second option time and will be on during 3-minute realign period.

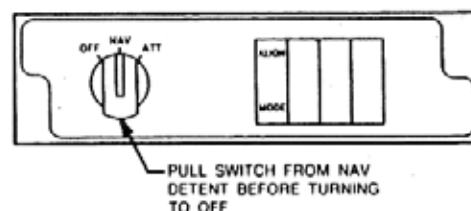


Figure 3-17

Section 3
ISDU Operation

ISDU: During first 5 seconds, "OFF" and seconds remaining to select realign option are displayed on ISDU.

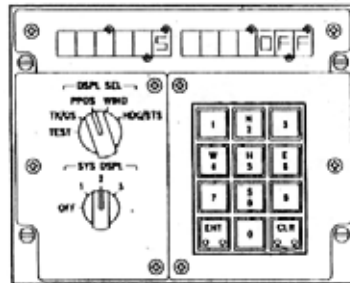


Figure 3-18

2) Set DSPL SEL switch to HDG/STS. Right display shows time until NAV (in minutes) and action code "3."

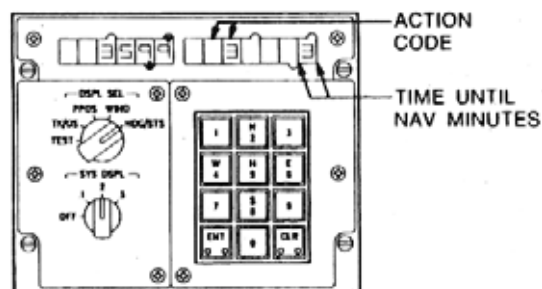


Figure 3-19

3) Pilot must enter new PPOS.

NOTE: Following the 3-minute realign, the system automatically goes into the navigation mode. **ALIGN MODE** annunciator flashes after 3-minute realign if latitude/longitude have not been entered.

3.5.1 Realign Option Problems

1) IRU only accepts latitude/longitude data if:

- Latitude < 0.5 deg from existing latitude at time of realign.
- Longitude < 1.0 deg from existing longitude at time of realign.

2) If ALIGN MODE annunciator cannot be extinguished by subsequent latitude/longitude insertions, turn IRU off and start over.

3) If excess motion is detected during realign, the ALIGN MODE annunciator flashes and action code "5" is sent. After 30 seconds, the system starts a full alignment. It is not necessary to reinsert latitude/longitude.

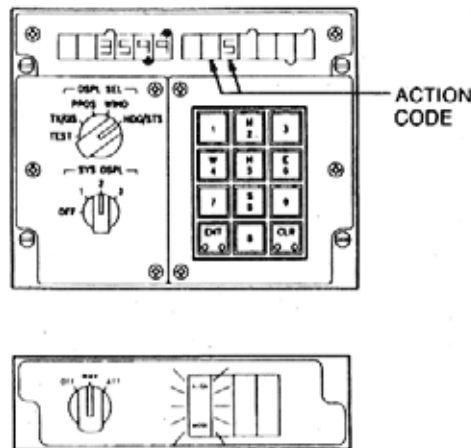


Figure 3-20

NOTE: Recall that flashing annunciator requires pilot action. ACTION CODES indicate required pilot action.

3.6 ATTITUDE MODE

Pilot Action:

1) Set MSU mode select switch to ATT (pull switch out of detent, each channel).

MSU: ALIGN MODE annunciator is on during 20-second attitude erection. Aircraft must stay straight and level during this time.

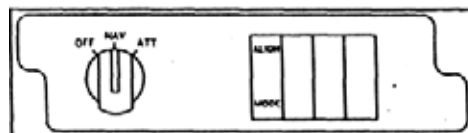
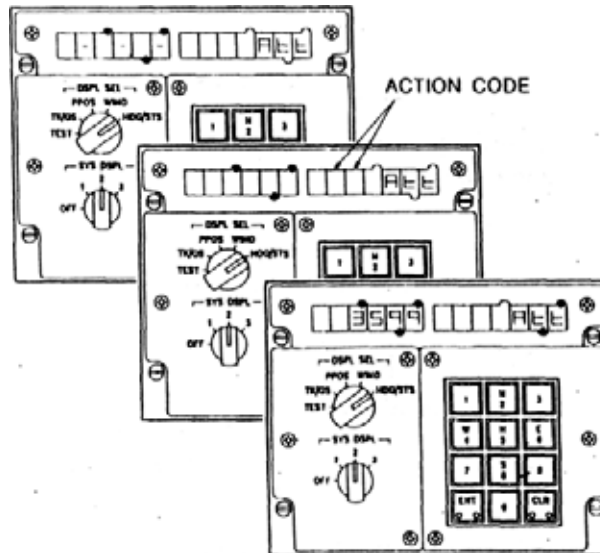


Figure 3-21

ISDU: "Att" appears as right three characters in display.


Figure 3-22

- 2) Set ISDU DSPL SEL switch to HDG/STS.
- 3) Press H key.

ISDU: Degree marker, zero decimal point, ENT, and CLR cue lights will light.

- 4) Enter heading (magnetic). (Press number keys to enter degrees and tenths of degrees.)
- 5) Press **ENT** key to enter data, and **CLR** key to change data.

ISDU: After entering heading, heading is displayed on left display.

NOTE: Magnetic heading may be periodically entered during flight to update magnetic heading to compensated for drift.

3.7 OFF MODE

Pilot Action:

- 1) Set MSU mode select switch to OFF. (NOTE: The NAV position of the switch has a detent and requires pulling before rotating.)

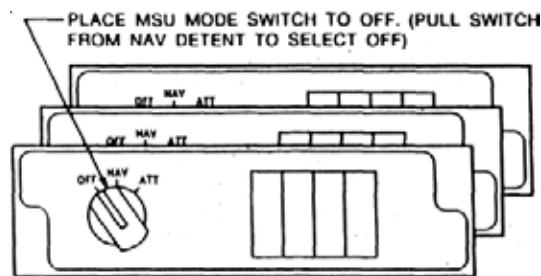


Figure 3-23

ISDU: NAV to OFF results in a 5-second countdown (realign option) followed by a 20-second countdown for the built-in test equipment (BITE) memory service cycle.

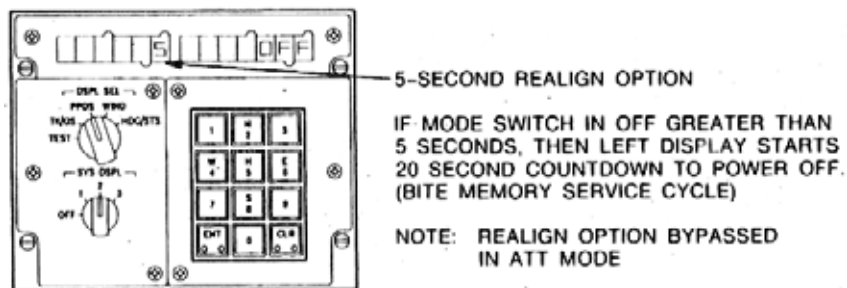


Figure 3-24

ATT to OFF results in a 20-second countdown.

NOTE: Circuit breakers must not be pulled until AFTER the 20-second countdown.

3.8 SYSTEM OPERATION DIAGRAM

The IRS has three basic modes: OFF, NAV, and ATT. Also, five operational submodes (mode states) are used in going from one primary operation mode to another. Their interrelationships are shown in the mode state diagram below.

MODES:	SUBMODES:	
Of	Initialization	Realign
Navigation	Align	Power Off
Attitude	Erect Attitude	

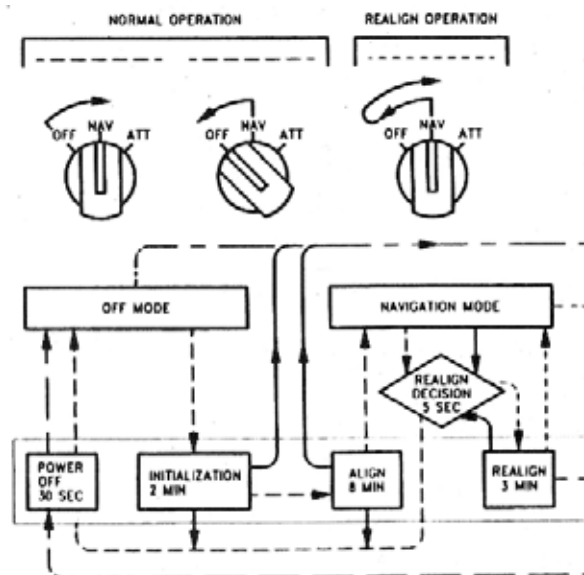


Figure 3-25

3.8.1 Off Mode - System Turn Off

The OFF mode may be entered from any mode or submode. The system switches to the 20-second power-off countdown, except from NAV or realign, where it first goes through the 5-second realign decision point and then to the 20-second power-off countdown.

Once the OFF mode is entered, the BITE test function (transferring of any failure data from the random access memory to the non-volatile memory) is accomplished.

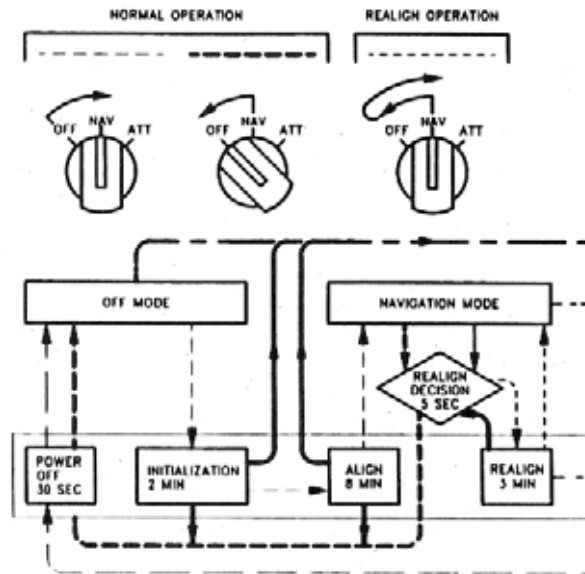


Figure 3-26

3.8.2 NAV Mode

Selection of the navigation (NAV) mode causes the IRU to utilize two submodes (initialization and align) before entering the actual navigation mode.

- **Initialization Submode** - During this two-minute period, the system is energized, (BITE) test functions are performed, and AutoCal function makes minor adjustments to sensor coefficients.

Align Submode - During align submode, the system goes through an eight-minute align.

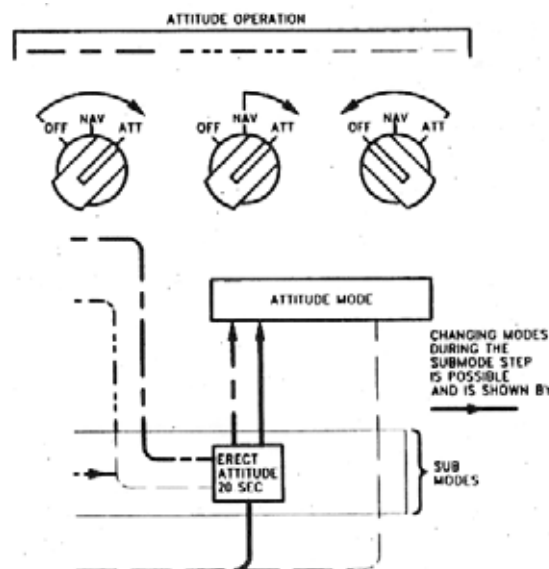


Figure 3-27

Realign Submode - With the aircraft not in motion, the pilot may elect to refresh the IRS system with a shorter than usual alignment at an intermediate stop.

3.8.3 Attitude Mode

The attitude (ATT) mode is a reversionary mode used in case the IRS experiences a total power shutdown, or in case of certain BITE detected failures (IRS WARN annunciator lit). The ATT mode can be entered at any time, both on the ground or during flight. Attitude reference is established during the 20-second erection time.

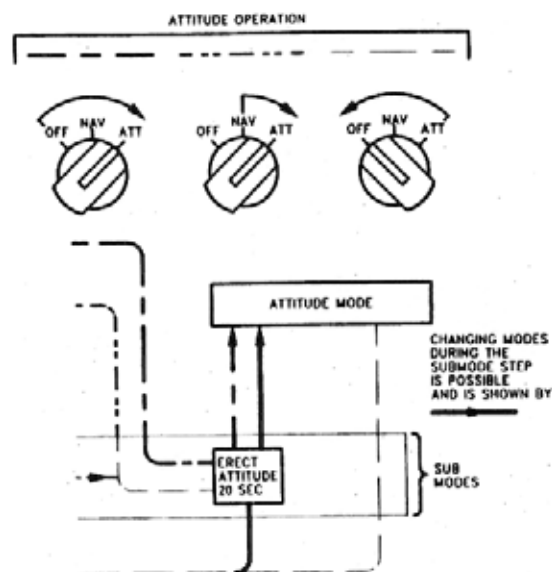


Figure 3-28

4.1 SECONDARY F-PLN

The SEC F-PLN function allows the pilot to define a separate flight plan called the secondary flight plan. The active flight plan is used for guidance and all special performance planning functions while the secondary flight plan is used for predictive purposes only. A description of the secondary F-PLN functions follow. Refer to page 4-8 for a SEC F-PLN tree diagram.

As a general rule, entry and display rules described for the active flight plan work exactly the same for the secondary flight plan. Where differences exist, they will be specifically noted in the following explanations.

4.1.1 SEC INDEX Page

The SEC F-PLN "INDEX" page is accessed by the SEC F-PLN key.

The SEC INDEX page provides access to the SEC F-PLN and functions related to it (see Figure 4.1)

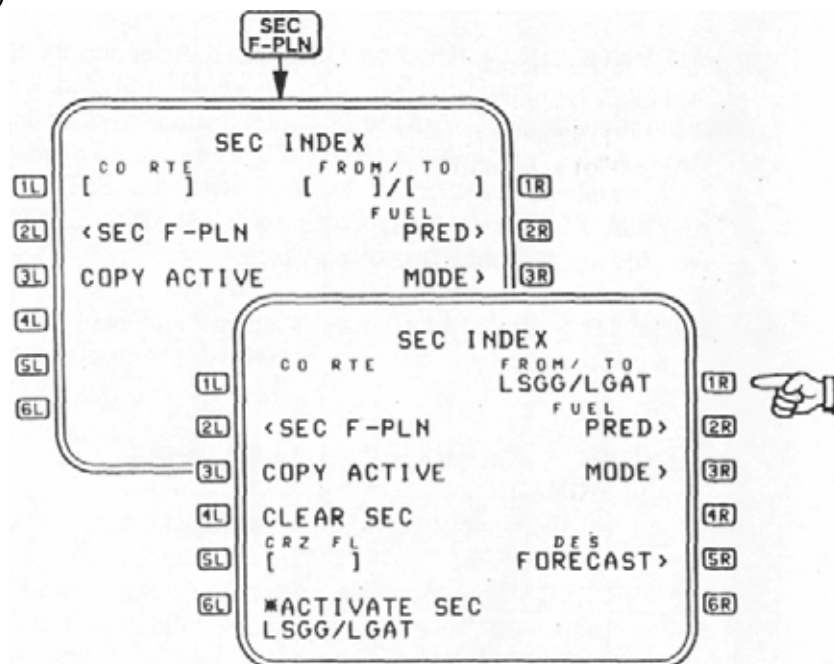


Figure 4-1

1L CORTE - Field defaults to entry prompts ([]) when no CO RTE or FROM/TO is defined. If any modification to the CO RTE is made, this field is blanked (see Figure 4.1). If the active flight plan is copied into the SEC F-PLN, then the CO RTE is reflected here if it exists in the active F-PLN.

2L SEC F-PLN - Accesses SEC F-PLN page A Figure 4-1.

- 3L** **COPY ACTIVE** - Copies Active flight plan into the secondary flight plan. See Figure 4-1.
- 4L** **CLEAR SEC** - Displayed only if there is at least one waypoint in the SEC F-PLN. Clears all lateral and vertical elements of the secondary flight plan and defaults to:
- PPOS
----END OF F-PLN----
- 5L** **CRZ FL** - Displayed only if there is at least one waypoint in the SEC F-PLN. Pilot alterable. (See Figure 4-1.)
- 6L** **ACTIVATE SEC** - Function activates the secondary flight plan by copying the SEC F-PLN to the active 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. NAV must be deselected for non identical SEC F-PLN insertion. At least one waypoint must exist in the SEC flight plan for the prompt to be displayed.
- 1R** **FROM/TO** - Defined by copying active flight plan, entering origin/destination or defaults to entry prompts with no entry.
- 2R** **FUEL PREP** - Accesses FUEL PRED page.
- 3R** **MODE** - Accesses SEC MODE (Strategic) page.
- 5R** **DES FORECAST** - Accesses descent forecast wind entry page. Displayed only if a primary destination has been defined.

4.1.2 SEC F-PLN Page A and B

Pressing **2L** in Figure 4-1 accesses the SEC F-PLN page A (see Figure 4-2). SEC F-PLN page B is accessed via the **PAGE** function key. All LSKs function identically to the active F-PLN LSKs except that EOSID is not available for selection and the asterisk (*) is not displayed. Vertically, TO/APPR parameters, MDA and MAX SPD are assumed to be identical to the active flight plan and cannot be changed in the SEC F-PLN. CRZ ALT is entered on the SEC INDEX page instead of INIT Page A and the MODE select is made via LSK **3R** on the SEC INDEX page.

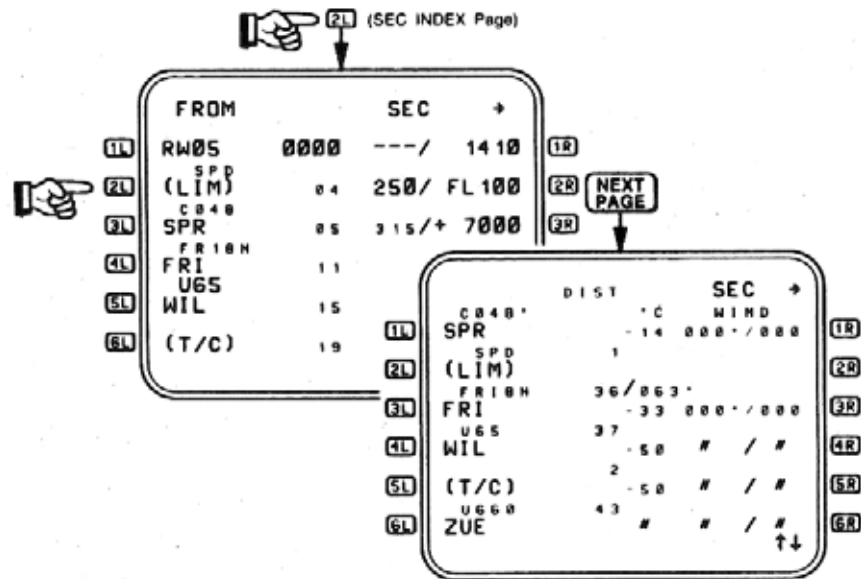


Figure 4-2

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 F-PLN 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 and the first leg of the ACT F-PLN are no longer the same, all SEC F-PLN leg sequencing ceases, if conditions for secondary flight plan sequencing exist at DONE the SEC F-PLN reverts to its initial default state of PPOS followed by a END OF F-PLN.

Flight Plan Memory Space in the FMC is shared among Active (ACT) F-PLN, ALT F-PLN and SEC F-PLN both primary and alternate. The ACT F-PLN has priority in occupying memory with the ALT F-PLN next and SEC F-PLN having lowest priority. When a revision is attempted and an overflow is encountered, the secondary F-PLN is cleared and the revision reattempted except if attempted to the SEC F-PLN, then it is not allowed. If activation of the SEC F-PLN causes an overflow, then activation will still occur but the secondary flight plan will subsequently be deleted. If a company route is being entered when an overflow is encountered, then route legs will be entered up to the point where the overflow occurs, with a discontinuity being strung to the destination airport. CDU Messages encountered during overflows include: F-PLN FULL, ALTN F-PLN CLEARED, and SEC F-PLN CLEARED.

4.1.3 SEC FUEL PREDICTION Page

Fuel predictions are only displayed if the conditions necessary for secondary flight plan predictions are satisfied, otherwise dashes are displayed.

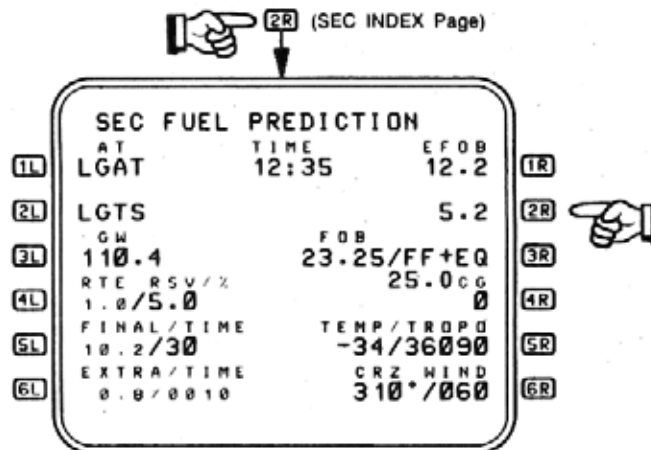


Figure 4-3

For the SEC FUEL PRED page in Figure 4-3, differences from the active FUEL PRED page include:

- 3L GW and FOB** - Aircraft gross weight and fuel on board are **3R** displayed but cannot be changed. Before engine start, this field displays dashes. After engine start, the values in the active flight plan are displayed (see Figure 4-3).
- 5R TEMP/TROPO** - A cruise temperature can be entered only if a CRZ FL has been defined for the SEC F-PLN. Entry of the TROPO altitude is not allowed.
- 6R CRZ WIND** - A cruise wind can be entered only if a CRZ FL has been defined for to the SEC F-PLN.
- 4R CG** - Center of Gravity cannot be changed.

For predictions to be calculated, the following conditions must be met for both the ACT F-PLN and SEC F-PLN.

- a. Laterally, during preflight, the origin airports must be the same. During flight phases, the SEC F-PLN must be made by a COPY ACTIVE and the first leg of the SEC F-PLN must be identical to the active leg of the F-PLN.
- b. Vertically, during takeoff or climb, the vertical profiles must be identical. During cruise, the cruise flight levels must be identical and predictions are not available when descent or approach is the active phase.

The following items are modifications which may be made specifically to the secondary flight plan:

- Speed constraint/limit
- Altitude constraint
- Cruise flight level (preflight phase only)
- Forecast wind/temperatures
- Cost index
- Strategic mode

Any of these modifications will cause the secondary flight plan predictions to be recalculated.

4.1.4 SECONDARY MOPE Page

The SECONDARY MODE page is shown in Figure 4-4. Strategic mode selection and predictions for the SEC F-PLN are made on this page.

For engine out predictions (copying engine out active F-PLN) the title SEC ENG OUT MODE is displayed. The COST INDEX may be changed via the SP and 1L of Figure 4-4. If the CI is undefined, brackets ([]) will be displayed. The company route or a pilot entry defines this field. All other information remains unchanged.



Figure 4-4

4.1.5 SEC DES FORECAST Page

This page is identical to the active flight plan

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.

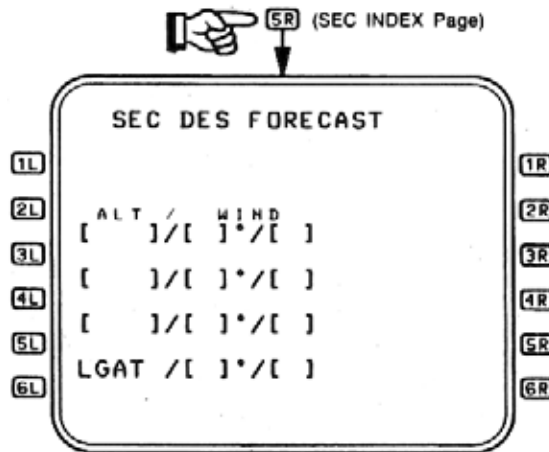


Figure 4-5

SEC F-PLN Tree

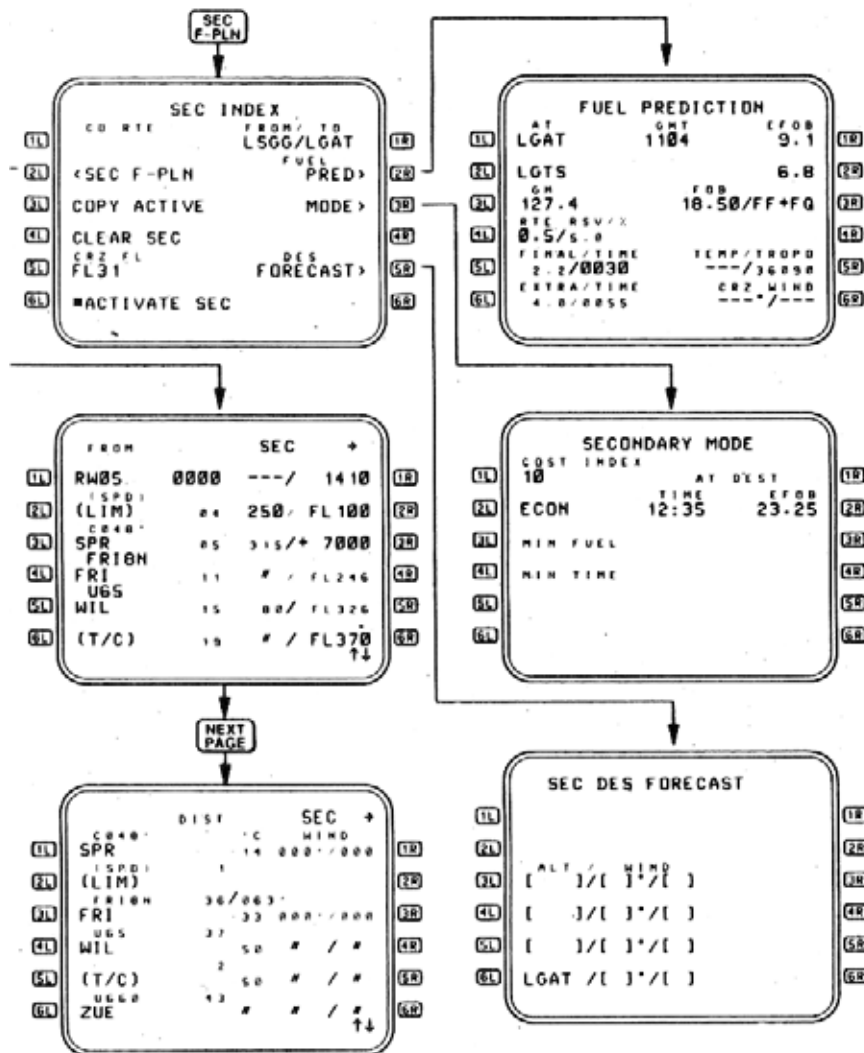


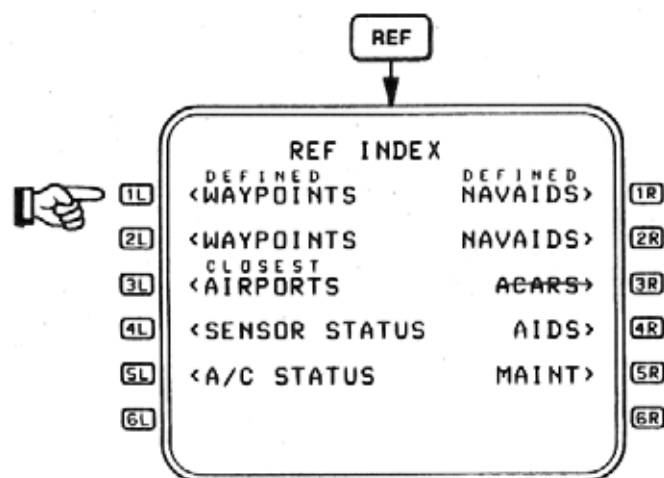
Figure 4-6

4.2 REFERENCE INDEX

In the REF INDEX section the following items will be covered:

- DEFINED WAYPOINTS to include oceanic waypoints
- WAYPOINTS and NEW WAYPOINTS
- CLOSEST AIRPORTS
- SENSOR STATUS
- DEFINED NAVAIDS/NEW NAVAIDS
- ACARS
- AIDS
- Maintenance

Accessing the **REF** key selects Figure 4-7. From the REF INDEX page, pressing **1L** (CILKDEFINED WAYPOINTS) accesses the DEFINED WAYPOINT page where pilot defined waypoints are displayed and may be deleted.


Figure 4-7

NOTE: From the **REF** page the AIRCRAFT STATUS page may be accessed by pressing **5L**.

4.2.1 Defined Waypoints

Place/Distance (PD) waypoint (also known as an along track offset waypoint) is a pilot defined point a given distance before or after an existing flight plan waypoint, and on the existing flight plan track. A new PD point is located before the waypoint if a minus (-) is used and after the point if a plus (+) is used. For example, by typing ZUE/-10 in the SP and pressing and left LSK abeam ZUE, the PD01 point 10 NM short of ZUE is generated and inserted into the F-PLN. See Figure 4-8 and 4-9. PD01 is the first (01) of 20 possible pilot definable waypoints.

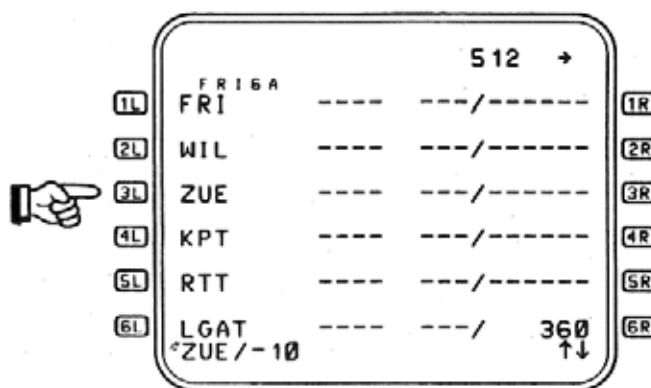


Figure 4-8
Place/Distance Waypoint

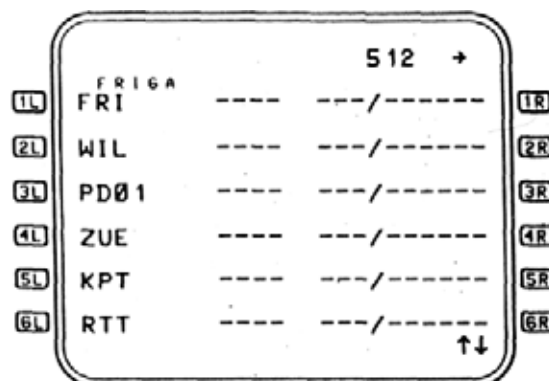
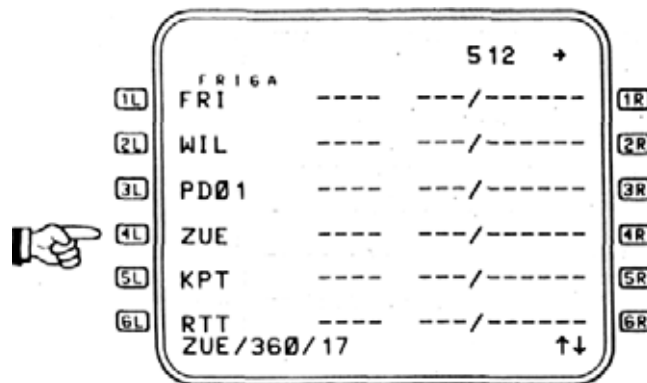
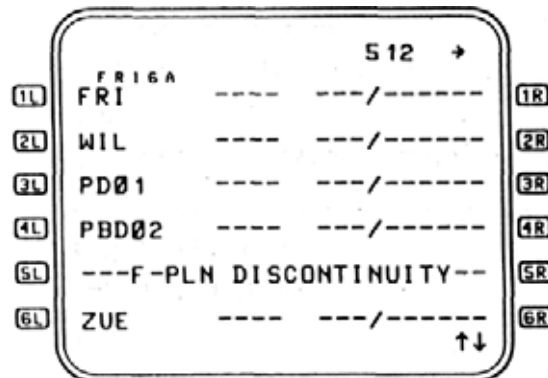


Figure 4-9

The referenced waypoint may not be the "From" waypoint. Also, when proceeding "DIRECT TO" a waypoint, a PD waypoint cannot be created short of the TO 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 present position.

A Place/Bearing/Distance (PBD) point (i.e., ZUE/360/17) may be created in a similar manner as a PD point. The PBD02 point becomes one of the pilot definable waypoints. For example, PBD02 is created in Figures 4-10 and 4-11. The EFIS should be reviewed when clearing the DISCON and establishing further routing.


Figure 4-10

Figure 4-11

A LAT/LONG waypoint (i.e., 4730.3N/00810.1E) may be generated the same as a PD or PBD point. It will be called a LL point and uses the next number in sequence when entered directly on the F-PLN page. For example LL03 is generated and displayed in Figures 4-12 and 4-13. Another DISCON must be cleared.

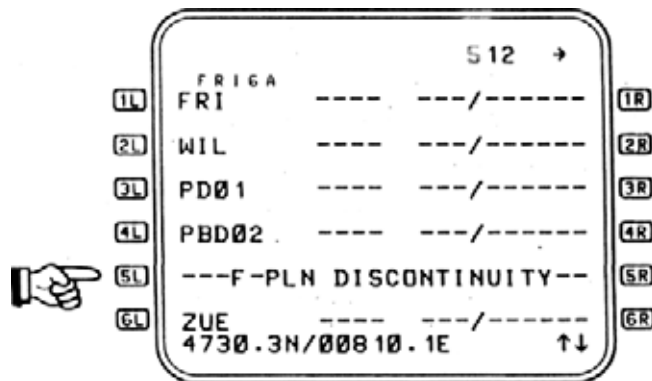


Figure 4-12

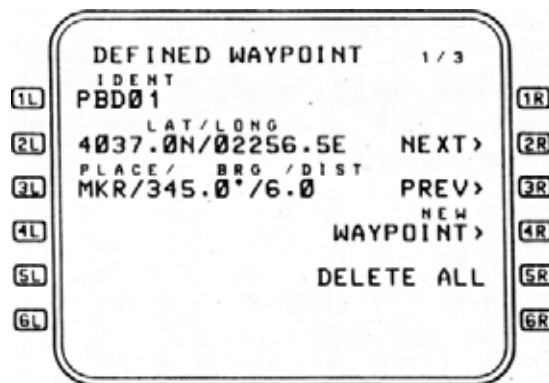


Figure 4-13

Individual waypoints may be deleted by using **CLR** in the SP and **1L** unless they are in the F-PLN. With only one waypoint to delete the display changes to the WAYPOINT page (see Figure 4-14). Pressing **5R** DELETE ALL will delete all waypoints not strung in a flight plan.

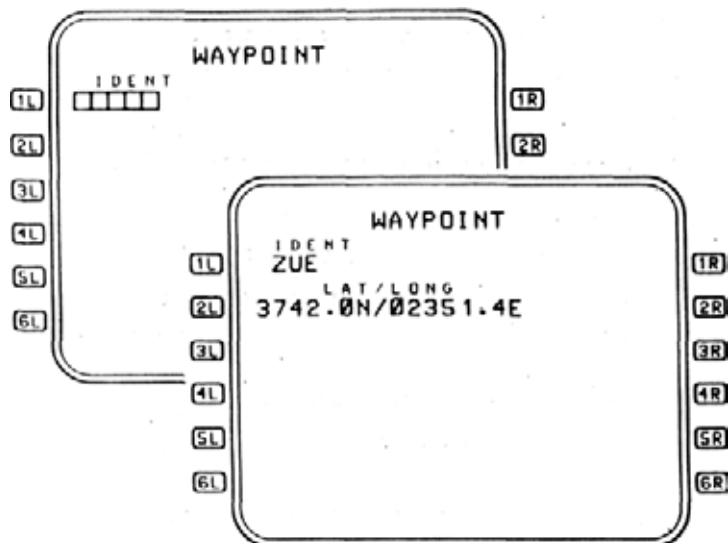


Figure 4-14

Access to the other pilot defined waypoints in Figure 4-13 must be made through **2R** and **3R** LSKs. Figures 4-15 and 4-16 show 2/3 and 3/3 pilot defined waypoints.

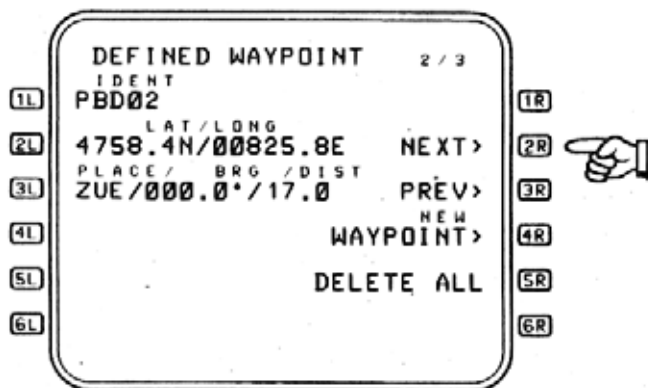


Figure 4-15

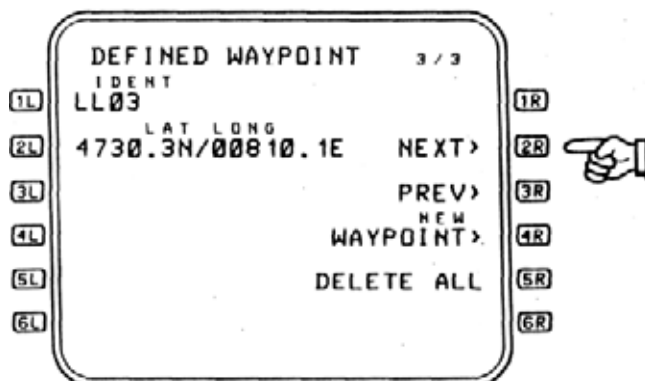


Figure 4-16

Up to 20 pilot defined waypoints may be created using entry procedures and/or the NEW WAYPOINT LSK **4R**.

4.2.1.1 Loading/Verifying Oceanic Waypoints

For oceanic flights, over-ocean waypoints should be loaded by one pilot and verified independently by the other pilot. Proceed as follows:

- All oceanic waypoints are entered through the Defined Waypoints page which is accessed through the **REF** key.
- All oceanic waypoints are "named" with a 5-digit name when defining each waypoint. For example, the waypoint N5300.0/W1500.0 should be named 53N15; the waypoint N5500.0/W2000.0 should be named 55N20. In this way meaningful waypoint names will appear on the flight plan page and on the ND rather than LL01, LL02, etc.
- When defining oceanic waypoints, be sure to load minutes digits even though they are zero. For example, to load N5300.0/W1500A it is necessary to press N,5,3,0,0,/,W,1,5,0,0.

if the tenths of a minute digit is not zero, it must also be entered, preceded by a decimal point. The N or S and W or E may be entered either before or after the digits.

- After all oceanic waypoints are loaded and named on the Defined Waypoints page, they should be entered into the Flight Plan page, in proper sequence using the waypoint names.
- The pilot who verifies each oceanic waypoint must check the exact latitude and longitude of each waypoint using the Defined Waypoints page.

NOTE: It is a good technique to have the waypoints verified by the other pilot prior to entering them on the Flight Plan page. In this way, if an error were made in defining a waypoint, the waypoint can be deleted and re-entered correctly. A waypoint that has been entered into the active or secondary flight plan cannot be deleted unless it is first removed from the Flight Plan.

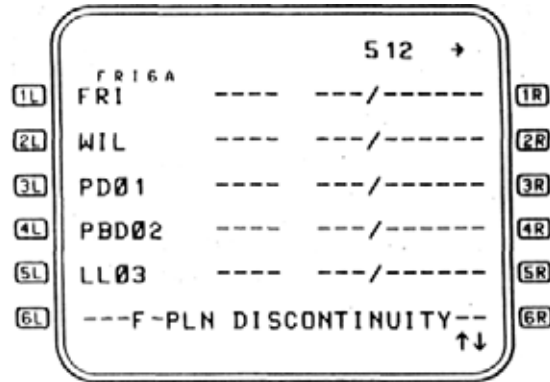


Figure 4-17

If a noncolocated VOR/DME is entered as a waypoint within the flight plan, always use the LAT/LONG of the VOR Navaid as the fixed waypoint. Attempted entry of more than 20 points results in the first point entered being dropped unless it is in the active flight plan.

4. 2. 2 WAYPOINTS/NEW WAYPOINTS Page

Pressing the **REF** key selects Figure 4-18. From the REF INDEX page, pressing **1L** (DEFINED WAYPOINTS) access the DEFINED WAYPOINT page where pilot defined waypoints are displayed and may be deleted. Pressing DELETE ALL (**5R** on Figure 4-16) deletes all waypoints previously defined by the pilot whereupon the display changes to the WAYPOINTS Page (shown in Figure 4-14). If any defined waypoints are within the active F-PLN or SEC F-PLN, they are not deleted and message F-PLN WPT/NAV RETAINED is displayed.

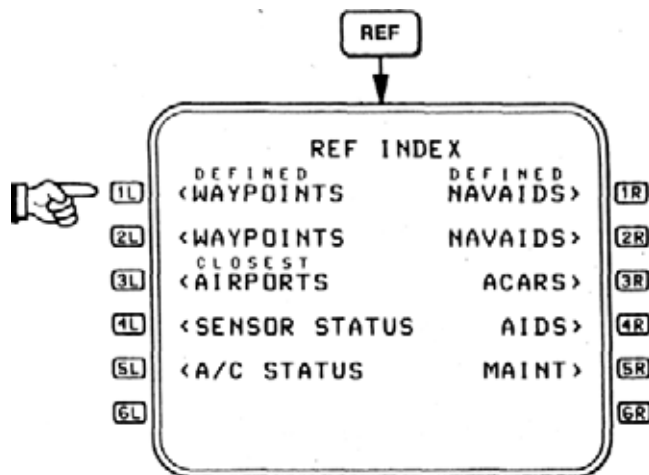


Figure 4-18

On the DEFINED WAYPOINT page. Pressing **4R** accesses the NEW WAYPOINT page found in Figure 4-19.

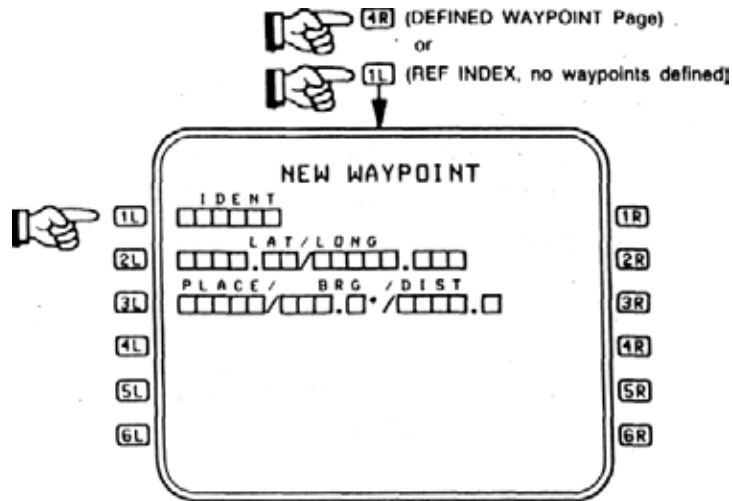


Figure 4-19

On this page instead of using PD, PBD or LL for the IDENT, the pilot may name the waypoint with any combination of alphanumeric characters. If a duplicate name is generated, the DUPLICATE NAMES display will appear when the point is next accessed.

When a LAT/LONG is entered in **2L** via the SP, the PLACE/BRG/DIST field is no longer displayed. If a PLACE/BRG/DIST is entered in **3L**. Then the LAT/LONG is calculated and displayed in **2L** above.

If a runway is entered in the context of RW16R, then the boxes associated with LSK **4L** (ELV), **5L** (LENGTH), and **6L** (CRS) are displayed and must have data entered to become a defined runway. If the runway length is displayed in meters, a small M appears to the right of the number. Figures 4-20 and 4-21 show all RW data inserted and the ENTER **6R** prompt which creates the point as one of the 20 pilot definable waypoints.

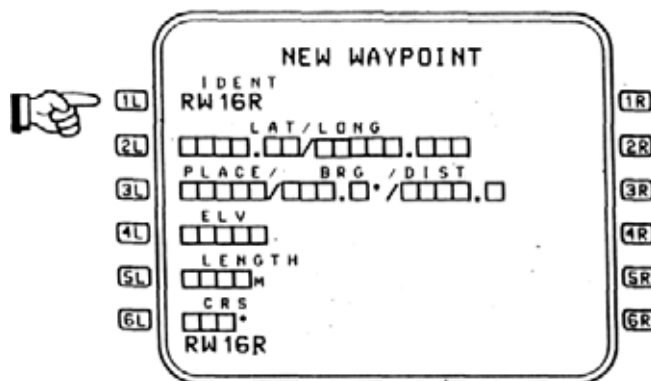


Figure 4-20

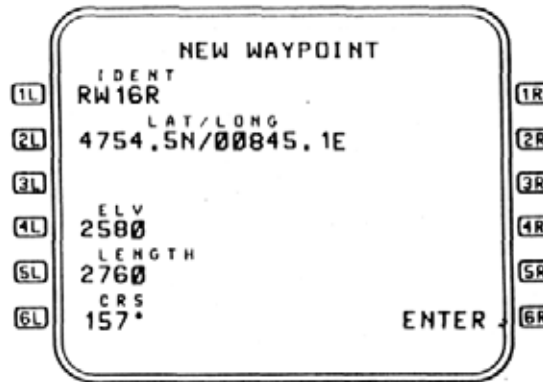


Figure 4-21

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.

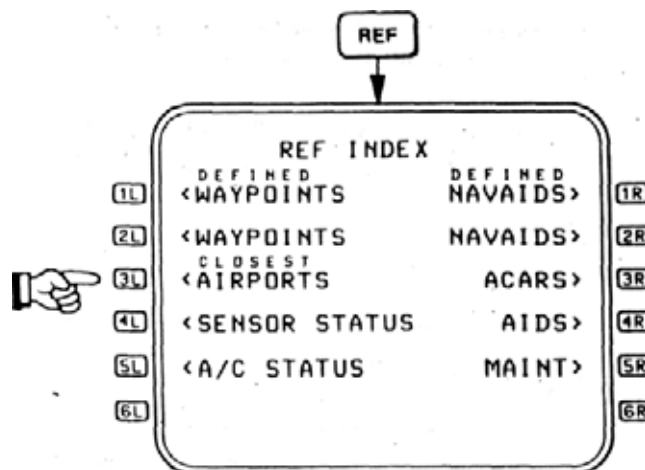


Figure 4-22

4. 2. 3 Closest Airports

The CLOSEST AIRPORTS page of the REF INDEX provides a means of reviewing the five airports in the navigation data base that are closest to the current aircraft position. Pressing **3L** of Figure 4-22 selects the CLOSEST AIRPORTS page shown in Figure 4-23.

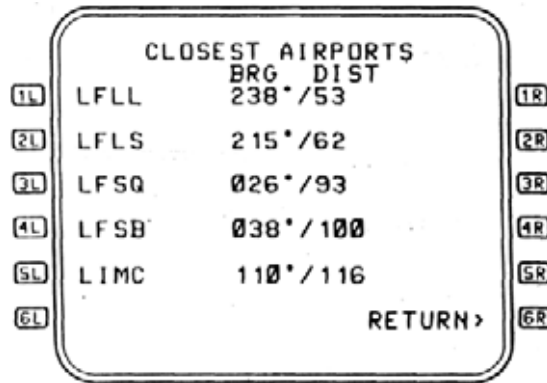


Figure 4-23

ICAO identifiers of those airports and their bearing and range are Misled in drder of increasing distance with the closest airport in **1L**. Only airports that are between 2 and 2000 NM from the aircraft will be displayed. If no airports are found within 2000 NM then NONE WITHIN 2000 NM is displayed on the CDU. No entries or changes are allowed on this page.



4.2.4 SENSOR STATUS Page

The SENSOR STATUS page of the REF INDEX provides information on the status of the devices that provide sensor inputs to the FMC. The status of each sensor for the current flight leg and the previous six flight legs in which a failure occurred may be viewed by using the **PAGE** key. The left two digit number in the title field denotes the flight leg during which a failure occurred. In **1R** data field, 1 = left side of aircraft, 2 = right side of aircraft, and 3 = center. (See Figures 4-24 and 4-25.)

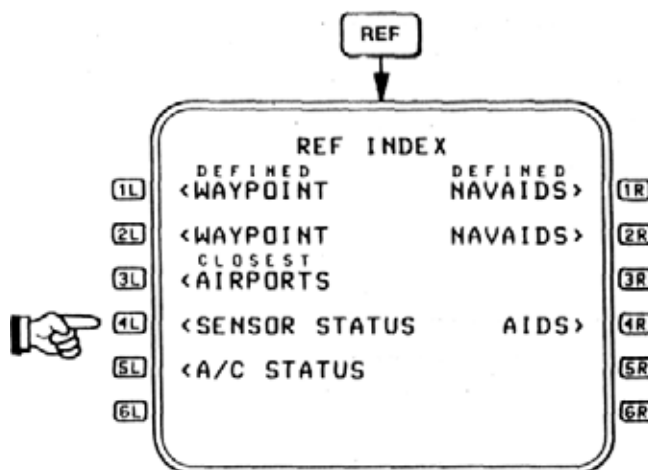
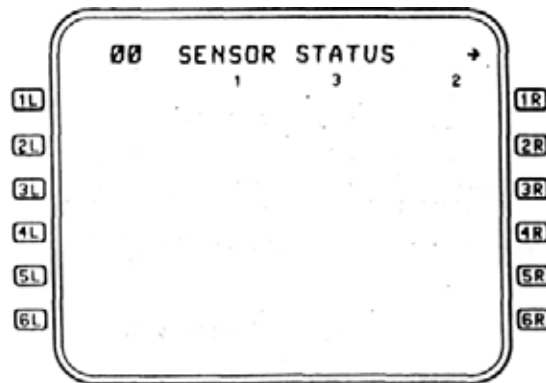


Figure 4-24


Figure 4-25

Sensor types are listed in the order of their display priority:

- | | |
|-------------------|---------------------|
| 1. IRS/AHRS 1,2,3 | 9. ILS 1,2* |
| 2. ADC 1,2 | 10. VOR 1,2 |
| 3. EFIS 1,2 | 11. Clock 1,2 |
| 4. TCC 1,2 | 12. DME 1,2 |
| 5. FAC 1,2 | 13. CDU 1,2 |
| 6. FF 1,2 | 14. FMC 1,2* |
| 7. FQ3 | 15. FMC 1,2* |
| 8. FCU 1,2 | 16. DIS-IN FMC 1,2* |

"Which ever is onside.

If the SENSOR STATUS page is accessed while the FMC is in independent operation, the message INDEPENDENT OPERATION is displayed and automatically cleared when exiting the SENSOR STATUS page.

4.2.5 DEFINED NAVAIDS/NEW NAVAIDS Page

A new NAVAID may be added to the data base using DEFINED NAVAIDS **1R** of the REF INDEX and then selecting NEW NAVAID **4R**. If there are no navaids defined, pressing **1R** will go directly to the NEW NAVAID page. Up to 20 navaids may be defined by the pilot and added to the data base (see Figure 4-27).

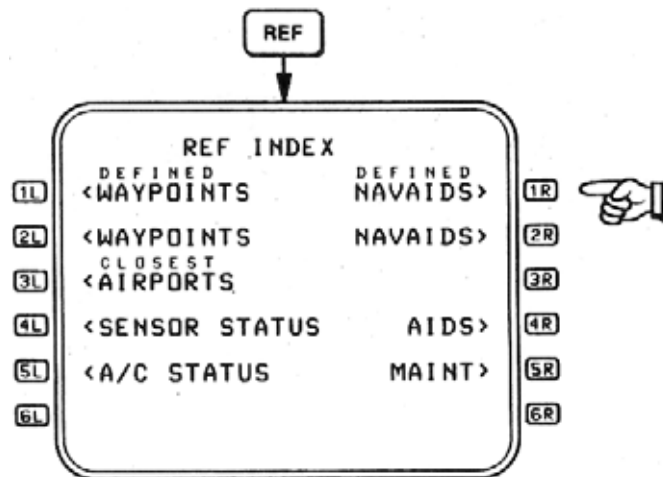


Figure 4-26



Figure 4-27

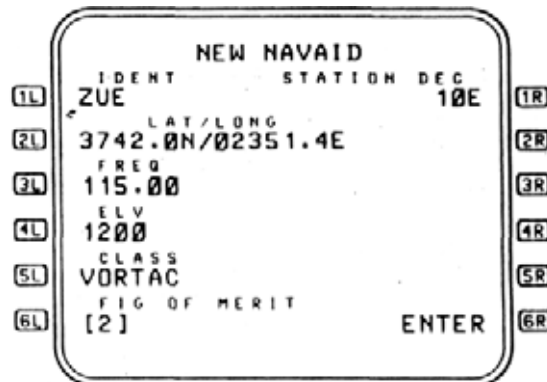
NOTE: When the 20 nav aids or 20 waypoints are defined, the message LIST OF TWENTY IN USE is displayed on the CDU.

While data lines, 1L, 2L, and 3L are self explanatory, 5L, the CLASS is entered as a:

VOR	VOR only	ILSDME	Collocated ILS and DME
DME	DME or TACAN	VORTAC	Collocated VOR and TACAN
VORDME	Collocated VOR/DME	LOC	Localizer

Figure 4-28

In Figure 4-29 after the CLASS is entered, **4L** ELEV is displayed (except VOR) and **6L** FIG of MERIT is displayed (except LOC) and may be entered. For Figure of Merit information see Figure 4-29.



NEW NAV AID	
1L	IDENT ZUE
	STATION DEC 10E
2L	LAT/LONG 3742.0N/02351.4E
3L	FREQ 115.00
4L	ELV 1200
5L	CLASS VORTAC
6L	FIG OF MERIT [2]
	ENTER

Figure 4-29

If no FIG of MERIT is entered, 2 is used as a default value. If the STATION DEC (magnetic variation) is displayed as it is for a VOR, VORTAC, or VOR/DME, a value must be entered. When all required data entries are made, the **6R** ENTER prompt is shown (see Figure 4-29) and when pressed the data is entered into the data base. Leaving this page without pressing ENTER deletes entered data.

4.2.6 ACARS

General: The Aircraft Communications Addressing and Reporting System (ACARS) is a means of transferring data to and from aircraft via existing communication links, i.e., VHP and HF radio. This section describes the ACARS interface for the Honeywell A310/A300-600 Flight Management System (FMS).

This FMS/ACARS interface definition involves the following:

1. The ground station's ability to uplink flight plan, load, predicted wind, and position request information to the FMS aboard the aircraft.
2. The FMS's ability to downlink flight plan, load, predicted wind requests, and position reports to the ground station.



Figure 4-30

4.2.6.1 ACARS Page

An example ACARS page is shown in Figure 4-30.

1. **Access** - Line select key **3R** on the Reference page.
2. **Purpose** - initiate ACARS downlinks, display status of FMC ACARS interface, and display and modification of certain data to be present in ACARS downlinks.
3. Data Fields:

1L ROUTE - initiates an ACARS Flight Plan (FPR) request downlink. If a valid entry has not been made in **1R** the downlink shall not be initiated. If an ACARS downlink is in progress, the downlink shall not be initiated.

2L T/O DATA - initiates an ACARS Load Information Data (LIF) request downlink. If a valid entry has not been made in **2R**, the downlink shall not be initiated. If an ACARS downlink is in progress, the downlink shall not be initiated.

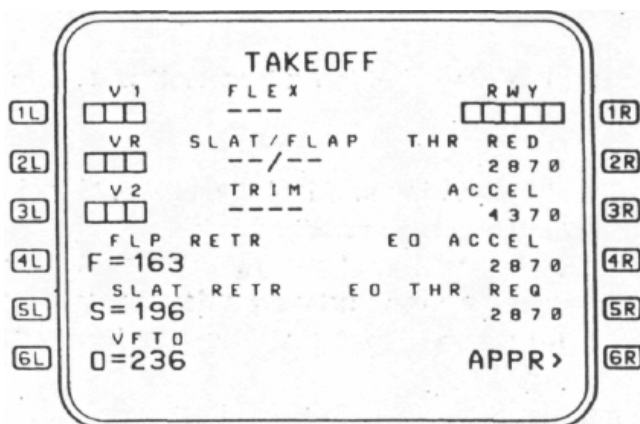


Figure 4-31

- 3L POS REPORT** - initiates an ACARS Position Report (AEP) downlink. If an ACARS downlink is in progress, the downlink shall not be initiated.
- 4L WIND PLAN** - initiates an ACARS Predicted Wind Data (PWD) request downlink. Selecting **4L** generates a PWD downlink to request wind data for planning. If an ACARS downlink is in progress, the downlink shall not be initiated. If a valid entry has not been made in **4L**, the downlink shall not be initiated.
- 5L WIND CHG (*WIND CHG)** - initiates an ACARS PWD request downlink. Selecting **5L** generates a PWD downlink to request wind data for incorporation into the selected flight plan. If **4R** contains "ACT", the prompt displayed for **5L** is " * WIND CHG" and the wind data requested shall be used in the active flight plan. If **4R** contains "SEC", the prompt displayed for **5L** is "WIND CHG" and the wind data requested shall be used in the secondary flight plan. If a valid entry has not been made in **4R**, the downlink shall not be initiated. If an ACARS downlink is in progress, the downlink shall not be initiated.
- 1R CO RTE** - company route input by pilot to be transmitted in FPR downlinks.
- 2R RWY** - runway input by pilot to be transmitted in LIF request downlinks.
- 4R F-PLN/FL** - flight plan type and flight level input by pilot to be transmitted in PWD request downlinks. If **4R** displays brackets, a flight plan type and a flight level must be entered; otherwise, a flight plan type and a flight level may be entered individually or together. Flight plan type entries are either "ACT" or "SEC".
- 6R STATUS** - status of FMC ACARS interface.

4.2.6.2 ACARS TAKEOFF Page

Example TAKEOFF pages are shown in Figures 4-31 and 4-32.

1. **Access** - TO/APPR key when the aircraft is in the DONE, PREFLIGHT, TAKEOFF phases. If this page is displayed when the flight phase transitions to CLB, the page will not automatically change to the APPR page.
2. **Purpose** - display or modify necessary takeoff parameters.
3. Data Fields:

1L These fields' contents may be altered by a change in takeoff **3L** parameters, a runway being entered in **1R**, or a LIF uplink being received. See sections below for specific operations of these fields. Manual entries in these fields shall be cleared when the takeoff mode is changed or a runway is entered in **1R**. If values exist for the new takeoff mode or runway, these values are displayed; otherwise, boxes are displayed in these fields.

When a LIF uplink is received and values from a previous uplink are displayed in these fields, boxes or values from the uplink are displayed. If the uplink just received contains values for the **1R** runway, but did not contain values for the current takeoff mode, boxes shall be displayed in these fields. If values for the current takeoff mode and **1R** runway are received in the uplink, the values received for these fields shall be displayed.

If an LIF uplink is received when a runway has not been entered in **1R** and the first runway in the uplink has data for the current takeoff mode, the first runway's values for these fields shall be displayed.

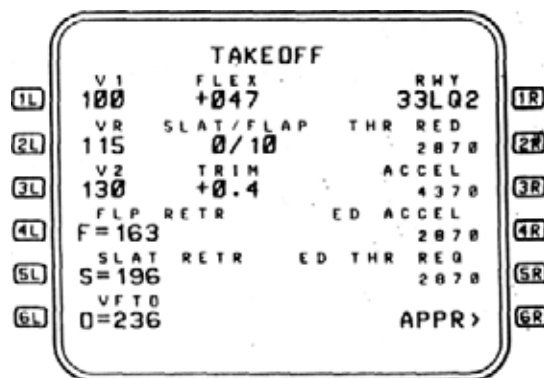


Figure 4-32

- 1L** **V1** - input by pilot or received in an ACARS LIF uplink. Entries received via an ACARS uplink shall be superseded by manual entries. This parameter is output on the EFIS bus for display on the PFD.
- 2L** **VR** - input by pilot or received in an ACARS LIF uplink. Entries received via an ACARS uplink shall be superseded by manual entries.
- 3L** **V2** - input by pilot or received in an ACARS LIF uplink. Entries received via an ACARS uplink shall be superseded by manual entries.
- 4L** **FLP RETR** - Flap Retraction Speed. This value is calculated by the FMC but may be changed by the pilot. It is always displayed in large font.
- 5L** **SLT RETR** - Slat Retraction Speed. This value is calculated by the FMC but may be changed by the pilot. It is always displayed in large font.
- 6L** **VFTO** - Final Takeoff Velocity. This value is calculated by the FMC but may be changed by the pilot. It is always displayed in large font.
- 1R** **RWY** - Runway input by the pilot or received in an LIF uplink. This field displays boxes until a pilot entry is made or a LIF uplink is received. If an LIF uplink is received and **1R** does not contain an entry, the first runway in the uplink shall be input.
- 2R** **THR RED** - Thrust Reduction Altitude (THR RED ALT) rounded to the nearest 10 feet.

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- 3R ACCEL** - Acceleration Altitude (ACCEL ALT) rounded to the nearest 10 feet.
- 4R EO ACCEL** - Engine Out acceleration altitude (EO ACCEL ALT) rounded to the nearest 10 feet.
- 5R EO THR RED** - ENG OUT Thrust Reduction altitude (EO THR RED) rounded to the nearest 10 feet.
- 6R APPR** - allows access to the APPROACH page. This prompt only displayed if there is a primary destination in the active F-PLN.
- 2R 5R** These fields display dashes until either the default values or a pilot entry is made. The pilot may enter these values and once the pilot has entered the value, the FMC will not change the entered "value to the default value unless the field is cleared.

Entries are allowed only while the flight phase is PREFLIGHT. Once the flight phase transitions from PREFLIGHT, entries are rejected.

- 1C FLEX** - Flex temperature shall be displayed when the flex takeoff mode is selected and an ACARS uplinked flex temperature was received for the runway entered in **1R**. If a flex temperature is available for the runway in **1R**, but the flex takeoff mode is not chosen, "AVAIL" shall be displayed. If a flex temperature is unavailable, "NONE" is displayed. If a runway has not been entered in **1R**, dashes shall be displayed. The flex temperature in **1C** shall be displayed when a flex temperature is received for the runway in **1R** and the flex takeoff mode is chosen.
- 2C SLAT/FLAP** - Slat and flap settings shall be displayed when ACARS uplinked values are available for the runway entered in **1R**. If slat and flap settings were not received, a runway has not been entered, or the flex takeoff mode is chosen and flex data was not received for the runway in **1R**, dashes shall be displayed.
- 3C TRIM** - Trim settings shall be displayed when ACARS uplinked values are available for the runway entered in **1R**. If a trim setting was not received, a runway has not been entered, or the flex takeoff mode is chosen and flex data was not received for the runway in **1R**, dashes shall be displayed.

4.2.6.3 ACARS Messages

An ACARS message, uplink or downlink, can contain only one message type. The message types are identified by three-character Imbedded Message Identifiers (IMI), which precede the message contents. A message can have several data elements. These elements are identified by two-character Imbedded Element Identifiers (IEI), which precede the element data. Imbedded elements are separated by a slash (/) preceding the IEI.

IMI	<u>Downlink Message Content</u>	<u>Uplink Message Content</u>
------------	--	--------------------------------------

AEP	Fixed Format Position Report with Time, Altitude, Temperature, Wind and a variable	Request for Position Report Downlink at waypoints in flight plan
-----	--	---

	length message	
FPR	Request for Flight Plan, i. e., Company Route and Flight Level	Flight Plan and Performance Information
LIF	Request for Load Information at a Runway	Load Information and Take-off Reference Information
PWD	Request for Cruise Winds for Flight Plan Waypoints	Cruise winds at waypoints and/or descent winds at altitudes

If an FPR message containing performance data is received while NOT AIRBORNE, the advisory scratchpad message ACARS PERF DATA is displayed. The ACARS PERF DATA message can be cleared by pressing the **CLR** key. The ACARS ROUTE DATA message is displayed after the ACARS PERF DATA message is cleared.

All applicable pilot-entered performance values are overwritten by ACARS values.

The FPR data shall propagate into other CDU pages, program predictions, and calculations in an identical manner to CDU-entered data.

If the FPR message is received while in the air, the ACARS PERF DATA message appears only when any of Cruise Temperature (CT), Cruise Altitude (CL), Cruise Wind (CW), and Tropopause Altitude (TA) elements are sent.

4.2.6.3.1 Uplink Messages (MU to FMC)

An uplink message can be received by the FMC as a result of an unsolicited initiation by the ground station or as a response to a crew-initiated flight plan request, via the CDU ACARS page. An ACARS message can contain one of four message types, each of which will be discussed individually.

4.2.6.3.2 System Message Logic

When a FPR uplink is received, the FMC loads flight plan data derived from the RT data into the SEC F-PLN. If the SEC F-PLN has existing flight plan data, the ACARS flight plan data will replace it.

A CDU alerting scratchpad message shall be generated, after the integrity of the message block has been established and before independent text processing begins on a received FPR, to alert the crew about the RT data. This message shall be:

"ACARS ROUTE DATA"

The message can be manually cleared using the **CLR** key.

If an error in the RT data is detected by CDU software, the data processing ceases and the proper error message is displayed. If an error is encountered, the crew should request the FPR uplink again via the CDU ACARS page.

4.2.6.3.3 Flight Plan (FPR) (Uplink)

The FPR uplink can be received both on ground and in air. It consists of flight plan data followed by performance data. It can be an unsolicited uplink from the ground station or a response to a crew-initiated request. An unsolicited uplink will be ignored unless the onside TCC is valid and the flight phase is DONE, or PREFLIGHT before "Engine Start". To request a flight plan, a crew member accesses the ACARS page and selects the appropriate options. FPR requests will be further discussed in the downlink section.

The FPR uplink is a variable format message using several Imbedded Element Identifiers (IEI), following the imbedded message identifier FPR. The only required element for an FPR uplink is Route (RT). Optional elements consist of Zero Fuel Weight (ZF), Cruise Altitude (CL), Cost Index (CI), Alternate Destination Airport (AN), Cruise Temperature (CT), Cruise Wind (CW), Performance Factor (PF), Zero Fuel Weight Center of Gravity or Gross Weight Center of Gravity (if no trim tank) (CG), Block Fuel (BF) and Taxi Fuel (TG) in any order after an RT.

If the FPR message does not contain the required element, the message is processed up to the point of error detection, and the INVALID ACARS DATA message is displayed. If any of the performance quantities (zero fuel weight, cruise altitude, etc) exceed the entry ranges, the INVALID ACARS DATA message will be displayed and processing of the FPR will cease. If any of the performance parameters is included several times in the same uplink, then only the final one is used. The valid processed portion of any FPR containing invalid data will be included in the FMC flight plan or performance data.

When NOT AIRBORNE all performance data elements are accepted but Performance Factor (PF), Cost Index (CI) and Block Fuel (BF) are allowed only if the onside TCC is valid, and the flight phase is DONE, or PREFLIGHT before "Engine Start". When AIRBORNE, only Route, Cruise Flight Level, Cruise Temperature, Cruise Wind and Alternate Destination Airport are processed. Therefore, the accepted Imbedded Element Identifiers (IEI) following an FPR in the air are RT, CL, TL, CT, CW, and AN. Any additional performance data included in the uplink is ignored.

4.2.6.3.4 Predicted Wind Data (PWD) (Uplink)

The PWD uplink can be received while either on the ground or in the air. It can be an unsolicited uplink from the ground station or a response to a crew-initiated request. An unsolicited uplink will be ignored unless the onside TCC is valid and the flight phase is DONE, or PREFLIGHT before "Engine Start". To request a PWD, a crew member would have to access the ACARS page, and select the appropriate options. PWD requests will be further discussed in the downlink section.

The PWD uplink consists of two PWDs: the Enroute Winds (ED) and the Descent Winds (DW).

The CDU advisory message ACARS WIND DATA will be displayed in response to a PWD uplink. Uplinked wind data is entered into either the ACT or SEC F-PLN only at pilot selection on the ACARS page. The data is entered only into the primary part of the flight plan and not the alternate.

4.2.6.3.5 Enroute Winds (ER)

ER text defines wind velocity and bearing at cruise waypoints. ER data is assumed to be at the current cruise altitude. An optimal message (215 free text characters) allows the maximum number of ER waypoints to be 19 if DW text is not appended or 15 with DW data for four flight levels. The variable field consists of text that has been entered in the scratchpad prior to manually-initiated downlink. The variable field is null for automatic position reports.

4.2.6.3.6 Descent Winds (DW)

DW text defines wind velocities and bearings at specified flight levels.

The DW text element is a fixed format field consisting of nine characters per flight level. The first three characters define the flight level (units: hundreds of feet). The next six characters define the wind vector; the direction the wind is coming from, in degrees, followed by the wind magnitude, in knots.

4.2.6.3.7 Predicted Wind Data Requests (PWD) (Downlink)

An ACARS downlink PWD can be transmitted while either on the ground or in the air. A PWD downlink will request wind data at a selected altitude for flight plan waypoints. The message can request either wind for actual use or wind for planning. The response to a planning request will go to the aircraft printer and not to the FMC. The response to an actual request will go to the FMC for use on the ACT or SEC F-PLN pages (accessed via the **F-PLN** key or the **SEC F-PLN** key and SEC F-PLN prompt on the SEC INDEX page) or the DESCENT FORECAST page (accessed via the DES FORECAST prompt on the PROG page) as appropriate.

From the ACARS page, a F-PLN type (ACT or SEC) and three-character flight level, separated by a slash, is entered into **4R**

Example1	ACT/350 Active F-PLN, FL350
Example2	SEC/090 Secondary F-PLN, FL090

If an entry has already been made, a F-PLN type alone or flight level alone will also be accepted as a valid entry. For example, if field 4R displays ACT/350 and /370 is entered, the display will change to ACT/370. This identifies the flight plan and flight level for which data is being requested.

Pressing **4L** or **5L** (Wind Plan or Wind Change) initiates an ACARS downlink PWD.

If no F-PLN/FL exists in **4R**, pressing **4L** or **5L** causes a "NOT ALLOWED" message to be displayed at the CDU.

The last entry into **4R** is retained until flight completion, or until a long-term power interruption occurs.

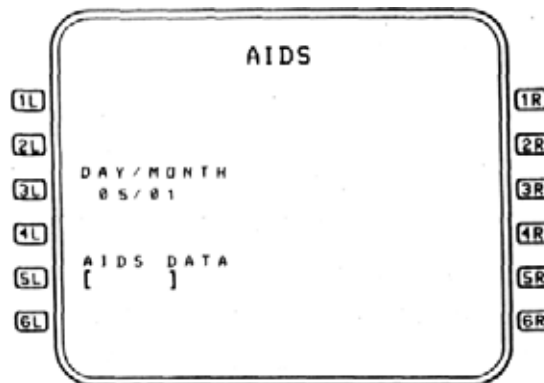
A PWD message consists of the entered flight level and the remaining waypoints (maximum of 39) in the flight plan selected in **4R**. If there are more than 39 waypoints in the flight plan that satisfy the PWD downlink criteria, the first 39 waypoints will be used.

4.2.7 AIDS Page



An example AIDS page is shown in Figure 5-33.

1. **Access** - LS key on REF INDEX page
2. **Purpose** - Allows flight crew to enter data into the AIDS system through the scratchpad.


Figure 4-33
3. Data Fields:

3L DAY/MONTH - If the date transmitted by the clock is valid, then it is the default value for this field. Otherwise, the field defaults to boxes. In either case, a pilot entry of DAY/MONTH replaces the default value. Clearing the field reverts the display to the appropriate default. Leading zeros are displayed on both day and month. For example, an entry of 1/1 would result in a display of 01/01. If a date is displayed on this page, then it is also transmitted on the General Output bus.

5L AIDS DATA - Entry into this field causes the entered data to be transmitted on the General Output bus as documentary data. The entry remains displayed and can be updated by a subsequent entry.

4.2.8 MAINT Page

An example MAINT page is shown in Figure 4-34.

Access

1. **5R** LSK from REF INDEX page.

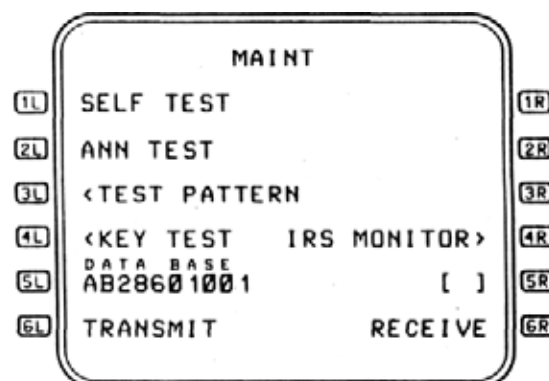


Figure 4-34

2. If the MAINT page is displayed when the flight phase transitions from PREFLIGHT or DONE to TAKEOFF, CLB, CRZ, DES, or APPR, the display changes to the F-PLN A page.

Purpose - To allow maintenance personnel to select and perform certain test functions.

3. Data Fields:

1L **SELF-TEST** - Pressing this LS key initiates the internal self-test of the FMC. During the test, the CDU display is blank. After completion of the test, (PASS) is displayed adjacent to SELF-TEST. Once this page is exited, the (PASS) is no longer displayed on subsequent accesses.

2L **ANN TEST** - Annunciator test. Pressing this LS key lights all four annunciators on the CDU front panel and the prompt CANCEL is displayed in line **2R**. Pressing LS key **2R** while CANCEL is displayed turns off the four annunciator lights and removes the CANCEL prompt. If the annunciator test is not cancelled manually, the annunciator lights are automatically turned off after 8 ± 2 seconds.

3L **TEST PATTERN** - Pressing this LS key causes the CDU TEST - TEST PATTERN page to be displayed.

4L **KEY TEST** - Pressing this LS key will cause the KEY TEST page to be displayed.

4.2.8.1 TEST PATTERN Page

An example TEST PATTERN page is shown in Figure 4-35.

Access

1. **3L** LSK from MAINT page
2. If the TEST PATTERN page is displayed when the flight phase transitions from PREFLIGHT or DONE to TAKEOFF, CLB, CRZ, DES, or APPR, the display changes to the F-PLN A page.

Purpose - To allow maintenance personnel to check alphanumeric presentation on the CDU and verify that the entire CRT can be written on.

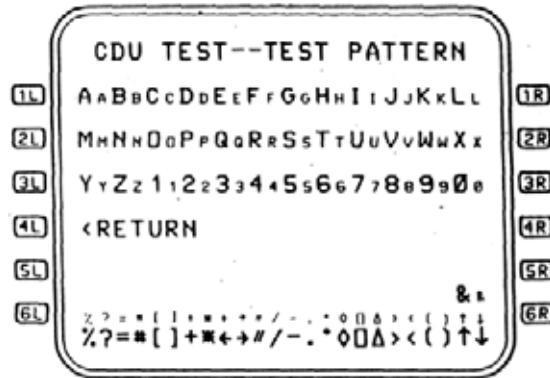


Figure 4-35

3. Data Fields:

This page displays all available symbols on the CDU in large and small font. All alphanumeric characters are written on lines **1L** - **1R** through **3L** - **3R**. The special characters are displayed on line **6L** - **6R** and in the scratchpad.

4L RETURN - Pressing **4L** returns the display to the MAINT page.



4.2.8.2 KEY TEST Page

Example KEY TEST pages are shown in Figure 4-36 and 4-37. Access

- 4L** LSK from MAINT page.
- If the KEY TEST page is displayed when the flight phase transitions from PREFLIGHT or DONE to TAKEOFF, CLB, CRZ, DES, or APPR, the display changes to the F-PLN A page.

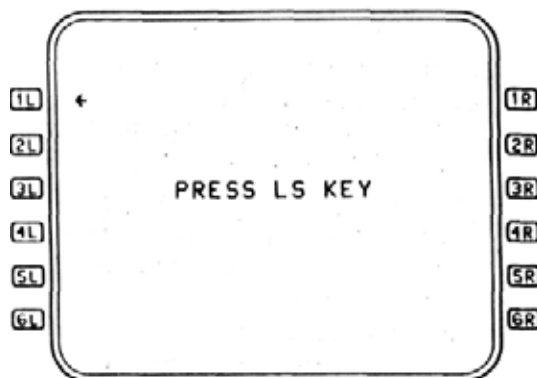


Figure 4-36

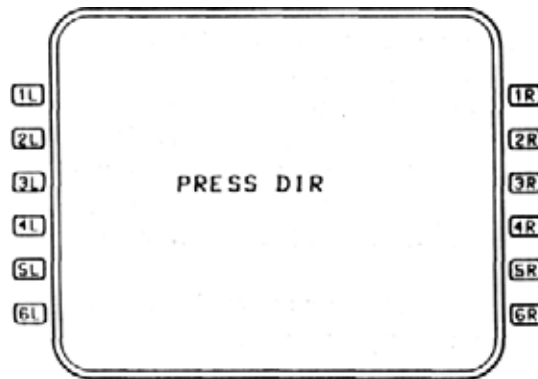


Figure 4-37


Purpose - To allow maintenance personnel to verify correct key operation on the CDU front panel.


3. Data Fields:

3L Throughout this test, PRESS is displayed in large font followed by a key identifier, which is displayed left-justified.


The first part of the Key Test checks the operation of the LS keys. During this part of the test, the key identifier is fixed at LS key and a large font arrow is displayed on the left or right side instructing the maintenance personnel to press the associated LS key. When that particular LS key is pressed, the arrow sequences to the next LS key (**1L** through **6L** and then **1R** through **6R**). Correct operation of the LS keys is verified by the arrow sequencing with the button pushes. An example of the KEY TEST page when first accessed is shown in Figure 4-36. (The position of the arrow indicates that the test is ready to begin.)


The second part of the Key Test checks the operation of the mode keys, and begins after **6R** is pressed at the end of the LS key test sequence. At this point, the arrow is removed and the key identifier becomes DIR (see Figure 4-37). Pressing the **DIR** key changes the key identifier to MODE. Thus, using the key titles as prompts, the mode keys are sequenced left to right

by rows with the down slew arrow  as the last key tested. Unassigned keys are not

tested. On pressing the down slew arrow  key, the display returns to the MAINT page. Correct operation of the mode keys is verified by the key identifier sequencing with the button pushes.

If a LS key or mode key is pressed out of sequence, then the key prompt does not increment.

The only exception to this rule is the down slew arrow  key.

Pressing the down slew arrow  key at any time during the Key Test terminates the test and returns the display to the MAINT page.

4.2.8.3 IRS MONITOR Page

NOT IMPLEMENTED

The IRS MONITOR page provides IRU error rates and terminal ground speed readings at the end of a flight. The page may be accessed on the ground only by pressing the **REF** key selecting the maintenance **5R** (see Figure 4-38) and pressing **4R** associated with the IRS MONITOR prompt (see Figure 4-39). The page cannot be accessed during flight and if displayed when the transition from preflight is made, the F-PLN page A is displayed

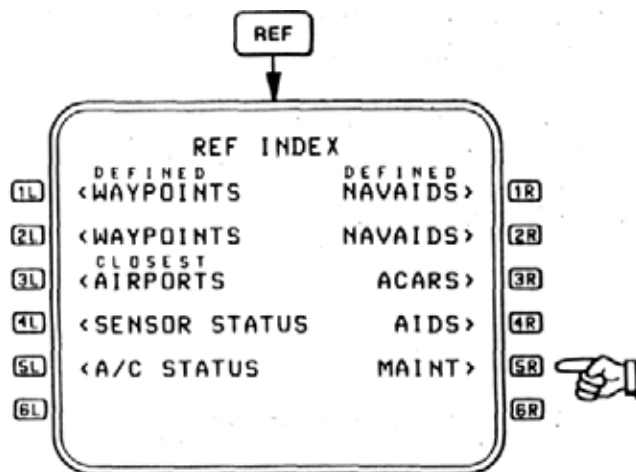


Figure 4-38

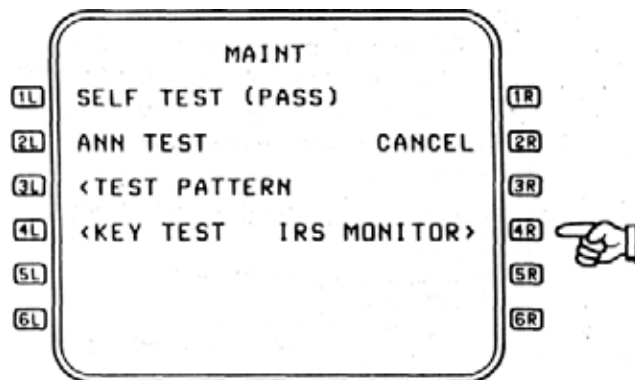
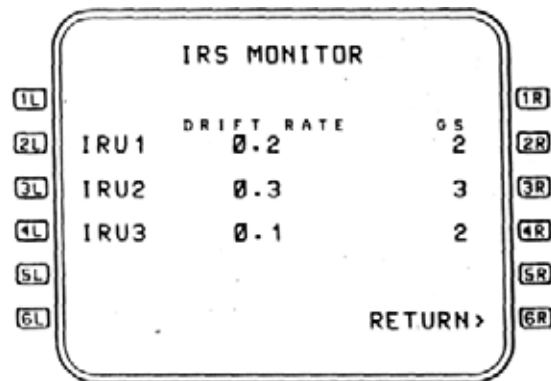


Figure 4-39


Figure 4-40

After the pilot has begun his takeoff roll and the ground speed is greater than 120 kts or the oleo strut indicates that the aircraft is airborne, the takeoff time and the bearing and distance from the FMC position to each IRU position is stored in FMC memory. After the aircraft has landed and the ground speed is below 60 kts and the oleo strut indicates on the ground, the FMC once again measures the land time and bearing and distance from the FMC position to each IRU position and records it in memory. By resolving the two bearings and ranges for each IRU into total drift and then dividing by the trip time, the average drift rate for each IRU is calculated and displayed. The value is rounded up to the next whole tenth of a NM/hour.

The ground speed (GS) displayed on the CDU is the residual ground speed for each IRU at engine stop rounded to the next whole NM/hour. If a valid ground speed is not being received at engine stop, dashes will be displayed.

Entries may not be made on this page. The RETURN prompt in **6R** returns the operator to the MAINT page.

4.3 ALTERNATE FLIGHT PLAN

The alternate flight plan vertical revisions are similar to the primary flight plan vertical revisions. However, the following revisions can be made to the primary flight plan but not to the alternate flight plan.

THR RED ALT ACCEL ALT EO ACCEL
 ALT EO THR RED ALT STEP PRED
 TO/APPR parameters TIME CSTR ALT
 CSTR SPEED CSTR

Revisions to the primary flight plan are totally independent of revisions to its alternate flight plan, with the exception of the following items:

1. Enable Alternate. This is the special revision function which incorporates the alternate into the primary flight plan.
2. Alternate Origin. The alternate flight plan origin is also the primary destination.

Additionally the following lateral revisions are allowed in the primary flight plan but not in the alternate flight plan:

1. SIDs are not strung in the alternate flight plan.
2. EOSIDs are not strung in the alternate flight plan.

Lateral revisions are made to both the primary and alternate flight plans in identical manners except for the above restrictions. If the revise point is in the ALTN flight plan, the revision is made to the ALTN.

Figure 4-41 is an example of the steps necessary to string the alternate flight plan manually. The process is essentially identical to stringing the primary flight plan except the last step.

As indicated by the LAT REV from LSGG display, pressing LSK^{6L} will ENABLE ALTN. The alternate flight plan becomes the primary flight plan and the display reverts to the F-PLN page.

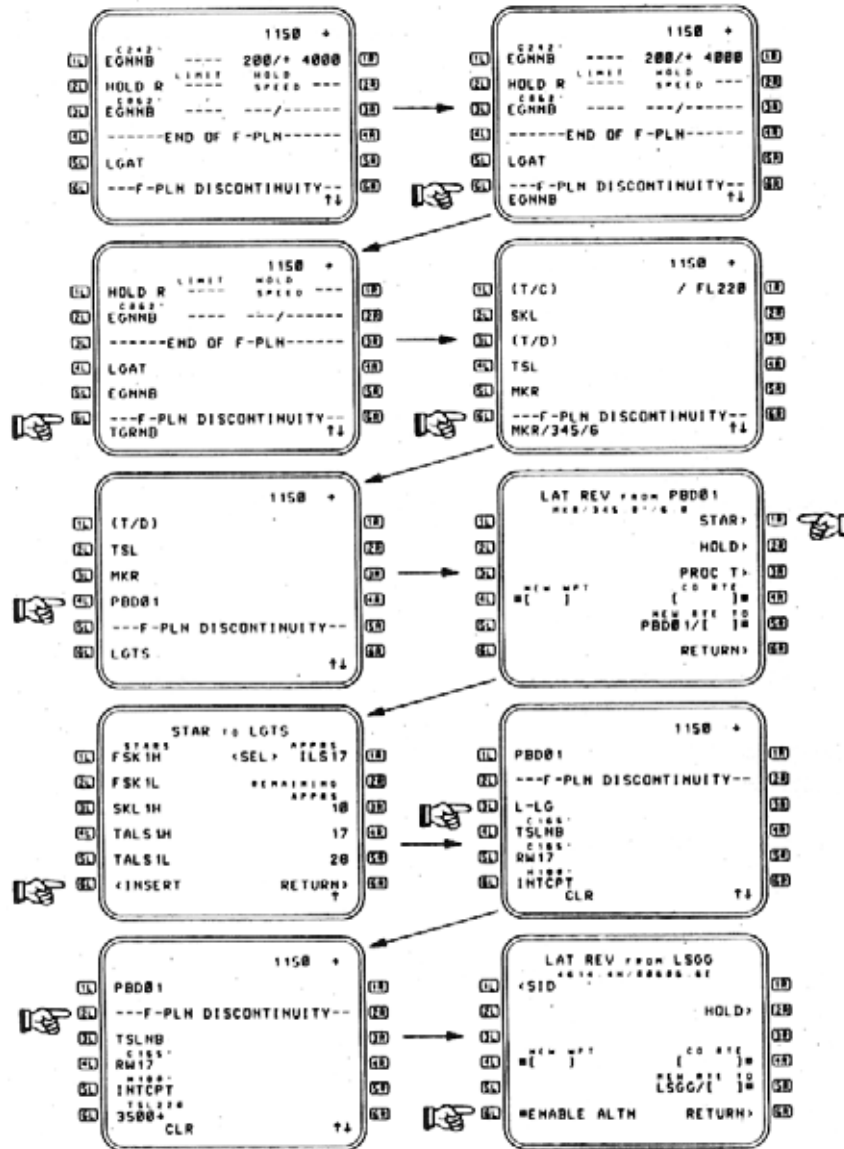


Figure 4-41

4.3.1 Alternate Flight Plan Prediction

The Performance function calculates an estimate of the fuel required to fly the alternate lateral flight plan assuming MIN FUEL mode operation. The alternate flight plan prediction is calculated when the associated primary flight plan has satisfied the necessary conditions to be invoked and a destination exists for the primary flight plan. The alternate flight plan prediction does not require any matching of flight plan defining parameters to be invoked as does the secondary primary flight plan predictions, except that the origin of the alternate flight plan is the destination of the primary flight plan. Therefore, the alternate flight plan prediction allows for the modification of the following defining parameters 1 through 4:

1. **Alternate Cruise Flight Level** - This assumes a default value of FL200 if the great circle distance between the origin and destination is less than 300 NM and FL300 if the distance is greater than 300 NM.

The pilot has the option of entering an altitude constraint at the alternate top-of-climb (T/C) pseudo waypoint. This is treated as a pilot-entered alternate cruise flight level.

2. **Constraints** - Apart from the altitude constraint at alternate top-of-climb used to enter alternate cruise flight level, no altitude, speed or time constraints are allowed. No speed limit entry is allowed, but the equations used for climb and descent is based on the default speed limit.

3. **Winds** - The pilot is able to enter a single wind magnitude and bearing at the alternate top-of-climb pseudo waypoint. This is resolved along the great circle course from the origin to the destination to obtain the headwind or tailwind component. For tail winds, 50 percent of the value is used in the predictions, while for headwinds, 150 percent of the value is used.

4. **Temperatures** - The pilot is able to enter a single temperature at the alternate top-of-climb pseudo waypoint. This is converted to a deviation from standard day at the cruise altitude. This value of AISA is used for all alternate flight plan predictions. If the pilot subsequently enters a new cruise altitude for the alternate flight plan then the value of AISA is retained. If no temperature is entered at the alternate top-of-climb, then the value of AISA at the primary destination is used.

A recalculation of the alternate flight plan prediction occurs when any of the above defining parameters 1 through 4 are modified.

Predictions for the alternate flight plan use simplified techniques (and data obtained from off-line computations), rather than the full prediction techniques used for the primary flight plan. The alternate flight plan length is computed from default leg distances and is not corrected due to leg transitions. The technique used for each flight phase is described in detail in the following paragraphs.

4.3.1.1 Takeoff (Go-Around)

The airport pressure altitude used for the alternate origin is the primary destination airport elevation, the final altitude is 3000 feet above the primary destination airport and the starting gross weight at the alternate origin is the estimated landing weight at the primary destination.

4.3.1.2 Climb

Predictions for the climb flight phase use a tabular data to obtain time, distance and fuel burn for a nominal weight and origin elevation, then modify these predictions to allow for actual weight and origin elevation.

4.3.1.3 Cruise

This uses a range equation and a single estimate of optimum speed (based on the alternate top-of-climb weight).

4.3.1.4 Descent and Approach

The combined descent and approach flight phase use a simplified computation based on descent at the MINIMUM FUEL speed.

4.3.2 Enable Alternate Function

This function is used to incorporate the alternate portion of the flight plan into the primary portion.

The rules for the enable alternate function are as follows:

1. The revise waypoint must be in the primary portion of the flight plan and there must be an alternate destination.
2. All waypoints in the original primary portion of the flight plan beyond the revise waypoint are deleted. (This includes the primary destination and missed approach.)
3. The alternate destination is redesignated as the primary destination. This primary destination becomes the new alternate origin waypoint.
4. The alternate flight plan is strung into the primary flight plan with a discontinuity between the revise point and the first waypoint in the alternate (always the alternate origin waypoint, no altitude constraint exists here). *t*
5. The FROM waypoint can be the revise point.
6. All SPD and ALT descent constraints, as well as TIME constraints at waypoints between the present A/C position and the primary destination (including primary destination) are deleted.

The alternate CRZ FL is assigned as the primary CRZ FL in accordance with the rules.