Pegasus Flight Management System

Honeywell

PILOT'S GUIDE

Boeing 757/767

ID-092862

Honeywell

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B757/767Pegasus[R]Flight ManagementSystem Pilot's Guide

This Honeywell FMS Pilot's Guide was written as a reference for the operation of the flight management system in the Boeing 757/767 aircraft. In no case, will this guide be used as an authorized checklist or procedural aid replacing FAA approved flight manuals, checklists, or training programs. Contact the pilots at Honeywell Flight Technical Services at (602) 436--1446 with any aircrew related questions, problems, or comments.

Pilots using the avionics system described in this document are required to maintain lateral and vertical situational awareness at all times through the use of current and approved en route, sectional, and other navigational charts. The avionics system herein described is designed to provide pilots with a TSO C-129 (A1) navigation capability. However, pilots are advised to use all available flight-following techniques appropriate for the phase of flight, to insure that a valid mental picture of the desired route is maintained at all times.

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1. Pilot Overview

The Honeywell Boeing 757/767 Pegasus Flight Management System (FMS) Pilot s Guide describes the operation of the Honeywell flight management system installed on the B757/767 aircraft. The Pegasus FMS operations described in this guide focus on those airplane models equipped with the large format display system (LFDS), which incorporates the primary flight display (PFD) and navigation display (ND) formats. Some Pegasus FMS operations may vary slightly on conventional (EFIS) 757/767 airplanes.

This automated system integrates sensors, systems, and displays to give economy with a minimum workload. The FMS gives the pilot substantial assistance in devising the flight plan. The FMS software was developed by Honeywell to meet the unique systems design specifications of Boeing. While optimizing the flight plan for winds and operating costs, it fills in the details, suggesting the most economical climb profile, cruise altitude, airspeed, step climb, and descent. If the pilot selects the automatic flight mode, the FMS guides the aircraft throughout the entire flight plan, from takeoff through landing. Additionally, the FMS attempts to provide the lowest possible cost for the flight while attempting to satisfy all operational constraints that are imposed on it. The key roles of the system are performance and arrival predictions.

While fuel consumption is a major component of cost, other factors are taken into account. These include flight and ground crew wages, costs of late arrival, and other factors determined by the operator. Thus, a cost index (CI) is determined by the operator and the flightmanagement computer (FMC) uses this cost index to develop an optimized flight.

The Honeywell flight management functions include:

D Navigation performance and optimization

D Flight planning management

D Managed guidance computation D Information display management.

The Pegasus FMS operates with all control display units (CDU) normally installed on 757/767 aircraft. Some retrofit configurations may incorporate the CDU and HMCDU with the Pegasus FMS. This guide describes FMS operation and functionality of the Pegasus FMS with the multifunction control display unit (MCDU) The following is a general list, for pilot information, of upgrades over previous FMS systems that the Pegasus FMS incorporates:

D Communication navigation surveillance/air traffic management (CNS/ATM) functionality

D Airline operational communications (AOC) functionality

D Global positioning system (GPS) position data via multi-mode receiver (MMR)

- Backup lateral navigation capability via MCDU (LAT/LON only, no waypoint names available).

The Pegasus flight management computer (FMC) interfaces with the global positioning system (using MMR) and the flight deck printer to support the following CNS/ATM functions:

- Air traffic services
  - Air traffic services facilities notification (AFN)
  - Automatic dependent surveillance (ADS)
  - Air traffic control data link (ATC DL)
- Controller pilot data link communication (CPDLC)
- Airline operational communication (AOC) data link
- Global positioning system (GPS)/FMC integration
- Required navigation performance (RNP)
- Required time of arrival (RTA)
- Printer interface.

This guide provides the following information:

- General FMS overview
- Step-by-step FMS operation as it could be used in airline operations
- In-depth description of system functions.

This guide provides the pilot with the information necessary to operate the FMS in most operational modes. When used with a training device, the pilot will be prepared for in-flight use of the FMS. Answers to most of the questions that arise through system use can be found in this guide.

Every effort has been made to ensure the accuracy of the information in this guide. Questions about current system operation and configurations should be directed to Honeywell B757/767 Engineering or the pilots at Honeywell Flight Technical Services.

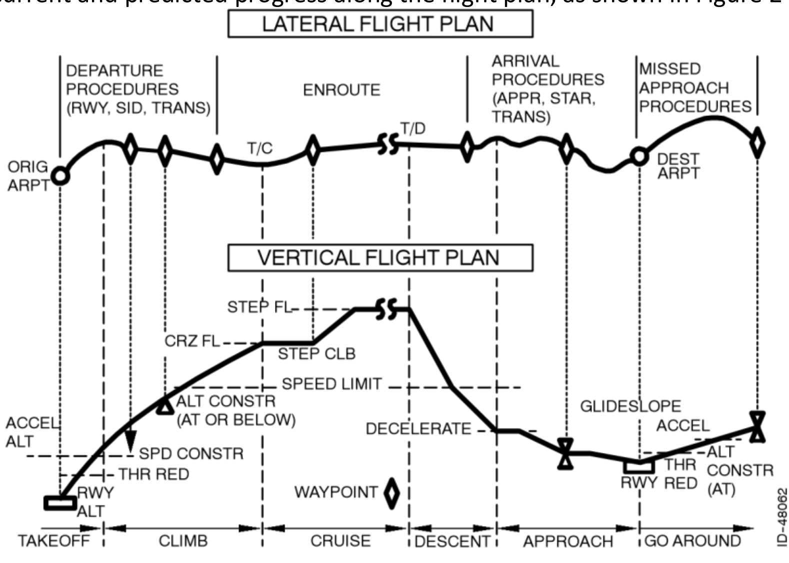
This guide is for system familiarization only. It does not supersede any Boeing, FAA, or airline approved procedures.

2. Flight Management

GENERAL OVERVIEW

The flight management system (FMS) provides a means via the mode control panel (MCP) on the glareshield panel and the multifunction control display unit (MCDU) for the pilot to enter a flight plan, select various flight control modes, and enter other necessary flight data. Flight progress is monitored through the MCDU and the electronic flight instrument system (EFIS).

After data entry, the flight management computer system (FMCS) generates the optimum flight profile from the origin to the destination airport. The system provides automatic aircraft guidance along the defined path while computing and displaying current and predicted progress along the flight plan, as shown in Figure 2--1.

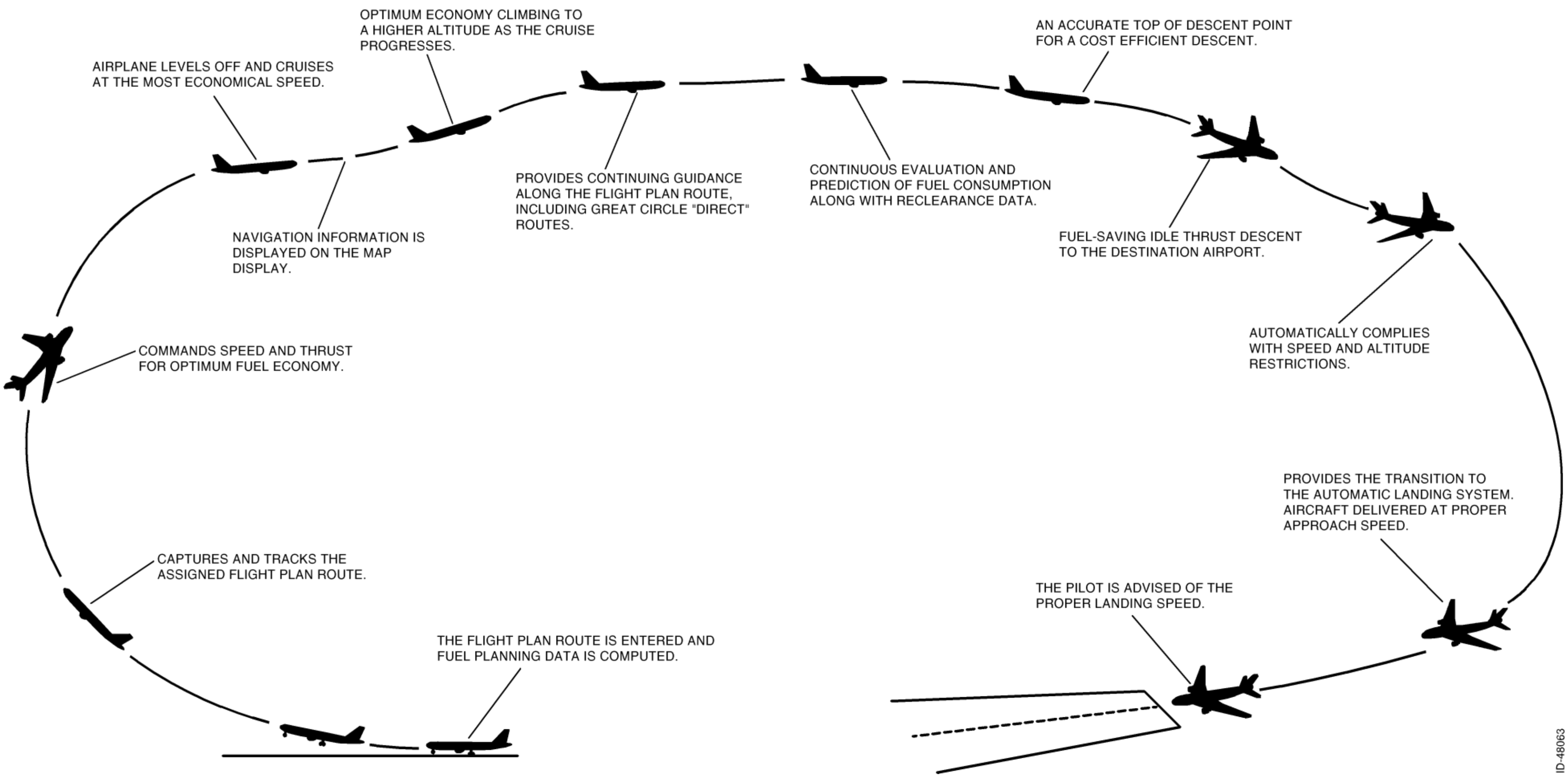


Flight Management System Profiles

Figure 2--1

To perform these functions, the FMS automatically tunes the navigation radios and sets courses. The courses are not constrained to navaid radials. The system provides automated en route and terminal area guidance along defined procedures, including standard instrument departures (SIDs), standard terminal arrival routes (STARs), holding patterns, and procedure turns. It also provides guidance to a vertical path that honors defined altitude and speed, and can fly lateral offsets to the defined path. In addition, the FMS computes predicted arrival times and fuel consumption along the flight plan route and to the flight s destination.

The FMS guides the aircraft along that profile, as shown in Figure 2--2, by sending roll, pitch, speed, and thrust commands to the flight control computers (FCC) and the thrust management function.


OPTIMUM ECONOMY CLIMBING TO A HIGHER ALTITUDE AS THE CRUISE PROGRESSES.
AN ACCURATE TOP OF DESCENT POINT FOR A COST EFFICIENT DESCENT.
AIRPLANE LEVELS OFF AND CRUISES AT THE MOST ECONOMICAL SPEED.
PROVIDES CONTINUING GUIDANCE ALONG THE FLIGHT PLAN ROUTE, INCLUDING GREAT CIRCLE "DIRECT" ROUTES.
CONTINUOUS EVALUATION AND PREDICTION OF FUEL CONSUMPTION ALONG WITH RECLEARANCE DATA.
NAVIGATION INFORMATION IS DISPLAYED ON THE MAP DISPLAY.
FUEL-SAVING IDLE THRUST DESCENT TO THE DESTINATION AIRPORT.
COMMANDS SPEED AND THRUST FOR OPTIMUM FUEL ECONOMY.
AUTOMATICALLY COMPLIES WITH SPEED AND ALTITUDE RESTRICTIONS.
PROVIDES THE TRANSITION TO THE AUTOMATIC LANDING SYSTEM. AIRCRAFT DELIVERED AT PROPER APPROACH SPEED.
CAPTURES AND TRACKS THE ASSIGNED FLIGHT PLAN ROUTE.
THE PILOT IS ADVISED OF THE PROPER LANDING SPEED.
THE FLIGHT PLAN ROUTE IS ENTERED AND FUEL PLANNING DATA IS COMPUTED.
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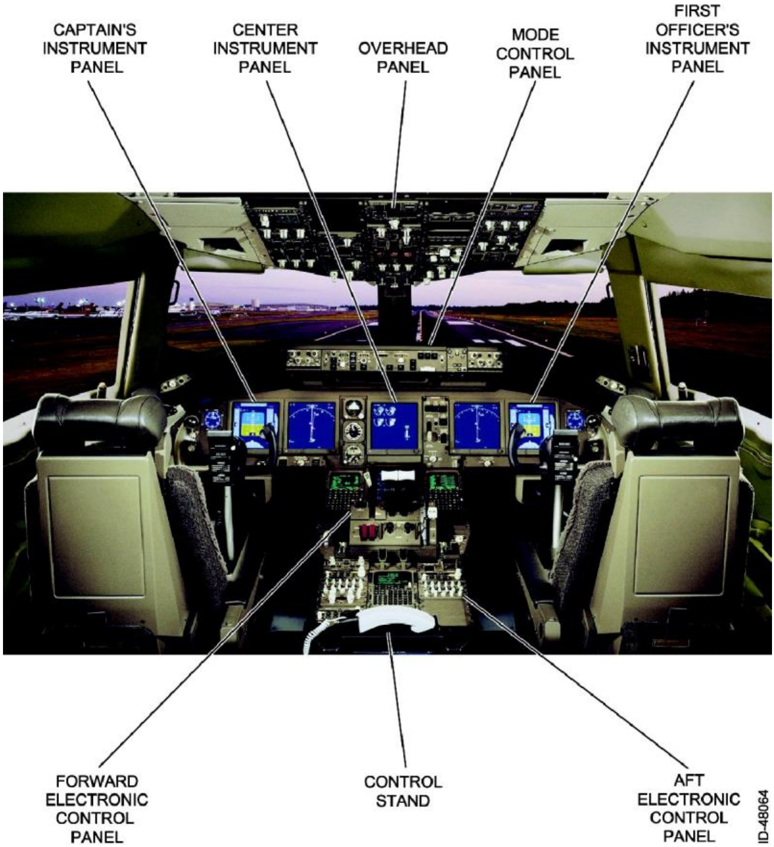
FMS Flight Profile
Figure 2--2

FLIGHT DECK CONFIGURATION

The flight management system (FMS) consists of two flight management computers (FMCs) that are installed in the avionics compartments and two multifunction control display units (MCDUs) that are installed in the left and right sides of the forward electronic control pedestal.

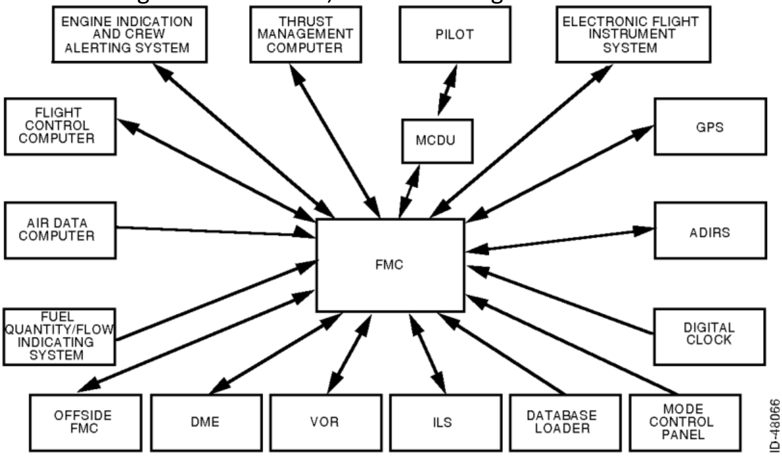
Figure 2--3 shows the location of control panels on the flight deck.



Flight Deck Configuration
Figure 2--3

SYSTEM INTERFACES

Both FMSs are integrated with other aircraft avionics for both input and output data. The FMS interfaces with the autopilot flight director system (AFDS) through the glareshield mode control panel (MCP) and the two FCCs. The left and right FMSs are interconnected, enabling either to supply data to the other by pilot selection. The left and right FMSs compute data independently; however, they communicate with each other (cross talk) on an intersystem bus (ISB). They receive information from multiple sources throughout the aircraft, as shown in Figure 2--4.



Aircraft Interfaces

Figure 2--4

Each of the two FMCs (left side is FMC1 and right side is FMC2) receives data from the following sources:

- Multifunction control display unit (MCDU)
- Electronic flight instrument system control panel (EFIS CP)
- Air data/inertial reference system (ADIRS)
- Digital clock
- Mode control panel (MCP)
- Database loader
- Instrument landing system(ILS)
- VHF omnidirectional radio range (VOR)
- Distance measuring equipment (DME)
- Global positioning system (GPS)
- Offside FMC
- Fuel totalizer

D Digital air data computer (DADC)

D Flight control computer (FCC)

D Engine indication and crew alerting system (EICAS) D Thrust management computer (TMC).

After processing the above inputs, the FMC outputs data to the following systems:

D Onside MCDU D Offside MCDU

D Left, right, and center inertial reference units (IRUs)

D Database loader

D ILS

D VOR

D DME

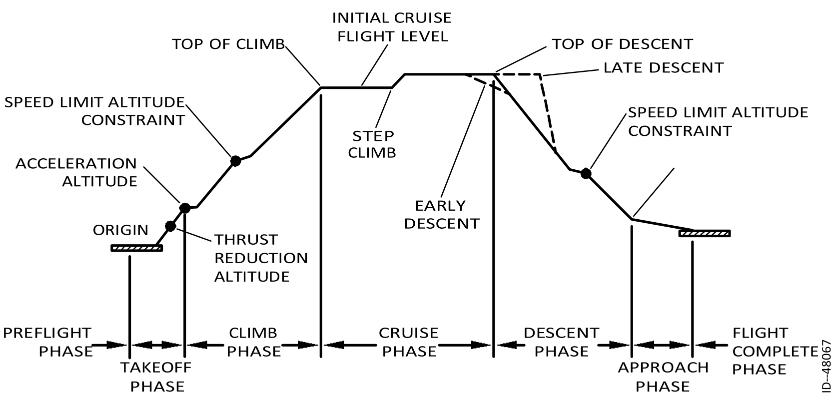
D Offside FMC

D Flight control computer (FCC)

D Engine indication and crew alerting system (EICAS) D EFIS symbol generator (EFIS SG) D Thrust management computer (TMC).

FLIGHT PHASES

Figure 2--5 shows a typical FMS profile from the PREFLIGHT phase at an origin airport to the rollout phase at the destination airport.



SLATS/FLAPS EXTENDED

DESTINATION

Typical FMS Profile
Figure 2--5

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The FMS supplies aircraft guidance and control commands through the following modes:

D VNAV -- Vertical navigation mode

D PERF -- Performance function

D LNAV -- FMS supplied lateral navigation guidance.

The predefined route can be divided into a numberof FMS-definedflight phases: PREFLIGHT, TAKEOFF, CLIMB, CRUISE, DESCENT, APPROACH, and FLIGHT COMPLETE.

D **PREFLIGHT** In the PREFLIGHT phase, the FMS is initialized and the flight plan is either recalled from the navigation database by company route designator, strung from the origin to the destination airport (entered waypoint by waypoint), or uplinked through datalink.

The PREFLIGHT phase also includes the following:

Review aircraft configuration and FMS database effective dates.

Enter/select origin, destination, cruise altitude(s), flight number, and cost index.

Enter weight and fuel data.

Align the ADIRU.

Enter flight plan, runway, standard instrument departure (SID), and transition points, and revise waypoints to include speed, altitude, and time constraints.

Confirm or enter takeoff VSPEEDS.

Select economy or pilot-defined flight phase speed.

Confirm autotuning of navigation radios for departure.

D **TAKEOFF** The TAKEOFF phase extends up to the acceleration altitude. VNAV and LNAV modes are normally engaged above 400 feet and 50 feet respectively.

D **CLIMB** The CLIMB phase extends from the acceleration altitude to the top-of-climb (T/C) for the first cruise flight level entered on the INIT REF page. During CLIMB, the VNAV climb mode (if engaged) does the following:

Supplies guidance for accelerating the aircraft when above the terminal area speed restriction altitude

Observes speed/altitude constraints that have been stored in the FMS database or inserted by the pilot

Supplies speed and altitude targets to the AFDS.

D **CRUISE** The CRUISE phase extends from the top-of-climb (T/C) point to the top-of-descent (T/D). CRUISE can include step climbs as well as en route descents. A step climb requires setting a new altitude target on the mode control panel. The FMS calculates the optimum step climb point, and the altitude change is initiated by the flight crew. Enroute descents are initiated by setting a new altitude target on the MCP followed by pushing the altitude knob or reinserting a new cruise altitude (CRZ ALT) into the MCDU.

D **DESCENT and APPROACH** These phases start from the top-ofdescent (T/D) or at a point where the pilot initiates a descent with flight level change (FLCH), vertical speed (V/S) mode, or VNAV DESCEND NOW. The FMS calculates the appropriate point for the start of descent and initiates the descent automatically if the mode control panel altitude has been lowered and the aircraft is in VNAV mode. LNAV and VNAV guidance during an approach are terminated when the ILS localizer and glideslope are intercepted and captured. If a missed approach is executed, LNAV and VNAV modes can be reengaged, if disengaged, to automatically fly the missed approach procedure (MAP).

D **FLIGHT COMPLETE** After landing and engine shutdown, the FMS goes through a flight complete phase, clearing the active flight plan to prepare for reinitializing. Also, some of the data entry fields are reset to default values.

OPERATION

The FMS supplies aircraft guidance and control commands through the following modes:

D LNAV -- Lateral navigation guidance D

VNAV -- Vertical navigation control D

Performance control.

The FMS data is coupled to the autopilot/flight director (FD) through targets and/or steering commands.

FMS-generated data, command entries, and performance data are displayed on the MCDU. Each flight mode has its own page or pages.

Other FMS functions include:

D Aircraft type and flight number identification D

Initialization

D Position reference

D Radio tuning

D Navigation reference

D Performance

D Thrust limiting

D Takeoff

D Climb

D Cruise

D Descent

D Approach

D Go-around

D Route data, legs, and progress

D Sensor data

D Maintenance D

Standby operation.

The FMS can be operated whenever electrical power is applied to the aircraft. The FMS monitors power supply levels to detect supply transients. Short or long duration power transients may interrupt FMS operation, but the FMS retrieves enough previously stored data to recover completely without affecting FMS operations, long term.

If both FMCs experience long-term power interrupts, the crew must reactivate the route and re-enter the performance data as outlined in Section 3, Flight Operations and Flight Data, and Section 4, Preflight.

Dual Mode

The FMS can operate in dual, independent, and standby modes. Normally, the FMS operates in dual mode.

When operating in dual mode, the FMCs cross talk to ensure that the following occurs:

D MCDU entries made on one side are entered simultaneously intothe other FMS.

NOTE: The respective MCDUs can display different pages. However, if the same page is displayed on each MCDU, the display is similar but the predicted values may not be the same because of independent FMC computation.

D Leg sequencing is initiated simultaneously in both FMCs.

D Aircraft position is calculated independently.

In the dual mode, each FCC is coupled to the on-side FMS. The FMS in use is the master. This selection process ensures that both flight directors are controlled with the same steering commands.

If no autopilot is engaged, the master FMC is determined by the flight director currently engaged. If neither an autopilot nor a flight director is engaged, the master FMC is the one that powers up first.

NOTE: When the FMS recalculates displayed data, momentary anomalies in displayed data can occur.

FUNCTIONS Navigation

The navigation function computes FMC position, velocity, true and magnetic track, vertical flight path angle, drift angle, magnetic variation, baro corrected altitude, and wind direction.

When the GPS option has been enabled, the primary mode of operation is to use GPS position to estimate errors in the inertial reference system (IRS) position and velocity. When GPS information is not available, cannot be validated, or is not enabled, range and bearing information from DME and VOR stations, respectively, is used to estimate errors in the IRS position and velocity. Once the IRS errors have been estimated, correction terms are added to the IRS position and velocity to form the FMC position and velocity.

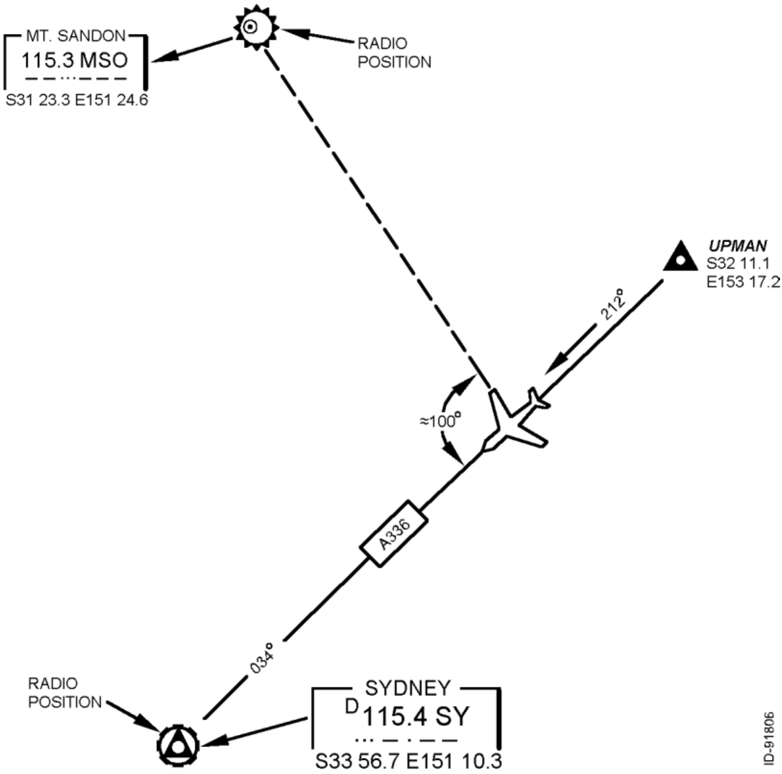
GPS data is subjected to rigorous integrity and accuracy checks prior to being accepted for FMC navigation position and velocity computation. DME and VOR data are subjected to a series of reasonableness checks prior to being accepted forFMC radioupdating.
If neither GPS nor DME/VOR data are available for FMC position/velocity updating, then the FMC position reflects the IRS position adjusted by the last computed corrections. The FMC velocity will, for a time, reflect the corrected IRS velocity. Velocity corrections are gradually eliminated so that during sustained periods of no GPS or radio updating the FMC velocity reflects pure, uncorrected IRS velocity.

As the airplane progresses along its flight path, the FMCuses itscurrent estimate of the airplane s position and its internal database to automatically tune the VOR and scanning DME receiversto thestations that will yield the most accurate radio position.

If a localizer-based approach procedure is active, the localizerdeviation data is used to update the FMC position in a direction normal to the runway centerline while GPS or radio position is used to update the FMC position in a direction along the runway centerline.

The database contains information on the class and figure of merit of the available navaids. The class of a navaid is defined as VOR, DME, VOR/DME, VORTAC, TACAN, ILS, ILS/DME, LOC DME, LOC, or MLS. Figure of merit (reception quality) is based on the usable distance and altitude of the station relative to the aircraft. These criteria are established by the FAA and other regulatory authorities.

The criteria used for FMC selection of navaids for the internal calculation of a radio-derived aircraft position is illustrated in a typical example (shown in Figure 2--6). The example shown indicates that two frequencies are being tuned by the FMC. They are SY 115.4 and MSO 115.3. In this case, SY is used for display of the bearing and distance to the next waypoint; MSO and SY are used for FMC internal calculation of the aircraft s present position from DME/DME data. The FMC has automatically selected MSO and SY because these stations meet the figure of merit distance requirement and, in addition, they intercept the aircraft s position at an included angle that is closest to 90° compared to other available navaids.



FMS Navaid Autotune Function

Figure 2--6

The FMC **does not** update the IRU at any time, and uses the IRU position exclusively for navigation only when GPS, DME, and/or VOR data are not available. When this occurs, after a predetermined time, the INERTIAL NAV ONLY message is displayed on the MCDU scratchpad (SP). The FMC position relative to the ADIRU position is maintained until valid GPS or radio updating is again received.

Further navigation information can be found in Section 8, Approach, Radio Tuning, and Section 14, Backup Functions, Alternate Navigation Radio Page.

Performance

The FMS performance modes optimize the aircraft s vertical profile integrated with the lateral profile. This function includes both flight plan predictions and flight optimization.

To develop an optimum flight path, the FMS determines the most economical climb (ECON CLIMB) and economical descent (ECON DES) speeds, the optimum target Mach for cruise(CRZ), optimumflight level, and an optimum top of descent (T/D) from cruise to destination airport. These predictions are periodically updated as the flight progresses, incorporating aircraft performance and groundspeed.

An economy profile results in an economical climb, cruise, and descent speed/Mach target that is calculated to obtain the minimum operating cost per mile traveled en route based on the entered cost index (CI). A 99 percent economy (ECON) cruise minimum fuel speed/Mach may be obtained when the CI is set to zero (ignoring the cost of time). A minimum time speed/Mach may be obtained when the CI is set to 9999 (producing maximum flight envelope speeds).

Pilot-entered speeds, such as speed requests from air traffic control (ATC), may alter the strategy for a flight segment with the entering of specific speed/Mach targets for climb (CLB), cruise (CRZ), anddescent (DES) phases of flight. These speeds are subject to flight envelope limits.

The computed speed target value is output to the vertical guidance function, which generates the required pitch commands to maintain the desired calibrated airspeed (CAS) or Mach. The thrust target value is used by the thrust management function (TMF) for use as a thrust setting parameter in those control modes for which speed is controlled through the elevator and as an initial thrust setting parameter value when in cruise. For the cruise portion of the flight, the optimum CAS or Mach is computed and thrust commands are sent by the autothrottle to maintain speed. For descent, a vertical path is computed based on a defined end-of-descent (E/D) waypoint. The vertical path accounts for such parameters as: wind, temperature, number of operating aircraft engines, engine anti-ice, intermediate waypoint altitude and/or speed constraints, and the airspeed restriction below the speed transition altitude (250 knots below 10,000 feet, FAA rules). Ideally, an idle thrust optimum airspeed descent profile is flown. However, airspeed may vary or thrust added to remain on the path to account for unforeseen wind conditions, or for tracking the vertical path between altitude constraints, respectively.

Without the autothrottle or autopilot engaged, the pilot can manually fly the optimum speed schedule by referring to the MCDU and to the airspeed bug on the speed tape on the primary flight display (PFD) or the electronic attitude director indicator (EADI).

Performance solutions are generated only when the gross weight, cost index, target altitude, and a route have been entered into the FMC. Vertical navigation (VNAV) can output valid vertical guidance only if performance initialization is complete.

Guidance

The FMS supplies guidance commands for controlling aircraft roll, pitch, speed, and engine thrust. Fully automatic, performanceoptimized guidance along flight paths in two or three dimensions is available in LNAV/VNAV modes. These modes are coupled to the flight director and/or autopilot and autothrottle via the mode control panel (MCP) on the glareshield. LNAV and VNAV may be used separately or together. LNAV provides lateral guidance, and VNAV provides vertical guidance and speed/thrust control through the TMC. ATC constraints may be inserted along the flight plan, giving path and performance guidance to the three-dimensional profile when LNAV and VNAV are flown together.

D **Lateral Guidance** This function is provided by a primary flight plan with automatic route leg sequencing and route leg updating. The LNAV guidance function compares the aircraft s actual position with the desired flight path and generates steering commands to the autopilot and flight director. This causes the aircraft to fly along the desired path. Direct guidance from the aircraft s present position to any waypoint is also available. LNAV can be engaged only when a route has been activated and executed through the MCDU.

D **Vertical Guidance** This function encompasses the takeoff, climb, cruise, descent, and approach phases of the flight plan. The flight planning capability of the FMS includes methods to enter published departure, arrival, and approach segments and individual waypoints that include speed/altitude and time constraints. These constraints, as well as the entered cruise altitude and cost index, define the vertical profile for which the FMS provides guidance. The entered profile may be modified at any time to comply with ATC requests.

The outputs of vertical guidance are pitch commands to theautopilot flight director computer (AFDC) and thrust or speed commands to the autothrottle. For unconstrained vertical paths (most climbs), the FMC generates pitch commands to control speed consistent with the performance management mode selected. The pitch commands are based on the difference between the actual CAS or Mach and the target CAS or Mach computed by the performance management function. During intermediate level-offs in climb, or in cruise, or when tracking the descent path, pitch commands are generated to maintain the desired path or altitude.

When the speed is controlled via elevator (vary the rate of climb to control speed), the autothrottle is commanded to maintain a target N1/EPR setting (for example, climb thrust, hold, or idle). However, when the path is controlled via elevator, the autothrottle is commanded to maintain the target CAS, Mach, or idle.

DATABASE

The FMS software includes the principal FMS operating program, navigation database, and performance data for the Boeing 757/767 aircraft. There is also an airline modifiable information (AMI) database and an operational program configuration (OPC) database.

The performance database in the FMS reduces the need for the pilot to refer to a performance manual during flight and gives the FMS the data required to compute pitch and thrust commands for the FCC and the TMC. The performance database is also used by the FMS to compute detailed predictions along the entire aircraft trajectory. The data stored in the database includes accurate aircraft drag and engine model data, optimum speed data, maximum altitudes, and maximum and minimum speeds. Ground maintenance can refine the database for each airplane by entering correction factors for drag and fuel flow.

The navigation database in the FMS includes most of the information the pilot would normally get from navigation charts. This information can be displayed on the MCDU or EFIS map. The geographic area covered includes all areas where the aircraft is normally flown. The database is tailored to specific airline customers. The stored data includes the location of VHF navaids, airports, runways, geographical reference points, and other airline-selected information such as SIDs, STARs, approaches, and company routes.

The FMS contains two sets of navigation data updated by maintenance procedures about every month to correspond to the normal revision cycle for navigation charts. When the navigation chart revision date arrives, the new data should have been loaded into the FMS and should be ready for the pilot to activate during preflight.

When operating outside the FMS nav database:

- Origins, destinations, and runways not in the nav database cannot be entered into the route.
- All waypoints not in the nav database must be entered as LAT/LONG.
- The FMS does not tune DMEs or VORs that are not in the nav database.
- The navigation display (ND) cannot display airports, navaids, or waypoints that are not in the nav database.

Navigation Database

The FMS navigation database includes most of the information the pilot would normally determine by referring to navigational charts and maps. This information can be displayed on the MCDU and/or on the navigation display (ND) in the map or plan modes. The geographical area covered includes all areas where the aircraft is normally flown and the data can be custom-tailored to an individual airline s requirements (sometimes called airline-tailored data).

Airline-tailored data can include company routes, including an alternate destination to the company route, airport gates, custom navaids, runways, procedures, waypoints, and fuel policy.

The standard data is public property and may be obtained from the International Civil Aviation Organization (ICAO) and government sources, etc. This standard data is updated periodically and, as a result, is updated on a 28-day cycle that corresponds to the normal revision cycle for navigation charts. Each update disk contains the data for the new cycle and the present cycle, giving the airline a window of time in which to load the new database.

The database part number (which identifies the customer, data cycle, and revision number) and the effective cycles appear on the data disks. This information is displayed on the MCDU IDENT page after the navigation database has been loaded by maintenance personnel.

Airline Modifiable Information Database

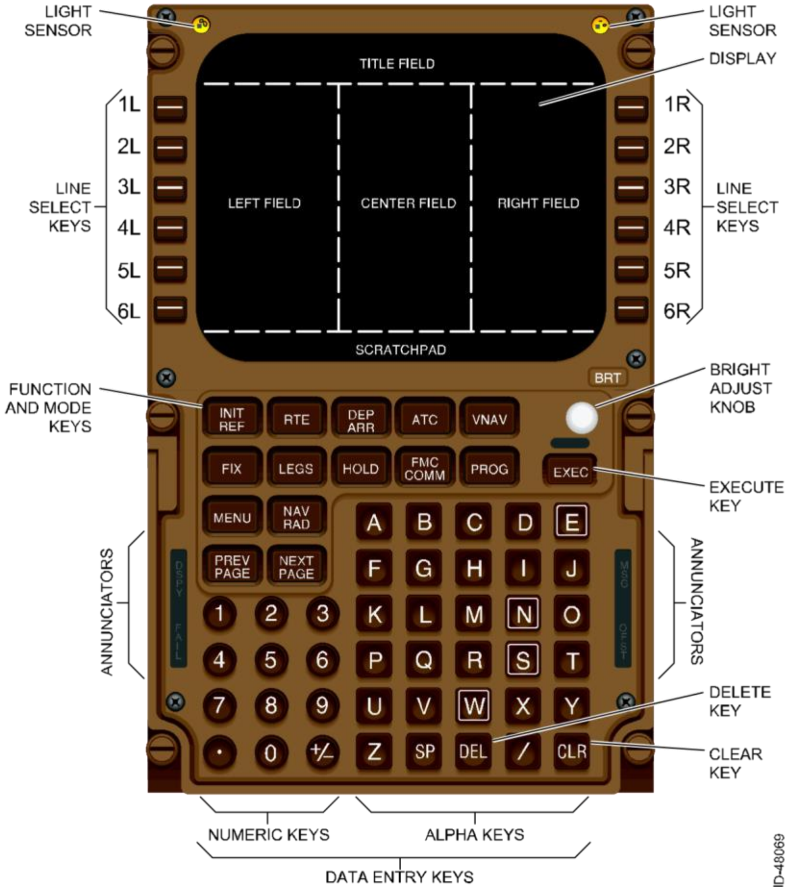
The FMS AMI is a separately loadable database that contains parameters that can be modified by the airlines to tailor operations of the FMC performance and datalink functions. The AMI databases are controlled by the airlines. AMI databases are not required for the FMC to operate, because hardcoded defaults are used when AMI is not loaded.

At power--up, the FMC validates the loaded AMI parameters where appropriate. If an AMI parameter fails the validation check, the FMC uses the hardcoded default for the parameter. When this happens, the parameter is displayed on the MCDU, with the scratchpad message **CHECK AIRLINE POLICY**.

MULTIFUNCTION CONTROL DISPLAY UNIT

The MCDU is the pilot interface to the FMS. The pilot enters system control parameters and selects operating modes on the MCDU, and the MCDU displays flight plan and advisory data. It also displays information from the FMS memory so the pilot can verify the data accuracy.

The MCDU keyboard, shown in Figure 2--7, is a full alphanumeric keyboard with mode, function, data entry keys, and advisory annunciators. The keyboard also has two automatic light sensors and a manual knob to control display brightness.



Multifunction Control Display Unit Figure 2--7

Display Screen

The cathode ray tube (CRT) display screen is divided into three functional areas:

- **Title Field** The title field is the top line of the display. It identifies the displayed page and indicates whether there are additional pages in a set.
- **Left, Center, and Right Fields** These fields are made up of six pairs of lines, extending from left to center and right to center of the screen. Additionally, information is occasionally displayed in the center of the screen for certain MCDU pages. A line pair has a label line and a data line. The pilot controls the left and right field data lines with the adjacent line select keys (LSK).

D **Scratchpad** The scratchpad is the bottom line of the screen. It displays alphanumeric characters that are entered on the keypad and FMS-generated messages. The scratchpads for the two MCDUs operate independently for data entry. Clearing a scratchpad entry on one MCDU has no effect on the other MCDU. However, FMS-generated messages displayed on both MCDUs can be cleared by one MCDU.

Line Select Keys (LSK)

There are six LSKs on each side of the display. For reference, the left keys are identified as **1L** through **6L**, and the right keys are identified as **1R** through **6R** and are numbered from top to bottom.

A momentary push of an LSK affects the adjacent line on the respective side of the MCDU for data entry, selection, or deletion. Transfer of data from the scratchpad to the line next to the LSK, if acceptable to the FMC, is done by pushing the LSK.

Bright Adjust Knob

The bright adjust knob (**BRT**) controls the brightness of the display. The brightness of the backlit keys is controlled by a remote flight deck control, and the annunciator brightness is controlled by the master bright-dim-test system.

Annunciators

Four annunciators are located on the keyboard two on the left side and two on the right side:

D **DSPY** (upper left) The **DSPY** (display) annunciator lights when the current display is not related to the active FMS situation (for example, when a secondary flight plan is displayed).

D

FAIL (lower left) The **FAIL** annunciator lights when the associated FMC has failed.

D **MSG** (upper right) The **MSG** (message) annunciator lights when an FMS-generated message is displayed in the scratchpad.

D **OFST** (lower right) The **OFST** (offset) annunciator lights when LNAV is based on a parallel route offset from the active route.

Alphanumeric Keys

The alphanumeric keys are used to enter letters and numbers into the scratchpad.

SLASH KEY

The slash (**/**) key is used to separate data that is entered into the data lines in pairs. The trailing entry of a pair is generally preceded by a slash if it is entered alone. The leading entry can be followed by a slash, but it is not required if it is entered alone.

PLUS/MINUS KEY

The first press of the plus/minus (**+/--**) key inserts a minus sign into the scratchpad. Subsequent presses change the sign in sequence, providing no intervening presses of other keys are made.

Function and Mode Keys

The function and mode keys are described in the following paragraphs.

FUNCTION KEYS

D **EXEC Key** The**[EXEC]** (execute) key is the command key of the FMS. A light bar above the key illuminates whenever a modification or activation is pending. The light bar illuminates only on pages that allow for lateral or vertical flight planning.

Pushing the key while the light bar is lit executes the modification or activation. Any pending modification/activation may be canceled by pushing the **ERASE** prompt, which is normally displayed when the **[EXEC]** key light bar is lit. Pushing the **[EXEC]** key or the **ERASE** prompt LSK extinguishes the **[EXEC]** key light bar.

Activating the flight plan is a two step procedure:

D Select the **ACTIVATE** prompt on the desired Route (RTE) or LEGS page (which illuminates the **[EXEC]** key light bar).

D Push the **[EXEC]** key.

Changing the active flight plan or the vertical profile is also a two step procedure:

D Enter and review provisional data (which illuminates the **[EXEC]** key light bar).

D Push the **[EXEC]** key to activate the change.

Whenever a modification is pending on the active route, **MOD** (modification) appears at the front of the title on the page where the modification was made. **MOD** also appears at the front of the title line on any page where a lateral or vertical modification can be made, no matter on what page the modification is being made.

D **PREV PAGE and NEXT PAGE Keys** The**[PREV PAGE]** and **[NEXT PAGE]** keys give access to additional pages of a set when another page is required to complete the display of data. The function is a closed loop; that is, it wraps around from the last page to the first page. The displayed page number and the number of total pagesare shown in the top right corner of the MCDU.

D **DEL Key** Pushing the **[DEL]** (delete) key inserts the word **DELETE** into the scratchpad, if the scratchpad is blank. Line selection into a data field by pushing an LSK replaces entered data with FMS predicted values, default values, box prompts, or dashes. Not all information can be deleted.

The **[DEL]** key is a special purpose key. The delete function is operational only on specific pages. Any date or message in the scratchpad makes the **[DEL]** key inoperative. The scratchpad must first be cleared by pushing the **[CLR]** key, which cancels the effect of having previously pushed the **[DEL]** key.

D **CLRKey** The**[CLR]** (clear) key is used to clear messages and data from the scratchpad or a data field. If alphanumeric characters have been entered into the scratchpad, a short push of the **[CLR]** key erases one character at a time starting with the last character. A longer push of the **[CLR]** key erases the entire contents of the scratchpad. The **[CLR]** key also erases any FMS-generated messages displayed in the scratchpad.

If the scratchpad is empty, pushing the **[CLR]** key enters **CLR** into the scratchpad. Subsequently pushing the LSK adjacent to a data field clears that data field. If the cleared data field has a default or FMS calculated value, the data field reverts to that value. If the cleared data field is a leg in the flight plan, the leg is deleted from the flight plan.

Data that has been entered by the pilot into a field that is normally blank cannot be cleared by pushing the **[CLR]** key, but it can be changed with a scratchpad entry.

D
SP Key Use the **[SP]** (space) key to enter a space into the scratchpad.

MODE KEYS

D **INIT REF Key** Pushing the **[INIT REF]** (initialization/reference) key selects the first page of a series of pages for display of data required for initialization of the FMS and IRS for flight, plus various pages of reference data.

D **RTEKey** Pushing the **[RTE]** (route) key displays the first or second route entered in the FMS and displays each segment of the flight plan. If the DEP/ARR or LEGS page is being displayed, pushing RTE displays the appropriate RTE page. Otherwise, with no active flight plan designated, pushing the RTE key displays RTE 1. With an active route designated, pushing the RTE key displays the present leg of the route and the continuation of the active route in clearance language.

D **DEP ARR Key** Pushing the **[DEP ARR]** (departure/arrival) key gives access to pages that define the departure and arrival segments of the route. If no active RTE or LEGS page is displayed on the MCDU, an index page is displayed. When an active route is displayed on an MCDU and on the ground, a departure page for the origin airport is shown. With an active route displayed in flight, and before traveling 400 miles, an arrival page for the origin airport is displayed. After traveling more than 400 miles, or more than halfway along the route, whichever is less, a listing of arrival procedures for the destination airport is displayed. Procedures can then be line selected into the route.

D **ATC Key** Pushing the **[ATC]** (air traffic control) key accesses the ATC datalink functions, automatic dependent surveillance (ADS), and the logon function. The page that is displayed when this key is pushed depends on whether or not a datalink connection has been established.

If logged onto an ATC center, the ATC LOGON/STATUS page is displayed.

If logged onto an ATC center and no pending uplinks exist, the ATC INDEX page is displayed.

If no new or one pending uplink exists, the XXXXz ATC UPLINK page corresponding to that message is displayed.

If more than one new uplink or no new uplinks and more than one pending uplink exists, the ATC LOG page is displayed.

If an ATC connection exists, holding down the ATC key results in display of the EMERGENCY REPORT page.

When no ATC datalink connection exists, the ATC/LOGON/STATUS page is displayed.

When the ATC key is not operational, pushing this key displays the **KEY/FUNCTION INOP** message in the MCDU scratchpad.

D **VNAV Key** Pushing the **[VNAV]** (vertical navigation) key gives access to the climb (CLB), cruise (CRZ), and descent (DES) pages. In flight, the page displayed corresponds to the active performance mode (CLB, CRZ, or DES). The pages are numbered 1/3, 2/3, and 3/3 respectively. Use the **[PREVPAGE]** and **[NEXTPAGE]** keys to select performance modes that are not displayed when the **[VNAV]** mode key is first pushed. As the aircraft sequences to another mode, the corresponding MCDU page is displayed.

Pushing the **[VNAV]** mode key on the ground displays the CLIMB (CLB) page.

D **FIX Key** Pushing the **[FIX]** key displays the fix information (FIX INFO) pages. These pages are used for creating waypoint fixes from the intersection of the active route and the selected bearing, or distance from stored waypoints or the navaid reference, creating intercept points on the active route. Predictions are displayed for distance to go as well as for estimated arrival time and altitude at the intercept point. It is used for the point abeam of the named fix.

D **LEGS Key** Pushing the **[LEGS]** key displays the first or second route and displays each leg of the flight plan. The data includes a listing of waypoints, airspeed/altitude predictions and constraints, distances between legs, winds, magnetic (or true) headings between legs, and estimated times of arrival.

The LEGS page controls the route segment displayed on the associated navigation display when the navigation display is in the PLAN mode.

In the event of an FMC failure, the **[LEGS]** key gives access to the IRS LEGS page of the MCDU.

D **HOLD Key** Pushing the **[HOLD]** key displays the page that establishes holding parameters. The standard holding procedures at some waypoints are displayed if they are contained in the FMS nav database. This key lets the pilot enter and activate selected holding patterns. This page also allows the pilot to modify a previously built holding pattern.

FMC COMM Key The**[FMC COMM]** (flight management computer communications) key gives access to the FMC--MCDU pages that access

D

company datalink information and datalink status. If the FMC COMM key is not operational, the **KEY/FUNCTION INOP** message is displayed in the MCDU scratchpad.

D **PROG Key** Pushing the **[PROG]** (progress) key displays pages with current dynamic flight and navigation data for the TO, NEXT, and DEST waypoints. Alternate waypoints can be entered into the DEST line. Altitudes, actual and estimated times of arrival, distances, predicted fuels, winds and other information are also available for review. Also shown are radios/frequencies the FMC is using for radio updating, and the RTA page.

In the event of an FMC failure, the **[PROG]** key gives access to the IRS PROGRESS page of the MCDU.

D **MENUKey** Pushing the **[MENU]** key displays the MENU page. This page lets the pilot access subsystems that use the MCDU for display, such as FMC and SATCOM(satellite communications).The MENU page also gives access for alternate control of the display select panel (DSP) and EFIS in the event of a control panel failure.

D **NAV RAD Key** Pushing the **[NAV RAD]** (navigation radio) key displays the navigation radio tuning page. On this page the pilot can control tuning for the VOR, ADF, and ILS receivers, and select the VOR TRACK and LOC ONLY modes.

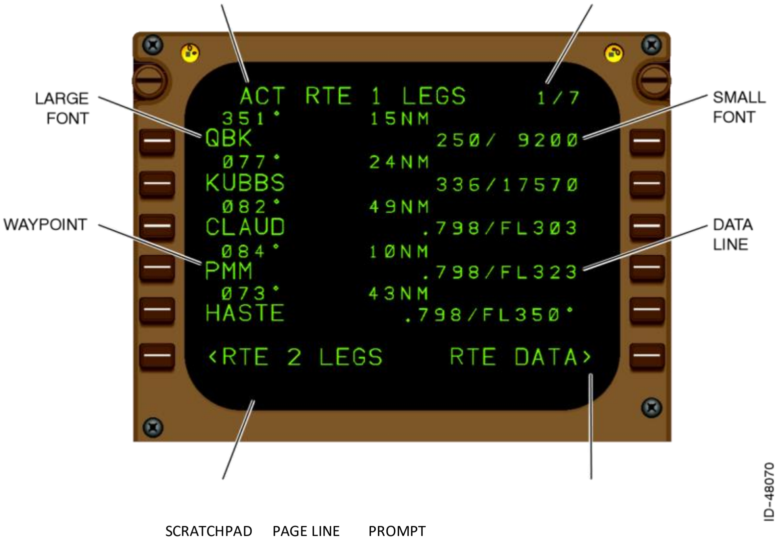
In the event of an FMC failure, the **[NAVRAD]** key gives access to the backup navigation radio page of the MCDU.

Page Formats and Data Labels

Pertinent FMS formats and data labels are displayed on MCDU pages that are selected by the function and mode keys. Typical page formats and data labels are shown in Figures 2--8 and 2--9.

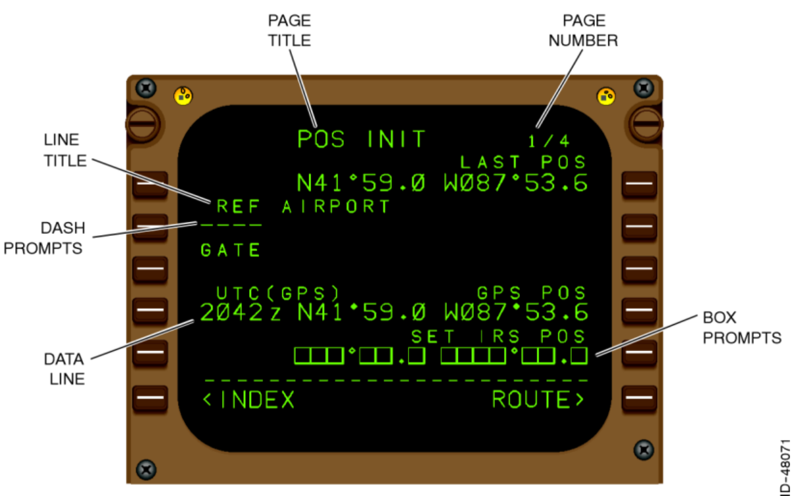
PAGE
TITLE

PAGE
NUMBER



MCDU Page Format (ACT RTE 1 LEGS Page)

Figure 2--8



MCDU Page Format (POS INIT Page)

Figure 2--9

Pushing a mode or function key on the MCDU displays the associated mode or function page. Each page has a page title and related prompts and data labels. The following are descriptions for the data labels and page formats shown in Figures 2--8 and 2--9, MCDU Page Formats.

D

Page Title (LARGE Font) The page title identifies the selected page and the type of data displayed on that page. ACT or MOD is displayed to indicate whether the page is active or modified.

D **PageNumber** The page number, in SMALL font, indicates the page number of a data set and the number of pages in the set. For example: 1/3 indicates there are 3 pages in that set and page 1 is displayed.

D **SMALL Font** Data that is predicted or calculated by the FMS, or is a default value, is displayed in SMALL font. When this data is next to an LSK, it can be changed by the pilot. When this data has been changed by the pilot, the font becomes LARGE.

D **Data Line** The data line can contain box prompts, dashes, computer generated data (small font), or pilot-entered data (LARGE font).

D **Page Prompt (< or >)** If an associated MCDU page can be accessed from the displayed page, the name of the associated page is displayed with a page prompt. Pushing the LSK next to the page prompt displays the associated MCDU page.

D **Scratchpad Line** The bottom line of the display is the scratchpad. It displays FMS-generated messages, keyboard entries, and data being moved from one line to another. When a message is received, the **MSG** annunciator on the right side of the MCDU lights. There are three types of messages, which are summarized in Section 15, FMS--MCDU Messages.

D **Waypoint** The waypoints on the selected route are displayed in LARGE font.

D **LARGE Font** Represents database or pilot entries that define FMS operation.

D **Box Prompts** (jjjjj) Boxes indicate that data entry is required for minimum FMS operation. Data is entered by using the scratchpad and the corresponding LSK. Entries into a box prompt are displayed in LARGE font.

D **Dash Prompts(-- -- -- -- --)** Dashes indicate that data entry into that field is optional, or that data is being calculated by the FMS. Data is entered by using the scratchpad and the corresponding LSK.

D **Line Title** The line title is displayed in SMALL font. It identifies the data directly below it.

Data Entry

Data is entered into the scratchpad from left to right with the alphanumeric keys. Normally, the display field or data field is an example of the format for the pilot to follow. After data has been entered into the scratchpad and it has been confirmed as correct, pushing the associated LSK transfers the data from the scratchpad to the data field. Data formats that are not obvious are explained in detail in the following sections. Data units of measure (lbs or kgs) are set for the carrier through the OPC.

If any entered data is not acceptable, an MCDU entry error advisory message is generated and the data is retained for display in the scratchpad, or there is no response to the line selection.

For specific formats it is possible to transfer data into the scratchpad by pressing the LSK when the scratchpad is empty. The data can subsequently be transferred to another data field by an appropriate keyboard procedure, or cleared from the scratchpad with the **[CLR]** key.

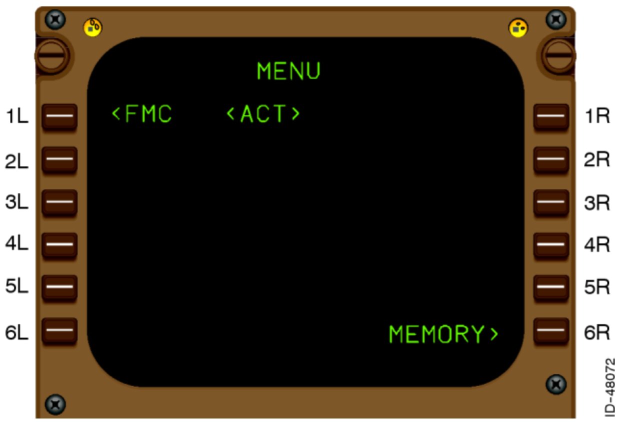
The two FMCs of the dual system communicate with each other over a private inter-system bus. Each FMC receives key pushes directly from its own MCDU and from the off-side MCDU.

The master FMC sequences key pushes in the order received, and transmits key push messages to the off-side FMC. Both FMCs process the same data simultaneously and do not start a new key push process until both have confirmed that the last key push is complete. If keys are pushed simultaneously on the MCDUs, the master FMC assumes that its own MCDU key push came first. This allows both pilots to operate simultaneously on the same or different MCDU pages and to enter data on different pages or on different lines of the same page. However, only one flight plan modification at a time is processed.

Initial Power-up Operation

With initial application of AC power to the aircraft, the MCDU MENU page is displayed, as shown in Figure 2--10. This page gives access to other subsystems that use the FMS-MCDU. The active system is indicated by the status text **<ACT>** message in the data line next to the system. Other systems requesting the MCDU display **[REQ]** in the data line. The **[REQ]** indicates that the non-active FMS-MCDU controller requires pilot action.

To select the FMC system, push the LSK next to the data line showing **<FMC**. This displays the IDENT page on initial application of AC power to the aircraft. If the FMC has been in use, then the same LSK push displays the last page used by the pilot.



MCDU Menu Page Figure 2--10

Flight Management System Terminology

The following information describes the unique terminology that is used to describe the flight crew interaction with the flight management system-multifunction control display unit (FMS-MCDU) and the flight management computer (FMC).

D **Active** Flight plan information that is currently being used to calculate lateral navigation (LNAV) or vertical navigation (VNAV) guidance commands. The active waypoint is the point toward which the system is currently navigating, and the active performance VNAV mode is the climb, cruise, or descent profile currently being used for pitch and thrust commands. ACT is displayed on the respective page titles.

D **Activate** The process of designating one of the two routes as active. It is a two step process, pushing the ACTIVATE LSK and pushing the **[EXEC]** key.

D **AltitudeConstraint** Refers to a crossing restriction at a waypoint on the route.

D **ECON** A speed schedule that is calculated to minimize the operating cost of the aircraft. ECON is based on a cost index (CI) that is entered into the FMS-MCDU during preflight on the performance initialization (PERF INIT) page. The CI is determined by dividing the operating cost of the aircraft by the cost of fuel. If fuel costs are high, the number is low. A low CI results in a low economy speed.

D **Enter** This is the process of typing or line selecting alphanumeric characters into the MCDU scratchpad line and then line selecting the information into the desired location.

D **Erase** The removal of a modified LNAV and VNAV path from the system by pushing the LSK adjacent to the word ERASE.

D **Execute** Refers to making entered information part of the active flight plan by pushing the **[EXEC]** key.

D **Inactive** Refers to route, climb, cruise, ordescent informationthat is not currently being used to calculate LNAV or VNAV commands.

D **Initialize** Process of entering information into the MCDU that is required to make the FMS operative.

D **Message** Information the FMS automatically writes in the scratchpad to inform the flight crew of some condition.

D **Modify** Change active data. When a modification is made to the active route or performance mode, **MOD** is displayed in the page title, **ERASE** appears next to one LSK, and the execute light illuminates. Pushing the ERASE LSK removes the modification. Pushing the **[EXEC]** key changes the modified information to active.

D **Prompt** Symbol displayed on the MCDU page to aid the flight crew in accomplishing a task. It may be boxes (jjjjj), dashes (**-- -- -- -- --**), or a careted line (**< >**) to remind the pilot to enter or validate information on the respective data line.

D **Select** Refers to pushing a key to obtain the desired information or action.

D **Speed Restriction** Refers to an airspeed limit beyond a specified altitude constraint entered by the pilot.

D **Speed Transition** This is an airspeed limit below a specified altitude that is entered automatically.

D **Waypoint** Refers to a point in the route. It may be a fixed point, such as a latitude and longitude, a VOR or NDB station, an intersection on an airway, or a conditional point. An example of a conditional point is when reaching 1000 feet.

3. Flight Operations and Flight Data

This section and the following sections (Sections 4through 10)describe FMS operations on a typical company flight, beginning with system initialization prior to flight, and continuing to engine shutdown at destination. All FMS flight phases (PREFLIGHT, TAKEOFF, CLIMB, CRUISE, DESCENT, APPROACH, and AFTER LANDING) are covered in detail. Not all system functions are described; however, the most used functions that are a part of normal operation are included.

NOTES, CAUTIONS, and WARNINGS are used throughout this guide for specific reasons. These are as follows:

NOTE: Calls attention to methods that make the job easier.

CAUTION

CALLS ATTENTION TO METHODS AND PROCEDURES THAT MUST BE FOLLOWED TO AVOID DAMAGE TO EQUIPMENT.

WARNING

CALLS ATTENTION TO USE OF MATERIALS, PROCESSES, METHODS, PROCEDURES, OR LIMITS THAT MUST BE FOLLOWED PRECISELY TO AVOID INJURY OR DEATH.

FLIGHT DATA

A typical flight from Chicago Illinois O Hare International Airport (KORD) to London, UK Heathrow Airport (EGLL) is used as an illustration. Table 3--1 and Figure 3--1 contain route data detailing the flight.

B767 Aircraft

Climb and Descent Flight Plan Summary

Airline	
Company Route	Not Available
Flight Number	767PEG
Departure Airport	Chicago O Hare (KORD)
Destination Airport	London Heathrow (EGLL)
Alternate Airport	Manchester (EGCC)
Perf Factor	+0.0/+0.0
Cost Index	80
TOGW	360,000 lbs
ZFW	260,000 lbs
CG	30%
Taxi Fuel	1000 lbs
Fuel Burnoff	80,000 lbs
10% Fuel	8,000 lbs
Reserve Fuel	12,000 lbs
CRZ levels	FL350/FL390

Climb to FL350 initially

Step Climb to FL390 after WPT N61W030 Top-of-Descent begins 186NM from EGLL

Flight Data Chicago to London Table 3--1 (cont)

Flight Plan Routing is filed as follows:

KORD

M083F350 DCT OBK J94 ECK J546 YQB J560 YZV DCT YYR

DCT LOACH DCT N58W050 DCT N60W040 DCT N61W030

DCT N60W020 DCT N59W010 DCT BEN DCT GOW A1 CALDA

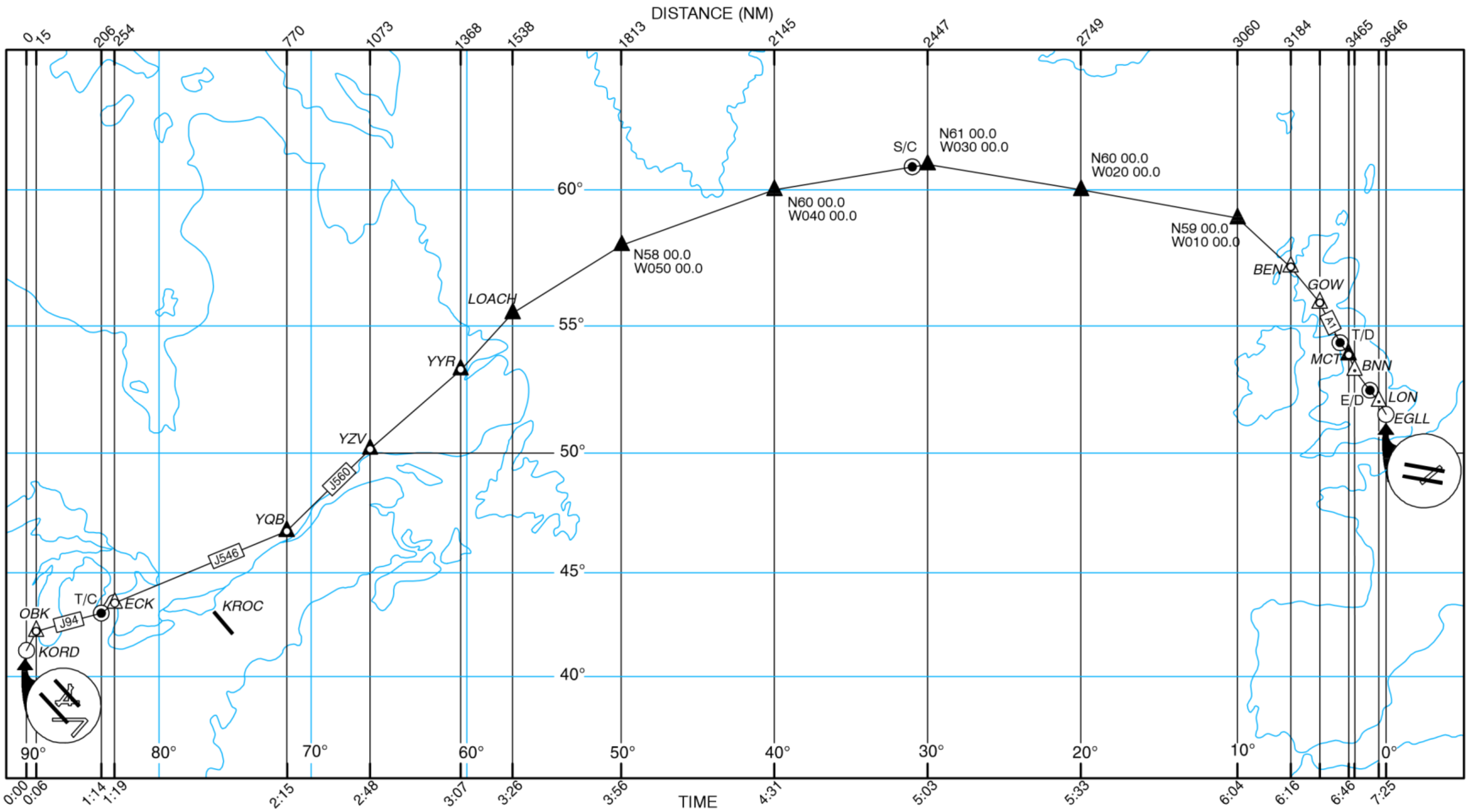
DCT LON DCT EGLL

En route Winds

The winds at FL350 are 270 degrees at 100 kts

Flight Data Chicago to London

Table 3--1


DISTANCE (NM)
0
15
206
254
770
1073
1368
1538
1813
2145
2447
2749
3060
3184
3465
3646
KORD
OBK
J94
T/C
ECK
J546
KROC
YQB
J560
YZV
YYR
LOACH
N58 00.0
W050 00.0
N60 00.0
W040 00.0
S/C
N61 00.0
W030 00.0
N60 00.0
W020 00.0
N59 00.0
W010 00.0
BEN
GOW
A1
T/D
MCT
BNN
E/D
LON
EGLL
60°
55°
50°
45°
40°
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°
TIME
0:00
0:06
1:14
1:19
2:15
2:48
3:07
3:26
3:56
4:31
5:03
5:33
6:04
6:16
6:46
7:25
ID-48073

Flight Plan -- KORD to EGLL
Figure 3--1

4. Preflight

In addition to the normal aircraft acceptance checklist, the pilot has the following tasks:

- Verify FMS aircraft status.
- Initialize the system.
- Check/modify the flight plan.
- Configure the FMS for the flight:

    Position initialization

    Route selection and entry

    Gross weight

    Cost index

    Cruise altitude

    Winds

    Thrust limits

    Time constraints

    NAV/radio tuning

    Departure runway

    SID selection

    V_{SPEEDS}

    Take-off gross weight (TOGW) update (after engine start and before takeoff).

INERTIAL REFERENCE SYSTEM

One of the first items to do after power-up is to initialize the IRS. This is done by turning the IRU mode selector switches on the IRS Mode Selector Panel to NAV, as shown in Figure 4--1. After approximately 10 seconds, the **ALIGN** annunciator lights, indicating the start of alignment. Rotating the IRU mode selectors to NAV activates a full 10-minute alignment cycle.

The alignment requires the present position LAT/LON coordinates.This entry can be made on the IRS mode selector panel. However, it is normally made on the MCDU POS INIT page (described later). These coordinates become the navigation starting point. When the **ALIGN** annunciator goes out, the system is in the NAV mode.

The following paragraphs give greater detail about IRS initialization and alignment.

Air Data Inertial Reference Unit

The air data inertial reference units (ADIRUs) combine the function of an air data computer (ADC) with an inertial reference unit (IRU). The air data and IRS functions of the ADIRUs are controlled separately and are described as separate systems.

INERTIAL REFERENCE SYSTEM OPERATION

The inertial reference system (IRS) is controlled by the IRS mode control panel on the overhead panel. When operating in navigation mode, the IRS provides attitude, acceleration, groundspeed, track, true and magnetic heading, present latitude and longitude, and wind speed and direction to other systems.

Magnetic heading and track are not available in polar regions. Magnetic reference is provided between N82_ and S82_ latitude,except forareas near magnetic poles. The north magnetic polar region is bounded by W80_ and W130_, where magnetic reference is provided to N70_. The southern magnetic polar region is bounded by E120_ and E160_, where magnetic reference is provided to 60_.

IRS ALIGNMENT

An IRS must be aligned before it can enter NAV mode. Rotating the IRS mode selector from OFF to NAV begins the IRS alignment. The IRS performs a short power test, during which the ON DC light illuminates. When the ON DC light extinguishes, the ALIGN light illuminates. Alignment requires approximately ten minutes.

Present position (latitude and longitude) must be entered on the MCDU position initialization page to complete the alignment. If the present position cannot be entered through the MCDU, it may be entered through the IRS mode selector keyboard.

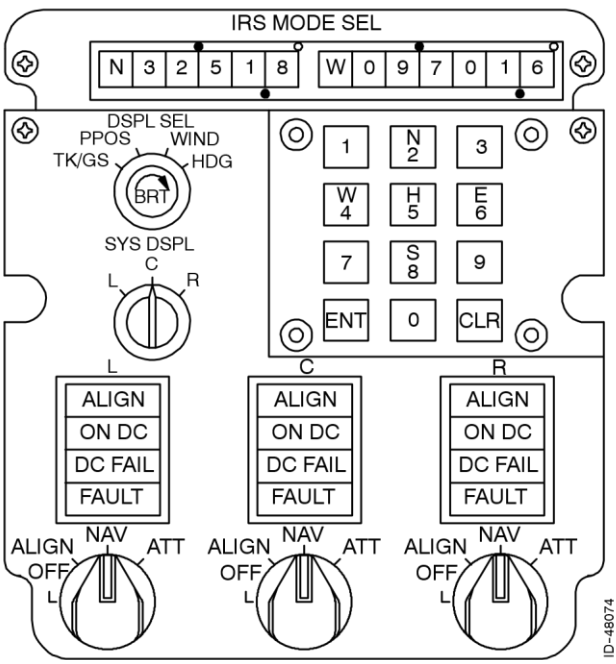
If the latitude/longitude position is not near the origin airport, the MCDU scratchpad message **VERIFY POSITION** is displayed. If the entered latitude/longitude position does not pass the IRS internal comparison tests, the scratchpad message **ENTER IRS POSITION** is displayed.

Alignment can be accomplished only when the airplane is parked. Alignment stops if an IRU detects motion during alignment. When the motion stops, the alignment automatically restarts.

The IRS is aligned when all IRUs enter the navigation mode. The latitude and longitude display on the SET IRS POS line of the MCDU POS INIT page then blanks. Alignment is lost if the selector is moved out of the NAV position.

Inertial Reference Mode Panel

The inertial reference mode panel (IRMP), shown in Figure 4--1, is installed in the flight deck overhead and can be used by the flight crew to initialize the inertial reference section of the ADIRU and to display current position, selected inertial reference data, miscellaneous inertial reference fault/status annunciations, and maintenance code information from both the inertial reference and the air data reference sections of the ADIRU.



IRS Mode Selector Panel Figure 4--1

The IRMP gives the flight crew direct interface to the IRU. It can be used to ALIGN the inertial reference frame, manually enter present position (LAT/LON) data, manually enter Mag heading (SET HEADING) datafor ATT mode operations, and give the flight crew a method to monitor selected inertial reference data, status, and maintenance information.

FMC MCDU

One of the first items to do after power-up is to initialize the IRS. The only flight crew manual input to the IRS during normal operations is initialization of the IRS by aligning and inputting present position through the FMC MCDU keypad. The MCDU is normally used by the flight crew to enter present position (LAT/LON) for inertial reference sensor initialization, and magnetic heading (SET HEADING) data for the ATT mode.

When the ADIRU inertial reference function is in the IR ALIGN mode, input of LAT/LON data is done by the flight crew keying the entries in the MCDU when accessing the SET IRS POS line on the POS INIT page. When the inertial reference function is in the ATT mode, the ADIRU requires periodic manual updates of magnetic heading. Although this can be done using the IRMP, the MCDU is normally used. A prompt for the SET HEADING data is on the SET IRS HDG line of the POS INIT page when in the ATT mode.

ALIGN Mode

During the align mode, the aircraft must remain stationary. If aircraft motion is sensed, the alignment process is interrupted and then automatically restarted, with a **MOTION DETECTED** message sent to the MCDU. Inertial sensor alignment is done by internal gyros and accelerometers using earth sensed rates, such as gravity, for the vertical axis and sensed earth rotation for latitude. Alignment is classified into two categories: **full alignment** and **quick alignment**. After each flight, it is necessary to perform either a full alignment or a quick alignment. The full alignment is the normal alignment procedure and should be performed regularly to maintain required inertial reference output accuracy.

FULL ALIGNMENT

Full alignment is done by moving the IRMP mode switches, shown in Figure 4--1, from the OFF to the NAV position. After a brief automatic system test, the alignment process is initiated. During the system test portion of the alignment process, the **ON DC** annunciator lights briefly while the system checks the DC power source, then extinguishes if the normal AC power is available. While the IRS is aligning, the **ALIGN** annunciator is lit, extinguishing when the process is completed. To complete the alignment process, the aircraft present position must be entered. This is routinely done by keying the LAT/LON present position into the FMC MCDU keypad. If the aircraft is moved during this period, the alignment process is required to be manually reinitiated. Once the alignment process is completed, the inertial reference function automatically transitions to the NAV mode as commanded.

Variable or fixed alignment times depend on the selected enhanced mode alignment option, as discussed in the next paragraph. The length of time to complete the alignment process in the enhanced mode with the variable option depends on current latitude. Positions nearer to the poles require additional time to accurately detect and calculate sensed earth rates. Thus, positions nearer to the equator can require only a 5-minute alignment time, with the required time increasing as a function of latitude up to a maximum of 10 minutes beginning at latitudes of 60 degrees north or south with that alignment remaining constant through 70.2 degrees north or south. For positions above 70.2 degrees north or south, the alignment times are 17 minutes. Alignment cannot be conducted at latitudes greater than 78.25 degrees north or south. The basic fixed alignment takes about 10 minutes for latitudes below 70.2 degrees north or south and about 17 minutes from latitudes between 70.2 degrees north or south up to 78.25 degrees north or south.

ENHANCED MODE AND AUTOMATIC NAVIGATION REALIGNMENT

Full alignment includes an option pin selectable enhanced mode that offers the capability of having a fixed alignment time or a variable alignment time. The variable alignment time is preferred, because it offers a slight increase in alignment accuracy. Enhanced mode also features an automatic navigation realignment (ANR) that lets the IRS continue minor sensor alignments even after the ALIGN processing is completed and the IR has gone to the NAV mode. ANR reduces sensor drift while the aircraft is stationary for extended periods after initial alignment has been completed. Once the aircraft is moved, ANR is halted. ANR is halted only temporarily if the aircraft does not exceed 60 kts when the movement occurs, and automatically reenters ANR after the aircraft stops. If aircraft motion exceeds 60 kts, the function is disabled until either a full alignment or a quick alignment is initiated manually.

QUICK ALIGNMENT

Quick alignment or align downmode is available after the inertial reference has been in the NAV mode. It is initiated by moving the IRMP mode switches from NAV to ALIGN and back to the NAV position, without going down to the OFF position. It takes about 30 seconds to complete, and present position must be entered within that 30 second time period. If the aircraft is moved during this period, a full alignment is required. Initiation of the quick alignment mode starts IRS adjustments of the heading and attitude and zeros velocity errors. If the keyed-in present position does not agree within tolerance to the IRS current calculated position, ALIGN lights on the IRMP flash, indicating a full alignment is necessary. If the keyed-in present position is within tolerance, NAV mode is automatically reentered.

NAV MODE

The IRMP mode switch must be in the NAV mode before moving the aircraft or the aircraft will require IR realignment. IR data is available to the flight crew and aircraft systems while in the NAV mode, providing attitude, acceleration, groundspeed, inertial track, True and Mag heading, present LAT/LON, wind speed, and wind direction data to the user system.

FAST ALIGNMENT

Following operation in the navigation mode and with the aircraft parked, performing a fast alignment removes accumulated track, groundspeed, and attitude errors, levels the system, and updates present position. This is done by positioning selectors to ALIGN, entering present position, and repositioning selectors to NAV. Fast alignment completes in approximately 30 seconds.

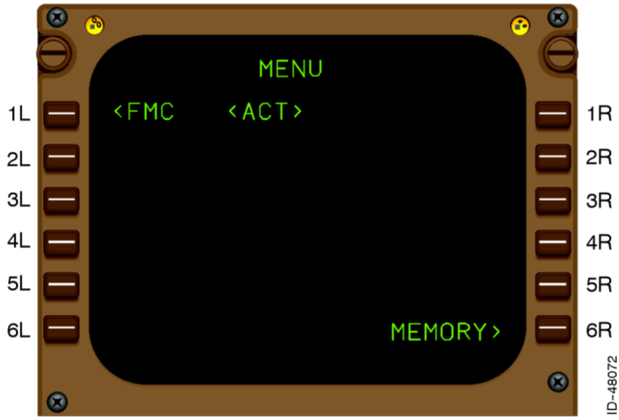
Fast alignment can be done without entering present position. However, greater navigation accuracy is attained by entering present position. A full alignment, done by rotating the IRS mode selector to OFF and back to NAV, must be done when the time from the last full alignment exceeds 18 hours.

IRS ATTITUDE

If alignment is lost in flight, the navigation mode is inoperative for the remainder of the flight. Attitude information can be obtained by moving the selector to the ATT position. The IRU enters the align mode for 30 seconds, during which the aircraft should stay in straight and level flight. This re-levels the system and provides an attitude reference. Some attitude errors can occur during acceleration. After acceleration, errors are slowly removed.

AT POWER APPLICATION

At power application, the FMC executes an internal self-test. On successful completion of the self-test, selecting the **<FMC** prompt on the MCDU MENU page, shown in Figure 4--2, displays the IDENTpage, shown in Figure 4--3.



MCDU MENU Page

Figure 4--2

AIRCRAFT IDENTIFICATION

The IDENT page, shown in Figure 4--3, is also accessed through LSK **1L** (**IDENT** prompt) of the INIT/REF INDEX page (described later in this section). This page lets the crew review the aircraft type, engine type, navigation database, and operating software version. The only data that can be changed on the IDENT page is the active navigation database cycle and the drag and fuel flow data field. Any MCDU messages can be cleared from the scratchpad by pushing the **[CLR]** key. MCDU messages are described in Section 15, FMS--MCDU Messages.

LSKs **6L** and **6R** are page access prompts to the INIT/REF INDEX and POS INIT pages. Following the prompts at LSK **6R** for the succeeding pages guides the pilot through the FMS preflight entries.

NOTE: All data on the IDENT page should be reviewed for applicability and currency.

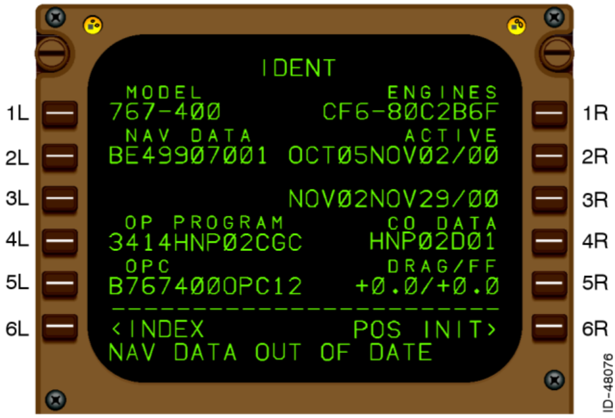
IDENT Page
Figure 4--3

The data on the IDENT page is described in the following paragraphs. D

MODEL (1L) This is the aircraft model used for FMS calculations.

D **NAV DATA (2L)** This is the navigation database serial number (LARGE font) used in FMS navigation planning. The first two digits of the database part number designate the airline. The third digit designates the airline s database number. The fourth and fifth digits designate the year the database was produced. The sixth and seventh digits designate the database cycle number. There are 13 database cycles in one year, so sometimes the database cycle number coincides with the month that it is effective, and sometimes it does not. The eighth, ninth, and tenth digits designate the sequence number.

NOTE: If the FMC time indicates the active navigation database cycle is expired, the **NAV DATA OUT OF DATE** message is displayed in the scratchpad, as shown in Figure 4--4. This message is displayed only when the aircraft is on the ground.



IDENT Page – NAV DATA OUT OF DATE

Figure 4--4

D **OP PROGRAM (4L)** This is the operational program software serial number.

D **OPC (5L)** This is the operational program configuration part number. The OPC is controlled by Boeing

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **ENGINES (1R)** This displays the engine identification number model contained in the performance database. If the ENGINES line is blank, the FMC is not compatible with the aircraft configuration.

D **ACTIVE (2R)** This is the active navigation database period in the FMS. Line **3R** displays the inactive navigation database period stored in the FMS. The active navigation database cannot be down-selected into the scratchpad by pushing LSK **2R**. It can be changed only by inserting the inactive navigation database.

D **(INACTIVE) (3R)** The inactive navigation data range displays the effective data range for the inactive navigation database.

D **CO DATA (4R)** The data line displays the airline modifiable information (AMI) part number. The FMS AMI is a separately loadable database that contains parameters that can be modified by the airlines to tailor operations of the FMC performance and datalink functions. The AMI databases are controlled by the airlines. AMI databases are not required for the FMC to operate, as hardcoded defaults are used when AMI is not loaded. The first 4 characters of the AMI part number are not displayed, due to space limitations, but the entire part number is displayed on the AIRLINE POLICY 1/2 page. Entries cannot be made on this line.

- **DRAG/FF (5R)** This data line displays the drag and fuel flow correction factors, as a percentage, that the FMS is using for performance calculations. Setting the drag/fuel flow factors is a maintenance function.

  Selecting **5R** while on the ground is non-operational.

  Selecting, deleting, or entry into **5R** while airborne is non-operational.

  When values must be changed, **ARM** is entered into the scratchpad and transferred to **5R**. This arms the line for subsequent actual data entry. The required drag/fuel flow data is entered into the scratchpad and transferred to **5R**.

  Drag-only entries must be followed by a slash (**/**).

  Fuel flow only entries can optionally be preceded by a slash (**/**).

  Drag and fuel flow factor combined entries must be separated by a slash (**/**).

  Valid entries following ARMing of the field are numeric entries ranging from --9.0 to +9.9 with the plus sign (**+**) optional for positive values.

  Any entry other than **ARM** displays **INVALID ENTRY** in the scratchpad.

  Following ARMing of the field, **ARM** is displayed in SMALL font in the **5R** header (**ARM DRAG/FF**). Armed status is cleared upon leaving the IDENT page or when the aircraft becomes airborne.

  Valid entry of drag or fuel flow factors invalidates the current performance predictions.

  Attempted deletion while on the ground results in the display of the **INVALID DELETE** message in the scratchpad.

- **POS INIT (6R)** Line **6R** displays the **POS INIT** prompt. When all the data has been checked and verified as correct, pushing LSK **6R** gives access to the POS INIT page. Following the prompts at **6**R of the succeeding pages guides the pilot through the FMS preflight entries.

To Change the Active Navigation Database

1. Push LSK **3R** (**NOV02NOV29/00**) to place the inactive navigation database into the scratchpad, as shown in Figure 4--5.

IDENT Page – Change Active Nav Database – LSK 3R

Figure 4--5

2. Push LSK **2R** to enter the new active navigation database, as shown in Figure 4--6.

IDENT Page – Change Active Nav Database – LSK 2R

Figure 4--6

The active navigation database can be changed only while on the ground.

NOTES: 1. With the aircraft on the ground, valid entry to **2R** results in the active and inactive navigation database exchanging places.

2. Attempting to delete while on the ground displays **INVALID DELETE** in the scratchpad.

3. Any entry other than inserting the inactive navigation database displays **INVALIDENTRY** in the scratchpad.

Cycling the navigation database from the active to the inactive cycle causes the following results:

NOTES: 1. Deletes all route data for route 1 and route 2.

2. Erases any information entered on the route and position initialization pages (POS INIT, REF NAV DATA, TAKEOFF REF, WINDS, FIX INFO, ALTN, XXXX ALTN), the en route or alternate destination on PROGRESS page 1, and the manually entered step size on the PERF INIT and CRZ pages).

3. Clears all pending uplink status and pending uplink data.

4. Purges the uplinked alternate airports list, if it exists.

5. If the previously displayed page on the other MCDU is the:

- DEPARTURES or ARRIVALS page, then the DEP/ARR INDEX page is displayed.

- RTE DATA, RTE LEGS DIRECT TO PENDINGS or WINDS page, then RTE 1 LEGS page 1 is displayed.

- HOLD page, then RTE 1 LEGS Hold At page 1 is displayed.

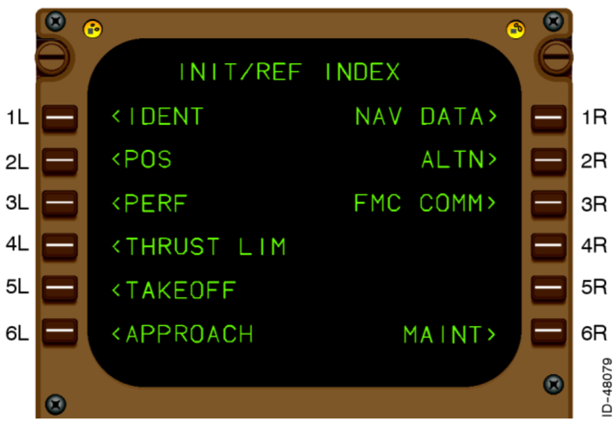
- SELECT DESIRED WPT page, then the page before the SELECT DESIRED WPT page is displayed.

INIT/REF INDEX

During the PREFLIGHT phase, the FMS lets the pilot easily cycle through all pertinent preflight steps by accessing the next applicable preflight function in line **6R** of each of the preflight pages. The preflight pages include the IDENT, POS INIT, RTE, PERF INIT, THRUST LIM, and TAKEOFF REF pages.

The initialization/reference index page gives access to these functions as well, both during preflight or while in other phases of flight. Any page that is accessible by the INIT/REF INDEX page contains an **INDEX** prompt adjacent to LSK **6L**. Figure 4--7 shows the INIT/REF INDEX page. Most of the pages available through the INIT/REF INDEX are outlined in the following sections. The others are detailed in subsequent sections.

Access the INIT/REF INDEX by pushing the MCDU **[INIT REF]** key and then pushing LSK **6L** (**INDEX**) on the INIT/REF INDEX page, shown in Figure 4--7. The Initialization/Pages diagram, shown in Figure 4--8, gives details on which page is displayed by pushing the INIT REF key.



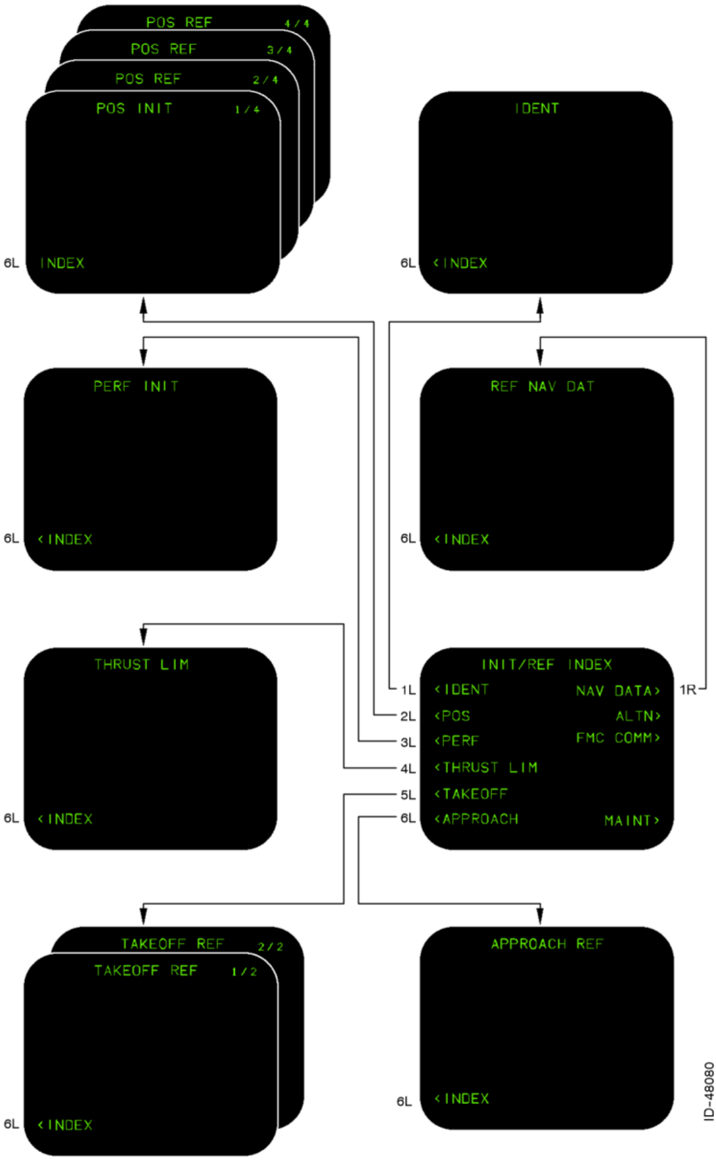
INIT/REF INDEX Page

Figure 4--7

The alternate (ALTN) airports prompt is at LSK **2R** on the INIT/REF INDEX page. The ALTN page is described in Section 9, Alternate Page.

NOTE: LSK **6R**, the **MAINT** prompt, is accessible only when the aircraft is on the ground. Once the aircraft is airborne, the field is blank.

The desired page can be selected from the INIT/REF INDEX. The one exception to this is the POS REF page, which requires you to display the POS INIT page first and then push the **[NEXT PAGE]** key, as shown in Figure 4--8.



Initialization/Pages Figure 4--8

POSITION INITIALIZATION

The POS INIT (position initialization) page lets the pilot enter the FMS initialization parameters. Pushing LSK **6R** on the IDENT page (see Figure 4--3) gives access to the POS INIT pages.

NOTE: The POS INIT page can also be accessed through the **POS** prompt in line **2L** of the INIT/REF INDEX page (see Figure 4--7). Pushing the INIT REF key on the ground before the aircraft position has been initialized displays the POS INIT page.

The POS INIT page, shown in Figure 4--9, lets the pilot initialize the IRS. The originating airport and a specific gate can also be entered on this page, and the pilot can initialize the IRU by using the origination airport, specific gate, or GPS.

The position initialization task aligns the IRS units to the present ground position of the aircraft. This function can be initialized through the IRS mode selector panel, but it is more convenient to use the MCDU.

Failure of a manually entered position to pass the ADIRU internal check displays the scratchpad message **ENTER IRS POSITION**. The manually entered position is also compared with the FMC origin airport location. Failure of the entered position to compare within 6 NM of the FMC origin airport displays the scratchpad message **IRS POS/ORIGIN DISAGREE**.

To select the POS INIT page, push LSK **6R** (POS INIT) on the IDENT page (see Figure 4--3) to display the POS INIT page, shown in Figure 4--9.

POS INIT Page

Figure 4--9

The data on POS INIT page 1/4 is described in the following paragraphs.

D **REF AIRPORT (2L)** This is the airport of origination. Valid entries are four-character ICAO (International Civil Aviation Organization) airport identifiers contained in the navigation database. Valid entries are displayed in line **2L**, with the corresponding airport reference point (the central point of the airport) LAT/LON shown in **2R**. The REF AIRPORT entry deletes any previously selected gate number entry and permits another gate entry at **3L**. The REF AIRPORT is cleared once the aircraft is airborne.

D **GATE (3L)** This is the originating gate, if the gate has a specific identifier in the navigation database. Line **3L** is blank if line **2L** is blank, or contains dashes if the reference airport has been entered in **2L**. Valid entries are one to five alphanumericcharacters andmust be stored in the navigation database. Valid entries are displayed in line **3L** with the corresponding LAT/LONGs shown in line **3R**. This line display is cleared at liftoff or returns to dashes with a different REF AIRPORT entry.

D **UTC (4L)** Displays the aircraft Coordinated Universal Time (UTC) when the FMC time is referenced to UTC. The header displays **MAN** when the FMC time is referenced to flight deck clocks.

An entry of a manual time can be done. The two-digit hour is the only part of the time a pilot can manually set and only when the header displays **MAN**.

D **SET HDG (5L)** The data and header lines are blank except when an IRS is in the attitude mode, and then dashes are displayed. Entering heading information resynchronizes (updates) the IRS magnetic heading signal for all inertial reference systems in attitude mode.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, as shown in Figure 4--7.

D **LAST POS (1R)** The last latitude/longitude present position of the aircraft is displayed at all times, as calculated by the FMC. The data is retained when the aircraft is powered down.

D **REF AIRPORT LAT/LON(2R)** With a valid reference airport entry displayed in line **2L**, the corresponding airport reference point (the central point of the airport) LAT/LON is displayed in **2R**.

D **GATE LAT/LON(3R)** With a valid originating gate entry displayed in line **3L**, the corresponding originating gate LAT/LON is displayed in **3R**.
D **GPS POS (4R)** Displays the GPS present position. The field is blank if the GPS position is not valid or the GPS option is not enabled.

D **SET IRS POS (5R)** The LAT/LON of the aircraft present position can be entered for IRS alignment purposes. Valid entries are LAT/LON in the format outlined in Section 11, Advanced Flight Planning, Pilot--Defined Waypoints, LAT/LON Waypoint. Entries can be made only when box prompts (jjj_jj.j jjjj_jj.j) or data are displayed in this field.

Box prompts are displayed only when the IRSs are in the align mode. The entered data is displayed only until at least one valid IRS enters the NAV mode.

The data field is blank when airborne or when on the ground and no IRSs are in the align mode.

NOTES:

1. Entries not in standard LAT/LON are not accepted and result in the display of the **INVALID ENTRY** message in the scratchpad.
2. If either the **ENTER IRS POSITION** or the **IRS**

   POS/ORIGIN DISAGREE message is annunciated, then entry of an inertial position into line **5R** on the POS INIT page, (shown in Figure 4--9), clears the message.

D **ROUTE> (6R)** The ROUTE prompt gives access to the active route page, or the RTE 1 page if no route has been activated, to continue the preflight sequence.

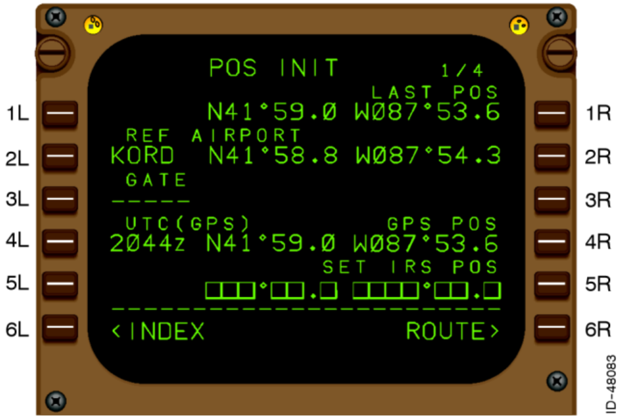
Position initialization is done as follows:

1. Enter the origin airport, KORD in this scenario, into the scratchpad. The display is as shown in Figure 4--10.

POS INIT Page Origin Airport Entered Into Scratchpad Figure 4--10

2. Push LSK **2L** to enter the origin airport, as shown in Figure 4--11. The airport LAT/LON is displayed in **2R**.

   NOTE: If there is a specific gate identifier, it can be entered in the scratchpad. LSK **3L** is pushed to enter the gate data. The gate LAT/LON is displayed in **3R**.



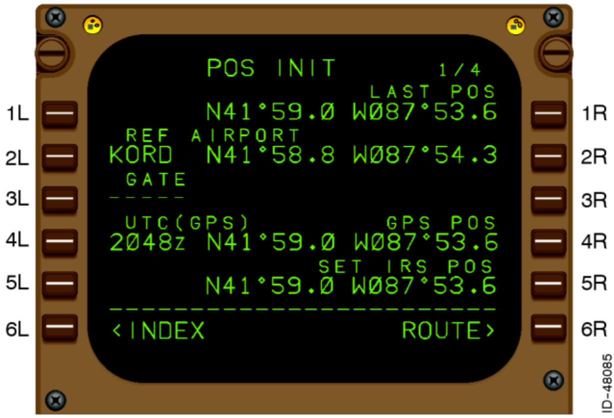
POS INIT Page Origin Airport and its LAT/LON Entered Figure 4--11

3. If the IRS position must be entered, the pilot can select the airportreference (**2R**), gate position (**3R**), or GPS position (**4R**), placing the most accurate LAT/LON in the scratchpad. For this scenario, push LSK **4R** to enter the GPS LAT/LON, N4159.0W08753.6, in the scratchpad, as shown in Figure 4--12.

   NOTE: The pilot can also enter the LAT/LON into the scratchpad manually.

POS INIT Page GPS LAT/LON Entered in Scratchpad
Figure 4--12

4. Push LSK **5R** to enter the GPS LAT/LON as the present IRS position, as shown in Figure 4--13.



POS INIT Page GPS LAT/LON Entered for Present IRS Position

Figure 4--13

5. When the IRS transitions from alignment to navigation mode, thePOS INIT page is as shown in Figure 4--14.

POS INIT Page – IRS in NAV Mode

Figure 4--14

POSITION REFERENCE PAGES POS REF Page 2/4

Position reference (POS REF) page 2/4 displays the aircraft present positions as calculated by the FMC, ADIRU, GPS, and RADIO navigation receivers. An FMC position update using ADIRU, GPS, or RADIO positions can be initiated from this page. Access POS REF page 2/4 by pushing **[NEXT PAGE]** on the POS INIT page.

POS REF Page 2/4

Figure 4--15

- **FMC (1L)** Displays the present FMC latitude/longitude computed position in **1L**. If the FMC position is invalid, blanks are displayed. The FMC position is blank from power up until an ADIRU enters NAV mode. The FMC position at **1L** is selectable to the scratchpad.

  The source for updating the FMC position shown in this scenario is **(GPS)**. Other methods for updating the FMC position are to display **IRS** and use ADIRU position data, or to display **RADIO** and use navigation radio position data.

- **IRS (2L)** Displays the latitude/longitude position as determined by the ADIRU. The inertial position is blank from power application until a position is entered. The IRS LAT/LON positions can be line selected to the scratchpad.

- **GPS (3L)** Displays the latitude/longitude position as determined by the GPS.

- **RADIO(4L)** Displays the latitude/longitude position as determined by the navigation radios, unless BRG/DIST has been selected.

- **RNP/ACTUAL (5L)** LSK**5L** lists the required navigation performance (RNP) and actual navigation performance (ANP). It displays a measure of FMC position accuracy in nautical miles. The accuracy is shown to the nearest 1/10 NM if the accuracy is equal to or greater than 10 NM (10.0 TO 99.9) or to the nearest 1/100 NM if the accuracy is less than 10 NM (0.00 TO 9.99). Position accuracy values in excess of 99.9 NM are displayed as 99.9.

  RNP (required navigation performance) is defined as a statement of the navigation performance necessary for operation within a defined airspace. RNP specifies an accuracy, integrity, availability of navigation signals, and availability of navigation equipment requirements for a particular area, airspace, route procedure, or operation.

For Pegasus CNS/ATM, the initial implementation of RNP focuses primarily on horizontal applications. Default values for RNP are specified for five phases of flight:

- **Takeoff** (RNP = 1 NM): A flight plan or modification has been performed on the ground and at least one IRU is in navigation mode.
- **Terminal** (RNP = 1 NM): The aircraft is below 15,500 feet; aircraft in takeoff above 3,000 feet above departure airport if no SID in flight plan; or the last waypoint of the SID is sequenced below 15,500 feet; or the aircraft is in Approach and is 3,000 feet above arrival airport elevation if no missed approach hold point is defined, or sequencing of the hold point.

D **En route/Domestic** (RNP = 2 NM): Aircraft is above 15,500 feet and not actively flying a SID; above 15,500 feet and sequences the last waypoint of a SID; or the phase of flight is Oceanic and radio updating is possible.

D **Oceanic/Remote** (RNP = 12 NM): Radio updating is not possible due to limited navaid coverage or no navaid coverage. Can be RNP = 10 NM depending on location, such as North Atlantic.

D **Approach** (RNP = 0.5 NM): The first waypoint on the active approach or approach transition is sequenced, or the aircraft sequences below 2,000 feet above airport elevation. The Approach phase is not active when a VFR approach is in the active flight plan.

— **ANP** (actual navigation performance) represents the horizontal position certainty associated with the FMC computed aircraft position, on a 95% basis (2-sigma), expressed in nautical miles. Position uncertainty reflects the confidence level associated with the current FMS aircraft position and navigation mode.

If RNP is enabled through operational program configuration (OPC), ANP is displayed on the POS REF 2/4 page, under the field header **ACTUAL**, shown in Figure 4--15.

ANP can assume a maximum value of 20 nautical miles. Typical values for ANP for various update modes are:

D **LOC/GPS/IRS** – Assumes a valid GPS position with a horizontal figure of merit (HFOM) of 0.054 NM (100 meters), and the range of ANP starts at 20 NM from the localizer and goes to the runway threshold, assuming a groundspeed of 200 kt (Range of ANP: 0.12 to 0.04 NM).

D **LOC/DME/DME/IRS** – This covers a DME/DME include angle of 30 to 150 degrees, with the range of ANP assuming the previous conditions (Range of ANP: 0.34 to 0.17 NM).

D **LOC/VOR/DME/IRS** – Covers the VOR/DME update navaid range of 40.0 to 0.6 NM with the same assumed ANP range (Range of ANP: 1.17 to 0.14 NM).

D **LOC/IRS** – A typical ANP that assumes an initial ANP of 0.04 NM, the same previously assumed range, but groundspeed is assumed to be 149 kt (Range of ANP; 0.87 to 0.30 NM).

D **GPS/IRS** – Typical ANP is:

- 0.10 NM with a valid GPS position accurate to within 100 meters and an assumed groundspeed of 650 kt

- 0.31 NM with a valid GPS position and a horizontal integrity limit of 0.30 NM with the GPS satellite fail detected bit set and an assumed groundspeed of 650 kt

- 0.07 NM with a valid GPS position with an assumed accuracy of 100 meters and an assumed terminal groundspeed of 200 kt.

D **DME/DME/IRS**

- A DME/DME includes angles of 30 to 150 degrees and assumes a groundspeed of 650 kt (Range of ANP; 1.00 to 0.54 NM).

- A DME/DME includes angles of 30 to 150 degrees and the range of ANP starts at 20 NM from the runway threshold and goes to the runway threshold assuming a groundspeed of 200 kt (Range of ANP; 0.48 to 0.24 NM). D **VOR/DME/IRS**

- The VOR/DME update navaid range of 40 NM flying toward the navaid and 25 NM flying away and excludes the inverted 60 degree zone-of-confusion; groundspeed is assumed to be 650 kt (Range of ANP; 1.65 to 0.60 NM).

- The VOR/DME update navaid range and the range of ANP start at 20 NM from the runway threshold and goes to the runway threshold assuming a groundspeed of 200 kt (Range of ANP; 1.65 to 0.20 NM).

D **IRS Only** -- Assuming an initial ANP of 0.40 NM and a groundspeed of 650 kt, typical ANP values range from 0.40 NM (at loss of position updating) to 20 NM (after 10 hours of no updating).

For a 20 NM approach scenario where the initial ANP is 0.40 NM with a groundspeed of 149 kt and the entire approach is flown with no position updating, ANP ranges from 0.4 NM (at the beginning of the approach) to 1.21 NM (at the runway threshold).

D **<INDEX (6L)** – Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

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D **ARM> (1R)** The ARM prompt is used to update the FMC position to match the INERTIAL, GPS, or radio position. When **ARM** is selected, it arms the FMC position update function and changes the prompt to **ARMED**.

When the **ARMED** prompt is displayed, **NOW>** prompts are added to the right side of the INERTIAL, GPS, and RADIO lines. Selecting LSK **2R** (**NOW>**) updates the FMC position to match the inertial position, selecting LSK **3R** (**NOW>**) updates the FMC position to match the GPS position, or selecting LSK **4R** (**NOW>**) updates the FMC to match the radio position.

D **DME/DME, VOR/DME, or LOC (5R)** LSK**5R** displays the threeor four-letter identifiers of the navigation station currently being used by the FMC in the radio position updating (not shown in Figure 4--15). The header indicates the active radio update mode is either DME/DME, VOR/DME, or LOC.

D **BRG/DIST or LAT/LON (6R)** Selecting LSK **6R** changes the position display format to bearing/distance when **BRG/DIS>** is displayed, or to latitude/longitude when **LAT/LON>** is displayed. LAT/LON is displayed when the position display format is a bearing/distance format. BRG/DIS is displayed when the position display format is latitude/longitude.

Figure 4--16, POS REF page 3/4, shows the latitude/longitude display format. Figure 4--17, POS REF page 3/4, shows the bearing/distance display format.

NOTE: The bearing/distance format displays the bearing and distance of the other position sources relative to the FMC position. The latitude/longitude format displays are actual positions.

POS REF Page 3/4

Position Reference page 3/4, shown in Figure 4--16, is shows the calculated positions from the left and right GPS receivers and the left and right FMC calculations.

Access POS REF page 3/4 by pushing the **[NEXT PAGE]** function key from POS REF page 2/4 or the **[PREVPAGE]** function key from POS REF page 4/4.

POS REF Page 3/4: LAT/LON Display Format
Figure 4--16 D **GPS L**

(1L) Displays the left GPS position.

D **GPS R (2L)** Displays the right GPS position.

D **FMC L (PRI) (3L)** Displays the left FMC calculated position.

(PRI) indicates that the left FMC is the master (primary) FMC and the right FMC is the inactive FMC. **(PRI)** is always on the header line with the active FMC either L or R.

D **FMC R (4L)** Displays the right FMC calculated position.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **GPSNAV(5R)** Selecting LSK **5R** alternately selects GPS NAV **ON** (active) and **OFF** (inactive).

In the **ON** position, GPS data is supplied to the FMC. **ON** is displayed in LARGE font letters and **OFF** is displayed in SMALL font letters.

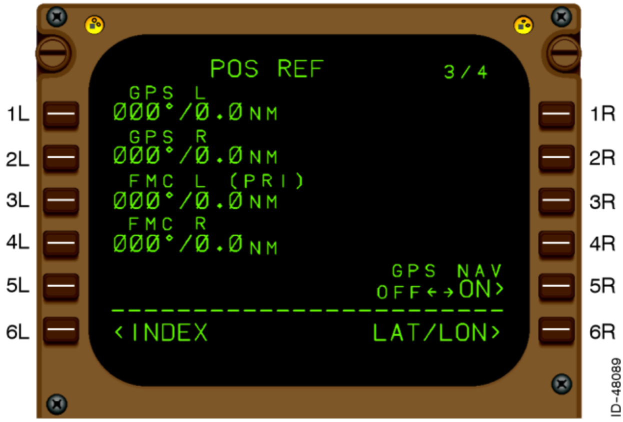
In the **OFF** position, GPS position data is not available to the FMC.

OFF is displayed in LARGE font letters and **ON** is displayed is SMALL font letters.

NOTE: When power is applied to the aircraft, GPS NAV is automatically **ON**.

D **BRG/DIS> or LAT/LON> (6R)** Selecting LSK **6R** (BRG/DIS or LAT/LON) toggles the position data display between bearing/distance and latitude/longitude.

Figure 4--17 shows POS REF page 3/4 in the bearing/distance display format.



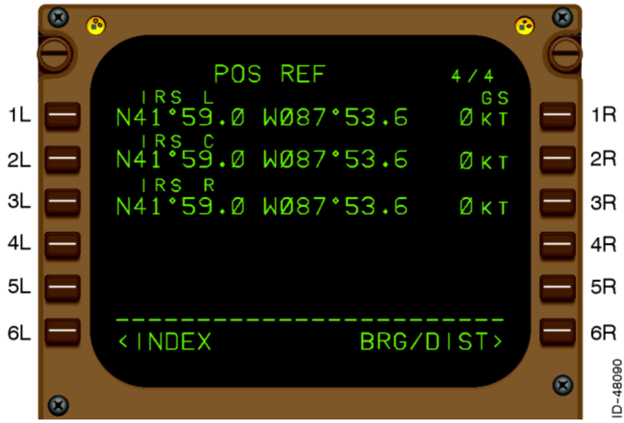
POS REF Page 3/4: BRG/DIST Display Format Figure 4--17

POS REF Page 4/4

Position Reference page 4/4, shown in Figure 4--18, is shows the calculated positions from the left, center, and right IRS receivers.

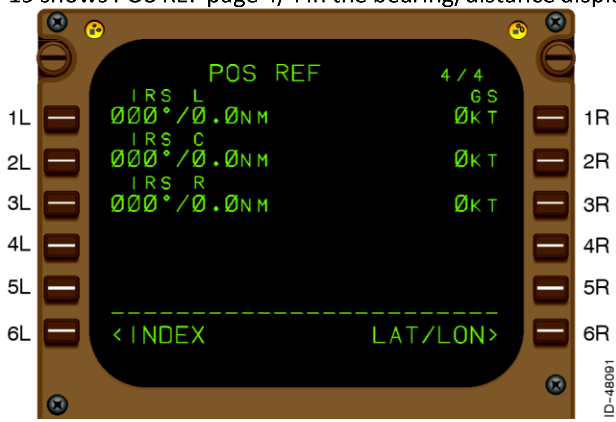
Access the POS REF page 4/4 by pushing the **[NEXT PAGE]** key from POS REF page 3/4 or the **[PREV PAGE]** key from POS INIT page 1/4.

Figure 4--18 shows POS REF page 4/4 in the latitude/longitude display format.



POS REF Page 4/4: LAT/LON Display Format
Figure 4--18

Figure 4--19 shows POS REF page 4/4 in the bearing/distance display format.



POS REF Page 4/4: BRG/DIST Display Format Figure 4--19

FLIGHT PLAN ROUTE ENTRY

When the POS INIT process is complete, pushing LSK **6R** (**ROUTE**) accesses the RTE pages. This lets the pilot select and activate the flight plan route in the FMC. The active route clears at engine shutdown after flight completion. The active route also deactivates with loss of electrical power. Figure 4--20 shows the first page of RTE 1.

NOTES: 1. Pushing the MCDU **[RTE]** key also accesses the RTE pages.

2. Two routes can be stored in the FMS, although only one can be active at any given time. LSK **6L** of the RTE pages lets the pilot select, view, and activate the other route.

Push LSK **6R** (**ROUTE**) on the POS INIT page, shown in Figure 4--14, to display the active route page, or the RTE 1 page, shown in Figure 4--20, when no route has been activated.

RTE 1 Page 1/2

Figure 4--20

D **ORIGIN (1L)** LSK**1L** is pushed to enter the origin airport using ICAO identifiers contained in the navigation database. Valid entries are accepted when box prompts are displayed. Entry clears any previous route and permits entry of departure or arrival procedures. Entry for the active route is inhibited in flight.

D **RUNWAY (2L)** Valid entries are runway numbers contained in the navigation database for the airport entered into the origin. The active runway can be entered using the scratchpad or the DEPARTURES page **[DEP ARR]**, outlined in Departure Selection later in this section. Upon sequencing the first waypoint, the RUNWAY data in this line is deleted.

NOTES:

1. If the RUNWAY entry is not compatible with the VIA entry, a scratchpad message is displayed (**RUNWAY N/A FOR SID**) and the runway entry is rejected (see Section 16, FMS--MCDU Messages).

2. A runway must be entered in order to anchor the beginning of the route to the first waypoint. Without the runway entry, there is no DIRECT leg to the first waypoint and the TAKEOFF REF page displays preflight as being incomplete.

D **REQUEST <SEND (3L)** Pushing LSK **3L** transmits a datalink request for a flight plan route uplink. During operation, flight crew can fill in the origin,

destination, runway, flight number, company route name, or route definition to qualify the request.

D **<PRINT(5L)** Pushing LSK **5L** initiates a transmission to the printer of the route data (RTE 1 or RTE 2) associated with that RTE page, regardless of the scratchpad content.

D **<RTE 2 (6L)** Pushing LSK **6L** displays RTE 2 page 1/X, which gives access to an inactive route for creating and modifying or for activating. Inactive route modifications do not change the active route. The prompt changes to RTE 1 when RTE 2 is displayed.

D **DEST (1R)** The destination airport is entered in line **1R** using ICAO identifiers contained in the navigation database. Entries can be made at any time. When a valid entry is made, any STAR, STAR transition, approach, or approach transition associated with a previous destination airport is deleted. If the active leg is part of the affected procedure, all legs of the procedure following the active leg are cleared. Entry in the DEST box prompts permits entry of arrival procedures.

D **FLT NO (2R)** Line**2R** displays the pilot-entered company flight number. The entry is optional for activation of the route. Up to 10 characters can be entered, either by the crew or by uplink.

D **CO ROUTE (3R)** If company routes are stored in the navigation database, an entire route can be constructed automatically. The company route identifier (no more than ten characters) is entered into the scratchpad and then LSK **3R** is pushed. The company route contains the origin, destination, departure, en route procedures, cost index, and cruise altitude.

Company routes can be entered any time the route is not active, or if the route is active and the aircraft is not airborne. Entry of a new company route clears an old company route and entersthe newone. If a company route is entered into a route that is either pending activation or modification, and no cruise altitude is defined, the company route specified cruise altitude is applied. Similarly, if a cost index is defined by the company route, the company route cost index is applied.

NOTES: 1. Entering a company route into the flight plan fills in the origin and destination airports.

2. If SIDs and STARs are not included in the company route, they must be entered manually.

D **ALTN> (5R)** Selecting LSK **5R** displays the ALTN (alternate airports) page. The ALTN page is described in Section 9, Alternate Page.

D **ACTIVATE> (6R)** The ACTIVATE prompt is pushed after the route has been entered and verified correct.

Entry of the origin and destination airports, the departure runway, and the flight number are done as follows and shown in Figure 4--21:

1. Enter the origin airport (**KORD**) in the scratchpad.
2. Push LSK **1L** to enter the origin airport.
3. Enter the destination airport (**EGLL**) in the scratchpad.
4. Push LSK **1R** to enter the destination airport.
5. Enter he departure runway (**32R**) in the scratchpad.
6. Push LSK **2L** to enter the departure runway.
7. Enter the flight number (**767PEG**) in the scratchpad.
8. Push LSK **2R** to enter the flight number.

RTE 1 Page 1/2 Origin, Destination, Runway Figure 4--21

9. Push the MCDU **[NEXT PAGE]** key to display RTE 1 page 2/2, shown in Figure 4--22, which displays the **VIA** and **TO** data entry fields.

RTE 1 Page 2/2 – VIA and TO Selection

Figure 4--22

VIA Route Segment

When entering airways, the beginning and ending waypoints determine if the entry is valid. The route segment must contain the waypoint entered in the **TO** position. The TO waypoint of the previous route segment must be the same as the beginning point of the current route segment or else a route discontinuity is created between the segments.

Entry of a SID or transition automatically enters the **VIA** and **TO** data for the route segments of the SID. A SID automatically links to the next route segment when the final SID waypoint is part of the route segment.

When no SID is used, entering an airway on the first line of page 2 initiates an airway intercept from the runway heading and: D Replaces the airway with dashes in the first line VIA

D Displays box prompts in the first line TO waypoint

D Moves the airway to line 2 after the TO waypoint is entered

D Enters the first fix on the airway nearest to being abeam of the departure heading in the airway line TO waypoint.

A route can contain segments formed by the intersection of two airways. Entering two intersecting airways in successive VIA lines without a TO waypoint causes the FMC to create an airway intersection waypoint for transition from one segment to the next. The FMC-created waypoint intersection (INTC) is automatically displayed in the first airway segment TO waypoint.

The **VIA** lines (**1L--5L**) display the procedure segments defining the route. Entries to a VIA line can contain the following:

- Valid entries are DIRECT or airways.
- Procedure names (SID, STAR, etc.) are automatically displayed when selected on the DEPARTURES or ARRIVALS page.
- Defaults to DIRECT if no entry is made and a valid entry is made in the corresponding TO line.
- Entering an airway that does not include the corresponding or previous TO waypoint is invalid.
- Entering an airway on the first VIA line initiates an airway intercept. Boxes are displayed under the first TO. Entering a waypoint in the boxes inserts dashes on the VIA line, and pushes the airway and waypoint down to the next line. The first fix on the leg of the airway closest to being abeam of the aircraft is then displayed on the first TO line.
- Dashes are displayed for the VIA line beyond the end of route.
- Airway identifiers can be downselected into the scratchpad, but selecting other VIA line displays cannot be downselected into the scratchpad.

VIA lines can be deleted, with the exception of those containing DIRECT and actions that affect the active leg while airborne.

Invalid VIA entries display the scratchpad message entry **INVALID ENTRY**. Invalid VIA entries are as follows:

- Airways and company routes that do not contain the TO waypoint of the previous line.
- Airways that do not intersect the previous airway.
- Airways or company routes that are not in the navigation database.

TO Waypoint

The **TO** lines (**1R--5R**) display the leg termination waypoints for the corresponding **VIA** lines.

Entries can be made only to TO lines that contain dashes, box prompts, or a previous leg termination, and must be consistent with the corresponding VIA field. The following entries are valid waypoint identifiers contained in the nav database or defined geographic points.

- Published waypoints, entered and displayed as LOACH, for example.
- Intersections (place bearing/place bearing), for example, entered as LAX249/FIM140, and displayed as LAXNN, where NN is FMC assigned.
- Place bearing/distance, for example, entered as OBK068/50, displayed as OBKNN, where NN is FMC assigned.
- VHF navaid, for example, entered and displayed as LON.
- Destination airport runway, for example, entered as 32R and displayed as RW32R.
- ICAO AIRPORT, for example, KORD, PHNL, EGLL.
- Latitude/Longitude, for example, entered as N5000.5 W02000.8 and displayed as N50W020. Entries require leading zeros. Trailing zeros are optional when latitude and longitude are whole degrees, for example, N60W040.
- Conditional waypoints associated with the procedure selected on the DEPARTURE or ARRIVAL pages.
- Boxes are displayed for route discontinuities (breaks in the route).
- Dashes are displayed for the first TO line beyond the end of the route.

The pilot can now enter the flight plan route by using the appropriate LSKs adjacent to the **VIA** and **TO** blank fields, along with the scratchpad. To fly direct to a waypoint, that waypoint is entered in the appropriate right LSK. DIRECT is displayed in the corresponding left data field. If part of the route follows a published airway, that specific airway is entered in the appropriate left LSK. The MCDU displays box prompts in the corresponding right data field. The pilot must then enter a TO waypoint for the airway.

NOTE: If the airway has more than one waypoint, only the final waypoint of the leg is entered. The nav database has in memory all waypoints along an airway that are displayed on the RTE LEGS pages.

If a waypoint or an airway is not in the navigation database, the message **NOT IN DATA BASE** is displayed in the scratchpad. If the airway is found in the navigation database but thepreceding orfollowing TO fix does not lie on the airway, an **INVALID ENTRY** message is displayed.

NOTE: Any non-navigation database waypoint entered in the formats outlined in Section 11, Advanced Flight Planning, Pilot--Defined Waypoints, are also permitted.

Flight Plan Route 1 Entry

The flight plan route as filed from KORD to EGLL, shown in Figure 3--1, is to be entered on the Route 1 pages. Figures 4--23, 4--24, 4--25, 4--26, and 4--27 show the route entry.

1. Type **OBK** into the scratchpad.
2. Push LSK **1R** to enter **OBK** into 1R.
3. Type **J94** into the scratchpad.
4. Push LSK **2L** to enter **J94** into 2L.
5. Type **J546** into the scratchpad, as shown in Figure 4--23.

RTE 1 ROUTE ENTRY
Figure 4--23

6. Push LSK **3L** to enter **J546** into 3L, as shown in Figure 4--24.

RTE 1 Route Entry Page 2/2
Figure 4--24

7. Type **YQB** into the scratchpad.
8. Push LSK **3R** to enter **YQB** into 3R.
9. Type **J560** into the scratchpad.
10. Push LSK **4L** to enter **J560** into 4L.
11. Type **YZV** into the scratchpad.
12. Push LSK **4R** to enter **YZV** into 4R.
13. Type **YYR** into the scratchpad.
14. Push LSK **5R** to enter **YYR** into 5R, shown in Figure 4--25. This entry creates another route page, 2/3.

RTE 1 Completed Page 2/3 Figure 4--25

15.Push the MCDU **[NEXT PAGE]** key to display the next page.

16.Type **LOACH** into the scratchpad.

17.Push LSK **1R** to enter **LOACH** into 1R.

18.Type **N58W050** into the scratchpad.

19.Push LSK **2R** to enter **N58W050** into 2R.

20.Type **N6000.0W04000.0** into the scratchpad.

21.Push LSK **3R** to enter **N60W040** into 3R.

22.Type **N61W030** into the scratchpad.

23.Push LSK **4R** to enter **N61W030** into 4R.

24.Type **N60W020** into the scratchpad.

25.Push LSK **5R** to enter **N60W020** into 5R, shown in Figure 4--26. This entry creates another route page, 3/4.

RTE 1 Route Entry Page 3/4
Figure 4--26

Figure 4--27 shows the completed route entry for the remaining waypoints in the flight plan. The remaining waypoints and airwayentries use the same basic steps as those used in the previous entries.

RTE 1 Route Entry Completed
Figure 4--27

Duplicate Waypoints

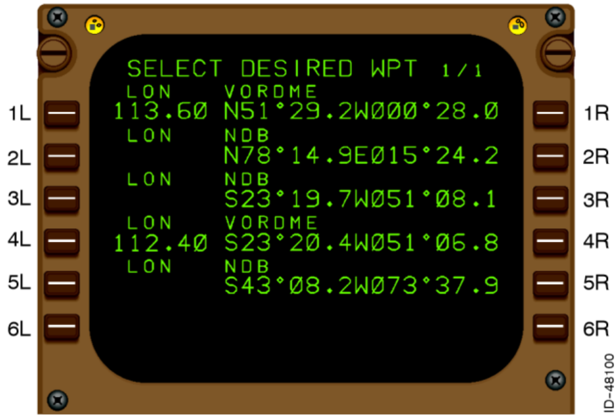
CAUTION

BEFORE MAKING FLIGHT PLAN SELECTIONS, TAKE EXTREME CARE TO COMPARE THE LAT/LON TAKEN FROM THE ELECTRONIC DATABASE AGAINST THE LAT/LON FROM THE NAVIGATION CHART, AND TO CHECK THAT THE PROPOSED ROUTING DISPLAYED ON THE ND APPEARS REASONABLE. ON AN APPROACH, THIS MAY NOT BE PRACTICAL. THEREFORE, THE PILOT SHOULD REVIEW THE NAVAID LAT/LON AND FREQUENCY AND COMPARE THIS DATA AGAINST THE CHART AND DESIRED ROUTE OF FLIGHT TO ENSURE PROPER WAYPOINT SELECTION.

If a non-unique identifier is entered through the MCDU, **LON** in this scenario, the **SELECT DESIREDWPT** page is automatically displayed for pilot review and waypoint selection, as shown in Figure 4--28. This is one page only, with two to six identifiers of duplicate waypoints.

The navigation database searches for navaids, waypoints, and airports in alphabetical order. Any found beyond the first six are not displayed. Information included on the SELECT DESIRED WPT page is the waypoint identifier, the frequency (if the waypoint is a navaid), and the waypoint

LAT/LON. The desired waypoint is selected by pushing the left LSK which inserts the point into the route and returns the MCDU to the previously displayed page.



SELECT DESIRED WPT Page

Figure 4--28

DEPARTURE SELECTION

The departure and arrival pages can be accessed by pushing the MCDU **[DEP ARR]** key. The departure and arrival index page is used to select the departure or arrival page for the origin and destination airports for each route. The index also gives access to departure or arrival information for any other airport in the nav database.

The following rules apply in determining which page is displayed when pushing the **[DEP ARR]** key:

D If there is no active route, or the display shows an inactive RTE or inactive LEGS page, the DEP/ARR INDEX is displayed.

D If the inactive route is displayed on the MCDU RTE, RTE LEGS, RTE HOLD, DEPARTURES, or ARRIVALS pages before the **[DEP ARR]** key is pushed, the DEP/ARR INDEX is displayed.

D If a pending activation exists but no origin airport has been defined, the ARRIVALS pages for the destination for that route are displayed. If no destination has been defined, the DEP/ARR INDEX is displayed.

D If no origin has been defined on the active route and no provisional or pending activations exist, the ARRIVALS pages for the destination are displayed. If no destination has been defined, the DEP/ARR INDEX is displayed.

D If the aircraft is on the ground and there is an active route, the DEPARTURES pages for the origin are displayed. If the aircraft is airborne with no destination defined, the ARRIVALS for the origin pages are displayed.

D If there is an active route and the aircraft present position is invalid, or the aircraft is greater than 50 NM from the origin, or the aircraft is more than halfway along the route, the ARRIVALS pages for the destination are displayed.

The DEP/ARR INDEX, shown in Figure 4--30, gives the pilot access to departures and arrivals for the originating and destination airports of both flight planned routes (presuming two routes have been defined). In this scenario, only RTE 1 has been defined.

In this scenario, an inactive route exists, with a defined origin, and the aircraft is on the ground. The DEP/ARR INDEX page is accessed and displayed as follows:

1. The MCDU **[DEP ARR]** key is pushed to display the DEPARTURES page for the origin, shown in Figure 4--29.

KORD DEPARTURES Page Figure 4--29

2. LSK **6L** (**INDEX**) (shown in Figure 4--29) is pushed on the DEPARTURES page to display the DEP/ARR INDEX page, shown in Figure 4--30.

DEP/ARR INDEX Page Figure 4--30

RTE 1 and **RTE2**, both in SMALL font, are displayed as labels above the first and third data fields. The originating airports are displayed in the center of the first and third lines (presuming two routes have been defined). The destination airports are displayed in the center of the second and fourth lines (presuming two routes have been defined). In this scenario, only RTE 1 has been defined and is still inactive.

NOTES:

1. If a route has been activated, **(ACT)**, in SMALL font, is displayed next to the RTE 1 or RTE 2 line.
2. If RTE 1 and/or RTE 2 have not been defined, the data fields below the respective labels are blank.

The **<DEP** prompt is displayed in line **1L** and/or **3L**, giving access to SIDs and runways of the defined departure airport(s). **ARR>** prompts are displayed for the departure and arrival airports of both routes in lines **1R** and **2R** and/or lines **3R** and **4R**.

The DEP/ARR INDEX also lets the pilot access departure and arrival information of airports not defined in one of the two routes. The label **OTHER**, in LARGE font, is displayed in the center of the sixth line. The pilot can review departures of an airport not defined in **RTE 1** or **RTE 2** by entering its identifier using the scratchpad and pushing LSK **6L**. The arrivals for an airport can be reviewed by entering its identifier, using the scratchpad and pressing LSK **6R**. Entries must be four-character ICAO identifiers and present in the navigation database for departures or arrivals to be displayed.

SID and Departure Runway Entry

To enter a departure runway and SID, if the appropriate DEPARTURES page is not already displayed after pushing the **[DEPARR]** key, then push the correct LSK (**1L** in this case, as shown in Figure 4--30). KORD DEPARTURES is displayed, as shown in Figure 4--31. The left data fields display the available SIDs and the right data fields display the available departure runways.

In this scenario, an inactive route exists with a defined origin and the aircraft is on the ground.

Push the MCDU **[DEP ARR]** key to display the DEPARTURES page for the origin, as shown in Figure 4--31.

KORD DEPARTURES Page – Entering a SID
Figure 4--31

NOTE: If a runway was defined through the RTE pages, the **<SEL>** (or **<ACT>** if the route has been activated) label is displayed next to that runway, as shown in Figure 4--32.

Access Page **3/3** by pushing the MCDU **[NEXTPAGE]** or **[PREVPAGE]** key.

Defined Departure Runway Figure 4--32

To enter a SID, the following steps must still be performed.

1. The appropriate runway is selected by pushing the correspondingLSK. In this scenario, LSK **3R** (**32R**) is pushed on KORD DEPARTURES page 3/3.

   NOTE: Selecting a departure runway before selecting a SID results in the display of only the SIDs applicable to the selected runway. For airports with numerous SIDs, selecting the runway first can reduce effort in locating a particular SID on the DEPARTURES pages.

2. As shown in Figure 4--33, the selected runway, with the label**<SEL>**, moves to line **1R** (and is displayed on RTE 1, page 1) and all other runways are removed from the display. The left data fields display only those SIDs compatible with the selected runway.

   NOTE: If no SIDs are available for the selected runway, the label **NONE** is displayed in **1L**.

Departure Runway Selection Figure 4--33

3. To select a SID, the appropriate LSK is pushed. In this KORD toEGLL flight plan scenario, there are no SIDs.

   Figure 4--33 shows the KORD DEPARTURES page after all the correct selections have been completed for the flight departure from KORD.

ROUTE DISCONTINUITY

A ROUTE DISCONTINUITY is created whenever there is no defined path between successive waypoints in a flight plan. Discontinuities can be created by waypoint deletion, line selection, or procedure stringing. Figure 4--34 shows a discontinuity on the the RTE LEGS page.

Push the MCDU **[LEGS]** key to access the ACT RTE LEGS pages. This example shows the route discontinuity labeling.

ROUTE DISCONTINUITY on RTE LEGS Pages

Figure 4--34

The FMS does not automatically bridge discontinuities by inserting route legs into the flight plan. Insertion of legs is a direct result of pilot action. Whenever LNAV is engaged and the aircraft enters a route discontinuity, the message **DISCONTINUITY** is displayed in the MCDU scratchpad and the aircraft maintains its existing track.

NOTE: Many route modifications result in a **ROUTE DISCONTINUITY** after activation. The pilot should always check for this situation and correct it when necessary.

Discontinuities can normally be cleared by entering the next waypoint after the **ROUTE DISCONTINUITY** into the scratchpad by line selecting the appropriate LSK. The pilot then pushes the LSK next to the discontinuity box prompts and then the MCDU **[EXEC]** key to clear the ROUTE DISCONTINUITY. Figures 4--35, 4--36 and 4--37 show this process on the RTE LEGS pages.

1. Push LSK **3L** (YZV) to enter waypoint YZV into the scratchpad, as shown in Figure 4--35.

Entering Next Waypoint Into Scratchpad to Clear a ROUTE DISCONTINUITY Figure 4--35

2. Push LSK **2L** to clear the route discontinuity and make waypoint **YZV** the next waypoint in the route, as shown in Figure 4--36.

ROUTE DISCONTINUITY Cleared and Route Pages Show Modified With Next Waypoint Figure 4--36

3. Push the MCDU **[EXEC]** key to activate the modified route and clear the route discontinuity, as shown in Figure 4--37.

ROUTE DISCONTINUITY Cleared and Modified Route Activated Figure 4--37

FLIGHT PLAN ROUTE ACTIVATION

The route is activated by following these steps:

1. Pushing LSK **6R** (**ROUTE**) on the KORD DEPARTURES page (Figure 4--33) accesses the RTE 1 page (shown in Figure 4--38) where the flight plan route can be activated.

RTE 1 Route Entry Completed

Figure 4--38

D **RTE 1** or **RTE 2 (6L)** If there is no pending activation, the alternate route prompt is displayed (**RTE 1** or **RTE 2**), giving the pilot access to that route.

If the route is pending activation or a modification is in progress (**MOD** is displayed in the title), then **ERASE** is displayed in **6L**. Selecting **ERASE** deletes any lateral or vertical route modifications or pending activations.

D **ACTIVATE> (6R)** The ACTIVATE prompt must be pushed once the route has been entered and verified correct. After ACTIVATE is pushed, the execute annunciator illuminates and **ERASE** is displayed in line **6L**. Pushing the **[EXEC]** key activates the flight plan and changes the page title to ACT RTE N (where N is 1 or 2). Figures 4--39 and 4--40 show the route activation. LNAV is available as soon as the route is activated.

2. Pushing LSK **6R** (**ACTIVATE**) on the RTE 1 page, shown in Figure 4--38, programs the route in the FMS.

   When the route has been activated, **PERF INIT>** is displayed in **6R** (shown in Figure 4--39), giving access to the PERF INIT page while on the ground and when performance initialization is incomplete. **TAKEOFF>** is displayed when on the ground, on the active pages, when performance initialization is complete.

RTE 1 Route ACTIVATE

Figure 4--39

3. Pushing the MCDU **[EXEC]** key activates the flight plan route and changes the page title to ACT RTE 1, shown in Figure 4--40.

ACTIVE RTE 1 Figure 4--40

4. Pushing **RTE COPY> (4R)** copies the entire active route (RTE 1) into the inactive route (RTE 2).The **RTE COPY** prompt is displayed only on the active route page. When copying is done, line 4R shows RTE copy complete, shown in Figure 4--41.

RTE COPY COMPLETE

Figure 4--41

PERFORMANCE INITIALIZATION

Once the flight plan has been activated and executed, the **PERF INIT** prompt is displayed in line **6R** of the RTE pages. Pushing this key gives the pilot access to the PERF INIT (performance initialization) page. This page is used to initialize the FMC performance calculations. The pilot can enter such performance items as weights, fuel, cost index, cruise altitude, and cruise winds. Gross weight, zero fuel weight (ZFW), cost index, and cruise altitude are required entries for FMS performance calculations and vertical guidance modes, so box prompts are displayed in their data fields. Any entered values clear with loss of electrical power or at engine shutdown after flight. Figure 4--42 shows the PERF INIT page.

NOTE: The PERF INIT page can also be accessed by pushing the **PERF** prompt in line **3L** of the INIT/REF INDEX, shown in Figure 4--7. Also, pushing the MCDU **[INIT REF]** key on the ground after the aircraft position has been initialized displays the PERF INIT page.

Pushing LSK **6R** (**PERF INIT**) on the RTE page (shown in Figure 4--40) displays the PERF INIT page, shown in Figure 4--42.

PERF INIT Page

Figure 4--42

D **GR WT (1L)** Gross weight displays the FMS-computed or pilot-entered gross weight in thousands of pounds (or thousands of kilograms when the kilogram option code is selected).

Line **1L** automatically displays the calculated weight when zero fuel weight (ZFW) (line **3L**) is entered first. If fuel weight (line **2L**) is valid but ZFW has not been entered, box promptsare displayed.If thefuel weight is not valid (**2L** displays blanks or box prompts), then line **1L** displays blanks.

The gross weight is always the sum of the ZFW (**3L**) and the fuel weight (**2L**). If the fuel quantity indicating system is inoperative, the gross weight field is blank until a manual fuel entry is made.

Valid entries for gross weight are three-digit values, followed by an optional decimal point and tenths digit. A pilot-entered value is verified using the performance database to determine if the entry is reasonable for the airframe configuration.

NOTES: 1. Entries not in valid format or not within gross weight range in the performance database or that would result in a ZFW less than the minimum ZFW value from the performance database result in the **INVALID ENTRY** scratchpad message.

2. Entry of a gross weight results in calculation and display of zero fuel weight and vice versa.

3. Entering gross weight, fuel weight, or zero fuel weight or deleting gross weight or fuel weight invalidates

VSPEEDS, center of gravity, and performance predictions.

D **FUEL (2L)** This line normally displays the FMC calculated (CALC) fuel quantity. Before engine start, the FMC calculated fuel quantity is set equal to the aircraft fuel totalizer system value. If at any time after engine start the fuel flow values become invalid for longer than two minutes, the calculated value is invalid; the fuel totalizer system value is used for FMC computations and is displayed as a SENSED value.

Pilot--entry is allowed whenever CALC value is displayed. Pilot--entry results in the entered fuel value being displayed as a MANUAL value. MANUAL entry of a fuel quantity value causes the FMC to ignore the fuel totalizer system input until the flight is completed.

NOTES: 1. Only manual entries can be deleted.

2. Box prompts indicate the aircraft sensing is not possible and crew entry is required.

Figure 4--42 shows the fuel total (**100.0LB CALC**) for the flight from KORD to EGLL. The fuel quantity is displayed in thousands of pounds.

D **ZFW (3L)** Zero Fuel Weight (displayed in thousands of pounds or kilograms depending on the option selected) displays box prompts until the pilot enters a value or until the FMS computes a value from gross weight and fuel weight.

NOTE: Enter gross weight or zero fuel weight, but not both. Either entry enables the FMS to calculate the other and display the result in the applicable data field.

D **RESERVES (4L)** The fuel reserves (RESERVES) weight is displayed in thousands of pounds (or thousands of kilograms when the kilograms option is selected). The reserves weight is used in determining an insufficient fuel condition and in calculating performance predictions.

Valid reserve entries are one- to three-digit weights that may optionally be followed by tenths or hundredths (if the entry is less than 100). The allowable entry range is determined by the performance database and entries violating this range result in the **INVALID ENTRY** message.

NOTE: Entry is required to complete the preflight.

D **REQUEST <SEND (5L)** This LSK is pushed to transmit a datalink request for performance data uplink. The crew can operationally fill in ZFW, CG, cruise altitude, reserves, or cost index to qualify request. See Section 13, Company Datalink, for additional information.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page (shown in Figure 4--7).

D **CRZ ALT (1R)** Valid entries for the desired cruise altitude (CRZ ALT) while on the ground are standard altitude entries **above** the current aircraft altitude. While airborne, standard altitude entries may be entered into box prompts, but are not allowed over existing cruise altitudes. An altitude entry greater thanthe maximumcertified altitude is rejected and **INVALID ENTRY** is displayed in the scratchpad.

Entry is propagated to or from the Climb or Cruise pages and may be changed by an approach procedure entry or by transitioning into the missed approach. The CRZ ALT display is cleared at flight completion.

D **COST INDEX (2R)** The Cost Index line is used in computations of economy (ECON) speed values. The cost index is determined by dividing aircraft operating cost ($/hour) by fuel cost (cents/pound). Only those portions of operating costs affected by trip time should be included in the calculation. A cost index of zero causes a minimum trip fuel operation, including cruise at maximum range cruise and a slow speed descent. Higher cost index entries result in higher climb, cruise, and descent speeds, which increase trip fuel costs but decrease trip time costs.

Valid entries for cost index are one- to four-digit values ranging from 0 to 9999. Attempted entries within 10 miles of the top-of-descent point result in the **INVALID ENTRY** message. On a valid entry of cost index, the performance predictions on the ACT RTE LEGS page are cleared and recomputed.

Company routes can enter the cost index automatically. The values used are determined by the operator. See Section 16, Additional Information, for more detailed information on the cost index.

D **CRZ CG (4R)** The cruise center of gravity (**CRZ CG**) displays a default value or pilot-entered cruise CG value. The CRZ CG is used by the FMC to calculate MAX ALTITUDE and maneuver margin to buffet. The valid entry range is within and includes the CGMIN and CGMAX values specified in the performance database (PDB).

The CRZ CG permits a pilot-enterable cruise CG to more accurately reflect the current CG of the aircraft. A crew entered or uplinked value is displayed in LARGE font.

D **STEP SIZE (5R)** The altitude step size displays the climb increment used for planning optimum step climb profile. The default value is the ICAO step size. The pilot can choose a different step size by entering the step size (in feet) as a four-digit multiple of 1000 feet, up to a maximum of 9000 feet. The pilot-entered value can be deleted, in which case the step size returns to the default ICAO.

NOTE: If no step climbs are made, it is important to enter zero (0) for the step size so that the performance calculations compute the most fuel efficient solution and make accurate fuel predictions. Otherwise, the performance calculations presume the computed optimum steps are made, possibly resulting in nonconservative predictionsof fuel at destination.

D **TAKEOFF REF> or THRUST LIM> (6R)** Gives access to the TAKEOFF REF page or the THRUST LIM (thrust limit) page.

The TAKEOFF REF prompt is displayed if the THRUST LIM page option is not enabled; otherwise, THRUST LIM is displayed.

Figure 4--43 shows a completed PERF INIT page for the flight using the data from Section 3, Flight Operations and Flight Data, Table 3--1.

On the PERF INIT page, the flight data is entered into the scratchpad and the appropriate LSKs are pushed.

260.0	LSK **3L**	ZFW
12.0	LSK **4L**	RESERVES
350	LSK **1R**	CRZ ALT
80	LSK **2R**	COST INDEX

Completed PERF INIT Page Figure 4--43

THRUST LIMIT DATA

The Thrust Limit (**THRUST LIM**) page provides a way to select thrust limit modes manually, enter selected temperature for the assumed temperature derate function, and display the thrust limit of the selected mode. The thrust limits are displayed on the THRUST LIM page, shown in Figure 4--44.

THRUST LIM Page
Figure 4--44

The THRUST LIM page can be accessed by pushing the **THRUST LIM** prompt at any of the following:

D LSK **4L** on the INIT/REF INDEX page (Figure 4--7) D LSK **6R**

on the PERF INIT page (Figure 4--43)

D LSK **6R** on the TAKEOFF REF page (Figure 4--49)

D LSK **6R** on the APPROACH REF page (Figure 8--2)

D The MCDU INIT/REF mode key while airborne and in CLIMB mode, and the THRUST LIM page option is enabled.

In this example, LSK **6R** on the PERF INIT page is pushed.

In the data fields, the **<SEL>** annunciator is always displayed for the current thrust limit mode as displayed on the EICAS, **except during reverse thrust**

operation. The **<ARM>** annunciator is always displayed for the appropriate climb thrust limit mode when a takeoff thrust limit is **<SEL>**.

The following steps are the preflight selections for the takeoff and climb out of KORD for the flight scenario to EGLL.

1. Push LSK **2L**.
2. Type **95F** into the scratchpad.
3. Push LSK **1L**.

THRUST LIM Page Derate

Figure 4--45

The pilot-entered assumed temperature **SEL** is displayed at **SEL (1L)**. This entry is for the thrust limit derate. Valid entries are 0 to 99 degrees Celsius (C) or 32 to 210 degrees Fahrenheit (F). Assumed temperature entry is inhibited after takeoff is initiated by the TOGA switch.

NOTE: The OAT (**1C**) default display is in Centigrade. If the assumed temperature is entered on **1L** in Fahrenheit, OAT also reflects Fahrenheit.

Entry of a value in **1L** after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**.

NOTES: 1. Entry is permitted into **1L** when the aircraft is on the ground and dash prompts or LARGE font temperature data is displayed, and no takeoff data uplink message is pending.

2. A valid entry invalidates LARGE font takeoff speeds, limited TOGW, and reference OAT values.

3. Attempted entry when neither dash prompts or LARGE font temperature data is displayed, or after 65 knots CAS, or after autothrottle engagement, or while a takeoff data uplink message is pending, is non-operational.

4. The assumed temperature method also reduces **TO 1** and **TO 2** when they are the selected takeoff thrust limits.

5. Invalid range or format entries result in display of the **INVALID ENTRY** scratchpad message.

6. Attempted deletion while dashes are displayed or while a takeoff data uplink message is pending results in display of the the **INVALID DELETE** scratchpad message.

Figure 4--46 shows how to set the manual thrust.

1. Type **108.1** into the scratchpad.

THRUST LIM Page – Manual Thrust

Figure 4--46

2. Push LSK **5L** to enter the manual thrust value in lines **5L** and **1R**, as shown in Figure 4--47.

THRUST LIM Page – Manual Thrust

Figure 4--47

The following paragraphs explain the remaining fields on the THRUST LIM display.

- **<TO (2L)** Line**2L** is the default thrust limit mode, which is the normal takeoff thrust limit.

- **<TO 1 (3L)** Derated takeoff thrust limits can be selected, if enabled, by choosing TO 1 derate percentage. Selecting a derate in **3L** clears an entered temperature in **1L**.

- **<TO 2 (4L)** Derated takeoff thrust limits can be selected, if enabled, by choosing **TO 2** derate percentage. Selecting a derate in **4L** clears an entered temperature in **1L**.

  NOTE: Takeoff percentage derates are optional and may not be enabled; if they are not enabled, **3L** or **4L** are blank. Takeoff datalink automatically selects a thrust derate.

- **MAN THR (5L)** Selecting this line is non-operational. Data display defaults to five dashes when no selected manual thrust has been entered. A manual N1 entry is displayed in the XXX.X format when PDB indicates an N1 type aircraft; and EPR entry is displayed in the X.XXX format when PDB indicates an EPR type aircraft. Valid entries are:

  N1: 0 -- 199.9%

  EPR: 0 -- 1.999

- **<INDEX (6L)** -- Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **OAT (1C)** The outside air temperature (OAT) is displayed in line **1C** in either _C or _F, as appropriate. The OAT default display is in Centigrade. If the assumed temperature is entered on **1L** in Fahrenheit, OAT also reflects Fahrenheit.

NOTE: Header and data line are blank when OAT is invalid or when not in takeoff thrust mode.

D **TO N1 or TO EPR (1R)** Figures 4--45, 4--46, and 4--47 show the field **D--TO N1**, **TO N1**, and **MAN N1**. This field displays **N1** when the performance database (PDB) indicates an N1 aircraft, or **EPR** when the PDB indicates an EPR aircraft. Figure 4--45 shows the N1 mode field, as well as the use of an assumed temperature derate, which shows the mode prefixed by **D**.

NOTE: Selection of field **1R** is non-operational regardless of the scratchpad content.

Thrust limit modes are shown in Table 4--1 as they are displayed.

Mode	Header Display
Takeoff	TO
Takeoff 1	TO 1
Takeoff 2	TO 2
Go Around	GA
Continuous	CON
Cruise	CRZ
Climb	CLB
Climb 1	CLB 1
Climb 2	CLB2

Thrust Limit Modes
Table 4--1

D **CLB> (2R)** Line**2R** selects a full rated climb thrust limit. This selection clears any existing entry in **5L**, **MAN THR**. **<ARM>** is displayed adjacent to the armed climb thrust limit mode. When the thrust limit mode is active, **<SEL>** is displayed.

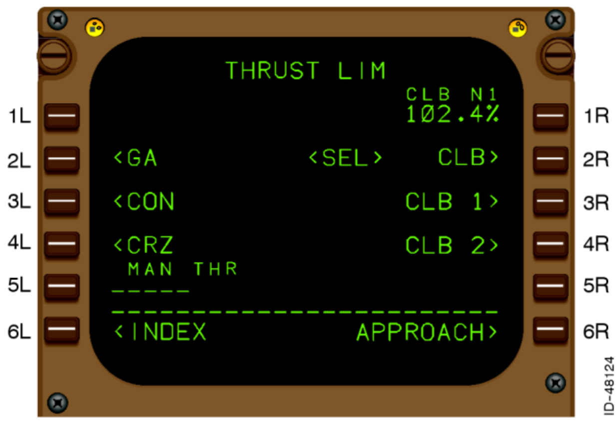
D **CLB 1> (3R)** Climb thrust derates are selected by choosing the **CLB1>** prompt. Before transitioning into climb, **<ARM>** is displayed adjacent to the armed climb thrust limit mode. When the thrust limit mode is active, **<SEL>** is displayed.

D **CLB 2> (4R)** Climb thrust derates are selected by choosing the **CLB2>** prompt. Before transitioning into climb, **<ARM>** is displayed adjacent to the armed climb thrust limit mode. When the thrust limit mode is active, **<SEL>** is displayed.

D **TAKEOFF> (6R)** The TAKEOFF prompt selects the TAKEOFF REF page 1/2 when in takeoff thrust limit mode. This is the next page to be completed during the preflight.

THRUST LIM Page Airborne

When the aircraft is airborne, the THRUST LIM page displays the information as shown in Figure 4--48. This page is automatically displayed on thrust reduction from the takeoff mode.



THRUST LIM Page Airborne
Figure 4--48

D **<GA (2L)** A go-around (**GA**) thrust limit is automatically selected during final approach, on flap extension.

D **<CON (3L)** This continuous thrust (CON) prompt is used to select maximum continuous thrust limit.

D **<CRZ (4L)** Cruise thrust limit is selected by pushing the cruise (CRZ) LSK. If it is designated on the AIRLINE POLICY page, CRZ is automatically

selected (SEL) after the FMC mode transition at top-of-climb if VNAV is engaged.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **APPROACH (6R)** The APPROACH prompt selects the APPROACH REF page when takeoff thrust limit mode is not active and the aircraft is airborne.

TAKEOFF DATA ENTRY

After completing the data entry and selecting all the information on the THRUST LIM page, the TAKEOFF REF page is accessed by pushing LSK **6R** on the THRUST LIM page. The TAKEOFF REF page displays uplinked, manually entered, and FMC calculated takeoff data, takeoff thrust, takeoff speeds, and preflight FMC initialization status.

NOTE: The TAKEOFF REF page 1/2 can also be accessed by pushing the **<TAKEOFF** prompt at LSK **5L** of the INIT/REF INDEX page, shown in Figure 4--7, and at LSK **4L** of the FMC COMM page, shown in Figure 12--2.

The takeoff reference page permits the crew to manage takeoff performance. Takeoff flap setting and V_{SPEEDS} are entered and verified. Thrust limits, takeoff position, and takeoff gross weight can be verified or changed. Preflight completion status is annunciated until complete.

When the Takeoff Datalink page is enabled, refer to Section 12, Company Datalink, TAKEOFF REF Page 1/2, for additional information.

The TAKEOFF REF page can be accessed by pushing LSK **6R** (**TAKEOFF**) on the THRUST LIM page, shown in Figure 4--47, to display the TAKEOFF REF page 1/2, shown in Figure 4--49.

TAKEOFF REF Page 1/2
Figure 4--49

D **FLAPS (1L)** Line**1L** displays the takeoff flap setting box prompts. Valid entries for flap setting are 5, 15, and 20 (from the PDB). Crew entry or datalink entry is valid.

Flap position is required for takeoff V_{SPEED} calculations.

Manually entered or accepted uplink values are displayed in LARGE font. Pending uplink values are displayed in SMALL font. Accepting the uplink (by pushing **LSK 5R** ACCEPT) results in LARGE font display of the uplinked value. Rejecting the uplink (by pushing **LSK 5L** REJECT) returns the display to pre-uplink status.

Entering a value after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**.

Attempting to delete when box prompts are displayed results in the display of the **INVALID DELETE** scratchpad message.

D **THRUST (2L)** Line**2L** displays the crew-entered or uplinked assumed temperature for takeoff thrust derate calculations and thrust mode. Valid entries are 0 to 99 degrees C or 32 to 210 degrees F.

Entry is permitted while the aircraft is on the ground, no takeoff uplink message is pending, and either dash prompts or an active assumed temperature are displayed. Entry and deletion is non-operational when a takeoff data uplink is pending, blanks are displayed, or the aircraft is above 65 kts.

A valid temperature entry or deletion invalidates LARGE font takeoff speeds, limited takeoff gross weight, and reference OAT. Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**.

D **CG TRIM (3L)** Center of gravity (CG) and stabilizer trim (**TRIM**) data are shown in line **3L**. Center of gravity values are blanked when airborne. Valid entry is one to two characters and falls within PDB limits.

After center of gravity is entered, the FMC calculates and displays the stabilizer trim takeoff setting to the right of the CG entry.

Entries are cleared at flight completion.

D **RWY/POS (4L)** Line**4L** displays the runway identifier and pilot-entered offset distance of the takeoff brake release point from the runway threshold, or an intersection identifier where the autothrottle will be engaged for takeoff. The runway number automatically transfers from the RTE page.

If GPS navigation is not enabled, the FMC updates its position to the takeoff runway when the autothrottle is engaged for takeoff. If a position shift distance is entered, the FMC updates to a position displaced from the threshold by the entered distance.
Valid position shift entries (the distance of the aircraft past the runway threshold) in feet are from 0--99 and followed by two zeros and preceded by a slash. For metric entries, the range is 0--30. Position distance entries can be preceded by an optional -- or + sign. When a runway number is displayed in this field, it is followed by either 00FT or 00M, determined by the runway metric option.

The optional pilot-entered offset from the threshold updates the aircraft position when the TO/GA button is pushed. Valid pilot entries are in + or hundreds of feet or meters (+300 is 300 feet/meters beyond the normal takeoff position).

Valid intersection entries can be up to three alphanumeric characters, preceded by a slash.

A position shift can be entered to be used for a position update at takeoff. The position update function uses exact latitude/longitude position for the runway threshold, as stored in the navigation database.

Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**.

NOTES: 1. The runway threshold LAT/LON for all runways in the nav database, both for takeoff and landing, is the **runway displaced threshold** LAT/LON position.

2. Entry and deletion is non-operational when a takeoff data uplink is pending.
3. The RWY/POS header is blanked if there is no active route.
4. The data line is blank if no active origin airport exists or the aircraft is airborne and no valid runway or runway position data exists.
5. The runway intersection is displayed in SMALL font with a LARGE font slash if a pending takeoff uplink exists and both of the following conditions are true:
   - No runway contains a matching runway intersection, and
   - The runway record being used as pending data contains a runway intersection that does not match the pilot entered or previously accepted runway intersection.
6. The pending uplink position shift value is displayed in SMALL font with a LARGE font slash and either a plus or minus sign to represent a positive or negative position shift, respectively, if a pending takeoff uplink exists and both of the following conditions are true:
   - No runway contains a matching runway intersection, and
   - The runway record being used as pending data contains a position shift, but no runway intersection.
7. A slash followed by dashes is displayed if no takeoff data uplink is pending, an active origin airport exists, no valid departure runway exists, and no pilot entered data exists.

D **REQUEST <SEND (5L)** Pushing the SEND prompt key transmits a datalink request for takeoff data uplink. Flight crew entered data is included with the request. See Section 12, Company Datalink, for additional information.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **V1, VR, V2 (1R, 2R, 3R)** The VSPEEDS are displayed in the respective data lines. The speeds can be overwritten by the pilot. The displays are dashes until valid gross weight, ZFW, OAT, and runway identifier are received, along with flap entry and thrust selection.

The FMC calculates and displays for selection a recommended set of V_{SPEEDS} based on gross weight, runway condition, derates, altitude, temperature, and other performance factors. **REF** is displayed in the header line for each speed when the value displayed is not pilot entered or prompt selected. Valid entries are three-digit numbers ranging from 100 to 300 and they can be entered over the existing values. If the pilot enters a speed that is less than the minimum value permitted for that speed, the minimum speed is displayed in the data line and the header for that line displays **MIN** in SMALL font to indicate that this is the minimum value.

Any change of performance information results in replacement of existing speeds by the FMC calculated speeds in SMALL font, removal of all V_{SPEEDS} from the PFD, and display of the PFD speed tape message **NO V SPD**.

If performance or takeoff data is changed after takeoff speeds are selected, the speeds are deleted, dashes are displayed, and the scratchpad message **TAKEOFF SPEEDS DELETED** is displayed.

D **TOGW (4R)** The takeoff gross weight (**TOGW**) of the aircraft is entered at LSK **4R**. An entry or uplink results in a new V_{SPEED} calculation.

Valid entry is any weight within the permitted aircraft takeoff gross weight range from the PDB and is displayed in LARGE font . Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**. Entries are in thousands of pounds or thousands of kilograms, based on the option code selected.

If a takeoff data uplink is pending ACCEPT/REJECT and no valid data exists, the data line is blank. Pending uplinked values are displayed in SMALL font. If a valid TOGW does not exist when the aircraft is airborne, then the line is blank.

Entering and deleting are non-operational when a takeoff datauplink is pending ACCEPT/REJECT. Deleting LARGE font values is permitted and returns the data display to dashes. Attempting to delete a SMALL font value or dashes results in display of the **INVALID DELETE** scratchpad message.

D **GR WT (4C)** Line**4C** displays the aircraft gross weight from the PERF INIT page. The **GR WT** header is also displayed when an uplinked zero fuel weight is pending; otherwise the header is blank.

D **REF SPDS (5R)** LSK**5R** enables or disables display of the FMC calculated reference (V) speeds in the center column to the left of the V_{SPEED} lines, as shown in Figure 4--52.

Pushing the LSK toggles between **ON** and **OFF**. When toggled **ON**, the FMC computed takeoff speeds are displayed (in the center column) for comparison with the V_{SPEEDS} in the right column. Toggled **OFF** removes the speeds from the center column.

The active state, ON or OFF, is displayed in LARGE font and the inactive state is displayed in SMALL font.

D **THRUST LIM> (6R)** Selects the THRUST LIM page. The title displays TAKEOFF REF when no takeoff uplink runway record is pending and displays TAKEOFF REF UPLINK when a takeoff uplink runway record is pending ACCEPT/REJECT.

With TAKEOFF REF page 1/2 displayed, the MCDU **[NEXT PAGE]** or **[PREV PAGE]** key is pushed to display TAKEOFF REF page 2/2, shown in Figure 4--50.

TAKEOFF REF Page 2/2

Figure 4--50

Takeoff reference page 2/2 displays supplementary takeoff data. Adjustments can be made to parameters that affect takeoff parameters calculations on pages 1/2 or 2/2 or on the thrust reference page.

All data fields are frozen when airborne and are cleared on flight completion (or by a long-term power interrupt). Data fields that contain no data and line **5L** are blanked when airborne.

While a takeoff data uplink is pending (ACCEPT/REJECT displayed), selecting, entering, and deleting data are non-operational. While a takeoff data uplink is pending, no field displays box or dash prompts. Such fields are blank until the uplink is accepted or rejected. If rejected, the status of each field reverts to what existed before the uplink.

D **ALTN THRUST (2L)** The ALTN THRUST header is displayed at LSK **2L** if a TAKEOFF REF uplink has been accepted that includes alternate thrust data.

Depending on the AOC datalink option code, the line label can display:

- **ALTN THRUST** - **ALTN THR/FLAPS** - **STD THRUST**, or
- **STD THR/FLAPS**.

The thrust mode is displayed under the header line as:

- **<TO**
- **<TO 1**, or -
<TO 2.

Pushing the prompt key with data on the line selects the displayed alternate thrust or alternate thrust/flaps for takeoff, resulting in:

Recomputation of VSPEEDS

Display of STD THRUST or STD THR/FLAPS in the line heading Display of the ACCEPT/REJECT prompt on the TAKEOFF REF page 1/2 for accepting the modification Display of new takeoff data

Display of the EICAS FMC message

Display of the scratchpad message TAKEOFF DATA LOADED. The **2L** header and data line are blank when either:

A takeoff data uplink pending condition exists and the current runway record does not contain alternate data, or

A runway identifier is entered into line **4L** on the TAKEOFF REF 1 page and no corresponding runway record exists.

- **WIND (3L)** Airport wind conditions are entered for calculation of runway wind components. Entry is optional for preflight completion. Initial wind direction and speed can be entered by the crew or uplinked.

  Initial entry is wind direction/speed. Subsequent entries can be wind direction or speed only; speed entries must be prefixed by a leading slash. A valid wind direction entry (referenced to magnetic north) is three digits between 000 to 360 degrees, inclusive, with 360 displayed as 000. A valid wind speed entry is a one to three digit value between 0 and 250, inclusive. Entries that violate range or format requirements result in display of the **INVALID ENTRY** scratchpad message.

  Entry of a new wind direction or speed results in recomputation of RWY WIND in **4L**. Entry of runway head or tail wind in **4L** results in **3L** returning to the default display of dashes. Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**.

  If valid data does not exist when airborne, the data line is blanked.

- **RWY WIND (4L)** Line**4L** displays the calculated headwind/tailwind and crosswind components for the takeoff runway and surface wind.

  Calculated values are in SMALL font. Speed is displayed in knots with **H** for headwind, **T** for tailwind, **R** for right crosswind, and **L** for left crosswind.

  Crew entry is limited to headwind/tailwind entry. Valid entries are a two digit number followed by **H** or **T**.

- **SLOPE/COND (5L)** Line**5L** displays the runway slope and condition when entered. Entry is optional for preflight completion. Entry is done by crew entry or uplinked data entry.

  Valid runway slope is **U** for up or **D** for down followed by 0.0 through 2.0, inclusive, in percent gradient. Entries without a U or D are presumed to be uphill slopes. Entry of a value after takeoff speeds are selected removes the speeds and displays the scratchpad message **TAKEOFF SPEEDS DELETED**.

  In operational program control (OPC), if the CAA/JAR FLT RULES option has been enabled, the header includes **/COND** (runway condition); otherwise valid entries consist of slope entries only.

  The runway condition (**COND**) is displayed in LARGE font when the CAA Flight Rules option is selected. Pilot-entry of W or WET results in the display of **WET** in **5L**. Entry of D or DRY results in **DRY** being displayed.

- **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **ACCEL HT (2R)** Line**2R** displays the acceleration height (**ACCEL HT**) in feet above the origin airport. VNAV commands acceleration at this altitude or at first flap retraction.

The default value is from the airline modifiable information (AMI) file. Valid crew entries are from 400 to 9999 feet above the origin airport elevation. Accepted uplinked or pilot--entry values are displayed in LARGE font followed by a SMALL font **FT** and pending uplinked values are displayed in SMALL font followed by a small font **FT**.

Entry is optional for preflight completion and is permitted when no takeoff data uplink is pending.

D **LIM TOGW (4R)** Line**4R** displays the uplinked takeoff gross weight limit for the current thrust, flaps, and temperature conditions. The data is displayed in SMALL font when the takeoff data is pending and in LARGE font when the takeoff data is accepted. Crew entry is not possible.
The header displays **ALTNLIM TOGW** when the ALTN takeoff data is pending or has been accepted. The header displays **STD LIM TOGW** when the STD takeoff data is pending or has been accepted. **LIM TOGW** is always displayed in the header.

D **REF OAT (5R)** Entry of outside air temperature is made here for STD LIM TOGW calculations. Entries are included in the takeoff data request downlink. Entry is optional for preflight completion.

The following steps complete the preflight on the TAKEOFF REF pages 1/2 and 2/2 for the flight from KORD to EGLL.

1. On TAKEOFF REF page 2/2, type **320/20** into the scratchpad and push LSK **3L**. The display is as shown in Figure 4--51.

TAKEOFF REF Page 2/2 – Wind Entry

Figure 4--51

2. Push the **MCDU [NEXT PAGE]** or **[PREV PAGE]** key displaying TAKEOFF REF page 1/2.

3. Type **20** into the scratchpad (takeoff flap setting) and push LSK **1L**. The display is as shown in Figure 4--52.

4. Type **26** into the scratchpad (aircraft CG) and push LSK **3L**. The display is as shown in Figure 4--52.

5. When entries are made on page 2/2, VSPEEDS are deleted and the scratchpad message **TAKEOFF SPEEDS DELETED** is displayed. The FMC does not calculate the VSPEEDS and they must be entered manually. For this scenario, the following VSPEEDS are entered into scratchpad and the respective LSKs are pushed.

145	V1	LSK 1R
150	VR	LSK 2R
161	V2	LSK 3R

6. The display is as shown in Figure 4--52:

TAKEOFF REF Page 1/2 – Entry Completed

Figure 4--52

5. Takeoff/Climb

TAKEOFF/CLIMB PHASE

The FMS takeoff phase begins with selecting Takeoff/Go-Around (TOGA). Preparation begins in the preflight phase and includes entering TAKEOFF REF page data.

During the takeoff phase of flight, from takeoff thrust through gear and flap retraction, airspeed is controlled at V2 + 15 knots (to a maximum of V2 + 25 knots) until the thrust reduction altitude, where the aircraft maintains flap speed limits. The climb (CLB) phase of flight starts once the flaps are retracted and lasts until the top-of-climb (T/C), where the cruise phase begins. Once the CLB phase begins, the airspeed begins to increase to the default speed limit of 250 knots below 10,000 feet (and/or other pilot-entered speed restrictions). Above 10,000 feet, the FMS target speed for the active performance mode is selected for the remainder of the climb. Airspeed and altitude constraints are observed during the climb, if they exist.

If an altitude conflict exists between the FMS target altitude and the mode control panel (MCP) selected altitude, the message **RESETMCP ALT** is displayed in the scratchpad. This condition can occur when the MCP altitude is set at or below aircraft altitude in CLB, or at or above aircraft altitude in descent.

Autothrottle Takeoff

The pilot advances the throttles slowly and smoothly to approximately 1.05 EPR and permits EGTs to stabilize. Once the EGTs are stabilized, the TO/GA switch is pushed. This permits the thrust management computer (TMC) to advance the throttles to the takeoff EPR reference bugs by 50 knots CAS. The throttles are advanced to the thrust level selected on the THRUST LIM page, for the flight scenario the **D TO N1** setting of **105.1%**, shown in Figure 4--45.

Once the TMC has set the thrust level and the aircraft reaches a speed of 80 knots, control of the throttles is relinquished (HOLD) until 400 feet AGL. This is shown by THR REF being lit on the PFD until 80 knots, and then HOLD replaces THR REF above 80 knots. The pilot has command of the throttles throughout the takeoff process, and can terminate the HOLD mode and cancel any derate thrust limits by a second push of the TO/GA switch after liftoff.

The thrust is reduced to the CLB thrust limit by pushing the N1 or SPD button on the MCP. If operating with an engine out, then the maximum continuous thrust (CON) limit is set, rather than CLB, after flaps are up.

Climb Phase

At the acceleration height flap retraction, or AFDS altitude capture before the acceleration, VNAV commands anairspeed increase,limited by the aircraft flap and gear configuration, to the greater of:

D 250 knots

D VREF+80 knots or

D The airspeed limit associated with the origin airport, whichever is greater.

The VNAV commanded speed is limited by the current aircraft configuration. At acceleration height, VNAV initially commands a speed 5 knots below the flap placard speed for the current flap setting.

At the climb thrust reduction point, the FMS commands a reduction to the selected climb thrust. Passing 10,000 feet, VNAV commands an acceleration to the economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority, provided they are greater than VREF+80 or 250 knots.

During the climb, VNAV complies with the ACT RTE LEGS page waypoint altitude and speed constraints. A temporary level-off for a crossing altitude restriction is done at the current commanded speed.

When the climb speed profile causes an anticipated violation of a waypoint altitude constraint, the FMS displays the MCDU scratchpad message **UNABLE NEXT ALTITUDE**. A different speed profile that provides a steeper climb angle must be manually selected.

If a CLB 1 or CLB 2 derate is selected, the derate is maintained for the initial part of the climb. Thrust eventually increases to maximum climb thrust by the time the aircraft reaches the scheduled altitude.

If an altitude conflict exists between the FMS target altitude and the MCP selected altitude, the message **RESET MCP ALT** is displayed in the scratchpad. This condition can occur when the MCP altitude is set at or below aircraft altitude in CLB, or at or above aircraft altitude in descent.

CLB Page

The climb (CLB) page is used to evaluate, monitor, and modify the climb path. The data on the climb page comes from preflight entries made on the route and performance pages, and from the airline policy file.

The climb page is automatically selected by pushing the MCDU **[VNAV]** function key on the ground and during takeoff and climb. When the FMS transitions to the cruise (CRZ) mode, the climb page data is blanked. CLB is the first (Page 1/3) of the three vertical navigation pages.

NOTE: The VNAV mode key is used for selecting climb,cruise and descent performance modes. On pushing **[VNAV]**, the MCDU displays the active performance mode. Use the **[PREV PAGE]** or **[NEXTPAGE]** keys to display pages for any currently inactive performance modes.

The CLB page, shown in Figure 5--1, provides access to current and upcoming climb profile conditions, with the active climb speed mode displayed in the title line. During the takeoff phase, the title reflects the limit speeds for the flap position of the aircraft. Following takeoff acceleration, the legend changes to **ACT 250 KT CLB** (or reflects any speed restrictions). When the aircraft reaches the speed transition altitude, the legend changes to **ACT ECON CLB** (or the selected climb mode).

To access the CLB page, push the MCDU **[VNAV]** key for a display as shown in Figure 5--1.

Climb (CLB) Page

Figure 5--1

D **CRZ ALT (1L)** The cruise altitude entry on the PERF INIT page, (shown in Figure 4--43) is propagated to this line. Valid entries to the cruise altitude field are standard altitude entries and must be less than or equal to the maximum certified altitude. The FMS automatically lowers the cruise altitude to the maximum engine out altitude when engine out (**ENG OUT>**) is selected and the current cruise altitude is above the maximum engine out altitude.

NOTES:

The cruise altitude can be changed by using one of the following two methods:

A new altitude can be entered manually from the MCDU at any time. Changing the altitude in this manner creates a modification.

If the altitude intervention option is enabled, a new altitude can be entered from the MCP, provided no intermediate altitude constraints exist between the current aircraft altitude and the MCP target altitude. Selecting a new altitude on the MCP and pushing the altitude selector places the new altitude in the CRZ ALT data line. Entering a new cruise altitude in this manner does not create a modification.

D **ECON SPD, SEL SPD,** or **EO SPD (2L)** This data field is the command speed. The economy (ECON SPD), selected (SEL SPD), or engine out (EO SPD) speeds are displayed in this line, as appropriate. The speed can be a CAS, Mach, or CAS/Mach schedule.

The default display is the ECON mode values that are computed by the FMS.

Selected speed is the pilot--entry of a CAS and/or Mach value using the scratchpad, pushing LSK **2L**, and then pushing the MCDU **[EXEC]** key. The line title changes to **SEL SPD**. Valid entries to this field require a three-digit CAS value (100 to 400 inclusive), a oneto three-digit Mach number preceded by a decimal point (.100 to .990 inclusive), and finally a CAS/Mach or Mach/CAS schedule, where the CAS and Mach are separated by a slash and each conforms to the entry format and range requirements (for example, 280/.80 or .80/280).

This flight scenario displays **SEL SPD** with a selected value of **250** kts, shown in Figure 5--1.

D **SPD TRANS (3L)** The speed transition, speed/altitude value, is defined in the nav database for the origin airport. The default value for the flight scenario is 250/10,000 or the CAS/altitude value required by performance computed limits.

The speed transition is blanked on climbing through the speed transition altitude.

NOTE: Pilot-entry to the **SPD TRANS** is **not** permitted; however, the speed transition can be deleted.

- **SPD RESTR (4L)** The speed restriction (**SPD RESTR**) field permits manual entry of a CAS speed restriction to an altitude less than the cruise altitude. When a new speed/altitude is entered into the data line, it creates a modification and is displayed in LARGE font text until executed.

  Valid entries for speed restriction consist of a valid speed followed by slash (**/**) and a valid altitude. Valid altitude entries are standard altitude format entries that are at or above the current aircraft altitude and below the cruise altitude.

  To enter a speed restriction:

1. Type **280/12000** into the scratchpad, as shown in Figure 5--2.

SPD RESTR Entry

Figure 5--2

2. Push LSK **4L** and the display is as shown in Figure 5--3.

SPD RESTR MOD

Figure 5--3

3. Push the MCDU **[EXEC]** key completing the entry, as shown in Figure 5--4.

SPD RESTR Entry Completed

Figure 5--4

- **<ECON, <EO SPD,** or **<ALL ENG (5L)** Selecting ECON changes the climb speed mode to ECON and results in a flight plan MOD. ECON is displayed when the current climb mode target speed is not ECON and engine out has not been selected.

  Selecting ECON changes the speed target in **2L** to **ECON SPD**. Selecting ECON deletes the speed restriction in **4L** if the restriction speed is greater than the economy CAS.
  Selecting **EO SPD**, when it is displayed, changes the climb speed mode to EO and results in a flight plan MOD.

Selecting **ALL ENG**, when displayed, changes the climb speed mode to the climb mode active before EO detection and results in a flight plan MOD. ALL ENG is displayed when an engine failure has been detected but not verified.

The data line is blank when ECON is the current FMS climb target or when the cruise altitude is not displayed.

- **<ERASE (6L)** Selecting ERASE when displayed, regardless of the scratchpad contents, erases all pending flight plan modes. ERASE is displayed when a modified active, pending activation lateral, or pending activation VNAV-only vertical profile is displayed. Otherwise the header is blank.

- **AT XXXXX (1R)** Displays the next waypoint speed and altitude constraint. The display is blank if no restriction, such as the flight scenario, exists.

- **ERROR (2R)** The ERROR at waypoint displays the predicted undershoot for the next waypoint constraint. It displays altitude discrepancy and distance past the waypoint where altitude is reached. ERROR is displayed when the following conditions exist; otherwise the data line is blank:

  Performance predictions are valid.

  Line **1R** displays a constraint.

  The undershot error is predicted to be greater than 200 feet low. The

  distance error is predicted to be greater than 1 NM long.

  The undershot error is a predicted error at the waypoint and the range is 200 to 9990 feet, rounded to the nearest 10 feet; and the along track error range is from 1 through 99 NM, rounded to the nearest 1 NM.

- **TRANS ALT (3R)** The climb transition altitude is displayed here in MSL format. If defined, the navigation database transition altitude for the origin airport is applied. If not, then a default value of 18,000 feet is used, but it can be changed with a standard altitude entry.

- **MAX ANGLE (4R)** The maximum climb angle speed (flaps up) is displayed here normally. This speed can be downselected into the scratchpad and entered at line **2L** to initiate a maximum angle climb.

To initiate a maximum climb angle speed:

1. Push LSK **4R** to enter 241 into the scratchpad, as shown in Figure 5--5.

MAX ANGLE Entry

Figure 5--5

2. Push LSK **2L** to create the MOD, as shown in Figure 5--6.

MAX ANGLE MOD

Figure 5--6

3. Push the MCDU **[EXEC]** key to execute the MOD, as shown in Figure 5--7.

MAX ANGLE MOD Executed Figure 5--7

The header line displays **MAX ALT** when performance has been initialized and the engine-out mode has been selected. When **MAX ALT** is displayed, and the engine-out maximum altitude is valid, the data line displays the engine-out maximum altitude, displayed to the next lower 100 foot increment. The data line displays the lesser of the current engine-out maximum altitude at EO SPD or at the planned or defaulted engine-out cruise speed. Pilot--entry into this line is not permitted.

Changes to the engine out climb speed, planned engine out cruise speed, or CRZ ALT after initial activation of this page can result in different MAX ALT values. These values are not transferred to field **1L** without pilot action. However, changes that result in a MAX ALT value less than the CRZ ALT value in **1L** cause a **MAX ALT FLXXX** scratchpad message.

The maximum engine altitude is defined by the lower of the:

Engine out climb maximum altitude (using the engine out climb speed), or

Engine out maximum cruise altitude (using the engine out cruise speed).

The header and data lines are blank if performance is not initialized.

D **ENG OUT>** or **ALL ENG> (5R)** Selecting ENG OUT when it is displayed and when climb is active, and if the ENG OUT maximum altitude computed at the EO minimum drag (EO SPD) is above the current altitude, results in a single engine minimum drag climb segment to the cruise altitude. Selection results in a flight plan MOD.

The ENG OUT speed is propagated to the top-of-climb and into the cruise segments.

Selecting ENG OUT invalidates the speed restriction in line **4L**.

If **ALL ENG** is displayed in **5R** and selected, it results in a speed transition speed climb to the speed transition altitude, if the aircraft is below the speed transition altitude at the time of the selection and the speed transition has not been deleted, followed by an economy climb to cruise altitude. If the aircraft is at or above the speed transition altitude, the vertical profile is modified to an economy climb to the cruise altitude. Selection results in a flight plan MOD. Figure 5--10 shows **ALL ENG>** on the ACT EO CLB page.

D **CLB DIR (6R)** Climb direct (CLB DIR) is displayed when climb is active and an altitude constraint exists in the climb phase of the flight plan between the current altitude and the cruise altitude. Selecting **6R** deletes all altitude constraints at waypoints between the current altitude and the MCP displayed altitude, **except** if the altitude constraint occurs at the MCP displayed altitude; then the altitude constraint is retained. Selection results in a flight plan MOD.

If the constraint to be deleted is a window constraint and only one of the two altitudes comprising the window constraint is below the MCP altitude, only that portion of the altitude window constraint is deleted.

The speed/altitude constraints not associated with waypoints are not affected. If the MCP altitude is higher than the cruise altitude in **1L**, the cruise altitude is not changed.

Engine Failure on Takeoff

Engine failure on the takeoff phase of flight causes the ACT CLB page to change to ACT VREF+80 CLB. The ACT VREF+80 CLB means engine failure has been detected, but not verified, during VNAV takeoff and the aircraft is above flap retraction altitude. Figure 5--8 shows this state.

ACT VREF+80 CLB Page Figure 5--8

NOTE: Note both **<ALL ENG** at LSK **5L** and **ENG OUT>** at LSK **5R** on this page.

1. Pushing LSK **5R**, **ENG OUT**, shown in Figure 5--8, displays the CLB page as shown in Figure 5--9.

MOD VREF+80 CLB Page Figure 5--9

NOTE: MOD VREF+80 CLB means a modified flight plan exists and engine failure has been detected, but not verified, during VNAV takeoff and the aircraft is above flap retraction altitude.

2. Pushing the MCDU **[EXEC]** key executes the MOD; the display is as shown in Figure 5--10.

ACT EO Page

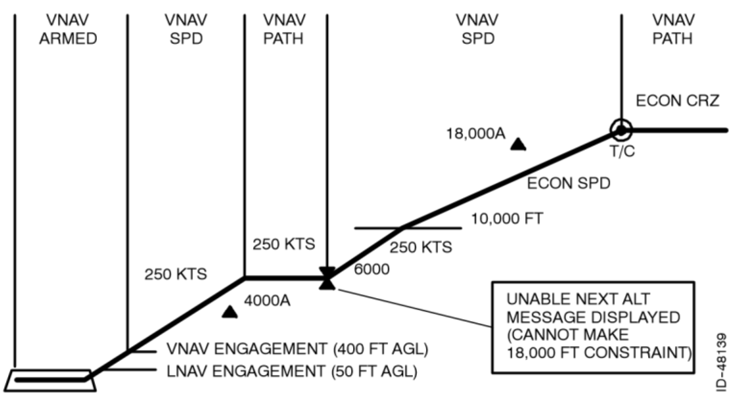
Figure 5--10

NOTE: ALL ENG is now displayed at line **5R**. The cruise altitude, max altitude, and engine out speed are now the updated information on this ACT EO CLB page.

CLIMB PROFILE

The normal default climb profile is a 250 knot climb to 10,000 feet followed by an economy climb to cruise altitude. The pilot can alter the default climb profile by entering any speed and/or altitude restrictions required to meet ATC clearances. If flaps are extended, the 250 knot climb is limited by the maximum speed permitted for flaps selected (LIM SPD CLB). The **UNABLE NEXT ALT** message is displayed when the aircraft is not able to make the next defined constraint using the current mode, such as ECON.

Figure 5--11 shows a climb profile. In this example, the 18000A (at or above) constraint is not possible at ECON speed and the **UNABLE NEXT ALT** message is displayed on crossing the 6000 foot constraint.



Climb Profile Figure 5-
-11

Climb Performance Change

The climb performance can be changed on the CLB page by entering a different airspeed. The CLB page is accessed by pushing the MCDU VNAV key. In order to climb at a modified speed, the speed is entered, using the scratchpad and pushing LSK **2L**. Once entered in **2L**, the lighted MCDU **[EXEC]** key is pushed to activate the new speed, which changes the page title to active and shows the new speed. The new label for line **2L** becomes **SEL SPD**. The following scenario shows the process.

To change the climb performance to climb at 300 knots:

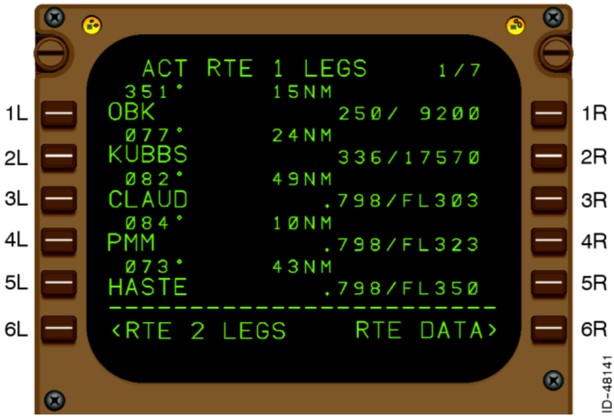
1. Push the MCDU **[VNAV]** key.
2. Type **300** into the scratchpad.
3. Push LSK **2L** to enter the modified speed.
4. Push the MCDU **[EXEC]** key activating the new speed, which changes the page title to **ACT 300 KT CLB**, as shown in Figure 5--12.

Climb (CLB) Page – SEL SPD Change
Figure 5--12

RTE LEGS PAGES

The RTE LEGS pages, shown in Figure 5--13, present a listing of and pertinent information about the consecutive waypoints of each leg on the route. Information displayed on the RTE LEGS pages include distance between waypoints, heading/course between waypoints, airspeed/altitude constraints at a waypoint, and airspeed/altitude predictions at a waypoint. The first waypoint listed on the LEGS pages of an active route is the waypoint toward which the aircraft is navigating, also referred to as the active waypoint.

The route legs pages are accessed by pushing the MCDU **[LEGS]** key.



ACTRTE1LEGSPage
Figure 5--13

The active waypoint displayed in Figure 5--13 is OBK (Northbrook). The computed leg length for the active waypoint (OBK) is 15NM and this distance-to-go (DTG) is dynamic. The FMS projects that the aircraft will cross over OBK at an airspeed of 250 knots at an altitude of 9,200 feet. As the aircraft passes over OBK, the ACTRTE LEGSdisplay setmoves upward, deleting the waypoint that has been passed (OBK), and inserting the next active waypoint (KUBBS) at the top of the page.

NOTES: 1. **ERASE** is displayed in **6L** if a pending activation or modification exists.

2. No DTG is displayed for conditional waypoints.

RTE LEGS pages are available for both routes. **RTE N LEGS** (where N is 1 or 2) in line **6L** gives access to the other route.

RTE DATA

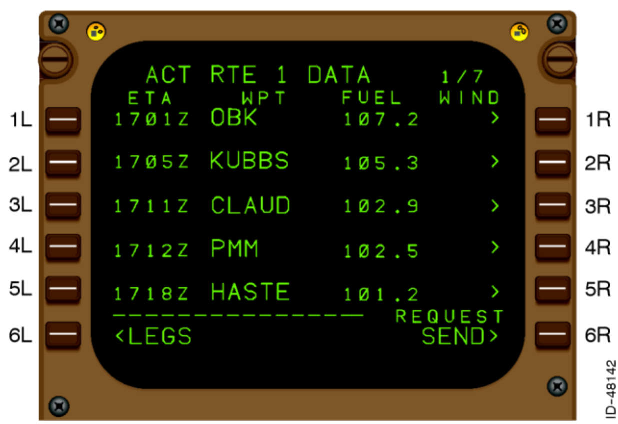
Each RTE LEGS page has a corresponding route data (RTE DATA) page that can be selected by pushing **6R**, **(RTE DATA)**. The route data page, using the flight scenario RTE 1, displays progress data for each waypoint on the ACT RTE 1 LEGS page.

The RTE DATA page, shown in Figure 5--14, is an extension of the RTE LEGS pages where additional leg information is presented. The route data page displays estimated time of arrival (ETA), fuel remaining at the different waypoints, and provides access to the waypoint wind page. Manual entry on the RTE DATA page is not possible. When on the RTE DATA pages, pushing **6L, LEGS**, returns to the RTE LEGS pages.

NOTES: 1. Winds can be entered at each cruise waypoint on the RTE DATA page by pushing the appropriate right LSKs. Before pilot--entry, each cruise wind data field displays prompts or the cruise winds entered on the PERF INIT page.

2. For company datalink equipped aircraft, refer to Section 12, Company Data Link, RTE DATA Page, for details on wind data requests and wind data uplinks.

The route data pages are accessed by pushing LSK **6R**, **RTE DATA** on the ACT RTE 1 LEGS page (shown in Figure 5--13).



ACT RTE 1 DATA Page
Figure 5--14

D **ETA (1L, 2L, 3L, 4L, 5L)** These fields display the FMS calculated waypoint ETA.

D **<LEGS (6L)** LSK**6L**, when pushed, displays the ACT RTE 1 LEGS page.

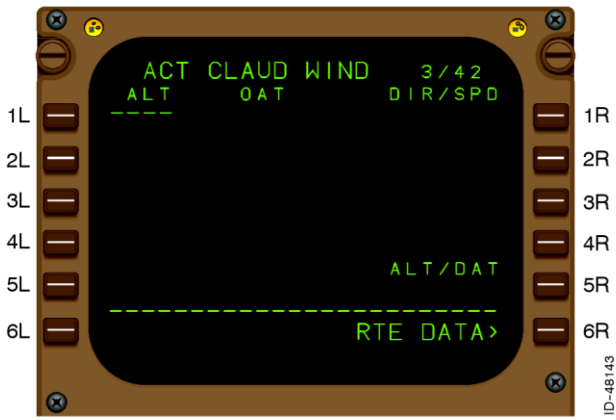
- **WPT (1C, 2C, 3C, 4C, 5C)** These fields display the identifier for the waypoint from the LEGS page.

- **FUEL (1C, 2C, 3C, 4C, 5C)** These fields display the FMS calculated fuel remaining at the waypoint.

- **WIND (1R, 2R, 3R, 4R, 5R)** These fields display the WIND page for the selected waypoint. **W** indicates wind data has been entered for the waypoint. No **W** indicates no wind is entered for that waypoint.

- **REQUEST SEND>6R** Pushing LSK **6R**,REQUEST SEND>,transmits a datalink request for wind and descent forecast data. The crew can enter up to four altitudes on any wind page to qualify the request. See Section 12, Company Data Link, for additional information.

To access the waypoint CLAUD WIND page and enter the forecast winds at WPT CLAUD on the ACT RTE 1 LEGS page, push LSK **3R**, adjacent to the CLAUD waypoint, shown in Figure 5--14. Figure 5--15 shows the CLAUD WIND page.



Waypoint WIND Page – CLAUD WIND; Page 3/42

Figure 5--15

WIND PAGE

As shown in Figure 5--15, this page provides entry and display of forecast winds and temperatures at specified altitudes for specific waypoints to enhance VNAV performance.

The FMS calculates step climb points based on the wind effect but does not calculate step climb points based on wind data entered at the step climb altitude.

A maximum of four altitudes can be entered and displayed at each waypoint. The wind effect is applied along the entire route in both directions, if no other waypoint winds have been entered. The altitudes are entered first and in any order; the FMS sorts and displays the altitudes in ascending order. Wind speed and direction are entered for the specific altitudes.

- **ALT (1L)** A waypoint wind altitude (ALT) is entered in this field. Dashed prompts (**-- -- -- -- --**) are displayed if fewer than four altitudes have previously been entered. Entries into this field are sorted into ascending order and displayed in fields **4L** through **1L** of all **WIND** pages. Dashed prompts are replaced by the fourth altitude entry and require deleting an existing altitude before another entry can be made.

- **OAT** Only outside air temperature (OAT) values are displayed in this field. They are derived from entries into the **5R** data field.

To enter the forecast winds and OAT at waypoint CLAUD:

1. To access the waypoint CLAUD WIND page, push LSK **3R** adjacent to the CLAUD waypoint prompt on the ACT RTE 1 LEGS page (shown in Figure 5--14). The CLAUD WIND page, shown in Figure 5--15 is displayed.

2. Type the altitude, **350**, into the scratchpad.

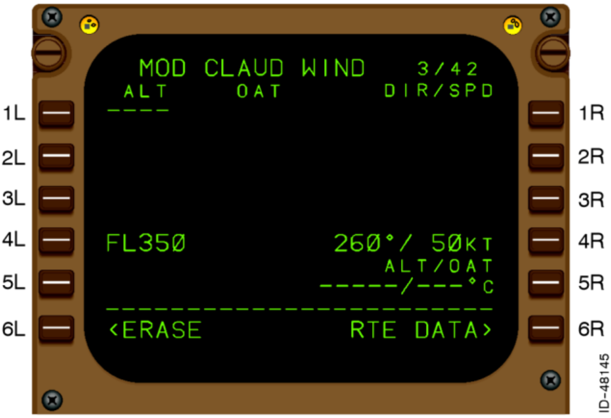
3. Push LSK **1L** to enter the altitude, **FL350**, in line **4L**, as shown in Figure 5--16.

MOD CLAUD WIND 350

Figure 5--16

4. Type the wind direction and speed, **260/50**, into the scratchpad.

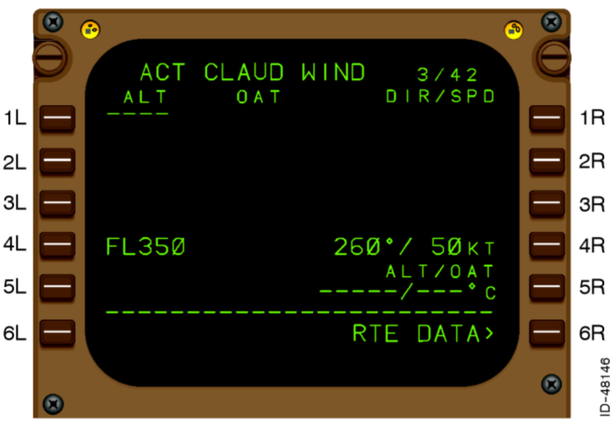
5. Push LSK **4R** to enter the wind direction and speed, **260_/ 50 KT**, in line **4R**, as shown in Figure 5--17.



MOD CLAUD WIND – Wind Direction/Speed Entry

Figure 5--17

6. Push the MCDU **[EXEC]** key to see the display as shown in Figure 5--18.

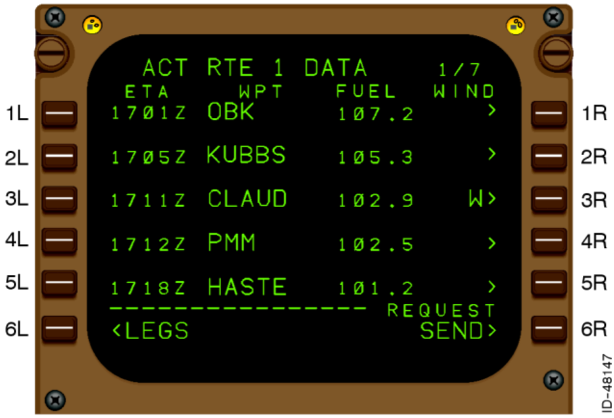


CLAUD WIND – Entry Completed

Figure 5--18

D **RTE DATA (6R)** Pushing LSK **6R**, RTE DATA, on the CLAUD WIND page shown in Figure 5--18 displays the RTE DATA that relates to the waypoint identified on this WIND page, shown in Figure 5--19.

On the CLAUD WIND page, shown in Figure 5--18, pushing **6R**, RTE DATA, displays the updated ACT RTE 1 DATA page, as shown in Figure 5--19.



ACT RTE 1 DATA – CLAUD WINDS

Figure 5--19

NOTE: The forecast wind entry is noted by a **W** in the wind column at the waypoint where it was entered.

Pushing LSK **6L** (**<LEGS**) on the ACT RTE 1 DATA page returns the display to the ACT RTE 1 LEGS page (see Figure 5--13).

On the RTE LEGs pages, if the EFIS is in PLAN mode, the MCDU displays a **STEP** prompt in line **6R** with the label **MAP CTR**, as shown in Figure 5--20. This lets the pilot change the center of the EFIS PLAN mode display. A **<CTR>** legend is displayed in the middle of that data field that is the center of the EFIS display. Pushing the MCDU **[LEGS]** key and the **[PREV PAGE]** or **[NEXT PAGE]** key makes the center of the EFIS the first waypoint of the page displayed.

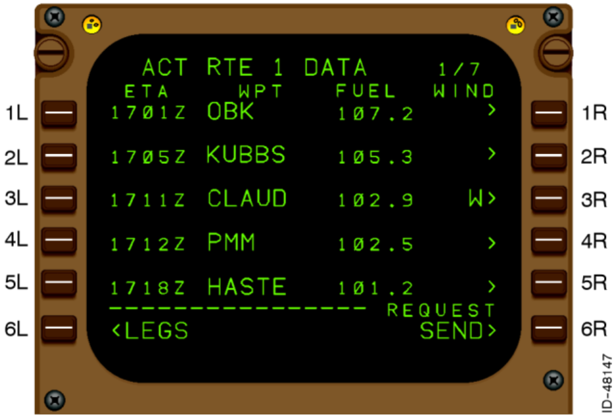
RTE LEGS Page – EFIS Control in PLAN Mode

Figure 5--20

If the EFIS is not in PLAN mode, and an inactive RTE LEGS page is displayed, then **ACTIVATE** appears at **6R**.

To check the propagated wind value at waypoint PECK (ECK) on the flight route scenario, the following steps are performed:

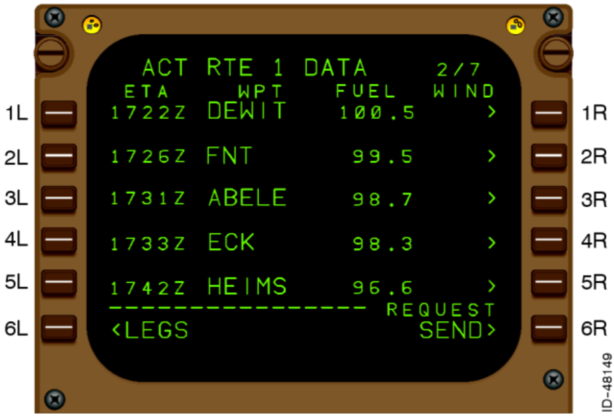
1. Push LSK **6R** (**RTE DATA**) on the ACT RTE 1 LEGS page shown in Figure 5--13 to display the ACT RTE 1 DATA page shown in Figure 5--21.



ACT RTE 1 DATA

Figure 5--21

2. Push the MCDU **[NEXTPAGE]** key to display page 2/7 of the ACT RTE 1 DATA Page, shown in Figure 5--22.



ACT RTE 1 DATA Page 2/7

Figure 5--22

3. Push LSK **4R** (**ECK >**) to display the ACT ECK WIND page, shown in Figure 5--23.

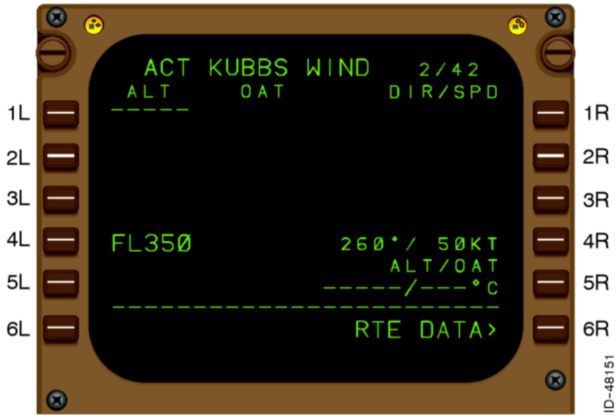
ACT ECK WIND

Figure 5--23

NOTE: The **propagated** wind value at ECK is displayed in SMALL font at **4R** for FL350.

Wind propagation backward to the waypoints between the waypoint CLAUD and the present position of the aircraft are shown in the following steps.

1. Push LSK **6R** (**RTE DATA**) on the ACT ECK WIND page, shown in Figure 5--23.
2. Push the MCDU **[PREV PAGE]** key on the ACT RTE 1 DATA 2/7 page to display page 1/7.
3. Push LSK **2R** (**KUBBS>**) on the ACT RTE 1 DATA 1/7 page, shown in Figure 5--21, to display the ACT KUBBS WIND page, shown in Figure 5--24.



ACT KUBBS WIND

Figure 5--24

NOTE: The wind direction and speed are propagated back from CLAUD to the waypoint KUBBS. The propagated wind is displayed in SMALL font at **4R** for FL350.

Guidelines for understanding forecast wind and temperature information entry are as follows:

- If there are no wind entries on any waypoint wind page, zero winds are presumed for the wind forecast for all waypoints at all altitudes.
- Entry into **2L** through **4L** is not possible.
- Entering an altitude in **1L** results in dash prompt fields for wind direction (DIR) and speed (SPD) on the right side line that corresponds to the left side line where the altitude is entered.
- The altitude on a wind page must be deleted before a new altitude can be entered to replace it. When the altitude is deleted, the associated winds on all pages are also deleted at all the waypoints.
- Entering a wind value (not altitude) at a waypoint propagates the wind value down-path until another entered waypoint wind at the same altitude (same field) is encountered.
- If no wind entry has been made up-path from a waypoint with a forecast wind, the up-path waypoints display the first waypoint wind in SMALL font.
- Propagated wind values are displayed in SMALL font.

D Pilot-entered wind values are displayed in LARGE font.

D Waypoint temperature forecasts are entered at a single altitude on any waypoint wind forecast page. An OAT entry at an altitude is displayed in **5R** and modifies the displayed OATs in lines **1L** through **4L**.

D The OAT is entered in Celsius. Valid temperature entries are a minimum entry limit of 80°C for all altitudes and a maximum entry limit interpolated between 40°C at 45,100 feet and +55°C at sea level.

D All temperatures on the page where the entry is made display in LARGE font and all propagated temperatures on the other pages are in SMALL font.

D If waypoint OAT entries are not made, then standard day temperatures are used.

Climb Airspeed/Altitude Constraints

When vertical altitude constraints, or deletions of them, occur during climb, the FMS provides updated vertical guidance and performance. Changes can be made to waypoint altitude and airspeed constraints (through the RTE LEGS pages), and to CRZ ALT (through the CLB page).

When flight plan changes are made, performance predictions become invalid for display (dashed fields) until the FMS calculates new information. The initially selected CRZ ALT must be eventually attained or changed, or the FMS does not transition into the CRZ phase of flight.

Altitude Constraints The pilot can enter ATC specified constraints at flight plan waypoints. To enter an altitude constraint, the restriction is entered into the right field of the RTE LEGS page for the waypointwith the constraint.

Figure 5--25 shows ATC specified constraints at flight plan waypoints. ATC instructions call for crossing KUBBS At or Below 15,000 feet. At or Below 15,000 feet is inserted in the flight plan by typing 15000B in the scratchpad and pushing LSK **2R**. Once entered, the modification must be activated by pushing the MCDU **[EXEC]** key. The resulting display is shown in Figure 5--25.

1. Push the MCDU **[LEGS]** key to display the RTE LEGS pages.
2. Type **15000B** into the scratchpad.
3. Push LSK **2R** to enter the constraint at KUBBS.
4. Push the MCDU **[EXEC]** key to activate the constraint.

Altitude Constraint Entry Figure 5--25

Only altitude constraints that are defined by the crew as **At, At or Below,** or **Block Altitude** are restrictive in the takeoff/climb phase of flight. If the aircraft is in a climb and a constraint is entered with an altitude below the aircraft, the entry is accepted and, if VNAV is engaged, the aircraft levels off and holds altitude until sequencing off the constrained leg, at which time the aircraft continues the climb.

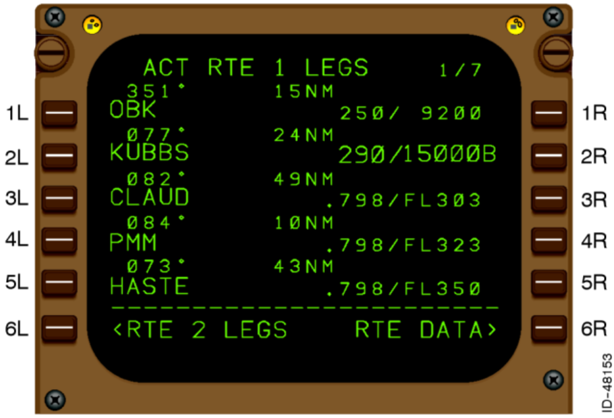
In the flight scenario, the aircraft crosses KUBBS At or Below 15,000 feet, and once the aircraft sequences KUBBS the aircraft continues climbing to FL350.

Airspeed constraints can be inserted during the climb using the RTE LEGS pages. To enter an airspeed constraint at a waypoint, enter the constraint (CAS is the only type of airspeed permitted) using the scratchpad, the corresponding LSK, and the MCDU **[EXEC]** key. The constraint can be entered with an altitude constraint separated by a slash (**/**). The constraint can also be entered without an altitude as long as it is followed by a slash (ex: 330/). An airspeed only constraint entered at a predicted altitude (SMALL font) is not permitted and causes an **INVALID ENTRY** message.

Figure 5--26 is an example of an airspeed constraint of 290 knots until passing KUBBS. The 290 knot constraint is inserted in the flight plan as follows:

1. Push the MCDU **[LEGS]** key to display the RTE LEGS pages.
2. Type **290/** into the scratchpad.
3. Push LSK **2R** to enter the airspeed constraint to KUBBS.

4. Push the MCDU **[EXEC]** key to activate the constraint.



Airspeed Constraint Entry

Figure 5--26

In the flight scenario, the aircraft crosses KUBBS At orBelow 290knots, and once the aircraft sequences KUBBS the aircraft continues climbing to .798 Mach.

RULES FOR AIRSPEED/ALTITUDE CONSTRAINTS

This section details all facets of airspeed/altitude constraints, including entry and display. Except where noted, the rules outlined in this section also apply to constraints in the cruise, descent, and approach phases of flight.
Constraints can be entered on any leg other than an altitude termination leg (course from a fix to an altitude, holding termination at an altitude, or a heading to an altitude). These leg types are outlined in Section 11, Advanced Flight Planning, Additional Flight Planning Information, Navigation Leg Types.

Constraints are entered on the RTE LEGS pages, and also on the RTE HOLD pages for holding patterns. Constraints associated with an entered departure or arrival procedure are inserted into the route, if the constraints are contained in the nav database. Constraints can be deleted through the RTE LEGS, RTE HOLD, CLB, and DES pages. Changes to the CRZ ALT can also delete constraints in a route.

Entry format is important when entering both an airspeed and an altitude constraint. They must be separated by a slash (**/**) with the speed first: airspeed/altitude. Airspeed only entries must be followed by a slash (that is, **330/**). Altitude only entries can be, but are not required to be, preceded by a slash. Altitude constraints are identified as **At**, **At or Above**, **At or Below**, or **Block Altitudes**, as detailed in the beginning of this section.

Airspeed entries are permitted only in three-digit CAS format (Mach entries are not permitted) in the range of 100 to 400 kts. Airspeed only entries are accepted when entered over an existing altitude constraint or when entered with an altitude constraint. Airspeed only entries are not permitted over dashes, next to a predicted altitude (SMALL font) or at an altitude termination leg.

Altitude entries of less than 1,000 feet must be preceded with zeros. A minimum entry of at least four digits is required (that is, 800 feet is entered as 0800). Negative altitude entries must be entered in the format NNNN, with nothing lower than 1,000 feet accepted. Altitude constraint entries must be lower than the CRZ ALT (it can be equal to the CRZ ALT only if the entry is made on a holding pattern leg and is not a Block Altitude).

NOTE: All entries must be executed using the MCDU **[EXEC]** key.

An **INVALID ENTRY** message is displayed on the MCDU scratchpad for any entry not meeting this criteria.

Constraint insertion is accomplished when new constraints are created and entered over dashes, predicted airspeed/altitudes, or existing constraints. Old constraint airspeeds are never saved when new constraints are entered. This is true even if an altitude-only constraint is entered.

If the aircraft is in a climb and a climb constraint is entered with an altitude below the aircraft, the entry is accepted. With VNAV engaged, the aircraft levels off and holds altitude until sequencing the constraint waypoint.
Constraint deletion is accomplished by using the MCDU **[DEL]** key. Deleting a constraint returns dashes to the display, which are then replaced by new predicted values. **DELETE** entered into dashes, boxes, predicted values, or altitude terminations are not accepted and result in an **INVALID DELETE** message.

Rules for airspeed/altitude constants in the cruise, descent, and approach phases of flight are outlined within their respective sections.

INTERCEPT COURSE FROM PRESENT POSITION

In the flight scenario, on the takeoff from KORD Chicago, departure requests a right turn to a heading track of 060°. ATC wants the heading held until intercept course as filed to waypoint KUBBS.

The following steps and figures show how this can be done on the MCDU using a feature called present/position (P/P).

1. Push the MCDU **[LEGS]** key to display the RTE LEGS pages.
2. Type **P/P060** into the scratchpad, as shown in Figure 5--27.

P/P060 Entry Figure 5--27

3. Push LSK **1L** to enter the intercept course to KUBBS (Figure 5--28).

P/P060 MOD Figure 5--28

4. Push the MCDU **[EXEC]** key to activate the intercept (Figure 5--29).

ACT RTE 1 LEGS 060 Course

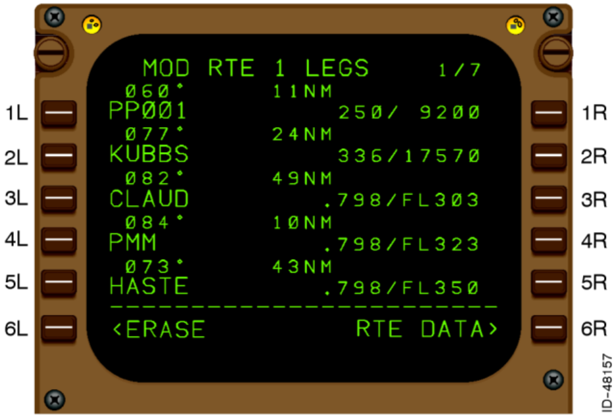
Figure 5--29

NOTE: The route discontinuity message exists on the legs page. The active route displayed on the navigation display is a magenta course line of 060_ that extends for 700 NM.

Complete the remaining steps to comply with the ATC clearance to intercept the airway and proceed on course to KUBBS.

5. Push LSK **4L** (KUBBS), shown in Figure 5--29, to download KUBBS into the scratchpad.

6. Push LSK **2L** to load KUBBS into the boxed prompts, which displays the MOD RTE 1 LEGS page, shown in Figure 5--30.



MOD RTE 1 LEGS – PP001 Waypoint

Figure 5--30

7. Push the MCDU **[EXEC]** key to activate the modified route waypoint.

PP001 Active Waypoint

Figure 5--31

The FMS built a waypoint PP001 at the intercept point on the airway inbound to KUBBS. The route discontinuity was closed by following the above steps.

6. Cruise

FMS cruise (CRZ) is the phase of flight between the top-of-climb (T/C) and the top-of-descent (T/D). During cruise, the pilot may be required to make navigation changes, transmit position reports, monitor flight progress, change cruise altitude, and prepare for descent to the destination airport. Preparing for descent can include STAR selection, descent forecast wind entry, and review of approach and missed approach data. These items are covered in the cruise section. Further information about flight planning and navigation can be found in Section 11, Advanced Flight Planning, Defined Waypoints and Additional Flight Planning Information.

CRZ PAGE

When the FMS transitions to cruise, CRZ becomes the active performance page, and the aircraft maintains the selected speedmode. The CRZ page is used by the pilot to evaluate, monitor, or changecruise altitude, speed, and step climb path.

The cruise page is automatically selected when transitioning from climb to cruise if the VNAV function is active. The cruise page is no longer available after the top of descent point.

The CRZ page is accessed by pushing the **[VNAV]** mode key when the cruise mode is active. If the cruise mode is not active, the CRZ page 2/3 of the vertical navigation pages is displayed by either pushing **[PREV PAGE]** or **[NEXT PAGE]** after the **[VNAV]** key has been selected.

The available speeds are: economy (ECON SPD), pilot-entered selected speed (SEL SPD), long-range cruise (LRC SPD), engine-out (EO), cruise climb (CRZ CLB), cruise descent (CRZ DES), required-time-of-arrival (RTA) speed, and limit speed (LIM SPD).

Push the MCDU **[VNAV]** and **[NEXTPAGE]** keys to access the CRZ page, shown in Figure 6--1. The title line displays the active or pending cruise airspeed command.

ACT ECON CRZ Page

Figure 6--1

Page Title

The page title displays the active or modified type of cruise. Normally, the title displays ECON for economy cruise mode. Fixed speed, engine out, and long-range cruise modify the title.

NOTES:

1. MOD replaces ACT at the front of the title line when a pending modification exists.
2. When a pending modification exists, the CRZ page displays the current active cruise mode, not the mode that becomes active after execution.
3. Active cruise speed is displayed as XXXKT if controlling to a fixed speed, M.XXX if controlling to a fixed Mach, or ECON if controlling to economy speed based on cost index set on the PERF INIT page.
4. LRC is displayed if long-range cruise is selected.
5. EO is displayed if Engine Out is selected. Company specified engine out cruise speeds display CO.
6. CRZ CLB or CRZ DES is displayed if a new cruise

altitude is entered on the active page.

D **CRZ ALT (1L)** The CRZ ALT displays the present VNAV cruise altitude. The cruise altitude entered on the PERF INIT page is propagated to this data field. When no cruise altitude exists or if descent is the active flight mode, the data line displays jjjjj.

The CRZ ALT can be changed in flight by pilot selection and executed by pushing the MCDU **[EXEC]** key. Any change to the displayed cruise altitude while in an active CRZ mode switches the page format to ACT CRZ CLB or ACT CRZ DES as applicable. After executing, the new CRZ ALT is also displayed on the PERF INIT page.

When a CRZ ALT entry is higher than the maximum certified altitude, the entry is rejected and the **INVALID ENTRY** message is displayed in the scratchpad Attempted deletion results in the **INVALID DELETE** scratchpad message. When a CRZ ALT entry is higher than the performance computed maximum altitude, the entry is accepted and a message **MAX ALT FLXXX** is displayed.

A cruise altitude entry deletes HOLD waypoint constraints higher than the entered cruise altitude. All other waypoint constraints higher than or equal to the entered cruise altitude are deleted.

NOTES:

1. When transitioning to a missed approach, the highest constraint altitude in the missed approach procedure is automatically entered as the new cruise altitude.

2. A cruise altitude entry above the MAX altitude deletes the fuel predications on the PROGRESS page 1/2 for all waypoints in the flight plan.
   BUT, with entry of any point that is not a flight plan waypoint into **3L** on Progress page 1/2, the MCDU displays time and fuel predictions even if cruise altitude is above MAX altitude.

D **ECON/SEL/LRC/EO/CO/RTA SPD (2L)** The cruise speed target is displayed on this line for the cruise phase of flight. The data line displays the speed of the cruise segment in either a three digit CAS or a three digit Mach preceded by a period, or a decimal point followed by a three digit Mach followed by a slash (**/**) followed by three digit CAS (for example, .800/330).

The data line displays three dashes (**-- -- --**) if economy or RTA is the cruise mode and performance initialization is notcomplete. Thedata line is blank if no cruise altitude is displayed in line **1L** or if descent is the active flight mode.

ECON SPD is displayed when the economy cruise speed is selected and the flight mode of the active flight plan is climb, cruise, cruise climb, or cruise descent.

SEL SPD is displayed when the pilot-entered CAS speed, Mach number, or Mach/CAS cruise mode is selected and the flight mode of the active flight plan is climb, cruise, cruise climb, cruise descent, or engine-out drift down.

LRCSPD is displayed when long-range cruise (LRC) is selected and the flight mode of the active flight plan is climb, cruise, cruise climb, cruise descent, or engine-out drift down.

EO SPD is displayed when the engine-out minimum drag cruise speed is selected and the flight mode of the active flight plan is climb, cruise, cruise climb, cruise descent, or engine-out drift down. The speed is displayed either as a three-digit CAS, ranging from 100 to 400 knots, or a three-digit Mach number preceded by a period ranging from .100 to .990.

CO SPD is displayed when the company defined (from the AMI file) engine-out Mach/CAS cruise speed schedule is selected and the flight mode of the active flight plan is climb, cruise, cruise climb, cruise descent, or engine-out drift down.

RTA SPD is displayed with an RTA time and fix entered (on the RTA PROGRESS page) and the active flight mode is climb, cruise, cruise climb, or cruise descent.

The pilot can change the cruise speed by using the scratchpad, line selection, and MCDU **[EXEC]** key. This action changes the performance mode to a selected CAS (ACT XXX KT CRZ) or a selected Mach (ACT M.XXX CRZ) cruise. Mach entry can be up to 4 digits, including the decimal point (**.**). The title of the data field also changes to **SEL SPD**. Figure 6--2 shows a performance change from ECON SPD to the SEL SPD of .82 Mach.

To change the ECON SPD to SEL SPD at .82 Mach:

1. Type **.82** into the scratchpad.
2. Push LSK **2L** to enter the selected speed.
3. Push the MCDU **[EXEC]** key to activate the selected speed. This changes the page title to **ACT M.820 CRZ**, as shown in Figure 6--2.

CRZ Airspeed Change

Figure 6--2

D **EPR** or **N1(3L)** Displayed here is the target EPR or N1 (depending on engine type as indicated in the PDB) required to maintain target airspeed at cruise altitude when on an active cruise, cruise climb, or cruise descent page. This area is blank when a modification (MOD) is in progress or when the page is inactive.

D **STEP (4L)** This is the default ICAO (International Civil Aeronautical Organization) or pilot-entered step size increment used for optimum step point predictions and step climb trip predictions. Valid entries are zero and multiples of 1,000 feet up to 9,000 feet. Entering zero results in the flight plan predictions to be computed with **no** step climbs. The pilot-entered step size value or deletions are propagated to or from the PERF INIT page. Deleting a pilot-entered step size results in returning to the default ICAO flight level.

NOTE: If step climbs are displayed, the FMS fuel predictions are based on the step climbs being done at the appropriate points. If no step climbs are to be made, then entering **0** into STEP SIZE is the correct procedure for accurate fuel predictions.

D **<ECON**, **<COSPD**, or **<RTA/ECON(5L)** ECONis displayedwhen LRC SPD or SEL SPD is the active speed mode in line **2L**. Selecting **ECON** and then pushing the MCDU **[EXEC]** key changes data line **2L** and the active cruise mode to ECON SPD.

Selecting **CO SPD**, when displayed, and then pushing the MCDU **[EXEC]** key, changes the cruise speed mode to a Mach/CAS schedule defined in the AMI.

Selecting **RTA/ECON**, when displayed, and then pushing the MCDU **[EXEC]** key, changes the cruise speed mode to RTA.

D **<ERASE**, **<EO SPD**, or **<RTA PROGRESS (6L)** ERASE is displayed when a route modification is pending. Pushing LSK **6L** when the prompt is displayed cancels all pending vertical and lateral modifications.

Selection while **EO SPD** is displayed results in changing the cruise speed mode to engine-out minimum drag.

Selection while **RTA PROGRESS** is displayed results in display of RTA Progress page 3/3.

D **STEP TO (1R)** The STEP TO altitude displays the next altitude that minimizes either the trip cost or fuel cost based on step size; if step size is ICAO, CRZ ALT is selected before takeoff.

This field displays step to altitude entered at waypoints on the LEGS page. These altitudes may be greater or less than CRZ ALT and cannot be overwritten on the CRZ page.

STEP TO altitude has a default value of 2000 feet higher than the displayed cruise altitude or the maximum certified altitude, whichever is less, provided the active route range remaining permits.

Pilot-entered step climb or step descent altitudes supersede the default value until a new cruise altitude is entered. A valid entry is FLXXX or XXX (flight level), or XXXX (feet).

The field is blanked when there is no active route and no entry can be made. The field is also blanked when within 200 NM of the T/D or within 500 NM of the destination. The field is blank if the crew entered **0** in the STEP size at line **4L**.

NOTE: ICAO safe separation, step increments are additive to the optimum (OPT) cruise altitude base on the CRZ ALT selected before takeoff. Inflight changes to CRZ ALT does not change this base altitude. For example, the flight scenario displays a CRZ ALT of FL350 selected at takeoff and an OPT altitude of FL321. The STEP TO altitude will be FL390.

D **AT**, **AT XXXXXXX**, **AVAIL AT**, **TO T/D**, or **TO FLXXX (2R)** The header and data line are blank if the cruise altitude has not been entered or descent is the active flight mode. The following notes apply to the data line.

NOTES:

1. Estimated-time of arrival (ETA) is displayed in standard time format, followed by a **Z** in SMALL font, followed by a LARGE font dash. Blanks are displayed for the ETA, including a slash (**/**) if the ETA is invalid.
2. The distance-to-go (DTG) immediately follows the slash (**/**) in LARGE font, followed by **NM** in SMALL font (for example, 1320Z/ 320NM). The DTG can be four digits with blanks preceding the distance value. The DTG is displayed to the nearest mile until less than 10 NM; then it is displayed to the nearest tenth of a mile.

The header displays **AT** when an altitude is displayed in line **1R** that was not derived from a specified step point. When the header displays **AT**, the data line displays the ETA and DTG to the optimum step point. Figure 6--2 shows an example with an ETA of 1538Z and a DTG of 2283 NM.

At the point where the optimum step to altitude is passed, the data line displays **NOW**. When the step climb computation has determined that an optimum step to an altitude does not exist, then the data line displays **NONE**, as shown in Figure 6--1.

The header displays **AT XXXXXXX** (XXXXXXX represents the flight plan fix associated with the specified step altitude entry on the RTE LEGS page) when the next step altitude has been propagated from a specified step altitude entry on the RTELEGS page and a step to the specified altitude can take place within 5 NM of the associated flight plan fix.

When the header displays **AT XXXXXXX**, the data line displays the ETA and the DTG to the point that the step to the altitude in **1R** can be achieved. If the point where the step to the altitude has been passed, the data line displays **NOW**.

The header displays **AVAIL AT** when the next step altitude has been propagated from a specified step altitude entry on the RTE LEGS page and a step to the specified altitude cannot take place within 5 NM of the associated flight plan fix due to the thrust or buffet limits.

When the header displays **AVAIL AT**, the data line displays the ETA and the DTG to the point that the step to the altitude in **1R** can be achieved. If the point where the step to the altitude has been passed, the data line displays **NOW**. When the step climb computation has determined that a step to an altitude specified in a step point constraint is not advisable, then the data line displays **NONE**.

D **Destination ETA/FUEL (3R)** Displays the estimated time of arrival and calculated remaining fuel at destination assuming step climbs (if displayed) are made at optimum points to STEP TO altitude. If there are planned steps on the LEGS page, predicted values assume step climbs are made at the planned STEP AT points.

Displays the same data for the alternate airport when a DIVERT NOW modification is selected from the ALTN page.

D **OPT (4R**, **LC left-center field)** The optimum cruise altitude is displayed in the center field of line 4. This field displays optimum altitude that **minimizes trip cost** when ECON speed is selected. For economy cruise, the optimum altitude is the one at which the aircraft operating cost per NM is lowest at the economy Mach number for that altitude.

This field also displays the altitude that **minimizes trip fuel** when LRC or SEL SPD is selected. This altitude is based on the selected cruise speed and the route distance.

D **MAX (4R**, **RC right-center field)** The maximum cruise altitude is displayed in the center field of line 4. The data line displays the present maximum altitude based on current gross weight, number of operating engines, and current speed line value; and the aircraft climbs directly to the altitude without regard for altitude or speed constraints.

If climb is the active flight mode, the maximum altitude is computed as the lesser of the engine-out climb maximum altitude derived using the speed in line **2L** of the CLB page (shown in Figure 5--1), and the engine out cruise maximum altitude derived using the speed in field **2L** of the CRZ page (shown in Figure 6--1).

If cruise or driftdown is the active flight mode, the maximum altitude is computed using the speed in **2L** of the CRZ page displayed to the next lower 100 foot increment.

Changes to the engine-out climb speed, planned engine-out cruise speed, or cruise altitude after initial activation of the engine-out mode can result in different engine-out maximum altitude values. These values are not transferred to **1L** without pilot action. However, changes that result in an engine-out maximum altitude less than the cruise altitude causes a **MAX ALT FLXXX** scratchpad message.

D **RECMD (4R)** The recommended cruise level function selects the cruise flight level that provides the minimum cost, constant altitude cruise over a fixed distance, taking into account the route of flight, entered wind and temperature forecast, and cruise speed schedule, including specified cruise speed segments.
The cruise flight levels evaluated by the recommended cruise level function are up to 9000 feet below the current CRZ ALT and less than the current MAXimum altitude. These altitudes are selected consistent with the step climb schedule determined by the current CRZ ALT and the specified STEP SIZE, except in the case where a STEP SIZE of zero has been selected. In this case, the recommended cruise level function operates as if a 2000 foot STEP SIZE has been entered.

For the RTA CRZ mode, the recommended cruise level is not computed.

D **ENG OUT>**, **ALL ENG> (5R)** Selecting engine out displays EO LRC CRZ, EO LRC CRZ DES, EO LRC CRZ CLB, or EO LRC D/D as appropriate for the situation. These pages are described in detail in Section 12, Degraded Performance, Engine Out.

When an engine out mode is selected and the cruise altitude is set above the drift down altitude, the cruise altitude is automatically lowered to the engine-out maximum altitude and results in the engine out minimum drag climb speed (EO SPD) as the cruise speed.

Selecting this prompt when the current altitude is above the engine-out maximum altitude results in display of the LRC D/D page and changes the command speed to engine out LRC speed.

D **LRC> (6R)** LRC (long-range cruise) is displayed in **6R** only when ECON SPD or SEL SPD is displayed in line **2L**. Selecting LRC results in a long-range cruise mode either for all engine or for the engine out configuration based on the current engine out status.

Selecting and executing changes the speed in line **2L** to LRC SPD. LRC is defined as a Mach target optimized to give 99% of the aircraft maximum still air range at the specified cruise altitude.

Route Copy

The route copy function allows the pilot to copy the active flight plan into the alternate route, in this case, RTE 2. This function allows the pilot to make changes to a copy of the active route, or to preserve the active route before a major modification.

The route copy can be accessed on the ACT RTE LEGS page following a direct-to entry at LSK **1L**. Selecting **RTE COPY>**(**4R**) initiates the copy function, shown in Figure 6--3.

In the flight scenario KORD to EGLL, the ROUTE COPY function was done after RTE 1 was activated during the preflight. Refer to Figures 6--3 and 6--4 for an example of route copy use in the flight scenario.

NOTES: 1. LSK **2L** (**RUNWAY**) data, shown in Figure 6--3, is not displayed when airborne.

2. The route copy function results in any previously entered information in the alternate route (in this case, RTE 2), to be replaced with a copy of the active flight plan.

RTE COPY>

Figure 6--3

Push LSK **4R** (**RTE COPY**) to copy the active flight plan into the alternate route; the display is as shown in Figure 6--4.

RTE COPY COMPLETE

Figure 6--4

D **RTE COPY> (4R)** The RTE COPY is selected to copy the active unmodified route into the inactive route. The previous inactive route is erased. After the the route has been copied the data line at **4R** changes from **RTE COPY** to **COMPLETE**, indicating that the process is done, as shown in Figure 6--4.

D **<RTE 2 (6L)** Selecting RTE 2 on the ACT RTE 1 page or RTE 2 LEGS on the ACT RTE 1 LEGS page displays the copied route on the respective RTE or LEGS page.

Abeam Points

The abeam points function allows the pilot to retain reference points along a direct-to path. Flight plan waypoints on the active flight plan that are downpath of the aircraft and before the direct-to waypoint are projected onto the direct path abeam the original position. The abeam points are inserted into the flight plan as follows:

D If the original fix is a database waypoint, navaid, NDB, or airport; then a Place Bearing Distance (PBD) is created on the direct path.

D If the original fix is a LAT/LON waypoint, then a new LAT/LON waypoint is created abeam the original point.

D If the original fix is a PBD, a new PBD is created abeam the navigation database fix of the original PBD.

D If the original fix was a LAT/LON reporting point, the LAT/LON reporting point is recomputed so it accurately marks the crossing of a particular latitude or longitude; that is, it is not located abeam the original location.

NOTE: If the abeam location is within 100 NM of the original location, entered wind information is retained. However, any altitude or speed constraints are not retained for the created abeam points.

The abeam distance limit of 700 NM is applied to the abeam function; therefore, abeam waypoints are not generated if the distance abeam exceeds this limit.

Abeam points are not generated from procedural waypoints (that is, runways, departures, arrivals, approaches, and transitions) except for the fix terminating the last leg of any departure procedure in the route and the fix terminating the leg immediately preceding the first leg of any arrival procedure in the route.

The abeam point is accessed following a direct-to entry. In the flight scenario, Figure 6--5 shows the aircraft location on the active route. The ACT RTE 1 LEGS page shows the aircraft 43 NM from the active waypoint HASTE.

ACT RTE 1 LEGS Page 2/7

Figure 6--5

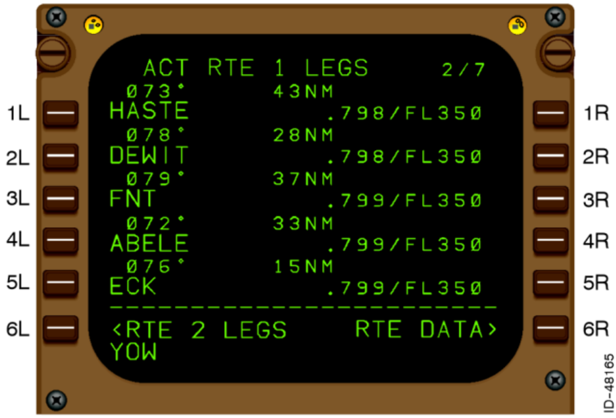
In this scenario, ATC issues a clearance from over HASTE, cleared direct to OTTAWA (YOW).

1. Push the MCDU **[NEXT PAGE]** key to display ACT RTE 1 LEGS 3/7.
2. Push LSK **1L** to place YOW into the scratchpad, as shown in Figure 6--6.

ACT RTE 1 LEGS – Page 3/7 – YOW in Scratchpad

Figure 6--6

3. Push the MCDU **[PREV PAGE]** key to display ACT RTE 1 LEGS 2/7 with YOW in the scratchpad, shown in Figure 6--7.



ACT RTE 1 LEGS – Page 2/7 – YOW in Scratchpad

Figure 6--7

4. Push LSK **1L**, to insert YOW into the modified flight plan for direct-to YOW, shown in Figure 6--8.

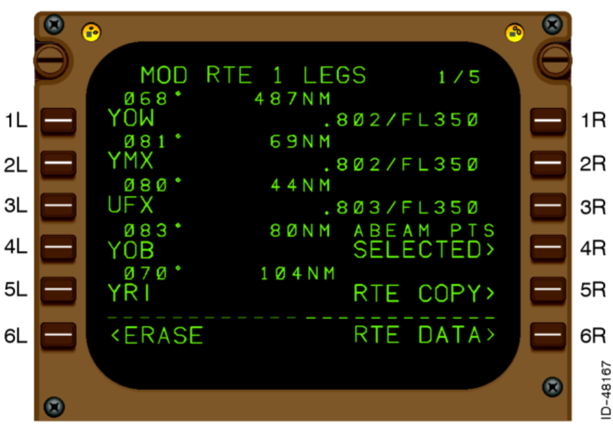
MOD RTE 1 LEGS – ABEAM PTS>

Figure 6--8

ABEAM PTS> (4R) ABEAM PTS (points) is displayed at **4R**. Selecting it creates abeam points on the new route to indicate waypoints bypassed by the direct-to function to waypoint YOW. The abeam points are perpendicular to the waypoints bypassed.

5. Push LSK **4R** to create abeam points on the new route.

   The line title changes to **ABEAM PTS** and **SELECTED** is displayed when completed, shown in Figure 6--9.



ABEAM PTS SELECTED

Figure 6--9

6. Push the MCDU **[EXEC]** key to execute the direct-to and insert the abeam waypoints into the active route, shown in Figure 6--10.

ACT RTE 1 LEGS – Abeam Waypoints
Figure 6--10

Direct-To/Intercept Course

Direct-to flight plan entries let the pilot fly direct to a particular fix or to intercept a course to any waypoint. The fix can be part of the active route or the modified active route, or it can be off path.

DIRECT-TO

A direct-to is performed by entering the desired fix into **1L** on the first ACT RTE LEGS page or MOD RTE LEGS page. The following are permitted entries into **1L**:

D Any navigational database defined waypoint, airport, navaid, or NDB

D Any fix defined in the active or modified active route, excluding conditional legs

D A valid PBD waypoint

D An along track waypoint

D A LAT/LON waypoint and LAT/LON reporting point D A course

intersection waypoint.

Once an entry has been made in **1L**, a modification (MOD) is created. After verifying the modified path on the navigation display, the pilot has the option to execute or erase the direct-to operation, shown in Figure
6--11.

1. Type **YZV** (SEPT--ILES) into the scratchpad.
2. Push LSK **1L**.

Direct--To YZV MOD
Figure 6--11

D **YZV (1L)** LSK**1L** displays the pilot-entered direct-to waypoint, YZV, and also the inbound course to the waypoint.

D **<ERASE(6L)** ERASE is displayed only on the MOD pages, as shown in Figure 6--11, and pushing ERASE displays the previous unmodified page.

3. Push the MCDU **[EXEC]** key to execute the direct-to. Figure 6--12 shows the result.

Direct--To YZV ACTIVE Figure 6--12

INTERCEPT COURSE

An intercept course to a particular fix is similar to the direct-to procedure. A fix is entered into **1L** on the first ACT RTE LEGS page or the MOD RTE LEGS page. The pilot then enters the intercept course in **6R** into box prompts or over a prompted value. If the fix is part of the flight plan (that is, it is not offpath), the current course to the fix is displayed in **6R**; for this flight scenario it is 063_. This value can be selected to define the intercept course.

Once executed, the aircraft captures the intercept leg if LNAV is engaged and the current aircraft track crosses the intercept leg. The course displayed in the header of **1L** represents the course required to follow a great circle path that intercepts the fix at the selected course. If the current track does not cross the intercept leg, the **NOT ON INTERCEPT HEADING** message is displayed in the scratchpad.

Using the flight scenario to EGLL, the aircraft flies direct-to YZV and intercepts a course of 060_ from a position WEST of waypoint YYY (MONT-JOLI).

1. Type **YZV** into the scratchpad.
2. Push LSK **1L** to enter YZV into line **1L**, as shown in Figure 6--13.

MOD RTE 1 LEGS INTC CRS

Figure 6--13

D **INTC CRS TO (6R)** The intercept course to (INTC CRS TO) displays box prompts jjj for entering the intercept course to the selected waypoint if the **1L** entry is not in the active route.

If the selected waypoint is in the active route, the current route course is displayed with a **>** caret prompt selection.This isshown in Figure 6--13; the course is 063_.

Selecting or entering the intercept course line overwrites the active waypoint course.

Selecting the intercept course line removes the **ABEAM PTS>** and **ROUTE COPY>** prompts.

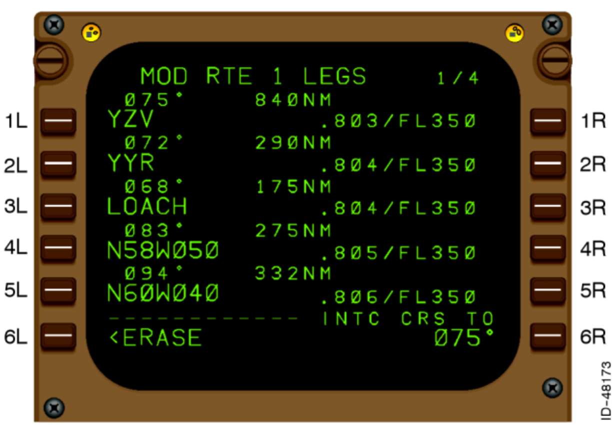
To establish an intercept course to a fix:

1. Type **075** into the scratchpad, as shown in Figure 6--14.

MOD RTE 1 LEGS – 075° in Scratchpad

Figure 6--14

2. Push LSK **6R** to enter an intercept course of 075 into line 6R, as shown in Figure 6--15.



MOD RTE 1 LEGS – 075° Intercept Set

Figure 6--15

3. Push the MCDU **[EXEC]** key to execute the intercept course, as shown in Figure 6--16.

ACT RTE 1 LEGS – 075° Course
Figure 6--16

INTERCEPT COURSE FROM

The same rules apply to both an intercept course FROM and an intercept course TO as explained in the previous section, Intercept Course.

When a waypoint and course are entered into the active waypoint line, then **INTC CRS FROM** is displayed at the bottom of the page at **6R**. A waypoint and course are entered as the waypoint identifier followed by the 3-digit course, for example, YZV075.

INTC CRS FROM replaces **INTC CRS TO** when a point of reference and course are entered into the scratchpad and inserted into the route.

D **INTC CRS FROM (6R)** INTC CRS FROM is displayed when a waypoint and course pair is entered into the active waypoint line; for example YXV075.

This permits entry of another course from the referenced point. When selected, it removes the **ABEAM PTS>** and **RTE COPY>** prompts.

PROGRESS PAGE

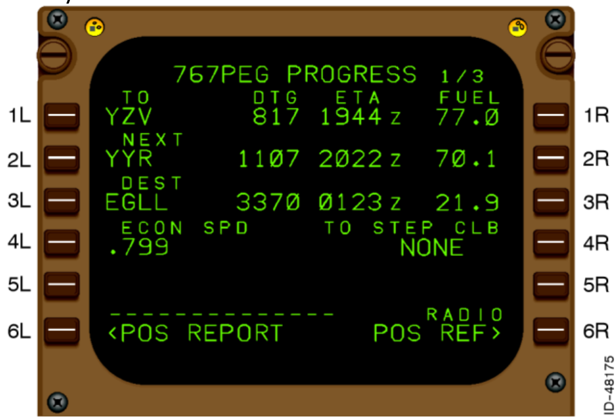
The PROGRESS page displays dynamic flight information relative to the present progress of the flight. The PROGRESS page can be accessed at any time to review current status. The page is accessed by pushing the MCDU **[PROG]** mode key, and it contains pages 1/2 and 2/2. If the RTA function is enabled, there are three PROGRESS pages:
1/3, 2/3 and 3/3. Figure 6--17 displays the first PROGRESS page.

PROGRESS Page 1/3

To access page 1/3 of the PROGRESS pages:

1. Push the MCDU **[PROG]** key.

2. Push the MCDU **[PREVPAGE]** or **[NEXTPAGE]** key if moving from page 2/3 or 3/3, respectively.



PROGRESS Page 1/2

Figure 6--17

The following paragraphs explain the fields on this page.

- **TO (1L)** Displays the **TO** waypoint identifier, **DTG**, **ETA** and **FUEL** (estimated fuel) remaining at the active waypoint. The distance to go (DTG) is the direct distance from the aircraft to the termination point of the active leg.

  Predicted total fuel quantity at the active waypoint is in thousands and tenths of thousands of pounds or kilograms (when the kilogram option is set). Predicted fuel data is displayed as zero if there is insufficient fuel to reach the point.

- **NEXT (2L)** The**NEXT** waypoint line displays the waypoint identifier, **DTG**, **ETA,** and **FUEL** (estimated fuel) remaining for the waypoint after the active waypoint. The DTG is the distance along the flight path from the aircraft to the next leg termination point.

- **DEST (3L)** The destination (**DEST**) identifier is displayed on this line. The data on this line, **DTG**, **ETA**, and **FUEL** (estimated fuel) remaining, is all relative to the destination that is displayed.

  The **DEST** is displayed when the active route has not been modified and an alternate destination has not been entered. The data is relative to the en route distance from the aircraft to the destination.
  The alternate destination waypoint can be entered over the displayed destination. The **DEST** label is replaced by **DIR TO FIX**. The predicted information shown is based on flying direct to the FIX using the current speed and cruise altitude. Reset to the destination is done by using the MCDU **[DEL]** key or leaving the page.

  A flight plan waypoint can be entered over the displayed destination. The **DEST** label is replaced by **ENROUTE WPT** and predicted information shown is relative to the current route. If the en route waypoint exists more than once in the route, predictions for the first occurrence in the route are used. Sequencing an en route waypoint changes the display to the destination of the active route or last leg identifier.

D **SEL SPD (4L)** The speed line displays the FMS active command speed. The data line displays the respective speed in CAS or Mach.

The active speed mode is the same as that displayed on the performance page, unless changed by the MCP or a limit. The speed modes are listed below. **LRC SPD** (long-range cruise speed)

ECON SPD (economy speed)

SEL SPD (manually entered speed on the MCDU)

LIMSPD (speed is limited by V_{MO}, M_{MO}, flap limit, or buffet limit)

MCP SPD (speed intervention entered on the mode control panel IAS/Mach indicator)

EO SPD (engine out speed)

CO SPD (engine out operations at airline specified engine out company speed)

VREF+80(engine out detected during engine out takeoff) **RTA SPD** (required time

of arrival speed).

D **<POS REPORT (6L)** Selecting POS REPORT displays the POS REPORT page.

D **DTG, ETA**, and **FUEL (1R, 2R, 3R)** The distance-to-go, estimated time of arrival, and estimated fuel are displayed for the active waypoint, next waypoint, and destination, respectively. The **FUEL** value is the FMS estimated fuel remaining at the waypoint/destination.

D **TO (4R)** The data line displays the ETA and DTG to the various points as the flight progresses for the constraints listed below. **TO STEP CLB** (step climb) when remaining distance permits it.

- The data line displays **NOW** when the header line is TO STEP CLB and the aircraft is past that profile point.
- The data line displays **NONE** when the header line is TO STEP CLB and a step to the specified altitude on the CRZ page is not advised or entered.

TO T/C(top-of-climb) when climb is active.

TO T/D(top-of-descent) when cruise is active and within 200 NM.

- The data line displays **NOW** when the header line is TO T/D and the aircraft is past that profile point.

TO E/D(end-of-descent) when the descent is active.

LEVEL AT when the active guidance/performance mode is drift down (D/D).

D **POSREF> (6R)** Selecting POS REF displays POS REF page 2/3.

The header displays the navigation updating mode, in SMALL font, depending on the FMF NAV MODE as follows:

GPSwhen FMF NAV MODE is GPS/INERTIAL or GPS only.

RADIO when FMF NAV MODE is VOR/DME/INERTIAL or DME/DME/INERTIAL.

IRSwhen FMF NAV MODE is INERTIAL only.

LOC--GPS when FMF NAV MODE is LOC/GPS/INERTIAL.

LOC--RADIO when FMF NAV MODE is LOC/VOR/DME/INERTIAL or LOC/DME/DME/INERTIAL.

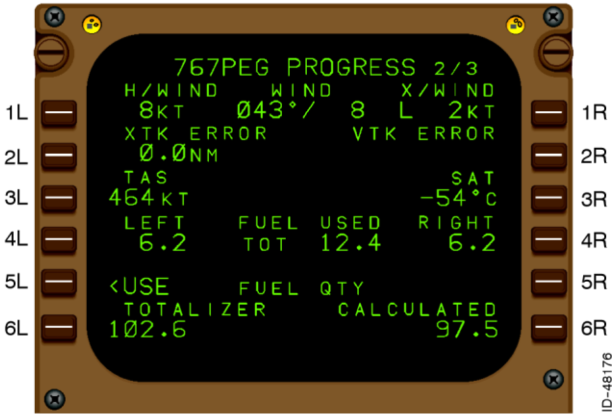
LOCwhen FMF NAV MODE is LOC/INERTIAL.

PROGRESS Page 2/3

PROGRESS page 2/3 contains wind information, tracking errors, airspeed, temperature, and fuel information and allows selecting the fuel information source when a discrepancy occurs.

To display PROGRESS page 2/3:

1. Push the MCDU **[PROG]** mode key.
2. Push the MCDU **[NEXT PAGE]** key to display PROGRESS page 2/3, shown in Figure 6--18.



PROGRESS Page 2/3

Figure 6--18

The fields are explained in the following paragraphs.

- **H/WIND** or **T/WIND (1L)** The actual wind magnitude is displayed at **1L**. Headwinds are indicated in the header line by H/WIND and tailwinds are indicated by T/WIND.

- **WIND (1C)** Displays the current wind bearing in degrees TRUE and speed information in knots.

- **X/WIND (1R)** Displays the current cross wind, when valid. The direction of the crosswind is indicated by **L** for left crosswind and **R** for a right crosswind.

  NOTE: The above winds are referenced to aircraft heading.

- **XTK ERROR (2L)** Displays the crosstrack (XTK) error in nautical miles (NM), indicating the distance the aircraft is left (**L**) or right (**R**) of the active route.

- **VTKERROR(2R)** The vertical track error(VTK) isdisplayed inthis field when the aircraft is active in the descent phase of flight in the range of 9990 to 10 feet. The preceding plus (+) indicates the aircraft is above path and the preceding minus ( ) indicates the aircraft is below the vertical path. The field is blank when the descent phase of flight is not active.

  NOTE: The vertical track error is displayed only during the descent phase of flight.

- **TAS (3L)** The true air speed (TAS) displayed is the current TAS.

- **SAT (3R)** The static air temperature (SAT) is displayed here in degrees centigrade.

D **LEFT--FUEL USED--RIGHT (4L, 4C, 4R)** The Total (TOT) fuel used by the two engines is displayed in field **4C**. The fuel used by the left and right engines is displayed at **4L** and **4R**.

If a fuel flow sensor goes invalid, the **FUEL USED** display for the affected engine and the **FUEL USED TOT** are blanked. The fuel used display for the unaffected engine continues to display current data.

D **<USE, USE> (5L, 5R)** USE prompts appear in the 5L and 5R data fields when the message **FUEL DISAGREE--PROG 2/3** is displayed in the scratchpad (otherwise the fields are blank). This message is displayed during flight if **MANUAL** is not displayed in line **2L** of the PERF INIT page (shown in Figure 4--43), and the difference between the totalizer and calculated fuel quantity values (in data field 6) exceeds 3000 lbs for 5 minutes when the reference initial fuel weight is less than 119,000 lbs, or exceeds 4500 lbs for 5 minutes when the reference initial fuel weight is greater than or equal to 119,000 lbs.

The pilot can choose either fuel monitoring system (the totalizer fuel quantity or the FMS calculated fuel quantity) when the **USE** prompts appear. The FMS uses the sensor the pilot selects and blanks the opposite fuel quantity value. When the **USE** prompts appear, the pilot can also reset the entire system by entering a manual fuel value in line **2L** of the PERF INIT page, shown in Figure 4--43. If no selection is made, the FMS continues to base performance calculations and predictions on the FMS calculated fuel quantity.

NOTE: A manual fuel weight entry on the PERF INIT page when the **USE** prompts are displayed results in both prompts going blank.

If **TOTALIZER** fuel is selected, the **CALCULATED** fuel blanks and fuel flow inputs are no longer used for fuel weight computations. Additionally, the FUEL USED fields are blanked, and line **2L** on the PERF INIT page displays **SENSED** fuel, and manual entries are not permitted.

If **CALCULATED** fuel is selected, the **TOTALIZER** fuel blanks and is not considered for fuel weight computations. Line **2L** of the PERF INIT page continues displaying **CALC** fuel. Manual fuel entries on the PERF INIT page are permitted, but deletions of manual fuel entries are not.

D **FUEL QTY (5C)** Line 5C is the label for data line six.

D **TOTALIZER (6L)** Data line**6L** displays the totalizer fuel value in thousands of pounds (or kilograms, depending upon the customer option selected). The totalizer fuel quantity is calculated by the fuel quantity indicating system (FQIS).

The totalizer fuel quantity is not displayed if the FQIS is inoperative or fails in flight, or a manual fuel entry is made in line **2L** of the PERF INIT page, or calculated fuel **USE> 5R** is pushed.

D **CALCULATED(6R)** Before engine start, **6R** displays fuel quantity calculated by the totalizer. After engine start, it displays fuel quantity calculated by decreasing fuel on board at engine start at the EICAS fuel flow signal rate. The FMS calculated fuel value is in thousands of pounds or kilograms.

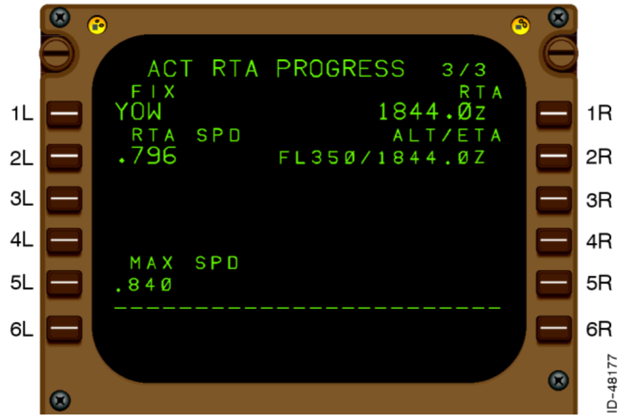
Calculated fuel quantity is not displayed if the fuel flow sensors are inoperative or fail in flight, or when the totalizer fuel **<USE** prompt at **5L** is selected.

NOTE: The calculated value is set equal to the totalizer value following any fuel jettisoning.

PROGRESS Page 3/3

The RTA PROGRESS page allows the pilot to enter a required time of arrival for an existing flight plan fix in the active route. FMS computed speed to meet the required time of arrival and predicted altitude and estimated time of arrival are displayed.

The RTA PROGRESS page, as shown in Figure 6--19, is displayed by selecting MCDU **[PREV PAGE]** while PROGRESS page 1/3 is displayed, or **[NEXTPAGE]** while PROGRESS page 2/3 is displayed. In addition, the RTA PROGRESS page can be accessed by selecting RTA Progress at line **6L** on the CRZ page, shown in Figure 6--1.



RTA PROGRESS Page Figure 6--19

D **FIX (1L)** The fix is a flight plan fix in the active route for which a required time of arrival is desired. Valid entry is a fix identifier of a fix existing in the active route (latitude/longitude or place/bearing/distance fixes can be entered in expanded format as downselected from the RTE LEGS page). Entries can be made while the aircraft is airborne and an engine-out condition does not exist, as well as on the ground before takeoff.

Valid entries are any waypoint before the missed approach in the pending activation, modified active, or active flight plan, when data or box prompts are displayed (jjjjj), as shown in Figure 6--21. The RTA waypoint is also uplinkable by using the FMC ATC COMM interface.

Attempted entries of waypoints not in the active, modified active or pending activation flight plan when data or box prompts are displayed results in the **INVALID ENTRY** scratchpad message. Attempted deletion of box prompts results in the **INVALID DELETE** scratchpad message. Valid RTA fix deletions result in any existing RTA cruise speed targets on the LEGS page changing to ECON cruise speed targets.

D **RTA SPD (2L)** The RTA SPD displays the FMS computed cruise speed to meet the entered required time of arrival at the entered fix. The header and data lines are blank when an RTA fix does not exist. The data line is blank when an RTA fix and time exist but a valid RTA SPD does not exist.

D **START**, **SPDSEG(3L)** The speed segment data displays the start and end point of the next cruise speed segment. The displayed speed segment changes any time a waypoint that has a specified cruise speed target is sequenced.

The header and data lines are blank when the aircraft is not airborne and, when airborne, no down path cruise speed target exists.

When airborne and a down path cruise speed target exists, the header displays **START**, followed by **SPD SEG**, in SMALL font. The data line in this scenario, shown in Figure 6--20, displays RTA/FNT05

NOTE: Cruise speed targets can be either a Mach value (such as .840) or speed mode (such as ECON, LRC, RTA).

RTA PROGRESS Page With Speed Segment
Figure 6--20

D **MAX SPD (5L)** The MAX SPD displays the pilot-entered maximum speed, or a default speed that is the lesser of MMO -- 0.02 or .880, where MMO is defined by the performance database.

D **<ERASE (6L)** ERASE is displayed when a modified active or pending activation flight plan exists, shown in Figure 6--24. Pushing LSK **6L** when the prompt is displayed cancels the modified active or pending activation flight plan.

D **RTA (1R)** The RTA is the required time of arrival corresponding to the fix identifier displayed in line **1L**. Valid entry is a two-digit hour value, immediately followed by a two-digit minute value (no intervening spaces) and an optional tenths of minute value. **A** can be entered immediately following the time value to indicate a desired at or after time. **B** can be appended to the entry to indicate a desired at or before time. Entries with neither an **A** nor a **B** suffix indicate an AT time.

The header and data lines are blank when an RTA fix does not exist. When an RTA fix does exist and no RTA time exists, the data line displays box prompts (jjjj.jzj) and SMALL font z (ZULU time), shown in Figure 6--22.

NOTES: 1. The RTA time is cleared at flight completion.

2. The RTA fix is cleared if the navigation database is cycled.

D **ALT/ETA (2R)** The ALT/ETA displays the altitude and predicted arrival time for the RTA fix.

D **T/O** (time)**, RECMD T/O, END (3R)** T/O is displayed in the header line in SMALL font when not airborne and a PERF computed takeoff time is not displayed in the data line.

RECMD T/O is displayed in the header line in SMALL font when not airborne and a PERF computed takeoff time is displayed in the data line. The takeoff time is computed by the PERF when no pilot entered takeoff time exists and the PERF computed takeoff time is valid and later than or equal to current time.

When airborne, and no down path cruise speed targets exist, the header is blank. When a down path cruise speed target does exist, the header displays **END** in SMALL font and the data line displays **T/D** in LARGE font.

NOTES: 1. A cruise speed target is used to plan the speed changes in the cruise portion of the flight. Cruise speed targets are entered on the LEGS page and can be entered only after the last climb constraint or before the first descent constraint.

2. Cruise speed targets can be either a Mach value (for example, .820) or speed mode (that is, ECON, LRC, RTA). The cruise speed target and waypoint identifier are displayed with no leading spaces.

D **PRIOR RTA (6R)** PRIOR RTA is displayed only when the RTA function is not currently active but an RTA fix and time were previously entered and activated and the RTA fix is still present in the ROUTE. Selecting PRIOR RTA results in the previously active RTA fix and time to be displayed in lines **1L** and **1R**. This also initiates a flight plan MOD.

PRIOR RTA fix and time data is available when any of the following are true:

RTA is terminated by selecting ECON speed mode on the CRZ page.

RTA is terminated by selecting LRC speed mode on the CRZ page.

RTA is terminated by selecting a SEL SPD on the CRZ page.

Deleting and executing the RTA fix on the RTA progress page.

NOTE: If the RTA fix corresponds to a waypoint that exists more than once in the flight plan, removal of the RTA FIX from the flight plan does not result in the PRIOR RTA prompt. The PRIOR RTA prompt provides for reactivating RTA if RTA was terminated by a change to VNAV CRZ speed mode or deletion (and execution) of the RTA fixon theRTA PROGRESS page. The PRIOR RTA prompt is not displayed during EO, because exiting EO mode requires selecting the ALL ENG prompt. PRIOR RTA data is maintained during EO mode so that if the ALL ENG mode is selected, the previous RTA can be restored.

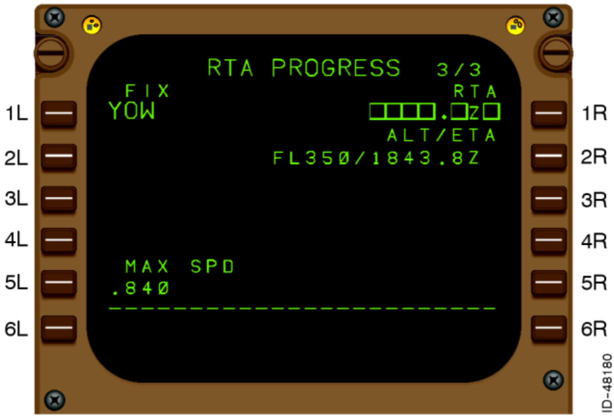
Figures 6--21, 6--22, 6--23, and 6--24 show the RTA entry process.

1. Push the MCDU **[PROG]** key to access page 1/3 of the PROGRESS pages.
2. Push the MCDU **[PREV PAGE]** key to access page 3/3 of the PROGRESS pages.
3. Type **YOW** into the scratchpad, as shown in Figure 6--21.

RTA Entry Process – YOW Entered in Scratchpad

Figure 6--21

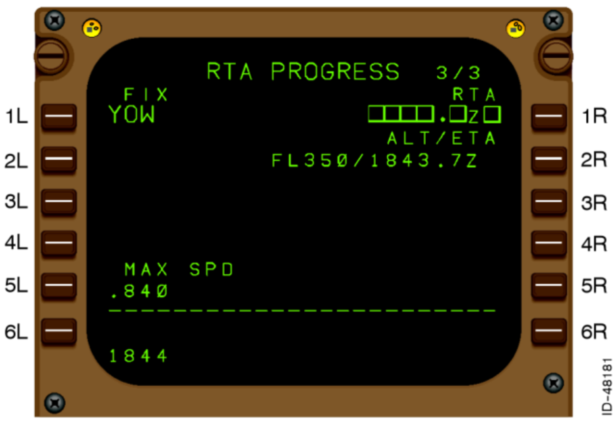
4. Push LSK **1L** to enter the fix, shown in Figure 6--22.



RTA Entry Process – YOW Entered in LSK 1

Figure 6--22

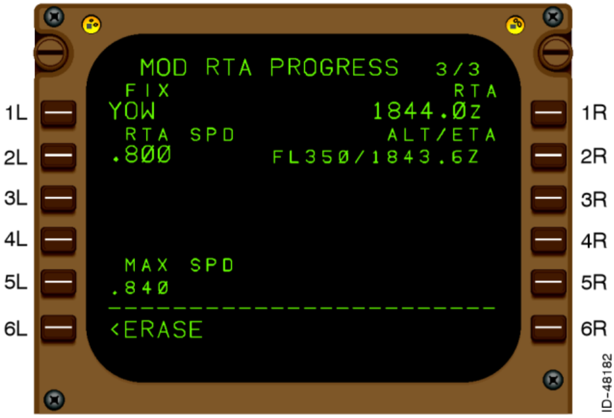
5. Type **1844** into the scratchpad, as shown in Figure 6--23.



RTA Entry Process – RTA Time Is Entered in Scratchpad

Figure 6--23

6. Push LSK **1R** to enter the required time of arrival, as shown in Figure 6--24.



RTA Entry Process – RTA Time Is Entered in LSK 1R

Figure 6--24

ALTITUDE STEP POINTS

Planned and FMS computed step points give advisory step points for the pilot. A step climb is executed by dialing thestep altitudeon theMCP altitude window and pushing the altitude knob. The FMS then enters a cruise climb (CRZ CLB) to the step altitude. **No stepscan beexecuted without pilot action**.

All performance predictions are based on the pilot executing all planned and/or optimum step altitudes. If a step point is crossed and the step is not initiated, the performance predictions assume the pilot has initiated the step climb.

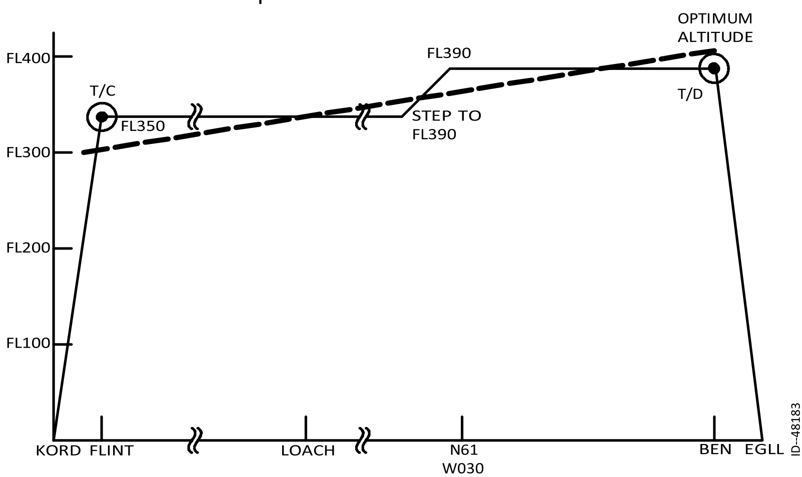
NOTE: If the planned or optimum steps are not made, zero should be entered into **4L** (STEP) to give accurate predictions, such as, for fuel remaining, top-of-descent, and ETAs. In the cruise phase of flight this can be done on the ACT CRZ page, shown in Figure 6--1.

Section 13, FMS Flight Plan Wind Usage, contains information on wind adjusted best step climb point calculations.

Optimum Steps

The FMS computes altitude step points based on the entered step size, resulting in minimum trip cost for the economy cruise mode or minimum trip fuel consumption for the LRC and selected speed cruise modes. The STEP TO altitude is the next ICAO standard altitude or step interval but cannot exceed the maximum altitude at the step point. Figure 6--25 shows an optimum step cruise profile for the flight scenario from KORD to EGLL.

The calculated step point, displayed as step climb (S/C) on the ND/EHSI, is the position along the route at which the cruise climb should be initiated. No steps are predicted within 200 NM of the top-of-descent.



Optimum Step Cruise Profile Figure 6--25

Planned Steps

Planned steps let the pilot specify step altitudes at flight plan waypoints. The FMS uses the pilot-entered step points in performance calculations and displays the planned step on the navigation display. Planned steps, like optimum steps, are advisory and must be initiated by pilot action, using the MCP altitude window and knob to depart the current cruise altitude.

A planned step point is made on the RTE LEGS page by entering the step altitude followed by **S** adjacent to the desired step point. The flight scenario requires a step climb to FL390 at N61W030, so adjacent to N61W030 the pilot enters **/390S**.

1. Push the MCDU **[LEGS]** and **[NEXT PAGE]** keys to access the ACT RTE 1 LEGS 2/4 page.

2. Type **/390S** into the scratchpad, as shown in Figure 6--26.

STEP CLIMB S/C Entry in Scratchpad Figure 6--26

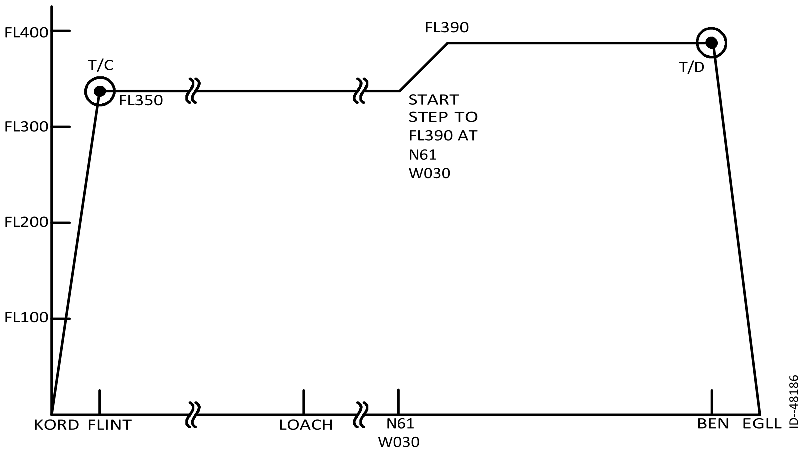
3. Push LSK **1R** to enter the step climb into the flight plan, as shown in Figure 6--27.

4. Push the MCDU **[EXEC]** key to activate the selected step climb, shown in Figure 6--27.

STEP CLIMB S/C Entry in Flight Plan
Figure 6--27

The FMS follows planned steps from the first step to the last pilot-defined step followed by computed optimal steps. If the last step is a step down, that step is maintained until the descent profile is intersected.

The FMS calculates a step climb from FL350 to FL390 on the KORD to EGLL flight at N61W030. Figure 6--28 shows the planned step cruise profile for the flight scenario.



Planned Step Cruise Profile Figure 6--28

LATERAL OFFSET ROUTE

The pilot can establish a parallel lateral path offset to the left or right of the original flight path. The activation of a lateral offset can be done only on the active leg. Valid offsets are distances of 1 NM up to and including 99 NM. Offset paths can be constructed from the primary route if the aircraft is airborne.

The pilot may initiate, change, or cancel the offset at any time using the MCDU. When an offset is executed and becomes the active path the LNAV mode turns the aircraft to leave the original path and capture the offset route.

NOTE: At 2 minutes before passing the last leg of the offset path and the offset has not been canceled, the MCDU **MSG** annunciator is lit and the scratchpad message **END OF OFFSET** is displayed.

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After passing the last leg of the offset path, the LNAV guidance recaptures the active original path, or if the LNAV capture criteria cannot be satisfied, the LNAV maintains LNAV heading hold as long as LNAV remains engaged or until the active flight plan leg is intercepted. When LNAV commands heading hold and the current heading does not intercept the active flight plan leg, the MCDU **MSG** annunciator is lit and the scratchpad message **NOT ON INTERCEPT HEADING** is displayed.

Entering an offset is inhibited while active in a selected SID or SID transition. An offset path propagates parallel to the active leg, but not preceding the last SID or SID transition waypoint through the remainder of the flight plan up to the end of route waypoint, to a discontinuity, to the start of a published STAR transition, STAR, approach transition, or approach procedure to an arc or heading leg, or to a holding pattern.

If a holding pattern is defined in the original path, the holding pattern is not included in the offset path and the offset path terminates abeam the holding fix. Offset paths are also terminated abeam a fix where a course change of 135 degrees or greater exists. Use of the DIRECT TO/INTC LEG route modification automatically cancels any existing offset.

Entries are made at **OFFSET** (**6R**) on the ACT RTE page with the aircraft airborne.

Figure 6--29 shows **OFFSET (6R)** on the ACT RTE page. The the MCDU **[RTE]** key is pushed to access the active route page (when airborne).

ACT RTE 1 OFFSET

Figure 6--29

A valid entry first includes the direction, either left (**L**) or right (**R**) of the active route followed by the NM offset. As an example, the pilot requests, and ATC approves, a 20 NM offset to the right of the original path to avoid thunderstorms. The following paragraphs describe how to enter and activate the offset.

1. Type **R20** into the scratchpad.
2. Push LSK **6R** to set the OFFSET.
3. Push the MCDU **[EXEC]** key to activate the OFFSET, shown in Figure 6--30.
4. The MCDU **OFST** annunciator is lit.

OFFSET R20

Figure 6--30

NOTE: The offset is displayed as a WHITE dashed line on the ND/EHSI until the offset modification is executed or erased. After execution, the offset route is displayed as a dashed MAGENTA line on the navigation display. The original route is displayed as a solid MAGENTA line.

Once executed, the active offset route can be canceled by entering **DELETE** into the scratchpad by pushing the MCDU **[DEL]** key, selecting **6R**, and then pushing the **[EXEC]** key. Entering an offset of **L0**, **0**, or **R0**, also cancels the offset.

The following example cancels the offset by entering an offset of 000: 1.

Type **000** is into the scratchpad (0 could also be entered).

2. Push LSK **6R** to set the modified route with an OFFSET of 000, as shown in Figure 6--31.

OFFSET MOD

Figure 6--31

3. Push the MCDU **[EXEC]** key to cancel the OFFSET, as shown in Figure 6--32.

ACT RTE 1 OFFSET Canceled

Figure 6--32

HOLDING PATTERNS

This section describes holding pattern creation, modification, and guidance. A detailed coverage of holding is found in Section 11, Advanced Flight Planning, Holding Patterns.

The holding function permits the inserting holding patterns into the flight plan and modifications of existing holding patterns. A holding pattern can be inserted at any waypoint or at the aircraft present position. While in holding, any inserted changes of the pattern become effective upon the next crossing of the holding fix. Changes of the pattern become effective immediately if made before entering holding.

Anytime the route contains a holding pattern, whether from the nav database or pilot-defined, the aircraft automatically enters holding after sequencing the holding fix. If desired, holding patterns can be deleted by performing a DIR TO function or by entering a waypoint over the holding pattern on the RTE LEGS pages.

The MCDU **[HOLD]** key provides access to the different holding pages.

RTE 1 LEGS HOLD AT PAGE

The RTE LEGS HOLD AT page lets the pilot initiate a holding pattern at a fix on path, at the aircraft s current position, or at any other geographical point. This page is accessed by selecting the MCDU **[HOLD]** key while the displayed route or RTE 1 contains no holding pattern or by selecting **NEXT HOLD** on the RTE HOLD page.

To access HOLD AT on the RTE LEGS page:

1. Push the MCDU **[HOLD]** key if no holding pattern is in the route.
2. Push LSK **6L**, **<NEXT HOLD**, on the ACT RTE 1 HOLD page, shown in Figure 6--35, to display the RTE LEGS page, where line 6 is labeled **HOLD AT** if a holding pattern is in the route, as shown in Figure 6--33.

ACT RTE 1 LEGS HOLD AT Figure 6--33

The relevant fields are explained in the following paragraphs.

D **HOLD AT (6L)** The HOLD AT line permits entering a waypoint as a holding fix. The waypoints displayed in Figure 6--33 can be transferred to line **6L**. The HOLD AT leg is then created after the leg to that waypoint. All intervening legs remain in the route and the display goes to MOD RTE HOLD, shown in Figure 6--34.

Pushing the MCDU **[EXEC]** key activates the MOD RTE HOLD page. This results in the aircraft entering the holding pattern at the holding fix. The page title changes to ACT RTE 1 HOLD.

NOTE: If on an offset path, the aircraft does not enter a pre-planned holding pattern.

D **PPOS> (6R)** Line**6R** of the RTE LEGS HOLD AT page displays **PPOS** prompt, which permits the aircraft to hold at present position. After pushing LSK **6R**, and then executing by pushing the **[EXEC]** mode key, a holding fix is defined and assigned an identifier, for example, WPT01 (as detailed in Section 11, Advanced Flight Planning, Pilot-Defined Waypoints). A RTE HOLD page is displayed for pilot editing.

NOTE: The pilot can use the PPOS prompt when flying on an offset path. Selecting the PPOS while on an offset path deletes the offset path.

MOD RTE 1 HOLD PAGE

The RTE HOLD page is used to review and change data associated with the holding pattern contained in the route. The page is used to display and change the holding pattern parameters and to initiate an exit from an active holding pattern. Modifications made to a holding pattern while active in the hold become effective only on the next crossing of the holding fix.

To access the MOD RTE 1 HOLD page shownin Figure6--34, pushLSK **6R**, **PPOS>** on the ACT RTE LEGS page (shown in Figure 6--33).

MOD RTE 1 HOLD Figure 6--34

D **FIX (1L)** Displays the holding fix identifier. The holding fix cannot be changed or deleted on the RTE HOLD page, but it can be deleted on the RTE LEGS page.

D **QUAD/RADIAL (2L)** Displays the holding quadrant and radial. Normally this line displays dashes. Quadrants are expressed in terms of N, NE, E, SE, S, SW, W, or NW. Valid entries are three-digit radials optionally preceded by a slash (/), or a quadrant followed by a three-digit radial optionally separated by a slash (/). The FMS corrects the quadrant entry display if the entered radial does not fall within the limits defined in Table 6--1. Deletions are not permitted for this field. A valid radial entry results in the reciprocal inbound course being displayed in **3L**.

Quadrant	**Quadrant Radials**	
N	Between	337.5_ and 022.5_
NE	Between	022.5_ and 067.5_
E	Between	067.5_ and 112.5_
SE	Between	112.5_ and 157.5_
S	Between	157.5_ and 202.5_
SW	Between	202.5_ and 247.5_

W	Between	247.5_ and 292.5_
NW	Between	292.5_ and 337.5_

Quadrant Boundaries Table 6--1

NOTE: An entry in the QUAD/RADIAL box prompts overrides any entry that was made in the INBD CRS/DIR at line **3L**.

D **INBD CRS/DIR (3L)** Displays the inbound course and the turn direction of the holding pattern. The INBD CRS/DIR are entered with the keyboard. Valid entries for the course are three-digit bearings optionally followed by L for left turn and R for right turn. A slash between the course and the turn direction is required. The holding turn direction is displayed as either **L TURN** or **R TURN**.

NOTES: 1. Default values for the line **3L** data field are the course of the leg preceding the holding fix for the inbound course and a right turn.

2. Valid entries in either line **2L** or **3L** automatically enters the appropriate data in the other line. The turn direction, however, can be changed only by pilot--entry. An entry in the INBD CRS/DIR (**3L**) overrides any entry that was made in the QUAD/RADIAL (**2L**).

D **LEG TIME (4L)** Displays the holding pattern inbound leg time in minutes. The field defaults to 1 minute at or below 14,000 feet or 1.5 minutes above 14,000 feet. Entry of a holding leg distance in **5L** (manually or from a nav database stored procedure) results in this data line displaying dash prompts.

D **LEG DIST (5L)** Displays the leg distance, in NMs, of the holding pattern. The LEG DIST data line normally displays dashes unless a keyboard entry for leg distance is made or a value is inserted from the nav database stored procedure.

D **<ERASE (6L)** ERASE is displayed only on the MOD RTE HOLD page. If a route activation, hold exit, or flight plan modification is pending, **ERASE** is displayed in this line. Selecting LSK **6L** deletes any vertical and/or lateral modifications that are pending, and returns the display to the RTE LEGS page if the holding fix is deleted as a consequence.

- **SPD/TGTALT(1R)** The speed/target altitude (SPD/TGT ALT)line displays the fix target speed/altitude constraint from the Route Legs page. Dashes are displayed if no holding target altitude has been specified and the predicted altitude at the fix is undefined or not equal to the cruise altitude.

  Predicted speeds or altitudes are displayed in SMALL font. LARGE numbers are constraints that are pilot-entered or nav database specified. An entry or an airspeed and/or altitude is propagated to the HOLD AT waypoint on the Route Legs page.

  During cruise, entering a TGT ALT lower than cruise altitude activates the DESCENT page and results in descent at T/D. The DESCENT page remains active unless a new cruise altitude is entered.

  A valid entry is three digits and a slash (**/**) for SPD, and three to five digits for TGT ALT. Speed entry requires altitude constraint, and an altitude entry must be below cruise altitude.

  If a descent profile exists beyond a holding pattern, and the holding pattern does not have a target altitude specified, the hold will be in level flight and the descent will be resumed only after exiting the hold.

- **FIX ETA (2R)** Displays the predicted time that the aircraft next crosses the holding fix. No changes are permitted to this line.

- **EFC TIME (3R)** Expect Further Clearance (EFC) Time displays a keyboard entry for the time further clearance can be expected. When an EFC time is entered, performance predictions downpath of the holding pattern assume the aircraft exits the holding pattern at the EFC time. If no EFC time is entered, performance predictions are based on an immediate exit from the holding pattern.

- **HOLD AVAIL (4R)** Displays the holding time available before an exit is required in order to reach the destination with the specified fuel reserves, as entered on the PERF INIT page.
- **BEST SPEED (5R)** Displays the best holding speed (L/D_{MAX}) for current altitude and conditions. The best speed represents the maximum endurance speed to give the maximum time aloft.

NOTE: Speed can exceed the ICAO limit speed.

ACT RTE 1 HOLD

When pushing the MCDU **[HOLD]** key, if the nav database contains a holding pattern in the active route, or if the pilot has already inserted a holding pattern, then a RTE HOLD page is displayed, as shown in Figure 6--35. The pilot can revise any entered holding patterns when required.

Figure 6--35 shows the ACT RTE 1 HOLD for the present position hold in the flight scenario. The present position is the hold fix identifier N44W078 that is on the active flight plan route.

To access the RTE HOLD page when a hold pattern was previously entered, follow these steps.

1. Push the MCDU **[HOLD]** key.

ACT RTE 1 HOLD Page Holding Pattern Previously Entered in Route

Figure 6--35

2. Push LSK **6R**, **EXIT HOLD**, as shown in Figure 6--35.

3. Push the MCDU **[EXEC]** key to execute EXIT HOLD and display the **EXIT ARMED** prompt, shown in Figure 6--36.

ACT RTE 1 HOLD – EXIT ARMED

Figure 6--36

The following paragraphs describe the relevant fields.

D **<NEXT HOLD (6L)** NEXT HOLD is displayed if the route is not modified, that is, if the MCDU **[EXEC]** light is not lit. Selecting the **NEXT HOLD** prompt displays another ACT RTE 1 LEGS HOLD AT page.

D **EXIT HOLD>, EXIT ARMED> (6R)** If the leg is the active leg of an active and the exit of the holding pattern is not armed, then **EXIT HOLD** is displayed.

Selecting **EXIT HOLD** at **6R** replaces **6R** with **EXIT ARMED**. This illuminates the EXECUTE light, and pushing **[EXEC]** activates the aircraft back to the fix via the inbound course and to continued flight along the active route.

Holding Exit Criteria Holding exit criteria are met in three different conditions, all of which result in **EXIT ARMED** being displayed in **6R**:

When the holding pattern is terminated after a specific altitude is reached (these patterns are applicable only in the CLB phase of flight).

When the holding pattern is terminated after crossing the fix the first time.

When the holding pattern is terminated after the pilot selects **EXIT HOLD** and pushes the MCDU **[EXEC]** key.

CAUTION

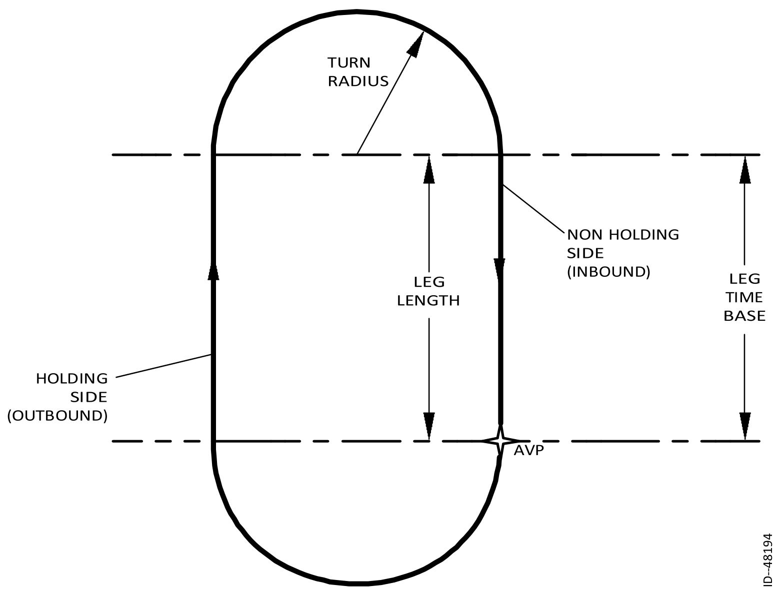
ENSURE HOLDING PATTERN CONFORMS TO ATC REQUIREMENTS. THE FMS DOES NOT AUTOMATICALLY GENERATE HOLDING PATTERNS AS PUBLISHED ON THE

ASSOCIATEDNAVIGATIONCHART,UNLESSHOLDINGPATTERN IS PART OF A MISSED APPROACH.

Holding Pattern Guidance

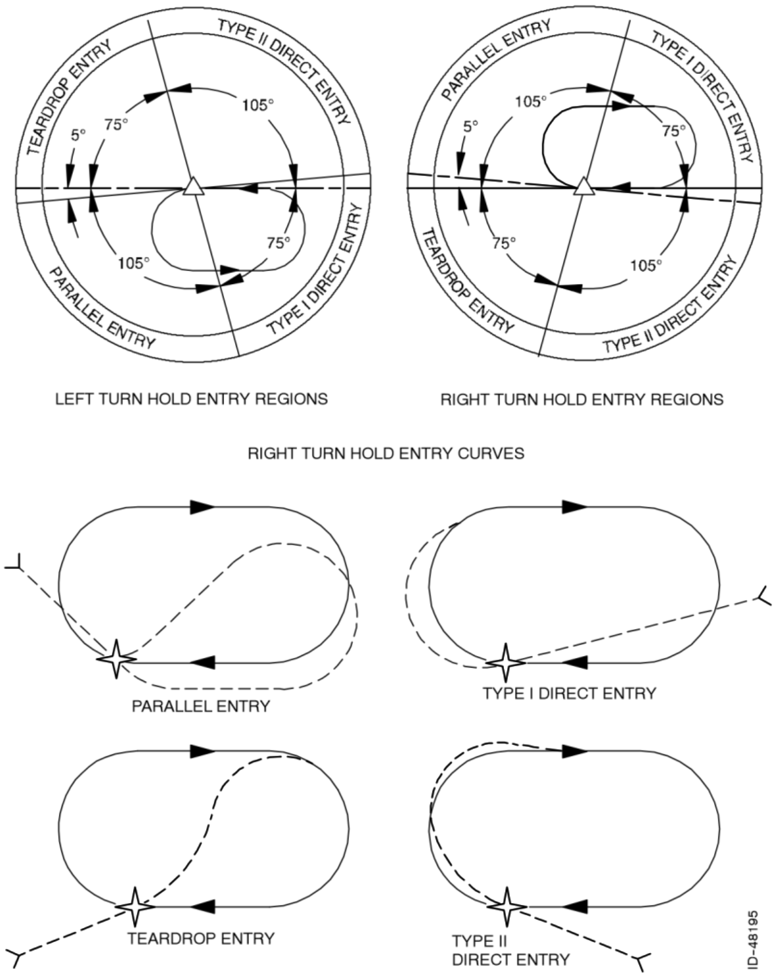
The geometry of the holding pattern shown in Figure 6--37 is computed on each passage over the hold waypoint and is displayed on the navigation display. The holding pattern turn radius is limited to not exceed FAA or ICAO protected airspace and is computed based on the true airspeed equivalent of the VNAV speed target for the hold plus the wind magnitude and a bank angle of 25 degrees. A bank angle limit of 30 degrees is used for all holding patterns and holding pattern entries.

The leg length is computed using the wind component parallel to the inbound course and the true airspeed equivalent of the FMS command speed.



Holding Pattern Geometry Figure 6--37

There are four types of entry into a holding pattern, as illustrated in Figure



6--38. The entry curve is not displayed on the ND/EHSI.

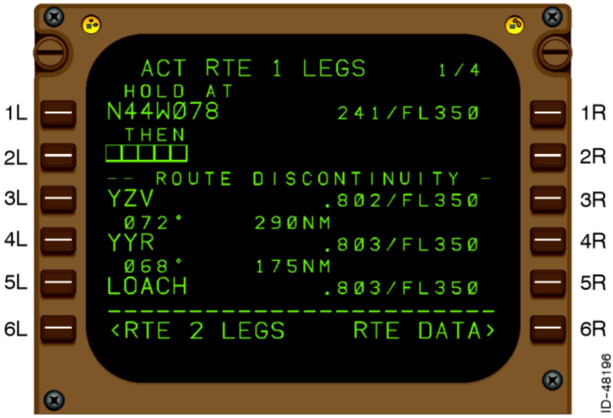
Holding Pattern Entry Curves Figure 6--38

Route Discontinuity Holding Pattern

The PPOS hold that was created in Figures 6--33 through 6--36 at waypoint N44W078 resulted in a ROUTE DISCONTINUITYon theACT RTE 1 LEGS page.

Before exiting the holding pattern, the ROUTE DISCONTINUITY should be removed.

1. Push the MCDU **[EXEC]** key.



ROUTE DISCONTINUITY
Figure 6--39

2. Push LSK **3L** to enter YZV into the scratchpad.

3. Push LSK **2L** to enter YZV into the box prompts (jjjjj).

4. Push the MCDU **[EXEC]** key.

On sequencing the hold fix, the ACT RTE 1 HOLD page, shown in Figure 6--36, changes to the display shown in Figure 6--40 if there are no more holds in the flight plan.

ACT RTE 1 LEGS – HOLD AT PAGE

Figure 6--40

FIX INFO PAGE

The fix information (FIX INFO) pages give the pilot a means of creating waypoint fixes and waypoints from the intersection points between the present flight plan and selected radials or distances from known waypoints for display on the navigation display. The bearing data is magnetic or true depending on the position of the heading reference switch.

1. Push the MCDU **[FIX]** mode key to display the FIX INFO page as shown in Figure 6--41.

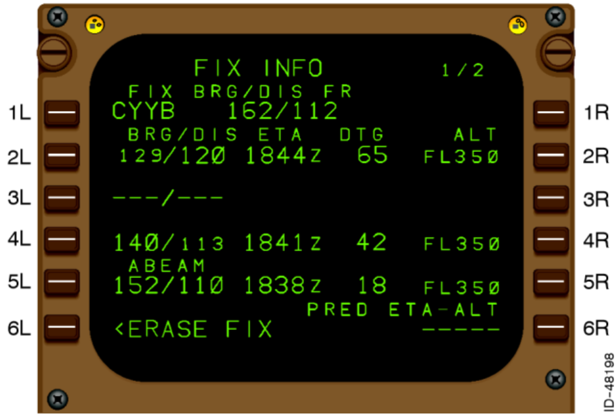
FIX INFO Page
Figure 6--41

Valid entries into the box prompts at **1L** are airports, navaids, or waypoint identifiers contained in the nav database. Entry is by keyboard action or line selection from another page. Entering a fix identifier results in the fix being displayed on the navigation display with a small circle encompassing the navaid, waypoint, or airport identifier.

The crew on the flight scenario to EGLL wants to know the bearing and distance to North Bay, as well as when the aircraft is abeam North Bay. The identifier is CYYB.

1. Type **CYYB** into the scratchpad.
2. Push LSK **1L**, entering **CYYB** into **1L**.
3. Push LSK **5L**, ABEAM.
4. Type **/120** into the scratchpad.
5. Push LSK **2L**, entering **120** into **2L**.
6. Type **140** into the scratchpad.

7. Push LSK **4L** to display the entries. See Figure 6--42.



FIX INFO CYYB

Figure 6--42

The FIX INFO fields are described in the following paragraphs.

- **FIX (1L)** The fix displayed is CYYB and the bearing and distance to CYYB. The bearing is 162_ and a great circle distance of 112 NM from the fix to the aircraft. A new fix can be entered over the existing fix, or the fix can be downselected.

  NOTE: The fix can be erased only by selecting **<ERASEFIX(6L)**.

- **BRG/DIS (2L, 3L, 4L)** Bearing and/or distance (BRG/DIS) references are entered into **2L** through **4L**, intothe blankfield orover an existing entry.

  Valid bearing (radial) entries are three digits ranging from 000 to 360 degrees. The entered radial is displayed on the ND/EHSI relative to the current map display as a radial. If the entered radial intersects the active flight plan within 512 NM of the reference fix, the intersecting distance is displayed in SMALL font following the slash (**/**). If no intersection is found, the distance portion of the display remains blank.

  If radial lines or distance circles intersect the active flight path, then distance along the flight path to the intersection, the ETA, and the estimated altitude at the intersection are displayed.

- **<ABEAM (5L)** ABEAM is displayed initially. Selecting it displays the bearing and distance from the fix perpendicular to the nearest intersection on the flight plan path. It also displaysdistance alongthe path to the abeam point, ETA, and the altitude at the point.
  If an abeam reference with respect to the active or active offset flight path cannot be found, **INVALID ENTRY** is displayed in the scratchpad.

A valid intersection can be downselected as a PBD waypoint for insertion into the route. An abeam reference can be removed by deleting the distance/bearing value.

D **<ERASE (6L)** Selecting **6L** removes all FIX data from that page (excluding a **6R** entry), as well as from the MCDU and navigation display.

Line **6L** is blank if no entry has been made in **1L**.

NOTE: The MCDU **[NEXT PAGE]** key permits the pilot to select three radials and/or distances and a point abeam from a second fix and a second ETA-ALT entry.

D **ETA/DTG (2C, 3C, 4C, 5C)** The ETA and DTG are displayed in **2C** through **5C** for bearing, distance, or abeam references for which an intersection with the active flight plan exists.

If the aircraft crosses a predicted intersection, the DTG is displayed as the distance back to the intersection, signified by a negative value. If no intersection exists, the corresponding ETA and DTG lines are blank.

D **ALT (2R, 3R, 4R, 5R)** The predicted altitude (ALT) at the intersection is displayed in **2R** through **5R** for bearing, distance, or abeam references for which an intersection with the active flight plan exists.

If no intersection exists, the corresponding altitude line is blank.

D **PRED ETA -- ALT (6R)** An ETA or altitude can be entered into **6R** to give an FMS predicted crossing point at the entered ETA or altitude. The crossing point is displayed on the navigation display as a profile circle with an altitude or time label located on the lateral flight path.

ETA entries consist of a four-digit time value followed by **Z** (ZULU). The FMS then estimates the aircraft position at the entered time and displays the distance to the position. The entered time is displayed adjacent to the profile circle on the navigation display.

Altitude entries consist of three-- to five-digit values in standard altitude format. The FMS estimates the aircraft lateral position at the point the aircraft reaches the altitude.

For either ETA or altitude entries, if the predicted position does not occur on the flight path, the distance portion of the **6R** display remains blank. Once a valid predicted position is passed, the entry is returned to dashes and the distance is blanked. A predicted entry can be overwritten with another valid entry or it can be deleted.

REF NAV DATA PAGE

The reference navigation data (REF NAV DATA) page provides information for waypoints, navaids, airports, and runways in the nav database. The page is also used to select navigation aid inhibit and to inhibit VOR/DME FMC radio update mode.

To access the REF NAV DATA page:

1. Push the MCDU **[INIT REF]** key.
2. Push LSK **6L** (**<INDEX**) of the displayed page (as shown in Figure 4--8) to display the INIT/REF INDEX page (shown in Figure 4--7).
3. Push LSK **1R** (**NAV DATA>**) to display the REF NAV DATA page, shown in Figure 6--43.

REF NAV DATA

Figure 6--43

For this scenario, the flight from KORD to EGLL, the pilot is interested in the reference nav data for the Quebec navaid.

1. Type **YQB** into the scratchpad.
2. Push LSK **1L** to enter **YQB** into line **1L**, as shown in Figure 6--44.

REF NAV DATA YQB

Figure 6--44

The REF NAV DATA fields are described in the following paragraphs.

- **IDENT (1L)** Line **1L** is where a valid identifier is entered. A valid entry is any waypoint, navaid, airport, or destination runway in the nav database.

  If the page is changed, the waypoint is replaced with dashes and associated data is removed. Deleting an entry from **1L** is not permitted.

- **FREQ (1R)** If the identifier displayed in **1L** represents a navaid, then line **1R** displays the navaid frequency (**FREQ**). In this scenario, the frequency for YQB is **112.80**.

- **LATITUDE (2L)** Line **2L** displays the latitude of the navaid, waypoint, airport (reference point), or runway threshold that is entered in **1L**.

- **LONGITUDE (2R)** Line **2R** displays the longitude of the navaid, waypoint, airport (reference point), or runway threshold entered in **1L**.

- **MAG VAR**, **LENGTH (3L)** Line **3L** header displays magnetic variation (**MAG VAR**) from true North when the identifier is a navaid. The magnetic variation is for the navaid.

  If the identifier in **1L** is a runway, this line displays the runway length and the header displays **LENGTH**.

  For any other entries in **1L**, this line and header line remain blank.

D **ELEVATION (3R)** Line**3R** displays the elevation of the navaid, airport (reference point), or runway threshold entered in **1L**. Waypoint entries in **1L** result in the field and header line at **3R** to remain blank.

D **NAVAID INHIBIT (4L, 4R)** These lines display dash prompts initially. The pilot can inhibit from FMS radio updating, or blackball, up to two VORs, VOR/DMEs, VORTACs, or DMEs contained in the nav database. This is done by using the NAVAID INHIBIT lines in **4L** and **4R**.

Once a valid entry is made, the entered navaid is inhibited from use by the FMS for radio updating. Entering a different navaid over an existing entry re-enables the existing identifier and inhibits the newly entered navaid.

Overwriting or deleting an entry clears the previously selected navaid and removes the inhibition of the navaid. Selections are automatically cleared at flight completion or long-term power interrupt.

NOTE: Navaids blackballed from this line are not inhibited from route tune, manual tune, or procedure tune capability. Entering a navaid identifier on this line inhibits the use of the whole navaid for navigational updating.

D **VOR ONLY INHIBIT (5L, 5R)** Initially dash prompts are displayed in this line. The pilot can inhibit for navigational updating up to two VORs contained in the nav database.

Only the VOR portion of the navaid is inhibited from use by the FMS for updating. Entries are cleared at flight completion. Deleting or overwriting an entry clears the previous navaid and removes the inhibition.

NOTE: VORs inhibited from this line are not inhibited from route tune, manual tune, or procedure tune capability. If the inhibited VOR is paired with a DME, the DME is not inhibited from being autotuned or from being used for DME/DME mode position updating.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **VOR/DMENAV(6R)** When LSK **6R** is pushed it alternately selects VOR/DME NAV ON (active) and OFF (inactive).

ON VOR/DME data is given to the FMS for position updates. **ON** is displayed in LARGE letters and **OFF** is displayed in SMALL letters.
OFF VOR/DME data is not available to the FMS. **OFF** is displayed in LARGE letters and **ON** is displayed in SMALL letters.

Selecting **OFF** displays **ALL** in both locations of the VOR ONLY INHIBIT line.

SELECT DESIRED WPT

The SELECT DESIRED WPT (waypoint) page is automatically accessed when an ambiguity occurs in entering a nav database fix, such as multiple waypoints, NDBs, and VORs existing with the same identifier. The SELECT DESIRED WPT page is displayed to let the pilot select the desired nav database fix.

CAUTION

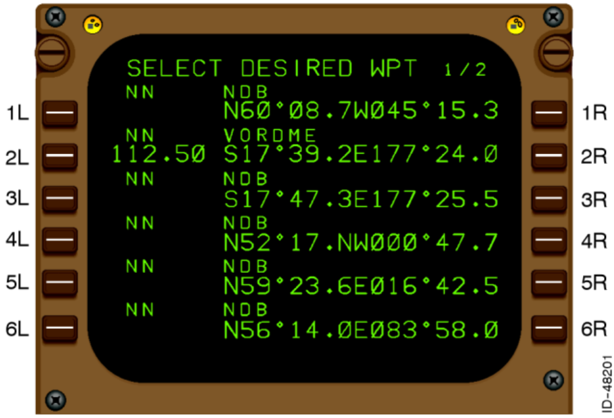
CARE SHOULD BE EXERCISED BEFORE SELECTING THE PROPER NAVAID FROM THE SELECT DESIRED WPT PAGE OR LIST. THE PILOT SHOULD REVIEW THE NAVAID TYPE, LAT/LON, FREQUENCY, AND COUNTRY CODE AND COMPARE THIS DATA TO THECHART ANDTHEDESIREDROUTETO ENSUREPROPER WAYPOINT SELECTION.

Displayed fixes are generally displayed by increasing distance from the aircraft. However, if the entry is made on the RTE or RTE LEGS pages, the fixes are displayed by increasing distance from the fix prior to the entry position.

To select a fix, push the adjacent line select key, either left or right. This selection returns to the page from where this page was accessed. The selected desired waypoint is inserted where the pilot had previously attempted to do so.

If more than six non-unique identifiers exist, the remaining fixes can be accessed using the **[NEXT PAGE]** or **[PREV PAGE]** mode keys. Failure to select a fix cancels the entry.

1. Type **NN** into the scratchpad.
2. Push LSK **1L** on the REF NAV DATA page displaying the SELECT DESIRED WPT page, shown in Figure 6--45.



SELECT DESIRED WPT 1/2

Figure 6--45

3. Push the MCDU **[NEXT PAGE]** or **[PREV PAGE]** to display the SELECT DESIRED WPT 2/2 page, shown in Figure 6--46.

SELECT DESIRED WPT 2/2

Figure 6--46

Identifier/Fix Type

The fix identifier and fix type are displayed in the header lines. The fix types can be any of the those listed in Table 6--2.

APRT	ILS	NDB	MLS
WPT	ILSDME	VOR	VORTAC
TACAN	MLSDME	LOC	

FIX Identifier Types

Table 6--2

Frequency

For fixes that are navaids, the frequency is displayed in **1L** through **6L** correspondingly.

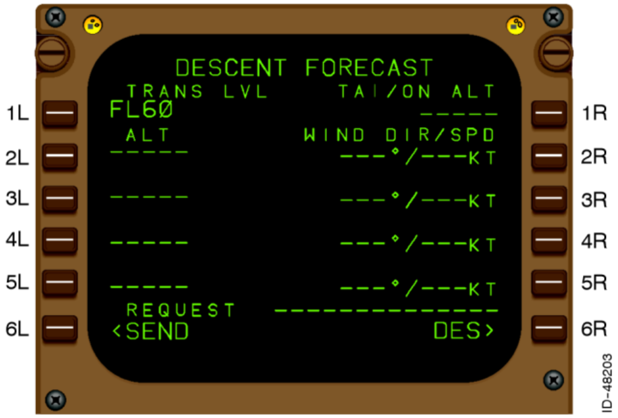
Position

The position of each of the fixes is displayed in the **1R** through **6R** data lines.

DESCENT FORECAST

The DESCENT FORECAST page is used to enter forecast winds and the altitude where thermal anti-icing is turned on to more accurately define the descent path. The page is accessed by pushing **5R**, **FORECAST>** on the DES page, which is page 3/3 when the **[VNAV]** mode key is selected. For company datalink equipped aircraft, see Section 12, Company Datalink, Descent Forecast Page, for details on descent forecast requests and descent forecast uplinks.

1. Push the MCDU **[VNAV]** key.
2. Push the MCDU **[NEXT PAGE]** key to display DES page 3/3, shown in Figure 7--2.
3. Push LSK **5R**, **FORECAST>**, to display the DESCENT FORECAST page, shown in Figure 6--47.



DESCENT FORECAST Page Figure 6--47

4. The pilot enters the descent forecast winds by typing the winds inthe scratchpad and pushing the respective line select key.

The DESCENT FORECAST fields are described in the following paragraphs.

- **TRANS LVL (1L)** The transition level (TRANS LVL) for the descent phase of flight defaults to FL180. The value can be changed by pilot--entry. The value changes automatically when entering a destination or arrival procedure with a stored transition level, if a pilot--entry has not already been entered. This flight scenario, KORD to EGLL, displays this with FL60 at **1L**. This information is stored in the nav database.

- **ALT (2L, 3L, 4L, 5L)** The wind altitude (**ALT**) line permits entering descent wind altitudes in standard altitude format. An altitude that is equal to another altitude in **2L** through **5L** is not permitted; that is, only one wind entry is permitted for a given altitude.

  The delete function selected into lines **2L** through **5L** results in the ALT and WIND DIR/SPD lines returning to dash prompts.

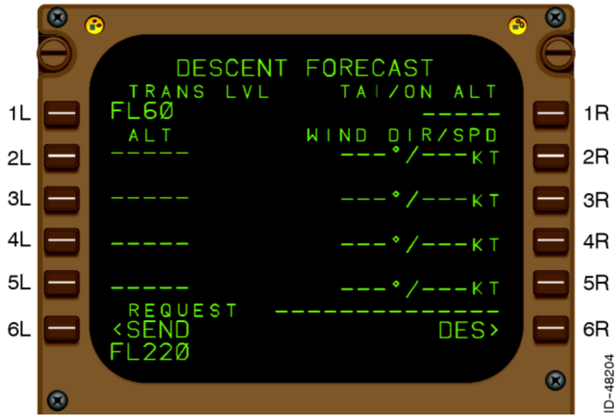
- **REQUEST <SEND (6L)** LSK**6L**, when pushed, transmits a datalink request for descent wind data. See Section 12, Company Datalink, for additional information.

- **TAI/ON ALT (1R)** The thermal anti-ice (**TAI**) line is for a pilot-entered altitude below where the use of thermal anti-ice is expected to be used. The FMS performance function uses the TAI altitude to make adjustments in the descent profile for a more cost-effective and accurate descent. Deleting a pilot-entered value returns the line to dash prompts.

  To enter a thermal anti-ice altitude:

  Type **FL220** into the scratchpad, as shown in Figure 6--48.

  Push LSK **1R** to enter the TAI altitude.



TAI/ON ALT
Figure 6--48

D **WIND DIR/SPD (2R, 3R, 4R, 5R)** The pilot-entered wind direction and speed correspond to the altitudes displayed in **2L** through **5L**.

Valid entries consist of a wind direction and speed separated by a slash (**/**). Wind direction is entered in true and is a three-digit value. Valid wind speed entries, in knots, consist of one to three-digit values ranging from 0 to 250. Leading zeros are optional for speed but required for wind direction. Initial entries must consist of both speed and direction; however, subsequent entries can be partialand only the entered portion is changed. A wind direction only entry must be followed by a slash (**/**).

D **DES> (6R)** Selecting DES (descent) returns the display to the DES page.

ALTITUDE INTERVENTION

Altitude intervention is the function of incorporating the MCP altitude window and knob-push operation with the FMS VNAV flight planning for heads-up operation. For cruise, altitude intervention allows the pilot to raise or lower the current cruise altitude without using the MCDU and without confirmation using the MCDU **[EXEC]** key.

Cruise Altitude Modification

If the MCP altitude is set to an altitude above the current cruise altitude, pushing the altitude knob changes the current cruise altitude to the MCP selected altitude.

If the MCP altitude is set to an altitude below the current cruise altitude but above the first descent constraint, and the aircraft is greater than 50 NM from the top-of-descent point, the cruise altitude is lowered to the MCP selected altitude. If the aircraft is within 50 NM of the top-of-descent, an early descent is initiated, consisting of a 1250 fpm descent until the descent path is intercepted.

7. Descent

The FMS descent (DES) phase of flight begins when the aircraft departs the CRZ ALT at the top-of-descent (T/D) or begins the deceleration segment before reaching the T/D. The DES phase extends to the last constraint in the descent, known as the end-of-descent (E/D) point.

The descent path is computed starting at the E/D and projects up to the cruise altitude. The descent vertical path is calculated to satisfy decelerations, configuration changes, altitude and airspeed constraints, forecast winds, preselected descent speeds and other constraining factors.

The FMS creates a deceleration segment at the T/D point when the cruise speed is greater than the descent speed. An acceleration segment is created also to meet speed constraints during the descent. A descent path can be one of two types. The first type is an ECON descent where the path is constructed for an optimal descent speed, subject to defined airspeed/altitude constraints. The second type is a SEL SPD descent where the path is constructed to fly a pilot-entered speed and still subject to defined airspeed/altitude constraints.

The descent speed is maintained until the intermediate deceleration point, when the aircraft begins to slow to the speed transition altitude airspeed or the speed restriction altitude airspeed. The FMS default is a speed transition of 240 kts (a 10 kt buffer so as not to exceed 250 kts) below 10,000 feet. The aircraft decelerates to 240 kts upon reachingthe intermediate deceleration point prior to 10,000 feet.

The FMC continuously updates the appropriate deceleration distance from the destination to slow to approach speeds. The approach phase normally begins at the last descent constraint in the flight plan.

DES PAGE

The DES page is used by the pilot to evaluate or revise the descent path. Descent speeds can be selected and access to DESCENT FORECASTS is available on this page. The transition altitude from the nav database is also displayed.

The DES page is accessed by pushing the MCDU **[VNAV]** mode key when the descent mode is active. The DES page is blank with DES as the title only when there are no altitude constraints below the cruise altitude. If the descent mode is not active, then DES page 3/3 of the vertical navigation pages is displayed by either pushing **[NEXT PAGE]** or **[PREV PAGE]** after selecting the **[VNAV]** key.

Figure 7--1 shows the flight scenario VNAV page 2/3 14 NM before the T/D.

1. Push the MCDU **[VNAV]** mode key.

ACT ECON CRZ

Figure 7--1

The scratchpad message **RESET MCP ALT** is displayed two minutes before the top-of-descent point, when MCP altitude is still set at the current altitude.

2. The aircraft passes the T/D point.

   Sequencing the T/D automatically changes the VNAV page to ACT ECON DES page 3/3.

CRZ to DES VNAV Page

Figure 7--2

The ACT ECON DES 3/3 fields are described in the following paragraphs.

- **Page Title** The page title includes ECON when VNAV economy descent speed mode is selected. When a fixed speed is selected, the title includes XXXKT for CAS or M.XXX for fixed Mach selections.

  The page title displays the type of descent. The page title displays are:

  ECON indicates the speed is based on a cost index.

  MCP SPD is displayed if speed intervention is selected on the MCP.

  LIM SPD is displayed if controlling to a limit speed, such as flap placard.

  END OF DES is displayed when E/D is reached, if not followed by a climb segment.

- **E/DAT (1L)** The end-of-descent (E/D) AT line displays the altitude and waypoint with the lowest altitude constraint propagated from the LEGS page. Figure 7--2 shows the descent ending at 1410 feet for RWY 27R at EGLL.

  If no constraint exists, the page is left blank with DES as the page title. If the E/D constraint is a window constraint the lower altitude is displayed. The altitude can be followed by an **A**, at or above, **B**, at or below, or an altitude window.

- **ECON or SEL SPD (2L)** The speed line displays the command speed used above all waypoint speed constraints, speed restrictions, and speed transition altitudes. It is the active descent speed, either economy or pilot-selected.

  Speed and/or Mach can be entered by the pilot and when it is entered manually, the line title changes to SEL SPD.

  The aircraft flies the constraint speed or the current performance speed, whichever is less.

  The flight scenario displays an ECON speed of .809/301 at this stage of the descent into London.

- **SPD TRANS (3L)** Line**3L** displays the transition airspeed and altitude. The speed displayed is 10 kts less than the nav database speed limit at the destination airport to ensure that the speed limit is not exceeded.
  The displayed value is 240/FL100. The default value of 240/10000 is automatically shown if a different value is not in the database for the destination.

  NOTES: 1. This field is blank if the E/D altitude is greater than the speed transition altitude, or if the field has been deleted, or when descending below the speed transition altitude making it the active descent segment, or if the the CRZ ALT is less than or equal to the speed transition altitude.

2. The speed transition can be deleted by pushing the DEL key, but the only means of restoring it is to enter a new destination, or activate the alternate route with a different destination, or rebuild the entire vertical profile. Deleting this field causes the aircraft to fly an economy or selected speed if not limited by a waypoint constraint or a speed restriction.

D **SPD RESTR (4L)** Line**4L** (speed restriction) is displayed if a valid speed restriction has been entered and the speed restriction altitude has not been crossed. The data field contains the restriction speed followed by the speed restriction altitude.

The speed restriction line lets the pilot enter an airspeed/altitude restriction. A slash (**/**) is required between the airspeed and altitude. Entries are permitted only when dashes are displayed, and dashes return to the field when descending below the speed restriction altitude.

NOTES:

1. Only CAS airspeeds are accepted and they must be equal to or less than the active speed in line **2L** of the first remaining descent segment andbe inthe range of 100 to 400 kts.
2. The entered altitude must be less than the cruise and current aircraft altitudes, and greater than the E/D constraint altitude in **1L**.
3. Speed restriction entries that conflict with the speed transition cause the speed transition displayed in **3L** to be blanked. If an entered speed restriction is then deleted, a blanked speed transition may be displayed.
4. If a waypoint airspeed constraint less than or equal to the speed restriction airspeed becomes the active speed, the speed restriction segment is deleted and dashes return to the field.

D **<ECON (5L) ECON** is displayed whenever the active descent mode is not economy. Pushing **5L** followed by the MCDU **[EXEC]** key changes data line **2L** and the active descent speed to the ECON SPD mode.

D **ERASE (6L)** ERASE is displayed whenever a modification or activation is pending.

D **AT (1R)** This is the waypoint constraint line that displays the airspeed/altitude at the next identified waypoint constraint (this includes the E/D point). If no speed exists for the constraint, or if the speed is predicted, the speed and slash are replaced with blanks.
In this scenario, the next descent waypoint constraint is the ECON SPD of 301 kts and FL150 at D313Y.

Constraints are entered on a RTE LEGS page by procedure selection or pilot--entry. The constraints can be deleted here at **1R** or on the RTE LEGS page. The label line may also display HOLD AT (name of fix), AT VECTORS, or AT (INTC).

D **WPT/ALT (3R)** Line**3R** displays the reference vertical bearing waypoint/altitude. Valid waypoints can be any waypoint in the nav database, any waypoint in the pending activation, modified active, or active flight plan, or expanded format LAT/LON, and LAT/LON reporting points in the pending active, modified active, or active route.

Conditional waypoints are allowed only as default entries from the flight plan. The internal LAT/LON of a conditional waypoint is used to calculate the vertical bearing and vertical speed to that conditional waypoint.

The vertical bearing (V/B) function has no ties to flight phase. It works in climb, cruise, and descent. However, vertical bearing information (that is, FPA, V/B, V/S) is displayed on the Descent page.

Manual entry of a waypoint, altitude, or both in **3R** makes the entire field a manual entry. Manual entries into **3R** are retained (even if the descent path is deleted or the point is sequenced) until they are manually cleared. Entry of waypoint, altitude, or both is considered manual entry even if it is the same as the default.

SMALL font is used to display both waypoint and altitude when they are default entries. When a manual entry exists, both waypoint and altitude are displayed in LARGE font.

If the descent path is deleted with a default entry in **3R**, the field is cleared and dashes are displayed.

D **FPA V/B V/S (4C, 4R)** Flight path angle (FPA), vertical bearing (VB), and vertical speed (V/S) are displayed in line 4. These lines cannot be selected, regardless of scratchpad contents.

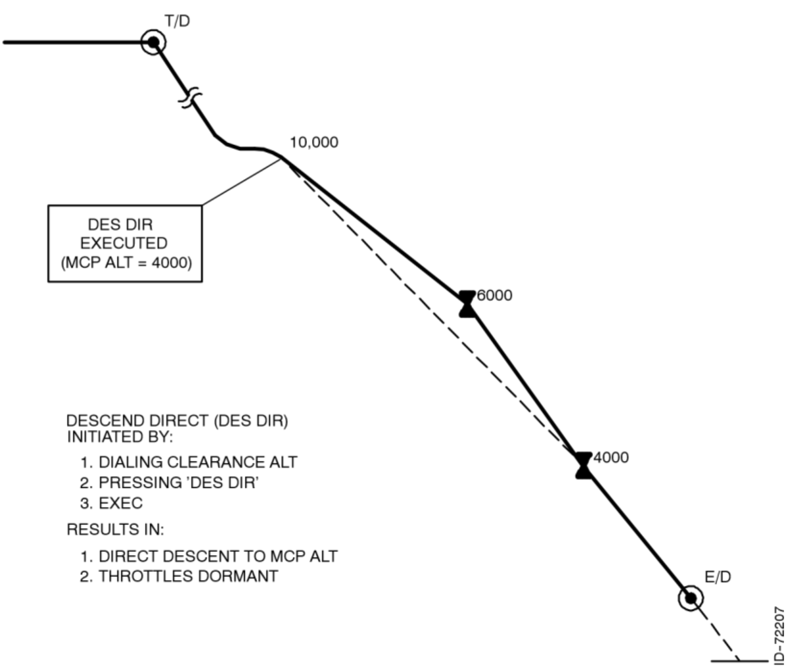
Values displayed in **4R** are used to provide pilots with a rough idea of what is required (in terms of (V/B and V/S) to fly the aircraft to the point displayed in **3R**. The information provided in **4R** does not take actual path (required to reach the point) into consideration. For example, if the point displayed in **3R** is at the aircraft s 9 o clock position, the information displayed in **4R** will not take the actual arc required to fly to that point into consideration. Information displayed in **4R** is point-to-point (aircraft position to the point in 3R). The information will be accurate (in terms of actual aircraft flight path) only if the point is directly in front of the aircraft.

- **FORECAST>** (**5R**) FORECAST provides access to the DESCENT FORECASTS page, as detailed in Section 6, Cruise, Descent Forecast.

- **DESDIR>** and **DESNOW>** **(6R)** The descend (DES) line displays either **DES DIR** (descend direct) or **DES NOW**.

  DESDIR(**6R**) DES DIR is displayed when the descent is active and an altitude constraint exists in the active flight plan between the current altitude and the E/D.

  Selecting **DES DIR** lights the MCDU **[EXEC]** mode key light. When executed, all descent waypoint constraints above the mode control panel (MCP) altitude are deleted and a descent is initiated to reach the MCP altitude. Upon reaching the MCP altitude, the vertical guidance function captures the computed vertical path for the selected mode of descent and meets any remaining descent constraints. Figure 7--3 shows a descend direct vertical path.

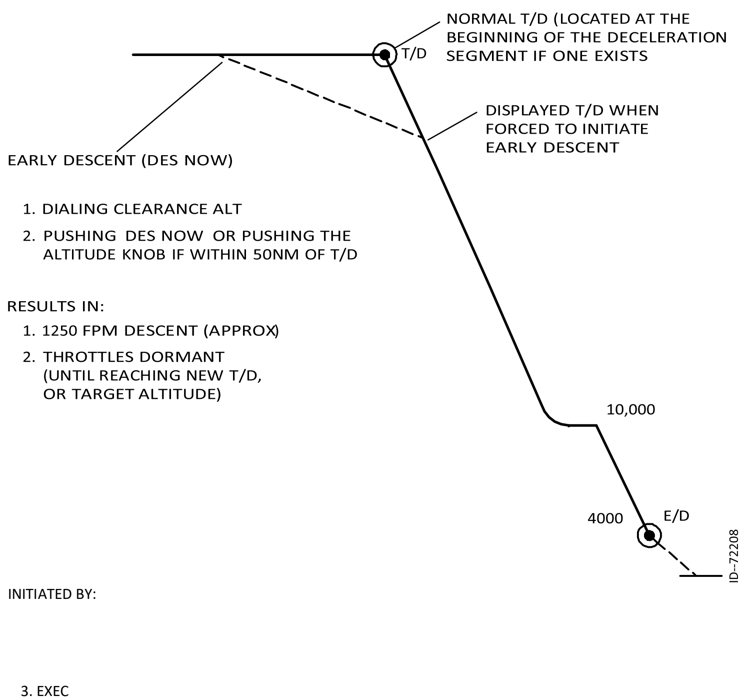


Descend Direct Vertical Path Figure 7--3

The prompt is redisplayed after passing the altitude set in the mode control panel that was set when the prompt was first pushed. The DES DIR function has no effect on speed transition, speed restriction, or E/D constraints.

DES NOW(**6R**) DES NOW is displayed when the descent phase of flight is not active.

Selecting **DESNOW** lights the MCDU **[EXEC]** mode light, deletes all remaining CLB and CRZ constraints, and initiates an early descent, that is, a descent before reaching the computed top-of-descent. When executed, the first descent segment becomes active. The aircraft begins an early descent at 1,250 feet/min and maintains that rate until capturing the descent path. This is shown in Figure 7--4.

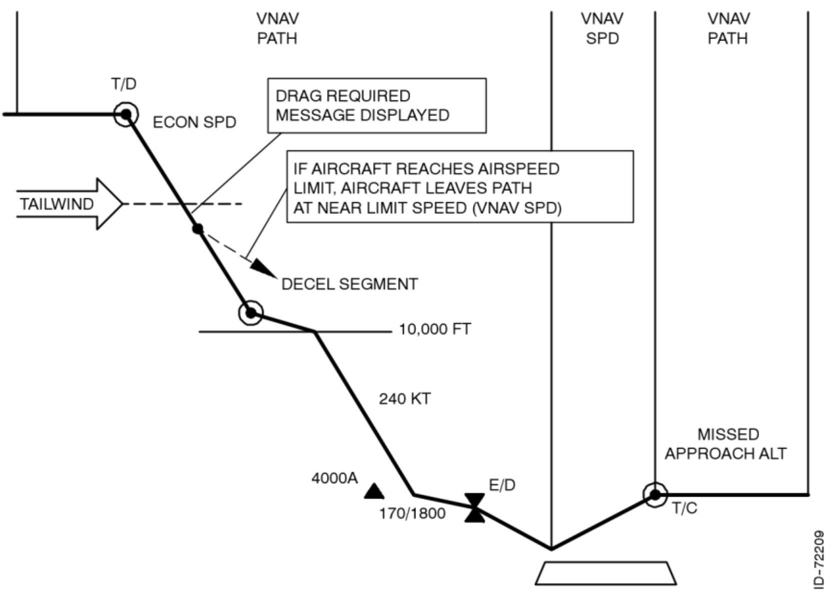


Descend Now Vertical Path Figure 7--4

The aircraft maintains the speed displayed in line **2L**. The autothrottles go into throttle hold (THR HOLD) mode on reaching the 1250 fpm descent rate to permit the pilot to readjust the throttles to change the rate of descent. On intersecting the original descent path, the vertical guidance function captures the computed vertical path for the selected mode of descent.

Descent Profile

The default descent profile is an economy descent to 10,000 feet followed by a 240 kt CAS speed descent. The pilot may, however, change the default descent profile by entering any speed and/or altitude restrictions required to meet ATC clearances. If the airplane reaches the limit speed, because of an unforeseen tail wind, for example, the aircraft departs the vertical path (VNAV PATH mode) and commands a speed target (VNAV SPD). The **DRAG REQUIRED** and **THRUST REQUIRED** messages are displayed on the MCDU scratchpad to advise the pilot of speed changes required to maintainthe descentpath. Figure 7--5 shows a descent profile.



Descent Profile
Figure 7--5

Altitude Intervention

Altitude intervention is the function of incorporating the MCP altitude window and knob-push operation with the FMS VNAV flight planning for heads-up operation. For descent, altitude intervention permits the pilot to delete constraints, perform altitude level offs, and resume descent.

DELETING CONSTRAINTS

If the aircraft is actively descending, the pilot can dial the MCP altitude window to an altitude below the current altitude and delete descent constraints. Each time the MCP altitude knob is pushed the next descent constraint below the current altitude and above the MCP altitude is deleted.

ALTITUDE LEVEL OFF/RESUME DESCENT

If the altitude window is set to an altitude between the current aircraft altitude and the end-of-descent constraint, the aircraft levels off at the MCP altitude. The descent can be resumed by dialing the altitude window to a lower altitude and pushing the altitude knob on the MCP.

OFFPATH DES PAGE

The OFFPATH DES (descent) page permits the analysis of descent performance off the current route of flight, direct to a selected waypoint. Data entered on the page displays clean and drag (speed brake) descent ranges on the page and on the navigation display. The ranges are based on an entered waypoint and altitude constraint. The range can be used to determine if the altitude constraint can be met in a direct descent to the waypoint.

This page is accessed by using the DES page or the DESCENT FORECAST page and pushing LSK **6L, OFFPATH DES>**.

1. Push the MCDU **[VNAV]** mode key to access the DES page, shown in Figure 7--2.
2. Push **OFFPATH DES>** (**6L**) to display the OFFPATH DES page, shown in Figure 7--6.

OFFPATH DES Page

Figure 7--6

The OFFPATH DES page fields are described in the following paragraphs.

D **DES TO, DTG (1L, 1C)** The descend to (DES TO) line displays the end-of-descent point propagated from the DES page. This line also permits pilot to enter any valid nav data waypoint. Pilot entries can be deleted, causing the descent fix to return to the DES page propagated fix.

Valid entry is any waypoint identifier in the nav database or active route, with the exception of along track waypoints and LAT/LON crossing points.

Deleting an entered waypoint is permitted and results in the display of box prompts or the next descent constraint. Attempting to delete box prompts or a waypoint that was not pilot-entered results in the **INVALID DELETE** scratchpad message.

The center field (**1C**) displays the direct-to distance to go (DTG) to the waypoint in **1L**.

When the aircraft altitude is within 150 feet of the altitude displayed in **1L**, the display defaults to the new end-of-descent point propagated from the DES page or to box prompts.

D **SPEED (2L)** The ECON or SEL SPD label is displayed with the appropriate speed in the field. Mach and/or speed can be entered. A pilot-entered speed results in the label changing to **SEL SPD**. Whenever **SEL SPD** is displayed, the **ECON>** prompt is displayed in **5L**.

The data line displays the end of descent point propagated from the DES page, in SMALL font, if no manual entry exists and an end of descent waypoint exists.

When data is entered into the data line, the data is displayed in LARGE font. Data can be entered into the data line by:

Crew entry from the scratchpad

Propagation of a speed entered on the DESCENT page.

D **SPD TRANS (3L)** The speed transition (SPD TRANS) displayed is the transition speed and altitude propagated from the DES page. This data can be deleted on either the DES page or this page. Deletion results in this field and header line blanking on both pages and lighting the **[EXEC]** light. Once deleted, the speed transition is redisplayed only by entering a new cruise altitude above the nav database stored altitude.

The field automatically displays 240/10000 if a different value is not in the nav database. Deleting results in the aircraft flying ECON or SEL SPD, if not limited by a waypoint constraint or speed restriction.

D **SPD RESTR (4L)** The speed restriction (SPD RESTR) line displays dashes before a pilot--entry is made. It permits entry of a speed limit at an altitude higher than E/Daltitude. Whentransitioning to the limiting speed, dashes are again displayed. The header and field are blank when a valid E/D target is not displayed in **1L**.

D **<ECON (5L)** The ECON prompt is displayed whenever the active descent mode is SEL SPD.

D **<DES, <ERASE (6L)** Selecting the descent (DES) prompt displays the DES page.

Selecting the **<ERASE** prompt deletes the provisional MOD and returns the active profile. MOD is cleared from the page title; however, ACT is never displayed in the title of the OFFPATH DES page.

D **SPD/ALT (1R)** The speed/altitude displays the restriction for the fix in the DES TO line, **1L**. Entering a standard altitude is permitted when data or box prompts are displayed. Altitudes can optionally be preceded by a speed and a slash (**/**). Speed entries are CAS only in the range of 100 to 400 kts, inclusive.

Entries do not propagate to the DES page. Window constraints propagate only the upper altitude.

D **TO CLEAN (2R)** TO CLEAN displays the direct-to distance from the aircraft to the clean idle descent path. Clean represents the energy circle with no speed brakes, flaps, or gear down permitting the pilot to reach the constraint flying direct to the fix displayed in **1L**.

Before reaching the clean circle, the descent can be made without losing excess energy. Once the clean circle iscrossed, somedegree of drag or path lengthening is necessary to meet the entered constraint.

A negative distance is indicated when the aircraft has passed the clean energy circle. This is displayed in the flight scenario which indicates the aircraft present position is past the T/D point by 17 NM.

The data line display requires that a fix be displayed in **1L** and an altitude be displayed in **1R**. The data line is blank if an end of descent point or constraint does not exist, performance is not initialized, or the aircraft position is not valid.

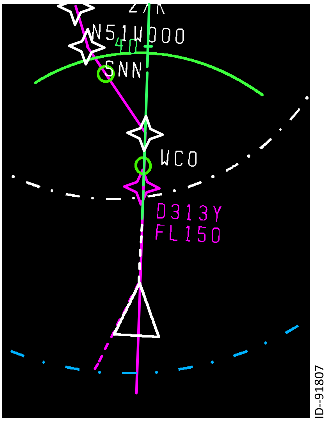
D **TODRAG(3R)** The drag circle displays the direct-to distance from the aircraft to the computed top-of-descent point at the current altitude for a full speed brake idle descent. The computed descent path is calculated direct to the fix displayed in **1L**, crossing the fix at the speed and altitude displayed in **2L** through **4L**.

Drag represents the energy circle with full speed brakes applied and with no flaps or gear extended, which permits the aircraft to make the constraint at the offpath descent fix. The distance to the drag circle is not displayed until the aircraft has crossed the clean energy circle. The constraint speed and/or altitude cannot be met without additional drag or path extension once the aircraft has entered into the drag circle.

D **DISPLAY (6R)** Pushing **6R** activates the **ON** or **OFF** prompts. **ON** displays the clean and drag circles on the appropriate navigation display (shown in Figure 7--7), and **OFF** removes the clean and drag circles from the appropriate navigation display.

The active state is displayed in LARGE font, and the inactive state is displayed in SMALL font.

The display automatically changes to **OFF** within 150 feet of the waypoint constraint altitude in **1R**.



Clean/Drag Circles Figure 7--7

ARRIVALS PAGE

The ARRIVALS page is used to select the desired standard terminal arrival route (STAR) or profile descent, approach, and transitionsstored in the nav database for the destination airport. Leaving and returning to the arrival page results in a display of all items.

This page can be used to view information about a selected airport that is not the destination. No selections can be made on the page. Route 1 and Route 2 have separate arrival pages.

When using the MCDU **[DEP ARR]** key to access the arrivals page, and less than 400 NM from the departure airport or less than halfway along the active route, whichever is less, arrivals for the departure airport are displayed. Otherwise, arrivals for the destination are displayed.

The flight scenario to London (EGLL) is used to show the arrivals page. Because the duration of the flight is well over halfway, the arrivals page is accessed directly by pushing the MCDU **[DEP ARR]** key.

The arrivals page can also be displayed by selecting the appropriate ARR prompt on the DEP/ARR INDEX page. Airports with more than 5 runways or STARS produce multiple arrivals pages. Subsequent pages are displayed by pushing **[NEXT PAGE]** or **[PREV PAGE]**.

1. Push the MCDU **[DEP ARR]** key to display the EGLL ARRIVALS page, shown in Figure 7--8.

EGLL ARRIVALS Page

Figure 7--8

The relevant fields are described in the following paragraphs.

Page Title The page title displays the arrival airport identifier and route number. Our scenario displays EGLL Arrivals and RTE 1.

STARS (1L -- 5L) The standard terminal arrival routes (STARS)/profile descent lines are listed for the EGLL airport. If **NONE** is displayed, then there are no STARS in the nav database.

If STARS are listed, pushing the desired line select key selects a STAR. Once selection is complete a **<SEL>** is displayed beside the selected arrival procedure. All other arrival procedures are no longer displayed and transitions for the selected procedure are displayed, as shown in Figure 7--9.

Selecting a procedure deletes any previously selected procedure.

<INDEX (6L) Pushing LSK **6L**, INDEX, displays the DEP/ARR index.

APPROACHES (1R -- 5R) A complete numerical list of approaches and a complete list of the runways contained in the nav database for the arrival airport are listed under APPROACHES.

An approach is selected by pushing the adjacent line select key. The selected approach is then indicated by a **<SEL>** or **<ACT>** label. Figure 7--9 shows **ILS 27R** selected.

2. Push LSK **4R** on the EGLL ARRIVALS page to select the ILS 27R approach. The selected approach is shown in Figure 7--9.

EGLL ARRIVALS ILS 27R

Figure 7--9

TRANS(2R) The approach transitions (TRANS) for a selected approach are now displayed in the right data fields beginning in **2R** on page 1/8. Select an approach transition by pushing its adjacent line select key. The selected approach transition is indicated by **<SEL>**.

The flight scenario STAR and TRANS into EGLL, as cleared by ATC, is the BNN1B STAR and BNN transition.

3. Push the MCDU **[NEXTPAGE]** key to display theEGLL ARRIVALS2/8 page, showing the STARs for EGLL, shown in Figure 7--10.

EGLL ARRIVALS Page 2/8

Figure 7--10

4. Push LSK **3L**, BNN1B, to select it and to display its transitions, shown in Figure 7--11.

EGLL ARRIVALS – BNN1B Selected

Figure 7--11

5. Push LSK **3R**, TRANS BNN.

6. The flight scenario STAR and TRANS into EGLL, ascleared byATC,are the BNN1B STAR and the BNN transition. The display is shown in Figure 7--12.

EGLL ARRIVALS <SEL>

Figure 7--12

APPROACH INTC> (6R) An approach intercept fix is displayed when airborne and when the route displayed is active, modified active, or pending, and an arrival runway or procedure has been selected or exists in the active flight plan. Pushing LSK **6R**, **APPROACHINTC**, selects the intercept leg to the approach fix or runway.

This displays a waypoint or approach course for the selected approach or approach transition. The waypoint sequences along the approach route as the flight progresses.

The field is blank if no arrival runway or procedure has been selected or exists in the active flight plan. The field is blank for the ARRIVALS page if the arrival airport displayed does not match the selected approach.

After pushing LSK **6R, APPROACH INTC**, the RTE LEGS page is displayed and a flight plan modification is created, with the intercept approach fix as the active flight plan waypoint and with a defined intercept course TO the fix. The LEGS page displays the routing with the approach intercept fix waypoint as the active waypoint. The intercept in-bound course to the fix is the same as the course outbound from the fix to the next fix/runway in the procedure.

For runway-only selections, the intercept course is the same as the nav database runway heading.
The RTE COPY and ABEAM waypoint prompts are not displayed on the RTE LEGS page after **APPROACH INTC** is selected. Any previously existing flight plan waypoints are deleted.

NOTE: If a transition exists between a STAR and an approach, it is entered into the arrival route automatically once both the STAR and the approach/initial approach fix (IAF) have been selected.

ROUTE>is displayed when on the ground or when the route displayed is inactive.

APPROACH INTERCEPT FUNCTION ADDITIONAL INFORMATION

The approach intercept function selection is enabled for the following:

- All published and tailored approaches defined in the nav database for the selected destination airport
- All runway selections with a VFR approach for the selected destination airport
- All runways with an entered runway extension fix distance for the selected destination airport
- Arrivals with only the runway selected at the destination airport.

The default approach fix is determined as follows:

- For published and tailored approaches, the default approach fix is the first fix for the selected approach.

- For runway selections with a VFR approach, the default approach fix is the FMS-created final approach fix (FAF) for the selected runway.
- For runway selections with an entered runway extension fix, the default approach fix is the FMS-created runway extension fix for the selected runway.
- For runway only selections, the runway is considered the default approach fix.

CAUTION

THE APPROACH INTERCEPT FUNCTION AUTOTUNES THE ILS FREQUENCY FOR THE NEW APPROACH ONLY IF THE ILS TUNING MODE IS AUTO. IF THE ILS TUNING MODE IS MANUAL, THEN AUTOTUNING IS INHIBITED.

Runway Extension Fixes

Runway extension fixes are pilot-defined waypoints that are in line with the runway centerline at a specified distance. When a runway is selected without an accompanying approach procedure, a runway extension distance can be entered into **3R** RWY EXT / . NM on the destination airport arrivals page. Valid entries are one or two-digit distances (NM), optionally followed by tenths, ranging from 1.0 to 25.0. Upon entering a distance, the FMS creates a flight plan fix along the runway centerline at the entered distance. The fix is named RXYYY where YYY is the designated runway, for example RX34.

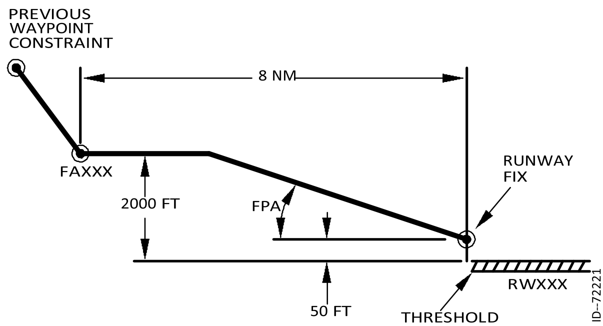
A runway extension fix is created when a runway is selected in order to provide for entering an end-of-descent target for VNAV guidance, particularly when radar vectoring is expected. VNAV optimizes the descent to arrive at the runway extension fix, in position for final approach, regardless of vectoring. VNAV guidance also results in descent to the required crossing altitude followed by level flight at the specified speed.

VFR Approach

A particular runway can be enabled for VFR approach capability by airline selection in the nav database, based on compatibility with obstacle clearance limits or procedural requirements. **VFR APPR>** is displayed when a runway is selected without an approach and has been VFR-enabled in the nav database.

VFR APPR provides path generation for LNAV and/or VNAV guidance to the entered runway as an aid to the pilot during a VFR approach. The FMS creates a path in line with the runway centerline beginning at a point 50 feet above the runway threshold and extending upward at the specified flight path angle until it intercepts a plane 2000 feet above the runway threshold.

The flight path angle has a default value of 3° but can be varied between 2.4_ and 3.7_ by pilot--entry. The path then extends level from the intersection point at 2000 feet above runway threshold to a point 8 NM from the runway threshold. This point is identified as the final approach fix FAXXX (FA is the nav database identifier for a VFR FAF) where XXX is the designated runway. This profile is shown in Figure 7--13.



VFR Approach Profile Figure 7--13

Guidance is given to arrive at the final approach fix at a speed of 155 kts along the path to the 50-foot point above the runway threshold. The crew can vary the speed by using the speed intervention mode or by line selecting the desired speed.

8. Approach

APPROACH AND RADIO TUNING

The Approach section describes the reference information available for approach. This information consists of the APPROACH REF page and navigation radio tuning on the NAV RADIO page.

ACT RTE 1 LEGS Page

Figure 8--1 displays the ACT RTE 1 LEGS page showing the aircraft location in regard to the active waypoint WCO on descent into EGLL.

Push the MCDU **[LEGS]** key to display the ACT RTE 1 LEGS page.

Aircraft Position – Preparing for Approach

Figure 8--1

APPROACH REF Page

The APPROACH REF page is accessed by pushing the MCDU **[INIT REF]** key when the aircraft is airborne or by selecting**<APPROACH** on the INIT REF/INDEX page or the THRUST LIM page.

The APPROACH REF page provides data relating to the approach profile. Push the MCDU **[INIT REF]** key to access the APP REF page, shown in Figure 8--2.

APPROACH REF EGLL
Figure 8--2

The following paragraphs describe the relevant fields.

- **GROSS WT (1L)** The gross weight (WT) line displays FMC instantaneous computed aircraft gross weight, or a pilot-entered gross weight value. Manually entered gross weight is replaced by instantaneous computed gross weight on leaving the page.

  Pilot-entered gross weights to **1L** are for approach reference speed computation only and do not affect the aircraft gross weight or the values displayed on the PERF INIT page.

  Box prompts are displayed when gross weight is not available from the FMC. The weight is displayed in thousands of pounds or thousands of kilograms, based on the OPC option.

- **LANDING REF (3L)** The LANDING REF toggles between QFE and QNH. The active mode is displayed in LARGE font, and the inactive mode is displayed in SMALL font.

  When the QFE/QNH option is not activated, LSK **3L** is blank and non-operational.

- **Runway Length Line (4L)** The origin or destination airport and runway are displayed in the **4L** header. The origin runway information is displayed until the aircraft is more than halfway to the destination or the aircraft is more than 400 NM from the origin runway, at which point the destination runway information data is displayed.

  The **4L** data line contains the runway length in feet and meters. For the flight scenario, Figure 8--2 displays the selected EGLL runway landing on runway 27R as **12,802FT** long and **3902M** long.

NOTE: No data can be entered, selected, or deleted and the display is cleared at flight completion.

Header and data lines display blanks if either no active route exists or the active route does not contain an origin runway or destination runway.

D **<INDEX (6L)** Pushing LSK **6L**, INDEX, accesses the INIT/REF INDEX page, shown in Figure 4--7.

D **FLAPS/VREF (1R, 2R, 3R)** The reference speeds (VREF) for up to three flap settings (20_, 25_, and 30_) can be displayed in **1R** through **3R**. The reference speeds are computed from the performance database on the gross weight in **1L**. If the performance database contains fewer than three flap references, fields **2R** and/or **3R** are blank.

Although these VREF values are not displayed on the speed tape, they can be down-selected and entered into **4R** to give a speed tape reference. Entry and deletion of fields **1R** through **3R** are not permitted.

D **FLAP/SPEED (4R)** The field initially displays dashes until data is entered. The pilot can enter a speed or flap setting/speed to indicate which speed is to be used for landing.

30_ 136KT is selected into **4R** for the EGLL landing by following these steps on the APPROACH REF page.

1. Push the MCDU **[INIT REF]** key.
2. Push LSK **3R** to down-select **136** into the scratchpad.
3. Push LSK **4R** to up-select the information from the scratchpad. The result is shown in Figure 8--3.

APPROACH REF Completed

Figure 8--3

NOTES: 1. The VREF speed is now displayed on the PFD.

2. Deleting a pilot-entered value returns the display at **4R** to dashes.

D **THRUST LIM> (6R)** Push LSK**6R**, THRUST LIM, to access the Thrust Limit page, shown in Figure 4--44.

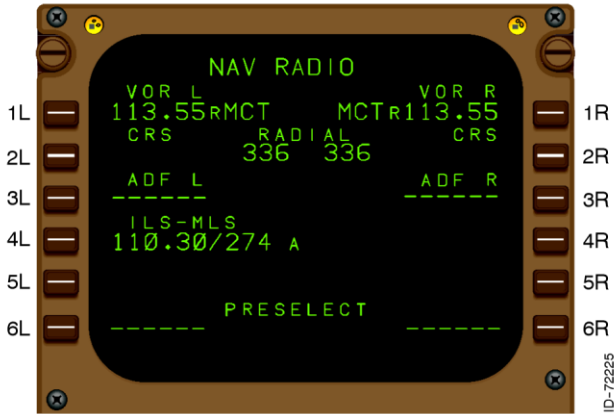
RADIO TUNING

The radio tuning function can be handled automatically by the FMC, or operated manually using the radio tuning control panel on the NAV RADIO page. Tuning capabilities are provided for VOR, ADF, ILS, and MLS receivers. In the event of FMC failure, radio tuning is handled by the MCDU, using pilot-selected stations or frequencies. Additional information can be found in Section 14, Backup Functions, ALTN NAV RADIO Page.

NAV RADIO Page

The NAV RADIO page, shown in Figure 8--4, displays current radio information and provides tuning capability for VOR, ADF, ILS, and MLS receivers.

Push the **[NAVRAD]** mode key to access the NAV RADIO page when the FMC is the tuning source.



NAV RADIO Page

Figure 8--4

The following paragraphs describe the relevant fields.

- **VOR L, VOR R (1L, 1R)** VOR frequency information for the currently tuned stations is displayed in **1L** and **1R** respectively. Valid entries are VOR and non-ILS DME station identifiers or VOR frequencies or identifier (frequency)/course. If the VOR is not tuned, the data line displays six dashes.

  The associated DME frequency in the respective radio is tuned. The field displays frequency, identifiers, and the tuning status.

  Tuning status is indicated by the following:

  A(Autotuning) The FMC selects the best available valid navaid that is not inhibited.

  M(Manual tuning) The displayed station or frequency is pilot-entered.

  R(Route autotuning) The FMC selected navaid is the next VOR, previous VOR, or a downpath VOR on the active route and within 250 NM of the current aircraft position.

  P(Procedure autotuning) The FMC selects navaids required for approach or departure procedure guidance.

  All tuning status symbols are displayed in SMALL font.

  Deleting a manual tuned frequency and/or station results in the corresponding channel reverting to autotuning and the corresponding VOR course being cleared.

  NOTE: When the magnetic variation at the airplane position and the magnetic declination of the VOR are significantly different, the ND VOR pointer and the ND POS green radial do not point directly to the VOR.

- **CRS/RADIAL (2L, 2C, 2R)** The VOR course (CRS)/radial line displays VOR course and radial for the selected VORs. Valid entries are course or VOR identifier (frequency)/course.

  The VOR course can be entered when a course or dashes are displayed. Course information is not displayed for autotuned navaids. Deleting field **2L** or **2R** while a course is displayed clears the displayed course.

The actual VOR radial received from the corresponding VOR receivers are displayed in **2C**. If a VOR radial is invalid, the corresponding radial display is blank. Entries or deletions are not possible.

With a VOR approach selected, sequencing an IAF/FAF causes the FMC to procedure autotune the VOR frequency. When the approach has a runway waypoint, the FMC selects the inbound course.

D **ADF L/ADF R (3L, 3R)** ADF tuning information is displayed in **3L** and **3R**. Frequency display is followed by BFO or ANT for the corresponding tuning modes of BFO or ANT. For the ADF mode, no suffix is displayed, and it is also the default mode.

Valid entries are three- or four-digit values optionally followed by a decimal point and a tenths digit. Entries are permitted into dash prompts or over existing ADF frequencies. The ADF frequency can optionally be followed by **A** to indicate ANT mode, or by **B** to indicate BFO mode. Likewise, if the current mode is BFO, **A** can be entered without a frequency to change the mode to ANT. If the mode is either ANT or BFO, a deletion results in the mode returning to ADF (no suffix displayed). Any other attempt to delete an ADF frequency is not permitted.

NOTE: ADF frequencies are NOT tuned automatically. The frequency must be manually entered.

D **ILS -- MLS(4L)** Valid entries displayed in **4L** are ILS frequency and front course, or front course with frequency already entered, or the MLS channel and azimuth, depending on which is being used.

The display is initialized to **PARK**. PARK indicates the ILS tuning is not active, it is in standby mode waiting for the proper conditions to become active. When an ILS, LOC, back course approach, or ILS/LOC runway is entered in the active flight plan, the appropriate frequency/course is displayed in SMALL font with a caret followed by **PARK**. This display becomes active when the aircraft is within 200 NM of the top-of-descent or the aircraft is more than halfway along the active route, whichever represents the lesser distance to destination.

When a valid frequency is manually or autotuned, **PARK** is removed and the frequency/course display is displayed in LARGE font. The pilot can select the SMALL font display to manually tune the ILS.

The FMC autotunes the ILS/MLS associated with the active flight plan destination runway when the aircraft is within 50 NM of top-of-descent or within 150 NM direct distance of the runway threshold (whichever is greater) or when active in descent.

The tuning status following the frequency/course is **A** for automatic tuning, **M** for manual tuning , and **PARK** for selected but standby condition.

NOTE: Autotuning does NOT override manual tuning. Deleting a manual tune frequency permits autotuning.

ILS receivers are inhibited from manual or automatic tuning when any of the following conditions occur:

Autopilot is engaged and either the localizer or glideslope is captured.

No autopilot is engaged and a flight director is engaged, either localizer or glideslope is captured, and the aircraft is below 500 feet radio altitude (RA).

On the ground and localizer is alive, with aircraft heading within 45 degrees of localizer front course, and groundspeed is greater than 40 knots.

NOTE: Autotuning is inhibited for ten minutes after takeoff.

Manual ILS tuning is restored when:

Either TOGA switch is pushed.

The autopilot is disengaged and both flight directors are turned off.

The MCP approach switch is deselected when the aircraft is above 1500 feet radio altitude.

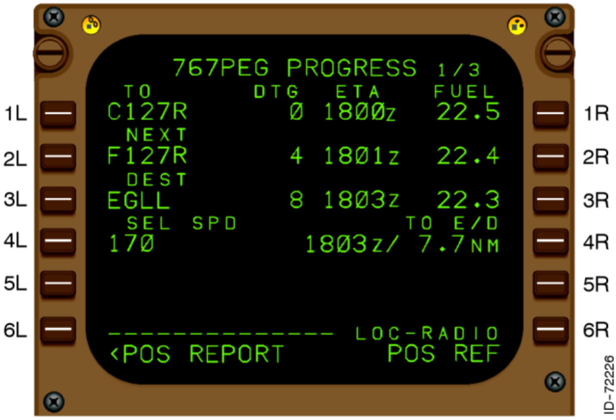
D **PRESELECT (6L, 6R)** The tuning preselect fields in **6L** and **6R** permit the pilot to preselect an entry for any field on the NAV RADIO page. This permits the pilot to pre-store an entry before actually making the tuning change. Once preselected, the entry can be down-selected into the scratchpad and then entered in the appropriate field on the NAV RADIO page. Valid entries are any valid tuning entry.

NOTE: On flight completion with the engines shut down, the NAV RADIO page with all the entered frequencies, including the manually tuned frequencies, are automatically cleared.

PROGRESS Page

Referring to the flight scenario, the aircraft is on short final for a landing on runway 27R at London Heathrow Airport.

Push the MCDU **[PROG]** key to display the PROGRESS page, shown in Figure 8--5.



PROGRESS Page 1/3 – Short Final

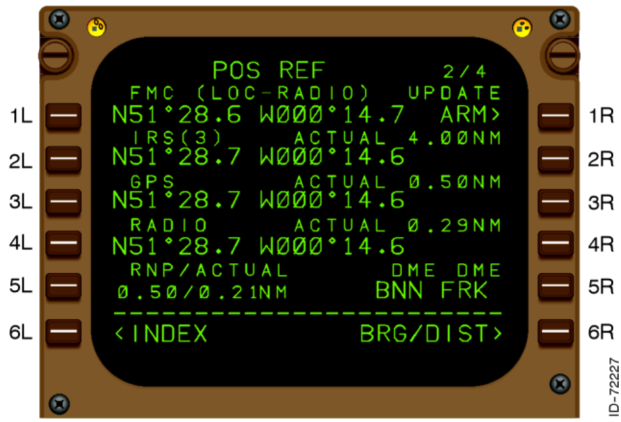
Figure 8--5

NOTE: The SEL SPD of 170 kts is displayed at **4L**, and the aircraft is 7.7 NM from touchdown.

POS REF Page 2/4

POS REF page 2/4 displays localizer radio updating and identifier at this approach phase of flight.

1. Push the MCDU **[INIT REF]** key.
2. Push LSK **6L**, **INDEX**, on the displayed page to display the INIT/REF INDEX page (shown in Figure 4--7).
3. On the INIT/REF INDEX page, push LSK **2L**, **POS**, to display the POS REF page.
4. Push the MCDU **[NEXT PAGE]** key to display the POS REF 2/4 page, shown in Figure 8--6.



POS REF 2/4 LOC
Figure 8--6

The following paragraphs describe the relevant fields.

- **DME DME (5R)** The FMS is using DME points BNN and FRK in relation to aircraft position in determining the aircraft location on final approach into London Heathrow.
- **RNP/ACTUAL (5L)** Position accuracy on final approach is displayed by required navigation performance versus actual navigation performance.

9. Alternate Page

The alternate page permits selection of alternate airports and displays data about the alternates. It is also used to command a diversion to an alternate airport.

If there were a reason to divert to an alternate airport during the flight scenario from KORD to EGLL, it would be done in the following manner.

ENGINE FAILURE EN ROUTE

Figures 9--1 through 9--3 show the scenario for an engine failure.

1. Push the MCDU **[VNAV]** key to display the ACT CRZ page, shown in Figure 9--1.

ACT ECON CRZ – Engine Failure Occurs

Figure 9--1

2. Push LSK **5R**, **ENG OUT**.

3. Push the MCDU **[EXEC]** key to display the ACT EO D/D page, shown in Figure 9--2.

ACT EO D/D

Figure 9--2

The relevant fields are explained in the following paragraphs.

D **CRZ ALT (1L)** LSK**1L** displays the FMS-calculated new cruise altitude for one engine operation, FL230 for this flight scenario.

D **EO SPD (2L)** LSK**2L** displays the engine out speed of 250 kts.

D **OPT, MAX (4C, 4R) 4C** and **4R** display the optimum (FL216) and maximum (FL230) altitudes for the engine out situation. Figure 9--3 displays the ACT EO CRZ page after the aircraft levels at FL230 in the flight scenario.

ACT EO CRZ Flight Scenario

Figure 9--3

ALTERNATE PAGE 1/2

When it is necessary to check the alternates available along the route of flight, display the ALTN page.

The ALTN page can be accessed from several pages. Pushing the **[ALTN]** prompt on the following pages displays the ALTN page, shown in Figure 9--4.

D RTE 1/X

D INIT REF/INDEX

D FMC COMM

D Or, for company datalink equipped aircraft, see Section 12, Company Datalink, Alternate Pages, for details on alternate requests and alternate uplinks.

Push the **[ALTN]** prompt to display the ALTN 1/2 page.

ALTN 1/2

Figure 9--4

Page Data

The ALTN page displays a list of up to four alternate airports, sorted in order of the ETA to the airport while airborne. The source of alternate airports can be:

D An uplink directly to this page

D Automatic selection from the ALTN LIST page

D Automatic selection from the nav database D Manual entry.

Alternate airports automatically selected from the alternate list or the nav database are displayed in SMALL font. All four alternates can be displayed on the navigation display using a CYAN alternate symbol. The currently selected alternate airport is displayed at all times on the navigation display map. The remaining three alternates can be displayed on the navigation display map display when the ARPT switch is **ON**.

NOTE: Display of the four alternate airports is automatic in the ND plan display.

D **Alternates (1L, 2L, 3L, 4L)** Lines **1L** through **4L** display the identifier of the four alternate airports in ETA order when **airborne**.

Lines **1L** through **4L** display the identifier of the four alternate airports in distance order when **on the ground**.

The selected alternate is identified with **<A>** or **<SEL>** to the right of the airport identifier. Normally, the closest alternate is selected automatically and identified by **<A>**. In this scenario, the ALTN page (Figure 9--4) displays **CYOW** as the selected alternate (**<A>** is to the right of the identifier).

Manually selecting an alternate places **<SEL>** to the right of the airport identifier. The selected alternate identifier is displayed in the label of the **DIVERT NOW** prompt in **6L**, shown later in Figure 9--7.

Manual entries are displayed in LARGE font and are resequenced according to ETA. The alternate at the location where the new airport is entered is removed from the list.

The **[DEL]** function key can be used to remove manually entered alternate airports from the ALTN page. Using the **[DEL]** function key on a manually selected alternate removes the selection and leaves the airport on the page. The automatic selection function selects a new alternate.

D **REQUEST <SEND (5L)** Pushing REQUEST <SEND (**5L**) transmits a datalink request for a company preferred list of up to 20 alternates. See Section 12, Company Datalink, Alternate Pages, for additional information.

Uplinked airports are displayed in ETA order, but are assigned a priority number by the transmitting site.

D **WXR REQUEST <SEND (6L)** Pushing WXR REQUEST <SEND (**6L**) transmits a datalink request for alternate airport weather information. See Section 12, Company Datalink, Alternate Pages, for additional information.

Uplinked weather is sent to the flight deck printer.

D **ETA (1C, 2C, 3C, 4C)** The ETA is displayed in the center column for each of the alternates. ETA is blank when the aircraft is on the ground.

NOTE: The alternate ETA predictions update every 5 minutes. Predictions continue to update following the selection of **DIVERT NOW** and execution of the diversion.

D **FUEL (1R, 2R, 3R, 4R)** Lines **1R** through **4R** display the alternate airport predicted arrival fuel. The fuel display is blank when the aircraft is on the ground.

D **ALTN INHIBIT (5R)** One or two airports can be entered, inhibiting them from automatically being displayed on this page.

Alternate inhibits can be entered manually or uplinked. Valid entries are airports from the nav database.

D **DIVERT NOW> (6R)** Selecting DIVERT NOW (**6R**) modifies the route to show flying from the present position to the selected alternate using the route displayed on the XXXX ALTN page. It creates an LNAV route modification for a divert to the selected alternate.

When pushed it automatically displays the MOD XXXX ALTN page for the selected alternate, shown later in Figure 9--11. Executing the diversion does the following:

Changes the route destination airport

Incorporates the route modification into the active flight plan

Deletes all parts of the original route that are not part of the diversion

If a descent path exists, deletes all descent constraints (the scratchpad message **DESCENT PATH DELETED** is displayed when **DIVERT NOW** is selected).

NOTE: After a divert is executed, the XXXX ALTN page is not updated until all MCDUs are selected off of the XXXX ALTN page.

In this flight scenario, the aircraft is going to Greater Rochester International airport (KROC), entered manually, rather than to the alternate that was selected automatically, which was Ottawa Mcdonald Cartier International airport (CYOW).

1. Type **KROC** into the scratchpad, as shown in Figure 9--5.

ALTN 1/2 KROC in scratchpad Figure 9--5

2. Push any left LSK to enter KROC sequentially by ETA into the list.

   The manual entry is displayed in LARGE font, as shown in Figure 9--6.

ALTN 1/2 KROC Entered

Figure 9--6

NOTES: 1. Entry into a field displaying SMALL font overwrites the SMALL font value but does not delete it from the alternates candidates list as long as it satisfies the earliest ETA criteria.

2. Entry of an alternate over a LARGE font alternate overwrites the large font alternate and deletes it from the alternate candidates list.

3. Push LSK **4L** to select KROC, as shown in Figure 9--7.

ALTN 1/2 KROC Selected

Figure 9--7

NOTE: The alternate KROC is now **<SEL>**, selected, and **6R** displays **KROC** at the **DIVERT NOW>** prompt.

ALTERNATE PAGE 2/2

To display ALTN page 2/2, push the **[NEXT PAGE]** or **[PREV PAGE]** key when ALTN page 1/2 is displayed. This page can be accessed only if company datalink is enabled. See Section 12, Company Datalink,
Alternate Pages, for details on Alternate Flight List Requests and Uplinks.

Push the MCDU **[NEXT PAGE]** or **[PREV PAGE]** key when ALTN page 1/2 is displayed to see the ALTN LIST 2/2, shown in Figure 9--8.

ALTN 2/2 Page

Figure 9--8

The second alternate page displays a list of previously uplinked alternate airports. The alternates displayed on the ALTN 1/2 page are automatically selected from this list, or from the nav database when a list does not exist.

The four lines display up to five alternate airports on each line. This page contains up to 20 airports that can be used as alternates. The alternates displayed on the ALTN 1/2 page can be manually selected from this list and preferred uplinked airports do not use all four selections.

The alternate list is uplinked directly to this page. No manual entry is permitted. Manual airport entries are done on the ALTN 1/2 page.

The entire alternate list can be deleted. A new list must be uplinked after a purge. When no list exists, the alternate airports are automatically selected from the nav database.

Selecting **PURGE** (**5R**) displays a **CONFIRM** prompt. Select **CONFIRM** to delete all current airports from the alternate airport list.

XXXX ALTN PAGES

The XXXX ALTN pages display specific information about alternate airports, the route used for a diversion, and conditions on which ETA and fuel calculations are based.

The alternate selected in the flight scenario is KROC, as shown in Figure 9--9.

Push LSK **6R**, **KROC DIVERT NOW** (shown in Figure 9--7), to display the KROC ALTN page.

KROC ALTN Page 4/4
Figure 9--9

This page is also selected automatically when the **DIVERT NOW** selection is not yet executed and the **ALTN** prompt is selected on these pages:

D RTE X

D INIT/REF INDEX D FMC COMM.

Page Data

All the data on this page relates to the alternate airport displayed in the page title.

Three routes to the selected airport can be selected:

D DIRECT

D OFFSET D OVERHEAD.

The selected route is identified by **<SEL>**. ETA and fuel remaining calculations are based on the selected route. Selecting a route for one alternate selects the same route calculation for the other three alternates.

D **VIA (1L)** **VIA** displays the three route options.

D **DIRECT TO (1L)** Selects a direct route from the aircraft present position to the airport.

D **OFFSET (2L)** Selects a left or right offset for the current active route to the airport. Normal procedures for selecting an offset apply.

D **OVERHEAD (3L)** Selection follows the current active route until overhead the specified waypoint, and then follows a direct route to the alternate airport.

Selecting and executing an overhead diversion deletes all waypoints from the original active flight plan except those waypoints that are between the aircraft position and the selected overhead waypoint.

The overhead point displayed is a waypoint called YZV.

D **<ALL ENG (5L)** Returns engine out information to ALL ENG information.

D **<ALTN(6L)** Selecting the the ALTN prompt displays the ALTN 1/2 page.

D **ALT (1R)** Line**1R** displays the advisory cruise altitude for which ETA and arrival fuel are calculated. The advisory cruise altitude is by pilot--entry or uplink.

On creating an engine-out modification, the altitude field overwrites any previously displayed ALT value greater than engine-out maximum altitude, or the previous default with the calculated default alternate ALT for the engine-out condition. An entered altitude that is less than the engine-out maximum altitude is not overwritten by a computed value.

D **SPD(2R)** Line**2R** displays the speed for which ETA and arrivalfuel are calculated.

The flight scenario displays the EO speed condition,shown inFigure 9--9.

Valid alternate speed entries can be **LRC**, **ECON**, **EO**, **EOLRC**, and **CO**. During the state of an engine-out modification, entry of an alternate speed is restricted to EO, EOLRC, LRC (LRC interpreted as engine-out long range cruise), and CO.

D **WIND (3R)** Line**3R** displays the estimated average wind for the divert route. The wind entry is by pilot--entry or uplink. Valid entry is a direction in degrees (000 to 360) and speed in knots (0 to 250, inclusive).

A wind entry for any alternate applies to that alternate only.

D **ALT/OAT (4R)** Displays OAT for a specific altitude. Valid entry is an altitude/temperature in degrees C.

An ALT/OAT entry for any alternate applies to that alternate only.

D **ETA/FUEL (5R)** Displays the calculated airport ETA and arrival fuel based on the selected route, altitude, and speed displayed on this page.

D **DIVERT NOW> (6R)** Selecting DIVERT NOW modifies the route to show flying from the present position to the selected alternate using the route displayed on the XXXX ALTN page. It creates a LNAV route modification for a divert to the selected alternate. The functions are as previously described on the ALTN 1/2 page.

After **DIVERT NOW** has been selected and before the diversion has been executed, the field displays **SELECTED**.

Referring to Figure 9--9, the flight scenario is flown to the alternate KROC via DIRECT TO route. The following steps and figures show this process.

1. Push LSK **1L** to select **DIRECT TO** on KROC ALTN 4/4

KROC ALTN – OVERHEAD <SEL>
Figure 9--10

2. Push LSK **6R**, **DIVERT NOW**, changing the display to that shown in Figure 9--11.

NOTE: Line **6R** changes to **SELECTED** and the page title changes to **MOD KROC ALTN**.

DIVERT KROC SELECTED

Figure 9--11

3. Push the MCDU **[EXEC]** key to activate the modification, which changes the title line to ACT KROC ALTN, as shown in Figure 9--12.

ACT KROC ALTN Page

Figure 9--12

NOTE: LSK **1L** shows that **DIRECT TO** is active, **<ACT>**.

4. Push the MCDU **[RTE]** key.

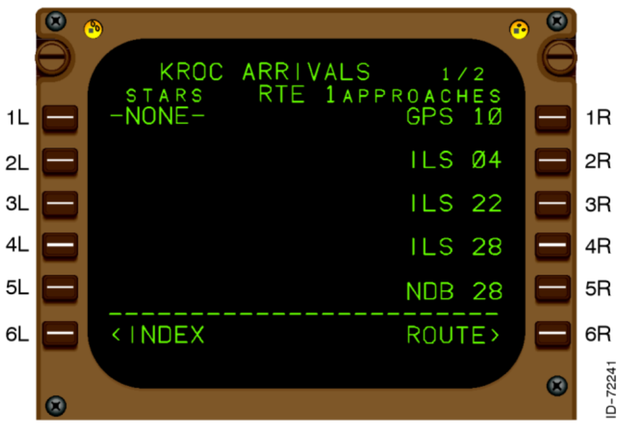
5. Push the MCDU **[PREV PAGE]** key.

Executing MOD KROC ALTN changes the destination in ACT RTE 1 to KROC, displayed in **1R**, as shown in Figure 9--13.

ACT RTE 1

Figure 9--13

6. Push the MCDU **[DEP ARR]** key to automatically display the KROC ARRIVALS page, shown in Figure 9--14.



KROC ARRIVALS Page 1/2

Figure 9--14

10. After Landing

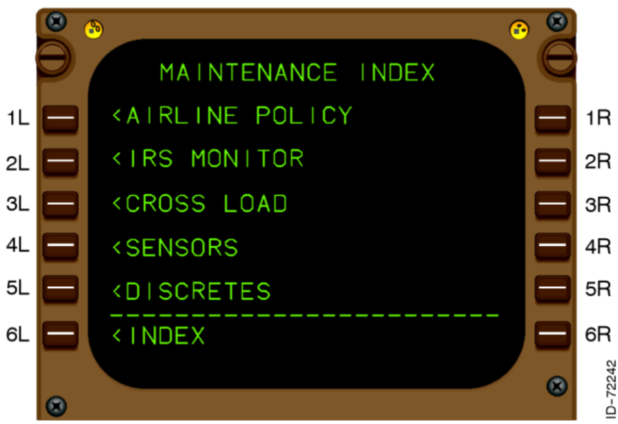
IRS MONITOR

The IRS MONITOR page displays the computed position error rate for each IRU upon flight completion.

NOTE: The **MAINT** prompt is functional only when the aircraft is on the ground.

To access the MAINTENANCE INDEX page:

1. Push the MCDU **[INIT REF]** key.
2. Push LSK **6R**, **MAINT**, on the INIT/REF INDEX page to display the MAINTENANCE INDEX page, shown in Figure 10--1.

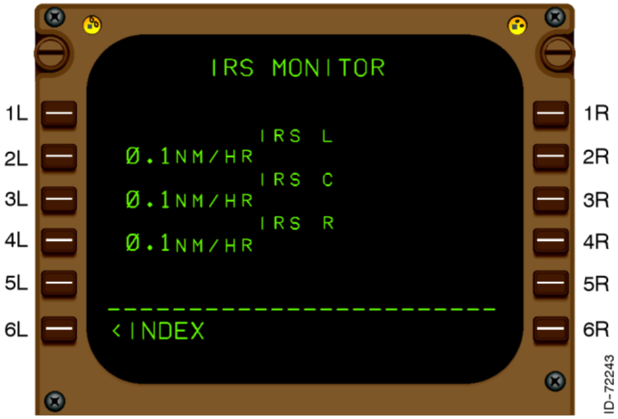


MAINTENANCE INDEX Page

Figure 10--1

3. Push LSK **2L**, **IRS MONITOR**, to access the IRS MONITOR page,

shown in Figure 10--2, .



IRS MONITOR Page

Figure 10--2

Lines **2L**, **3L**, and **4L** display the IRS position error rate for the flight, in nautical miles per hour, computed by dividing the computed distance from the FMC position to the IRS position during the flight (liftoff to flight completion) by the total flight time. This value is computed when the flight is completed. The display is cleared when the aircraft is airborne.

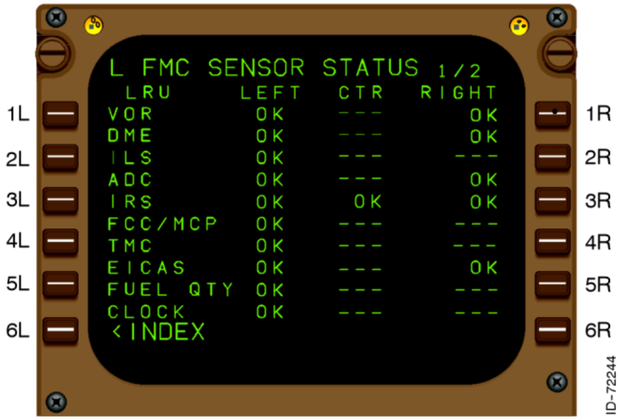
4. Push **<INDEX (6L)** to access the MAINTENANCE INDEX page.

FMC SENSOR STATUS

The FMC SENSOR STATUS pages display information on the status of sensors that give data to the FMC. Information about either the left (L) or right (R) FMC, depending on which FMC is operating the MCDU, is displayed in two pages. Figures 10--3 and 10--4 show the pages for L FMC SENSOR STATUS.

To access the FMC SENSOR STATUS page:

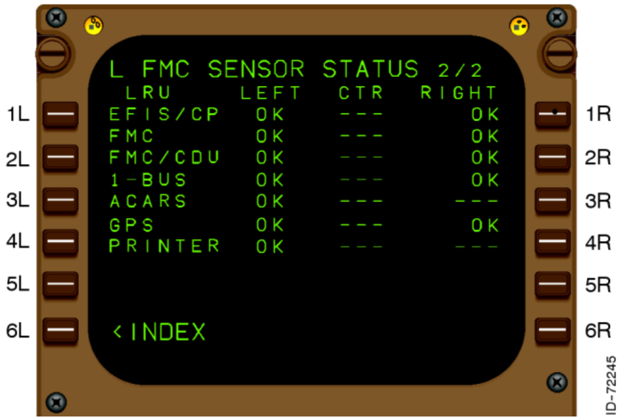
1. Push the MCDU **[INIT REF]** key.
2. Push LSK **6R**, **MAINT**, on the INIT/REF INDEX page to display the MAINTENANCE INDEX page (see Figure 10--1).
3. Push LSK **4L**, **SENSORS**, on the MAINTENANCE INDEX page, to display the FMC SENSOR STATUS page, shown in Figure 10--3.



L FMC SENSOR STATUS Page 1

Figure 10--3

4. Push the MCDU **[NEXT PAGE]** key to access page 2/2 of the FMC SENSOR STATUS page, shown in Figure 10--4, .



L FMC SENSOR STATUS Page 2

Figure 10--4

The status of the sensors to the LEFT, CTR, and RIGHT LRUs (line replaceable units) is displayed. The sensor input of each LRU is transmitted in one of three signals:

D **FAIL** Valid data was not received from the sensor input, or the input bus failed.

D **TEST** Valid data has been received from the input, but that input is in a test mode.

D **OK** The FMC is receiving valid data from the sensor input.

NOTE: The FMC accepts the sensor data only when that data is in the OK mode.

Three dashes are displayed in fields where the sensor input is not applicable for that LRU.

11. Advanced Flight Planning

This section explains how to create waypoints and insert them into the flight plan, and also explains FMS waypoint abbreviations, procedure turns, polar operations, holding patterns, and the use of wind information in the FMS.

PILOT-DEFINED WAYPOINTS

Waypoints are specified as navigation database waypoints or pilot-defined (non-nav database) waypoints. Pilot-defined waypoints include the following:

D Along-track waypoints

D Place bearing/distance (PB/D) and place bearing/place bearing (PB/PB) waypoints

D LAT/LONG waypoints

D Course intersection waypoints.

Generally, waypoints are entered in the scratchpad, then moved to the desired location by pushing the appropriate LSK. If a waypoint entry is line selected in an invalid format, the **INVALID ENTRY** message is displayed. If a waypoint entry referring to an identifier not present in the nav database is line selected, the message **NOT IN DATA BASE** is displayed.

Along-Track Waypoints

The along-track waypoint is a pilot-defined point at a given distance before or after an existing flight plan waypoint on the existing flight plan course. An along-track waypoint is located before the flight plan point if a minus ( ) is used and after the point if a plus (+) is used (the plus (+) is optional). The along-track waypoint is given a flight plan name consisting of the first three letters of the identifier followed by the number that corresponds to its order in the sequence of pilot-defined points.

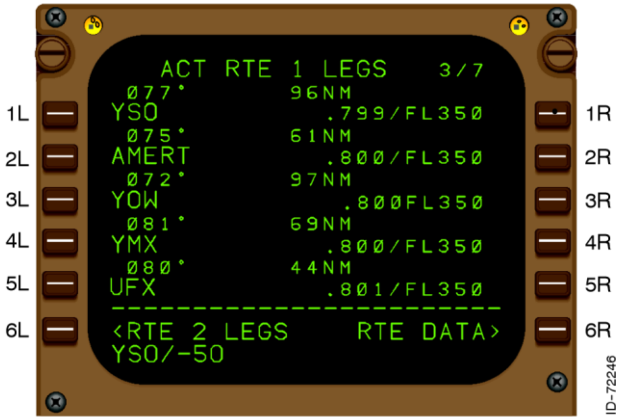
Latitude and longitude waypoints cannot be used to create along track waypoints.

An along-track waypoint is entered on the RTE LEGS pages. For example, ATC requests an estimated time of arrival 50 NMs prior to YSO.

To enter the along-track waypoint YSO/ 50:

1. Push the MCDU **[LEGS]** key to advance to page 3/7.

2. Type **YSO/--50** into the scratchpad, as shown in Figure 11--1.



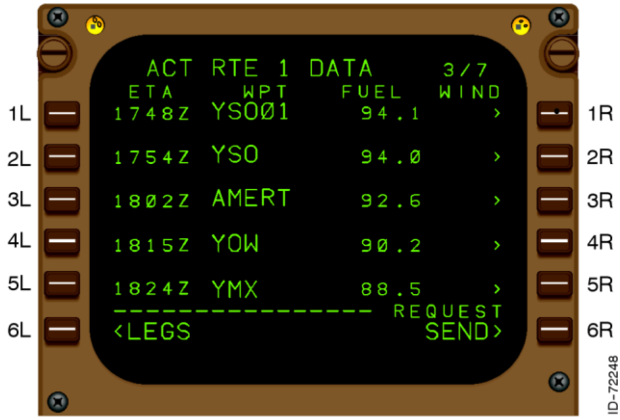
Along-Track Waypoint in Scratchpad Figure 11--1

3. Push LSK **1L** to enter the along-track waypoint into the route plan.

4. Push the MCDU **[EXEC]** key to activate the along-track waypoint, shown in Figure 11--2.

Along-Track Waypoint Active in Route Plan Figure 11--2

5. On the RTE LEGS page, push LSK **6R** to access the RTE DATA page to display waypoint ETAs, shown in Figure 11--3.



ETA at YSO01

Figure 11--3

By accessing the RTE DATA pages, the pilot can inform ATC that the aircraft will be 50 NMs from YSO at 1748z.

Place Bearing/Distance and Place Bearing/Place Bearing Waypoints

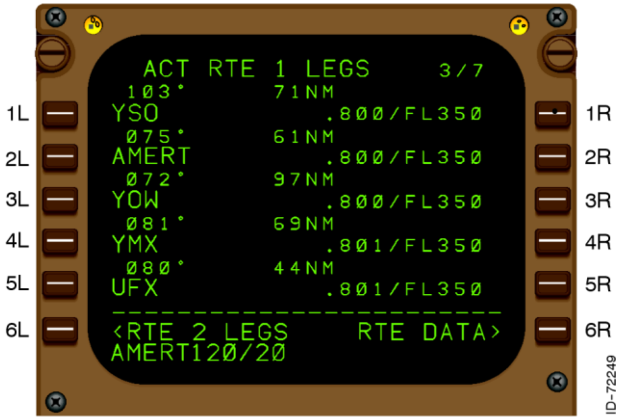
Waypoints entered as a place bearing/distance (PBD) or place bearing/place bearing (PB/PB) are identified by the first three characters of the entry followed by a two-digit sequence number.

For this scenario, a waypoint from the AMERT 120_ radial at 20 NMs is created and entered into the flight plan.

NOTE: The slash (**/**) between the radial and DME is required for all PB/D entries.

To enter a place bearing/distance waypoint:

1. Push the MCDU **[LEGS]** key to display the ACT RTE LEGS page.
2. Type **AMERT120/20** into the scratchpad, as shown in Figure 11--4.



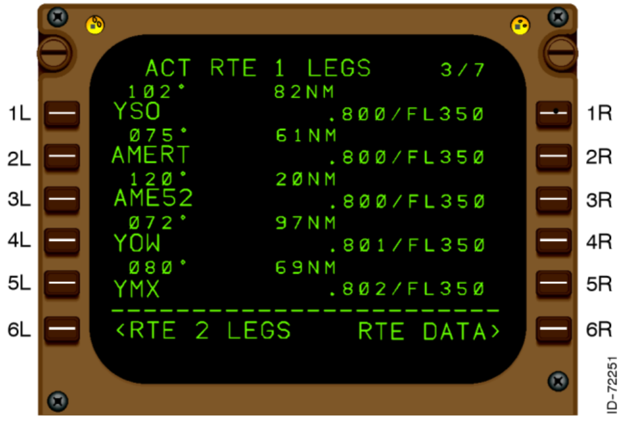
PB/D Waypoint in Scratchpad Figure 11--4

3. Push LSK **3L** to enter the PB/D waypoint after AMERT, as shown in Figure 11--5. This creates a discontinuity.

   NOTE: All PB/D waypoint entries create a break in the flight plan and result in a ROUTE DISCONTINUITY.

PB/D Waypoint in Route With Discontinuity Figure 11--5

4. Push LSK **5L** (YOW) to enter YOW into the scratchpad.
5. Push LSK **4L** to enter YOW into the discontinuity.
6. Push the MCDU **[EXEC]** key to activate the PB/D waypoint, as shown in Figure 11--6.



PB/D Waypoint Active in Route Plan, Discontinuity Removed Figure 11--6

LAT/LONG Waypoint

A LAT/LONG waypoint can be generated by inserting latitude and longitude coordinates directly into the flight plan on the RTE LEGS pages. Waypoint entries are displayed in a seven-character format and with no space or slash between the LAT/LONG entries. Leading zeros must be entered. All digits and decimal points (to one-tenth minute) must be entered, unless the latitude or longitude is in full degrees. For example:

D N56_ W060_ is entered as N56W060 and displayed as N56W060.

D N56_05.5 W060_06.7 is entered as N5605.5W06006.7 and displayed as N56W060.

Latitude or longitude reporting waypoints are entered as latitude or longitude followed by a dash, then the increment chosen for the multiple waypoints. For example:

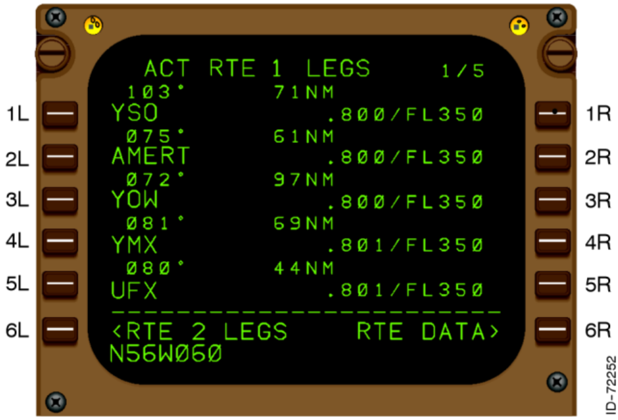
D W060--10 adds waypoints starting at W060 in ten-degree increments from that point to the destination.

Entered waypoints are named WPTNN where NN is the sequence number (if the LAT/LONG is line selected back to the scratchpad, it is always displayed in its complete format).

To enter a LAT/LONG waypoint:

1. Push the MCDU **[LEGS]** key to display the ACT RTE LEGS page.

2. Type **N56W060** is typed into the scratchpad, as shown in Figure 11--7.



LAT/LONG Waypoint in Scratchpad
Figure 11--7

3. Push LSK **2L** to enter the waypoint after AMERT, as shown in Figure 11--8.

LAT/LONG Waypoint in Route With Discontinuity Figure 11--8

4. Push LSK **5L** to enter YOW into the scratchpad.

5. Push LSK **4L** to enter YOW into the discontinuity, as shown in Figure 11--9.

6. Push the MCDU **[EXEC]** key to activate the LAT/LONG waypoint.

LAT/LONG Waypoint Active in Route Plan Figure 11--9

NOTE: LAT/LONG waypoints can be entered with or without minutes. When entered without minutes, they are displayed with 00.0 minutes if line selected back into the scratchpad.

Airway Crossing Fixes

Airway crossing fixes are entered as a five-character waypoint name or as consecutive airways on the RTE page. In the latter case, the display is an X followed by the second airway name. For example: entering J70 on the VIA line of the RTE page results in box prompts being displayed opposite on the same line. Leaving the box prompts empty and entering J52 on the next VIA line, directly below J70, results in the FMS computing the intersection of the two airways and replacing the boxes with the waypoint identifier, XJ52.

Summary of Pilot Waypoint Construction

Table 11--1 shows examples of pilot-defined waypoints and the FMS assigned sequence numbers

Type of Waypoint	MCDU Page and Valid Entry	Invalid Entry	Examples
Navigation Data Base	RTE or LEGS Navaid, Airport, Waypoint, Runway	NOT IN DATA BASE	Navaid: BEN Airport: EGLL Waypoint:LOACH Runway: RW32R
Along Track Waypoint	LEGS Waypoint must exist on LEGS page. (--) is prior to waypoint	Cannot coincide or extend beyond another existing waypoint	YSO/--50 BEN/30
Place Bearing/ Distance	RTE or LEGS Navaid, Waypoint	Runway Fix, LOM, MM, LAT/LONG	BEN090/70 OBK274/61
Place Bearing/ Place Bearing	RTE or LEGS Navaid, Waypoint	LAT/LONG, Distance greater than 700 NM from either Fix	GOW125/BNN097 OBK060/ECK090
Latitude/ Longitude	RTE or LEGS Leading zeros required	If LAT/LONG contains minutes, both LAT and LONG must have trailing zeros	N56W060 N5605.0W06006.0 N5950.0W01006.0
Crossing LAT or LONG	LEGS Route crosses that LAT/LONG	Route does not cross the LAT/LONG	W123, N05
Interval LAT or LONG	LEGS Route crosses that LAT/LONG	An interval greater than 20 degrees	W130--5 SO5--10

Pilot Waypoint Construction Table 11--1 (cont)

Type of Waypoint	MCDU Page and Valid Entry	Invalid Entry	Examples
Airway Intersection	RTE Airways that intersect	Airways that do not intersect **Must have a DEST.**	VIA TO J546 YQB J560 YZV A1 MCT

Pilot Waypoint Construction Table 11--1

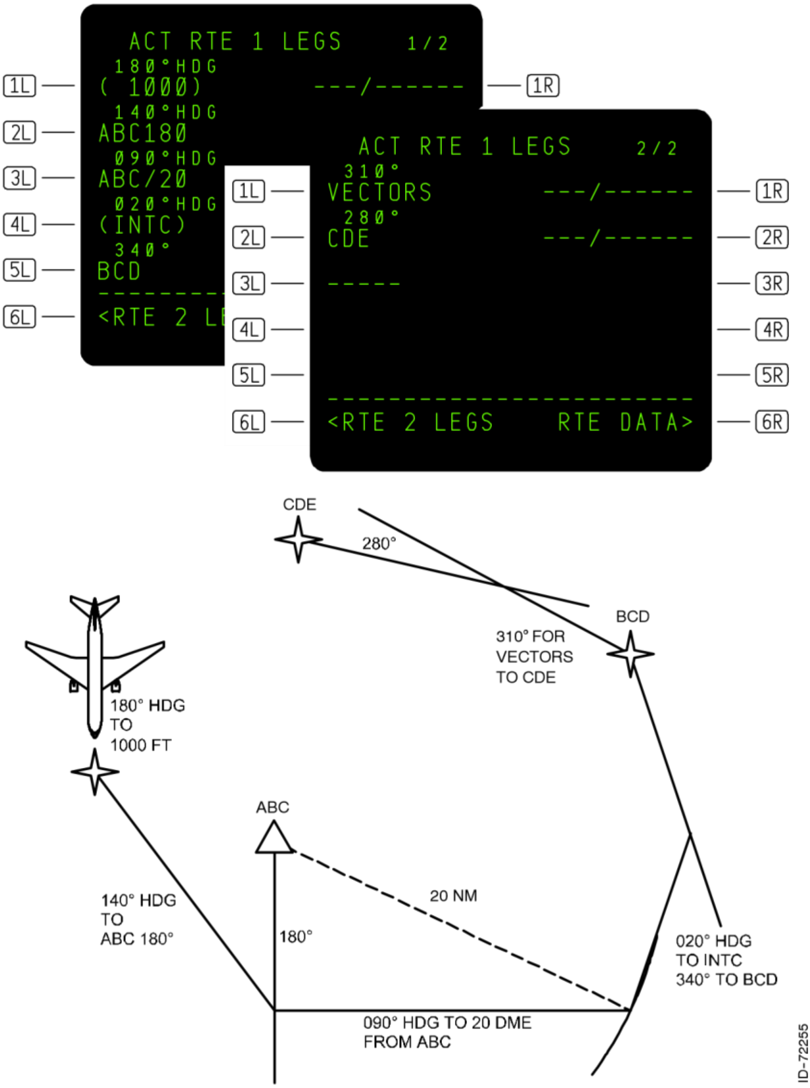
CONDITIONAL WAYPOINTS

Conditional waypoints are automatically entered in a route as a result of selecting a procedure on a DEPARTURES or ARRIVALS page. Conditional waypoints **cannot** be manually entered. These waypoints indicate when an event occurs and are not at a geographically fixed position.

There are five types of conditions: passing an altitude, flying a heading to a radial or a DME distance, intercepting a course, and heading vectors. Altitude and course intercept conditional waypoints are displayed on the MCDU in parentheses ( ).

The legend **VECTORS** on a LEGS page denotes a conditional leg under ATC heading instructions. When released from ATC vector control, the FMS uses LNAV HEADING HOLD to intercept the active leg.

Figure 11--10 shows a conditional waypoints routing.



Conditional Waypoints Figure 11--10

FMS ABBREVIATIONS

Waypoints located at unnamed runway-related fixes are identified by adding a two-letter prefix to the runway number. The following abbreviations are used with the runway number if a **single** approach exists to that runway:

CF Final Approach Course Fix

IF	Initial Approach Fix
FF	Final Approach Fix
OM	Outer Marker
MM	Middle Marker
IM	Inner Marker
RX	Runway Extension Fix
RW	Runway Threshold
MA	Missed Approach Point (not runway)
MD	Minimum Descent Altitude
TD	Touchdown Point Inboard of Threshold
BM	Back Course Marker

FA VFR Approach FIX A (+ an

alpha) Step Down Fix

Examples:

(ILS 28L)
CF28L, FF28L, RW28L

Table 11--2 lists abbreviations that are used with the runway number if **multiple** approaches exist to that runway (parentheses beside the waypoint type are included to compare with abbreviations listed on the previous page). The first letter identifies the type of fix and the second letter identifies the type of approach.

Waypoint Type	**ILS (I)**	**ILS (L) Localizer Only**	**ILS (B)**	**VOR (D) DME**	**VOR (V) Only**
Course Fix (CF)	CI	CL	CB	CD	CV
FAF (FF)	FI	FL	FB	FD	FV

MAP (MA)	PI	PL	PB	PD	PV
IAP (IF)	II	IL	IB	ID	IV
MDA (MD)	DI	DL	DB	DD	DV
TD (TD)	TI	TL	TB	TD	TV
Waypoint Type	**VOR (S) With DME Points**	**NDB (N)**	**NDB (Q) With DME Points**	**MLS**	**RNAV**
Course Fix (CF)	CS	CN	CQ	CM	CR
FAF (FF)	FS	FN	FQ	FM	FR
MAP (MA)	PS	PN	PQ	PM	PR
IAP (IF)	IS	IN	IQ	IM	IR
MDA (MD)	DS	DN	DQ	DM	RR
TD (TD)	TS	TN	TQ	TM	TR

Multiple-Approach Runway Abbreviations Table 11--2

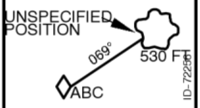
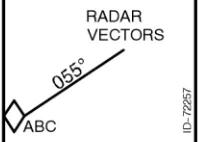
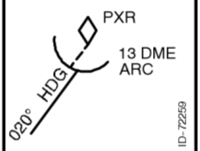
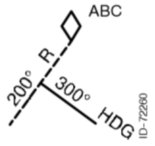
Examples:

(VOR 32R)
CV32R, FV32R, PV32R, RW32R

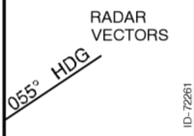
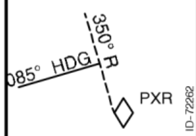
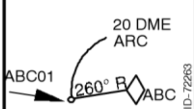
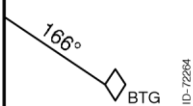
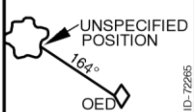
ADDITIONAL FLIGHT PLANNING INFORMATION

Navigation Leg Types

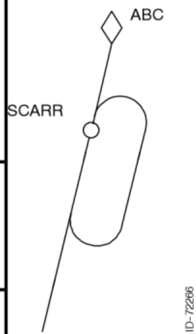
Table 11--3 displays an explanation and shows the different types of flight plan legs that might be flown and displayed on the MCDU during a typical flight. The table aids the crew in recognizing all leg types, particularly those that may not often be seen.

Leg Type	Description	Example	MCDU Display	Comments
FA	Course from a fix to an altitude		069° (530)	Tuned Navaid required.
FM	Course from a fix to a manual termination		055° VECTORS	Tuned Navaid required.
VA	Heading to an altitude		078° HDG (1530)	Tuned Navaid may be required.
VD	Heading to a DME distance		020°HDG PXR/13	Heading to a DME arc. Tuned Navaid required.
VI	Heading to a course intercept		300° HDG (INTC)	Heading to an intercept leg. Tuned Navaid may be required.

Navigation Leg Types
Table 11-3 (cont)

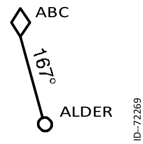
Leg Type	Description	Example	MCDU Display	Comments
VM	Heading to a manual termination		055° HDG VECTORS	Tuned Navaid may be required.
VR	Heading to a VOR/DME radial		085° HDG PXR350	Tuned Navaid required.
AF	DME arc to a fix		20 ARC L ABC01	ABC01=PB/D waypoint ABC260/20. Tuned Navaid required.
CF	Course to a fix		166° BTG	Tuned Navaid required.
DF	Computed track to a fix		164° OED	Direct to fix, fix to fix, or intercept to fix. Tuned Navaid may be required.

Navigation Leg Types
Table 11-3 (cont)

Leg Type	Description	Example	MCDU Display	Comments
	Holding Pattern Terminating:			Tuned Navaid may be required.
HA	At a specific altitude		HOLD AT (8000)	Hold until reaching a specific altitude (climb only).
HF	On crossing the holding fix once		HOLD AT SCARR	Exit holding after one turn.
HM	On pilot selection		HOLD AT SCARR	Exit holding manually.
IF	Initial fix		---° SEA	Leg is ignored if created by the nav database. Leg is inserted as a ROUTE DISCONTI-NUITY if created manually.
PI	Procedure turn		PROC TURN (INTC)	Tuned Navaid required. Always followed by a CF leg.

Navigation Leg Types
Table 11-3 (cont)

Leg Type	Description	Example	MCDU Display	Comments

TF	Track between two fixes		167_ ALDER	Direct to fix, fix to fix or intercept to fix. No required Navaid.

Navigation Leg Types
Table 11--3

LNAV WAYPOINT IDENTIFIERS

Waypoint (navigation fix) identifiers are displayed on the MCDU and the navigation display. The MCDU message **NOT IN DATABASE** is displayed if a manually entered waypoint identifier is not stored in the database. The waypoint can still be entered as a latitude and longitude, place-bearing/distance, or place-bearing/place-bearing waypoint.

FMS generated waypoints contain a maximum of five characters assigned according to the following rules.

Navaid Waypoint Names

VHF waypoints are located at VHF navaids (VOR/DME/LOC) and are identified by the official one-, two-, three-, or four-character facility identifier.

Examples:

D Los Angeles VORTAC LAX D

Tyndall TACAN PAM D Riga

Engure, USSR AN.

NDB waypoints are located at NDBs and identified by use of the station identifier.

Example:

D FORT NELSON, CAN YE.

Fix Waypoint Names

Fixes with one word names are waypoints located at fixes with names containing five or fewer characters and identified by the name.

Examples:

D DOT

D ACRA

D ALPHA.

Long Waypoint Names

Names with more than five characters are abbreviated using the following rules sequentially until five characters remain. Double letters are deleted.

Examples:

D KIMMEL becomes KIMEL

D COTTON becomes COTON D

RABBITT becomes RABIT.

Keep the first letter, first vowel and last letter. Delete other vowels starting from right to left.

Examples:

D ADOLPH becomes ADLPH D

BAILEY becomes BAILY

D BURWELL becomes BURWL.

Keep the last letter, then delete consonants from right to left.

Examples:

D ANDREWS becomes ANDRS

D BRIDGEPORT becomes BRIDT D

HORSBA becomes HORSA.

Fixes with multiword names use the first letter of the first word and abbreviate the last word as necessary, using the above rules sequentially until a total of five characters remain.

Examples:

D CLEAR LAKE becomes CLAKE

D ROUGH ROAD becomes RROAD.

Unnamed Point Waypoint Names

This section covers unnamed turn points, intersections, and DME fixes; unnamed flight information regions; and unnamed oceanic control area reporting points.

TURN POINTS, INTERSECTIONS, AND DME FIXES

If an unnamed turn point, intersection, or fix is collocated with a named waypoint or navaid on a different route structure (such as low altitude routes or an approach), the name or identifier of the collocated waypoint is used. Example:

> Unnamed turn point on J2 between the Lake Charles (LCH) and New Orleans (MSY) VORTACs is coincidental with the Lafayette (LFT) low altitude VORTAC. LFT is used as the identifier for the turn point.

Identifier codes for unnamed turn points not coincidental with a named waypoint are constructed from the identifier of a navaid serving the point and the distance from the navaid to the point. If the distance is 99 nautical miles or less, the navaid identifier is placed first, followed by the distance. If the distance is 100 nautical miles or more, the last two digits are used and placed ahead of the navaid identifier.

Examples (NAVAID DISTANCE IDENT):

D INW 18 INW18

D TCS 89 TCS89 D

CSN 106 06CSN.

FIR, UIR, AND AIRSPACE REPORTING POINTS

Unnamed flight information regions (FIR), upper flight information regions (UIR), and controlled airspace reporting points have cases where the government authority does not provide unique, five letter or less waypoint names. In cases where the supplied name cannot be converted to a unique five-letter identifier using previous rules, the following rules are applied:

D **FIR** Use the three characters FIR plus a number from 02 to 99. An identifier so developed is to be unique within the geographical area.

D **UIR** Use the three characters UIR plus a number from 02 to 99. An identifier so developed is to be unique within the geographical area.

D **Controlled Airspace** Use the three letter characters for the type of controlled airspace plus a number from 2 to 99.

Examples of controlled airspace types:

TMA Terminal Area

CTR Controlled Zone

ATZ Aerodrome Traffic Zone CTA Controlled Area.

OCEANIC CONTROL AREA REPORTING POINTS

Entry/exit positions to oceanic areas are often defined by waypoints that are undesignated as geographical coordinates (LAT/LONG) expressed in full degrees.

Positions in the northern hemisphere use the letters N and E, while positions in the southern hemisphere use the letters S and W. Latitude always precedes longitude. For longitude, only the last two digits of the three-digit value are used.

Placement of the designator in the five-character set indicates whether the first longitude digit is 0 or 1. The letter is the last character if the longitude is less than 100_.

N is used for north latitude, west longitude. E is used for north latitude, east longitude. S is used for south latitude, east longitude. W is used for south latitude, west longitude.

Examples:

D N50_W040_ becomes 5040N

D N75_W170_ becomes 75N70

D N50_E 020_ becomes 5020E

D N06_E110_ becomes 06E10

D S52_W075_ becomes 5275W

D S07_W120_ becomes 07W20 D

S50_E020_ becomes 5020S

D S06_E110_ becomes 06S10.

PROCEDURE ARC FIX WAYPOINT NAMES

Unnamed terminal area fixes along a DME arc procedure are identified with the first character **D**. Characters 2 through 4 indicate the radial on which the fix exists. The last character indicates the arc radius. The radius is expressed by a letter of the alphabet where A = 1 mile, B = 2 miles, C = 3 miles and so forth.

Examples:

D EPH252_/24 = D252X

D EPH145_/24 = D145X D

GEG006_/20 = D006T.

An unnamed waypoint along a DME arc with a radius greater than 26 miles is identified as an unnamed turn point that is not coincidental with a named waypoint.

Examples:

D CPR338_/29 = CPR29 D

GEG079_/30 = GEG30.

When there are multiple unnamed waypoints along a DME with a radius greater than 26 miles, the station identifier is reduced to two characters, followed by the radius, and then a sequence character.

Examples:

D CPR 134_/29 = CP29A

D CPR190_/29 = CP29B D

CPR201_/29 = CP29C.

PROCEDURE FIX WAYPOINT NAMES

Marker beacons A marker beacon is identified by the marker type identifier followed by the runway number.

Examples:

D Outer marker 13R = OM13R D

Middle marker 21 = MM21.

Waypoints located at unnamed runway-related fixes are identified by adding a two-letter prefix to the runway number. The following list is used to determine the applicable prefix:

D RX -- runway extension fix

D FA -- VFR final approach fix

D CF -- final approach course fix

D FF -- final approach fix

D BM -- back course marker

D MD -- minimum descent altitude

D A -- (+ an alpha) step down fix

- IF -- initial approach fix
- OM -- outer marker
- MM -- middle marker
- IM -- inner marker
- RW -- runway threshold
- MA -- missed approach point other than RW
- TD -- touchdown point inboard of RW

Examples: OM25L, MM09, IM23, RW04, RW18L.

POLAR OPERATION

This section identifies operations unique to the polar region for the magnetic/true reference and FMS polar operation.

Heading Reference Switch

Magnetic or true reference is normally selected by using the HDG REF switch located on the left forward panel. However, the reference is automatically changed to true, independent of the position of the HDG REF TRUE/NORM switch, when the aircraft is operating in the region north of N82_ or south of S82_ latitude.

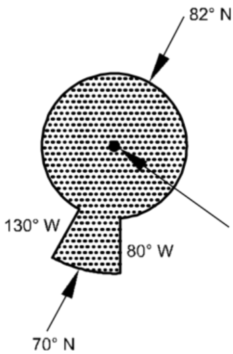
On leaving this region, the heading reference is again determined by the position of the HDG TRUE/NORM switch. When operating in the true reference mode, bearing information entered by the pilot is presumed to be a true bearing reference.

With the heading reference switch in TRUE, headings are referenced to true north regardless of latitude.

In NORMAL, the headings are referenced to magnetic north. NORMAL position gives no reference for AFDS roll modes other than LNAV when north of 82_N or south of 82_S latitude or in the vicinity of the magnetic poles.

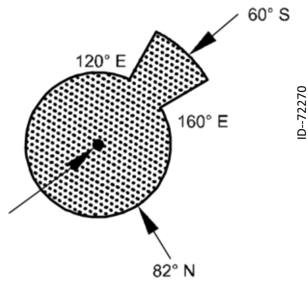
FMS Polar Operations

The FMS automatically begins polar operation when the computed aircraft position enters a polar region. The FMS provides all inputs to the flight displays referenced to true north while in these regions. Figure 11--11 displays the FMS Polar Regions.



TRUE NORTH POLE

TRUE SOUTH POLE



FMS Polar Regions
Figure 11--11

Entry into a polar region and automatic switching to a true north reference are annunciated by a flashing **WHITE box** around the word **TRU** on the navigation display (ND). A TRUE heading reference can be selected with the heading reference switch inside or outside the polar region. Transition back to magnetic reference is annunciated by the presence of a **GREEN box** around the word **MAG** on the navigation display. If a descent is accomplished with the headingreference inTRU, an **AMBER box** is displayed around **TRU**.

NOTE: When operating the autopilot in the polar region in other than LNAV, the TRUE position on the heading reference switch must be selected.

FMS LEGS Page

The MCDU displays, on the ACT RTE LEGS page, the waypoints where the heading reference automatically switches from magnetic to true north.

Push the MCDU **[LEGS]** key to display the ACT RTE LEGS page, shown in Figure 11--12.

RTE LEGS Magnetic vs. True North Waypoints
Figure 11--12

In this scenario, the display shows the magnetic course at LSK **1L** and **2L**. Note at **3L** the course heading is displayed with a true heading designated by a **T**. This means that at some point between waypoint N80W080 and waypoint N81W082, the heading reference automatically switches from magnetic to true.

NOTE: Figure 11--11 illustrates the heading reference occurring in what is called the key hole area of the pole, which is south of N82_ but west of W080_.

HOLDING PATTERNS

This section is an in-depth look at holding patterns and how the FMS computes and calculates the holding pattern.

Types of Holding Patterns

There are three types of holding patterns:

1. Patterns terminated by reaching a specific altitude (referred to asaltitude terminated).
2. Patterns terminated by crossing the hold fix the first time afterentering the hold (referred to as fix terminated).
3. Patterns terminated manually (referred to as manually terminated).

All three types can exist in terminal area procedures extracted from the navigation database and thus can be accessed by the pilot. Only manually terminated holds can be created using the FMC HOLD page.
Altitude terminated and fix terminated holds cannot be created with the FMC HOLD page.

D The altitude for **altitude terminated** holds is an AT or ABOVE constraint; therefore, altitude terminated holds occur only in climb. The FMS remains in the holding pattern until the AT or ABOVE constraint is met. If the aircraft is already at or above the specified altitude on reaching the holding fix, the hold is not flown. Onreaching the altitude constraint, the FMS enters the exit armed state, adjusts the holding pattern size to give the shortest route to the hold fix, and exits the hold the next time the hold fix is crossed.

D **Fix terminated** holds are permitted in all flight phases but are usually encountered in descent. This type of hold consists of only one loop (or partial loop) around the pattern and the FMS exits the hold on crossing the hold fix the first time after entering the hold. No special displays are used to alert the pilot the hold is terminated.

D **Manually terminated** holds are permitted in all flight phases. The pilot must manually terminate this hold by selecting line **6R** (**EXIT HOLD**) on the FMC HOLD page. On selecting line **6R**, the FMS enters the exit armed state, adjusts the holding pattern size to give the shortest route back to the hold fix, and exits the hold the next time the hold fix is crossed.

If a direct-to is executed while in any type of hold, the FMS exits the hold immediately.

Creating and Modifying Holding Patterns

Pilot-generated holding patterns are created on the ACT RTE HOLD page (shown in Figure 6--35), which can be accessed by pushing the MCDU **[HOLD]** mode key. If a hold does not already exist in the flight plan, this action displays the ACT RTE LEGS HOLD AT page (shown in Figure 6--33), permitting the pilot to specify a desired fix for the hold by entering the fix in line **6L** (box prompts) or to define a present position hold by selecting line **6R** (**PPOS**).

If one or more holds already exist in the flight plan when the **[HOLD]** key is pushed, the ACT RTE HOLD page is displayed, showing the characteristics of the nearest hold in the flight plan (shown in Figure 6--35). The pilot can access the ACT RTE LEGS HOLD AT page by selecting line **6L** (**NEXT HOLD**). If more than one hold exists, the pilot can access the next nearest hold in the flight plan by pushing the MCDU **[NEXT PAGE]** key.

Line **1L** of the hold page displays the fix at which the hold is defined. The holding quadrant and radial are displayed in line **2L** of the hold page. The quadrant abbreviations are N, NE, E, SE, S, SW, W, NW. Line **3L** of the hold page defines the inbound course and turn direction of the hold. For manually terminated holds, the inbound course defaults to the leg course of the leg preceding the hold fix and the turn direction defaults to right. The holding pattern s straight leg size is defined by either its length or the time spent flying wings level. Line **4L** defines the leg time and line **5L** defines the leg distance. Leg time and leg distance are mutually exclusive; an entry in either erases the value in the other. The FMS defaults to leg time. The leg time defaults to 1 minute at or below 14,000 feet and 1.5 minutes above 14,000 feet. The altitude used to compare to 14,000 is determined as follows:

- If the holding pattern is in the FMS climb or descent segment, use the constraint altitude on the hold. If a constraint altitude does not exist on the hold, use the constraint altitude on the flight leg before the hold. If neither exists, use 1 minute.

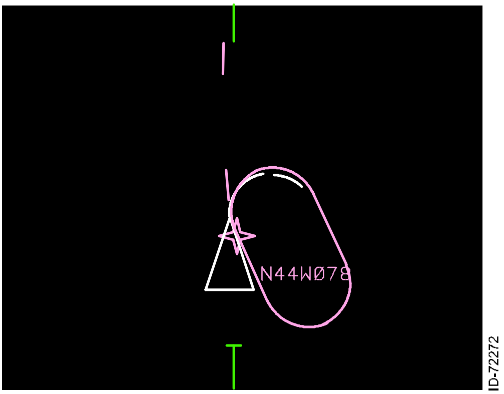
  NOTE: If a window constraint is defined, the upper altitude is used for comparison.

- If the holding pattern is in the FMS cruise segment, use the cruise altitude. If the cruise segment cannot be determined because the PERF INIT data has not been entered, use 1 minute.

Line **1R** displays the speed and altitude targets for the hold. If the values are in SMALL font, they are the FMS predicted values for the hold. If the values are in LARGE font, they are the constraint values defined for the hold. For manually terminated or fix terminated holds, the pilot canenter both an altitude and a speed constraint for the hold. Speed only constraints are not permitted, but an altitude only constraint can be defined. If an altitude constraint already exists, a speed constraint can be added separately. Line **2R** displays the predicted time the aircraft is to cross the next holding fix. Line **3R** permits entry of an expect further clearance (EFC) time; entry time and line **5R** displays the FMS computed best hold speed. Hold available time is computed only for manually terminated holding patterns.

ND Display of Holding Patterns

There are two types of displays for holding patterns: a SMALL symbol that does not change size as aircraft dynamics (for example, aircraft speed, wind direction and magnitude, etc.) change and a LARGE symbol that changes size as aircraft dynamics change. The SMALL symbol is used when the map scale is greater than 80NM or any time the hold fix is not the TO fix (that is, the holding fix is WHITE). The LARGE symbol is used when the hold fix is the TO fix (that is, the holding fix is MAGENTA) and the map scale is less than or equal to 80NM, shown in Figure 11--13.



ND Display of Holding Pattern

Figure 11--13

The displayed holding pattern size can change when crossing the holding fix. This is especially true of the first hold fix crossing during descent flight phase patterns without a deceleration segment (see the following section, Deceleration Segments, for a description of FMS commanded deceleration segments).

Calculating Holding Pattern Size

The holding pattern size is first calculated when the holding pattern fix becomes the TO fix (that is, the fix changes from WHITE to MAGENTA). If the FMS performance function is initialized (that is, data has been entered on the PERF INIT page), the holding pattern turn radius is calculated by presuming a 25_ bank angle at the aircraft s current groundspeed plus the absolute magnitude of the wind vector. If the FMS performance function is not initialized, the speed used is the true air speed from the ADC plus the absolute magnitude of the wind vector. After the initial computation, the pattern size is computed again each time the aircraft crosses the holding fix; the holding pattern turn radius is calculated by presuming a 25_ bank angle at a groundspeed equal to the true airspeed equivalent of the FMS holding command speed plus the absolute magnitude of the wind vector. The FMS holding command speed is determined using the following priority: If speed intervention is being used, the FMS command speed is the mode control panel (MCP) speed. Otherwise, if the pilot has entered a constraint speed for the hold on either the ACT RTE HOLD page or the ACT RTE LEGS page, the lesser of the pilot-entered constraint speed or best hold speed limited by VGMIN is used. Otherwise, the FMS computed best hold speed limited by VGMIN is used.

NOTE: On initial entry of a holding pattern while in descent, the FMS command speed may be the active descent speed (for example, ECON speed) if a deceleration segment has not been constructed (see the following section, Deceleration Segments).

The hold turn radius is limited to ensure compliance with protected airspace limitations as defined by the FAA and the ICAO.

If a leg time is used, the leg distance is calculated using the leg time divided by 60, times a groundspeed (equal to the true airspeed equivalent of the FMS holding command speed plus the wind vector along the inbound course) or times the true airspeed from the ADC plus the wind vector along the inbound course if the FMS performance function is not initialized.

Deceleration Segments

While in climb or cruise, the FMS decelerates to the FMS holding command speed before entering the hold. While in descent, deceleration to the FMS holding command speed before entering the hold occurs only when there is an altitude constraint on the hold. Therefore, if the hold does not already have an altitude constraint, the pilot must manually enter one through line **1R** on the ACT RTE HOLD page, or on the holding pattern fix on the ACT RTE LEGS page, for FMS commanded deceleration to occur before entering the hold.

Holding Pattern Entry Types

The aircraft must cross the hold fix before the FMS proceeds with guidance commands to enter the hold. The FMS uses three types of holding pattern entry: parallel, teardrop, and direct entry (shown in Figure 6--38). The type of entry is determined by the aircraft course when crossing the holding fix.

Parallel entries are constructed with a leg parallel to the inbound course and a 180_ turn towards the hold fix. After the turn, LNAV captures the inbound course. The length of the parallel leg is 2.41 times the turn radius; the crosstrack distance of the leg is determined by LNAV control using course angle error and groundspeed when the hold fix is crossed.

Teardrop entries are constructed with a leg from the hold fix on a course 40_ offset from the reciprocal of the inbound course and a 180_ turn toward the inbound course. The distance of the teardrop leg is 2.95 times the turn radius. After the turn, LNAV captures the inbound course.

Direct entries do not have defined segments. LNAV captures the inbound course or the outbound leg depending on aircraft course when crossing the hold fix.

Holding Pattern Guidance in Climb

During the climb phase, the FMS does not issue guidance commands to descend. While in the holding pattern, LNAV guidance commands up to 30_ of bank angle to track the lateral path. All types of holding patterns are permitted in the climb flight phase. For altitude terminated holding patterns, the hold is flown until the AT or ABOVE constraint is met. If the aircraft is already above the constraint before reaching the hold fix, the hold is not to be flown.

The following paragraphs focus on fix terminated and manually terminated holding patterns in the climb flight phase.

D If the hold is constrained by an AT or BELOW constraint, the FMS climbs until reaching the constraint or the MCP altitude, whichever is lowest. If the aircraft is already above the constraint or the MCP altitude when VNAV is engaged, the FMS levels off at the current aircraft altitude.

D If the hold is constrained by a window constraint, the FMS climbs until reaching the upper altitude constraint or the MCP altitude, whichever is lowest. If the aircraft is already above the upper altitude constraint or the MCP altitude when VNAV is engaged, the FMS levels off at the current aircraft altitude.

D If the hold is constrained by an AT or ABOVE constraint, the FMS climbs until reaching the cruise altitude, the next AT constraint, the next AT or BELOW constraint, or the MCP altitude, whichever is lowest.

D If the hold is not constrained, the FMS climbs until reaching the cruise altitude, the next AT constraint, the next AT or BELOW constraint, or the MCP altitude, whichever is lowest.

Holding Pattern Guidance in Cruise

While flying holding patterns in the cruise flight phase, LNAV guidance commands up to 30_ of bank angle to track the lateral path. Only fix terminated and manually terminated holding patterns are permitted in the cruise flight phase. The hold is always at the cruise altitude and all types of altitude constraints are permitted but cannot be above the cruise altitude. However, if a constraint that is below the cruise altitude is entered on the hold, the FMS enters the descent flight phase.

Holding Pattern Guidance in Descent

While flying in the descent flight phase, the FMS does not issue guidance commands to climb. While in the holding pattern, LNAV guidance commands up to 30_ of bank angle to track the lateral path.

Only fix terminated and manually terminated holding patterns are permitted in the descent flight phase. The following paragraphs presume that the MCP altitude is set below the descent path altitude and all constraint altitudes. While in descent, the FMS always captures the MCP altitude when descending from above the MCP altitude, and levels off at the current aircraft altitude if VNAV is engaged when the aircraft is below the MCP altitude.

D If the hold is constrained by an AT or BELOW constraint, the FMS descends until reaching the constraint or the descent path altitude, whichever is lowest; if the aircraft is already below the constraint and the descent path altitude when VNAV is engaged, the FMS levels off at the current aircraft altitude.

D If the hold is constrained by a window constraint, the FMS descends until reaching the lower altitude constraint or the descent path altitude, whichever is highest. If the aircraft is already below the lower altitude constraint when VNAV is engaged, the FMS levels off at the current aircraft altitude. If the descent path altitude at the hold fix is above the upper altitude constraint, the FMS descends until reaching the upper altitude constraint.

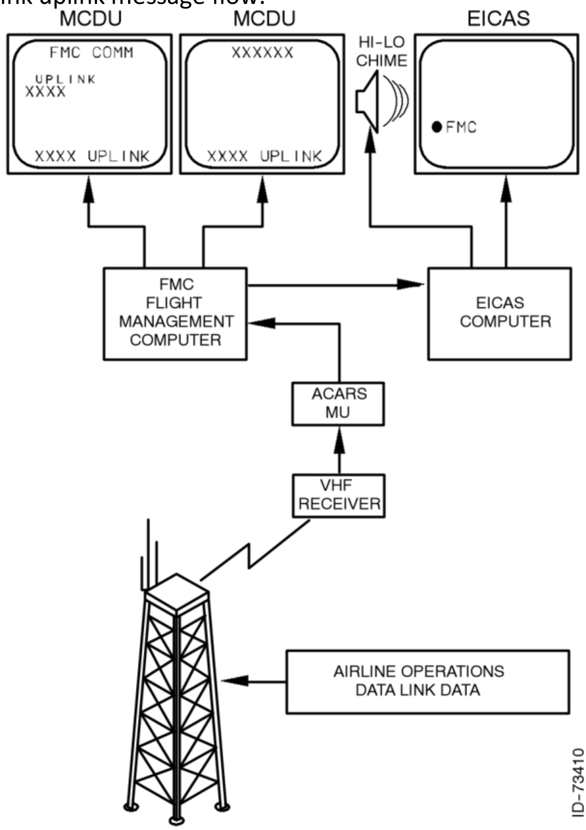
D If the hold is constrained by an AT or ABOVE constraint, the FMS descends until reaching the constraint altitude or the descent path altitude, whichever is highest. If the aircraft is already below the constraint when VNAV is engaged, the FMS levels off at the current aircraft altitude.

D If the hold is not constrained, the FMS descends until reaching the descent path altitude. If the aircraft is already below the descent path altitude when VNAV is engaged, the FMS levels off at the current aircraft altitude.

12. Company Datalink

The onboard communications system provides for two-way datalink communications between the FMC and airline operations. Information can be downlinked from the FMC either manually or automatically. Information can be uplinked at the discretion of the airline operations dispatcher or in response to a downlink request.

Data can be uplinked from the airline dispatcher directly to the RTE, ALTN, ALTN LIST, PERF INIT, TAKEOFF REF 1/2, RTE DATA, or DESCENT FORECAST pages. The uplinks are annunciated to the flight crew by the FMC EICAS communications alert and hi-lo chime. The uplink is identified by an MCDU scratchpad message and by the presence of **UPLINK** over the appropriate prompt on the FMC COMM page. Figure 12--1 shows the operation of the FMC datalink uplink message flow.



FMC Datalink Uplinks

Figure 12--1

If there is no active route, wind data uplink messages are not annunciated, and the **WIND** prompt on the FMC COMM page does not appear.

Takeoff data uplink messages are not annunciated until:

D Gross weight is entered on the PERF INIT page,

D A route is activated,

D The active route has a departure runway (and intersection, if applicable) matching takeoff uplinks (up to six records can be uplinked).

The flight crew processing actions depend on the specific type of uplink. Processing can be through ACCEPT/REJECT, LOAD/PURGE, LOAD (EXEC/ERASE), or by accessing the page containing the uplink.

Downlink requests for data can be initiated by selecting REQUEST SEND on the RTE page, ALTN page, ALTN LIST page, PERF INIT page, TAKEOFF REF page 1/2, RTE DATA page, or DESCENT
FORECAST page. Downlink reports can be initiated by selecting REPORT SEND on the RTE page or POS REPORT page.

The FMC can be configured by the company to transmit downlink messages of FMC data automatically at predetermined points during the flight or in response to specific information requests from the airline operations dispatcher. In these cases, the FMC response is completely automatic and no flight crew action is required.

FMC COMM PAGE

The FMC COMM page, shown in Figure 12--2, is accessed by pushing the MCDU **[FMC COMM]** mode key. This page can also be accessed by pushing **3R** on the INIT/REF INDEX page (shown in Figure 4--7).

The FMC COMM page provides centralized access tothe MCDUpages that contain Company Datalink functions.

FMC COMM Page

Figure 12--2

- **<RTE 1 or <RTE 2 (1L)** Selecting RTE displays the RTE X page 1 (where X is 1 or 2). If a flight plan uplink from the company is ready to be loaded, or a flight number uplink has been received but has not been reviewed, **UPLINK** is displayed in the header. If a flight plan uplink from the company is ready to be loaded, the prompt for the route that the uplink is being applied to is displayed.

- **<ALTN (2L)** Selecting ALTN displays the ALTN page 1/2 when no pending alternate diversion exists and no pending alternate flight list uplink message exists.

  If a pending alternate diversion exists, then selecting ALTN displays the XXXX ALTN page for the selected alternate.

  When a pending alternate flight list uplink message exists, then selecting ALTN displays ALTN LIST page 2/2.

  When an alternate inhibit uplink message, company preferred alternate uplink message, or alternate flight list uplink message from the company is ready to be ACCEPTED or REJECTED, **UPLINK** is displayed in the header.

  When both an Alternate Uplink message (company preferred or alternate inhibit) and an alternate flight list uplink message are pending, **UPLINK (2)** is displayed in the header.

- **<PERF (3L)** Selecting PERF displays the PERF INIT page. When a Performance Initialization uplink message from the company is ready to be ACCEPTED or REJECTED, **UPLINK** is displayed in the header.

D **<TAKEOFF (4L)** Selecting TAKEOFF displays the TAKEOFF REF page 1/2. When a takeoff data uplink message from the company is ready to be ACCEPTED or REJECTED, **UPLINK** is displayed in the header.

Takeoff data uplink messages are not annunciated until:

Gross weight is entered on the PERF INIT page,

A route is activated,

The active route has a departure runway (and intersection, if applicable) matching TAKEOFF uplinks (up to six takeoffrecords can be uplinked).

D **<WIND (5L)** WIND is displayed only when an active or modified active route exists. Selecting WIND displays of the ACT RTE X DATA page (where X is 1 or 2). When an en route wind data uplink from the company is ready to be loaded, **UPLINK** is displayed in the header.

D **<DESCENT FORECAST (6L)** Selecting DESCENT FORECAST displays the DESCENT FORECAST page. If a descent forecast uplink from the company is ready to be loaded, **UPLINK** is displayed in the header.

D **POS REPORT> (1R)** Selecting POS REPORT displays the POS REPORT page, shown in Figure 12--23.

D **LSK 2R, 3R, 4R, 5R** These LSKs are non-operational.

D **DATALINK (6R)** The datalink status field displays the current datalink status: **READY**, **NO COMM**, **VOICE**, or **FAIL**.

RTE PAGE 1/2

RTE page 1/2, shown in Figure 12--3, is used to LOAD and reviewuplink data from the company, request flight plan information from the company, or send a route report to the company.

RTE Page 1/2

Figure 12--3

- **REQUEST <SEND (3L)** Selecting SEND initiates a flight plan request downlink message to the company.

  If a flight plan uplink message from the company is ready to be loaded, field **3L** is blank.

  NOTE: An airline can choose to inhibit the route request prompt in field **3L**.

- **CO ROUTE (3R)** Entering a company route identifier is permitted at any time. The company route identifier is included with any flight plan request that is initiated by **3L** on the corresponding RTE page 1.

Request for Flight Plan Information

Figures 12--4, 12--5, and 12--6 show an example of sending a request for flight plan information to the company.

1. Type **ORDLH01** into the scratchpad to enter **ORDLH01** as a company route identifier and push **3R**. The display is as shown in Figure 12--4.

RTE Page 1/2 – CO ROUTE Ident

Figure 12--4

2. Push LSK **3L**, **REQUEST <SEND**. **SENDING** is indicated, as shown in Figure 12--5.

RTE Page 1/2 Route Request

Figure 12--5

3. **SENDING** is displayed until the network acknowledges receipt of the message. Once acknowledged, **<SEND** is redisplayed and tagged with a small **SENT** indicator, as shown in Figure 12--6.

RTE Page 1/2 – Message Acknowledged

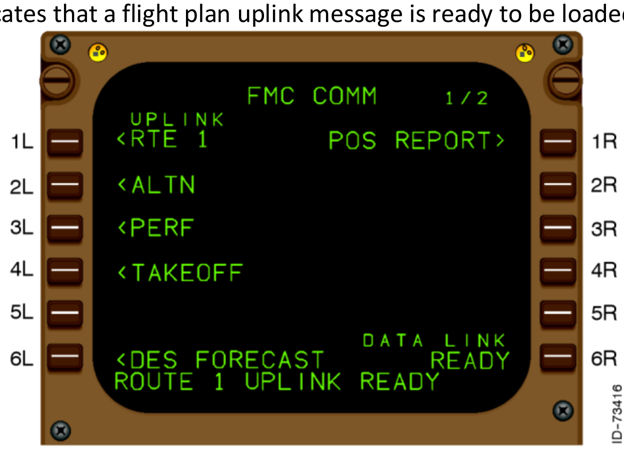
Figure 12--6

<SENDSENT is displayed when the message has been received by the network. This remains displayed until an uplink message is received with flight plan data, until a new company route identifier is entered into field **3R**, or until the route request prompt is selected again.

Loading a Route Uplink Message

Figures 12--7, 12--8, 12--9, and 12--10 show an example of loading a route uplink message from the company into the inactive route.

1. Push the MCDU **[FMC COMM]** key to display the FMC COMM page, as shown in Figure 12--7. **UPLINK** is indicated in the header of line 1. This indicates that a flight plan uplink message is ready to be loaded.



FMC COMM Page – Route Uplink Pending

Figure 12--7

2. Push LSK **1L** to display RTE 1 page 1/2, as shown in Figure 12--8. When a flight plan uplink message is sent to the FMC and is to be applied to the inactive route, **LOAD** and **PURGE** appear in lines **4L** and **4R**, respectively.

RTE Page 1/2 Inactive RTE Load Pending Figure 12--8

<LOAD (4L) LOAD is displayed when a flight plan uplink from the company is received by the FMC. Selecting LOAD:

- Loads the uplinked flight plan data for review.
- Clears the **ROUTEXUPLINKREADY** scratchpad message. **-** Replaces previously displayed data with uplinked data.
- Transmits a downlink accept message (if enabled) to acknowledge acceptance.

NOTE: Selecting LOAD on an inactive RTE page replaces the existing route with the uplinked route.

PURGE> (4R) PURGE is displayed when a flight plan uplink from the company is received by the FMC and is to be applied to an inactive route. Selecting PURGE:

- Clears the uplinked flight plan from memory without pilot examination.

- Clears the **ROUTEXUPLINKREADY** scratchpad message.

- Transmits a downlink reject message (if enabled) to inform of rejection.

3. Push LSK 4L(**<LOAD**) (see Figure 12--8) to load the uplink for review. The uplink is loaded into inactive RTE 1, and the display is as shown in Figure 12--9. While the flight plan is being loaded into the route, ACTIVATE in line **6R** is blanked.

RTE Page 1/3 Route Loading Figure 12--9

4. Push LSK **6R** (**ACTIVATE>**).

5. Push the MCDU **[EXEC]** key to execute and display the route, as shown in Figure 12--10.

RTE Page 1/3 CO REPORT

Figure 12--10

REPORT <SEND (4L) REPORT SEND is displayed when the displayed route is active. Selecting while **SEND** is displayed initiates a flight plan report downlink to the company.

NOTE: An airline can choose to inhibit **REPORT SEND**.

If a company flight plan uplink is sent to the active route, selecting **LOAD**:

D Loads the uplinked flight plan data for review and creates a MOD RTE page that permits for **ERASE** or **EXEC**ution of the loaded flight plan.

D Clears the **ROUTE X UPLINK READY** scratchpad message.

On selecting **ERASE**, a downlink reject message is transmitted (if enabled) to inform of rejection. On selecting **EXEC**ute, a downlink accept message is transmitted to acknowledge acceptance. **PURGE** is not available when a load condition exists for the active route. In this case, **LOAD**, shown in Figure 12--11, must be selected.

RTE Page 1/3 LOAD
Figure 12--11

ALTERNATE PAGES ALTN Page 1/2

ALTN page 1/2 is used to display up to four alternates and fuel and ETA predictions for the displayed alternates. This page can be used to ACCEPT or REJECT Company Preferred Alternate or Alternate Inhibit uplink data that has been received from the company. This page can also be used to request Company Preferred Alternate data or weather data from the company. Uplinked alternate data is initially displayed in SMALL font for preview.
ALTN page 1/2 is accessed by pushing **2L** on the FMC COMM page. This page can also be accessed by selecting **ALTN** on the INIT/REF INDEX page or the RTE page 1, or pushing the MCDU **[NEXTPAGE]** key from ALTN LIST page 2/2 or the MCDU **[PREV PAGE]** key on ALTN LIST page 2/2.

To display uplinked alternate data from the company:

1. Push the MCDU **[FMC COMM]** key to display the FMC COMM page.
2. Push LSK **2L** (**ALTN**) to display ALTN page 1/2, shown in Figure 12--12.

ALTN Page 1/2
Figure 12--12

The relevant fields are explained in the following paragraphs.

D **REQUEST <SEND (5L)** -- If no alternate uplink data is ready to be ACCEPTED or REJECTED, this field displays **SEND**. Selecting SEND initiates a Company Preferred Alternate data request downlink message to the company.

NOTE: An airline can choose to inhibit the Company Preferred Alternate **Request SEND** in field **5L**.

D **WXR REQUEST <SEND (6L)** -- If no alternate uplink data is ready to be ACCEPTED or REJECTED, this field displays **SEND**. Selecting SEND initiates a weather request downlink message to the company.

NOTE: An airline can choose to inhibit the Weather **Request SEND** in field **6L**.

D **<REJECT (6L)** -- If an alternate data uplink (Company Preferred Alternate or Alternate Inhibit data) from the company is ready to be ACCEPTED or REJECTED, this field displays **REJECT**, as shown in Figure 12--13. Selecting **REJECT**:

Replaces the uplinked alternate data with the previous data

Returns the ALTN page 1 display to normal (pre-uplink) format

Clears the **ALTNUPLINK** or **ALTNINHIBITUPLINK**scratchpad message

Transmits a downlink reject message (if enabled) to inform of rejection.

ALTN Page 1/2 – Uplink Pending

Figure 12--13

D **<ACCEPT (6R)** -- If an alternate data uplink (Company Preferred Alternate or Alternate Inhibit data) from the company is ready to be ACCEPTED or REJECTED, this field displays **ACCEPT**, as shown in Figure 12--13. Selecting ACCEPT:

Displays the uplinked data in LARGE font

Replaces the previously displayed data with the uplinked data

Returns the page display to normal (pre-uplink) format

Clears the **ALTNUPLINK** or **ALTNINHIBITUPLINK**scratchpad message

Transmits a downlink accept message (if enabled) to acknowledge acceptance.

ALTN Page 2/2

ALTN page 2/2 is used to view the list of uplinked alternate airport identifiers and to request alternate flight list data. The list of up to 20 alternates is automatically loaded into the ALTN LIST page 2/2 and does not require flight crew acceptance. The scratchpad message **ALTN LIST UPLINK** remains in the scratchpad display queue until ALTN list page 2/2 is displayed or until the scratchpad message is manually cleared.

ALTN LIST page 2/2 is accessed by pushing **2L** on the FMC COMM page (see Figure 12--2). This page can also be accessed by selecting **ALTN** on the INIT/REF INDEX page or RTE page 1, or by pushing the MCDU **[NEXT PAGE]** key on ALTN LIST page 1/2, or the MCDU **[PREV PAGE]** key on ALTN LIST page 1/2.

Figure 12--14 shows an example of displaying uplinked alternate data from the company.

1. Push the MCDU **[FMC COMM]** key to display the FMC COMM page.
2. Push LSK **2L** (**ALTN**) to display ALTN page 1/2.
3. Push the MCDU **[NEXT PAGE]** key for ALTN page 2/2, as shown in Figure 12--14.

ALTN LIST Page 2/2 Figure 12--14

The relevant fields are explained in the following paragraphs.

D **REQUEST <SEND (5L)** If no alternate flight list uplink data is ready to be ACCEPTED or REJECTED, this field displays **SEND**. Selecting SEND initiates an alternate flight list request downlink message to the company.

NOTE: An airline can inhibit alternate flight list **REQUEST SEND** in field **5L**.

D **PURGE> or CONFIRM>(5R)** If an alternate flight list uplink message exists, this field displays **PURGE**. Selecting PURGE displays **CONFIRM**. Selecting CONFIRM deletes the uplinked alternate flight list data.

PERF INIT Page

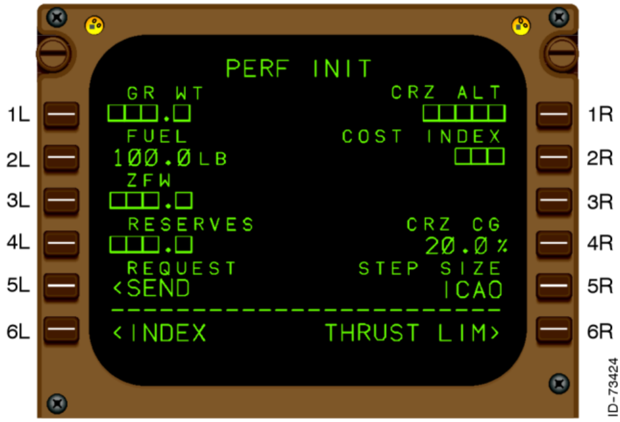
The PERF INIT page is used to ACCEPT or REJECT performance initialization uplink data that has been received from the company. This page can also be used to request performance initialization data from the company. Uplinked performance initialization data is initially displayed in SMALL font for preview.

The PERF INIT page is accessed by pushing **3L** on the FMC COMM page (shown in Figure 12--2). This page can also be accessed by selecting **PERF** on the INIT/REF INDEX page.

Figures 12--15 and 12--16 show examples of displaying uplinked performance initialization data from the company.

1. Push the MCDU **[FMC COMM]** key to display the FMC COMM page.

2. Push LSK **3L** (**PERF**) to display the PERF INIT page, shown in Figure 12--15.



PERF INIT Page Figure 12--15

The relevant fields are explained in the following paragraphs.

D **REQUEST <SEND (5L)** If no performance initialization uplink data is ready to be ACCEPTED or REJECTED, this field displays **SEND**. When the aircraft is airborne, SEND is blanked. Selecting SEND initiates a performance initialization request downlink message to the company.

NOTE: An airline can inhibit the performance initialization **REQUEST SEND** in field **5L**.

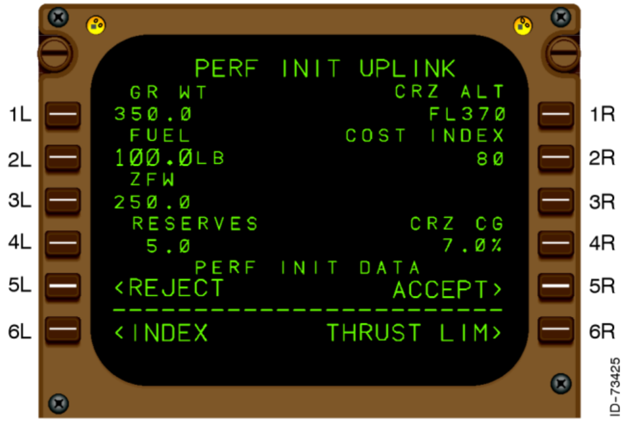
D **<REJECT (5L)** If a performance initialization uplink from the company is ready to be ACCEPTED or REJECTED, this field displays **REJECT**, as shown in Figure 12--16. Selecting REJECT:

Replaces the uplinked performance initialization data with the previous data

Returns the page display to normal (pre-uplink) format

Clears the **PERF INIT UPLINK** scratchpad message

Transmits a downlink reject message (if enabled) to inform of rejection.



PERF INIT Page – Uplink Pending
Figure 12--16

- **ACCEPT> (5R)** If a performance initialization uplink from the company is ready to be ACCEPTED or REJECTED, this field displays **ACCEPT**, as shown in Figure 12--16. Selecting ACCEPT:

  Displays the uplinked data in LARGE font

  Replaces the previously displayed data with the uplinked data

  Returns the page display to normal (pre-uplink) format

  Clears the **PERF INIT UPLINK** scratchpad message

  Transmits a downlink accept message (if enabled) to acknowledge acceptance.

TAKEOFF REF Page 1/2

TAKEOFF REF page 1/2 is used to ACCEPT or REJECT takeoff reference uplink data that has been received from the company. This page can also be used to request takeoff reference data from the company. Uplinked takeoff reference data is initially displayed in SMALL font for preview.

TAKEOFF REF page 1/2 is accessed by pushing **4L** on the FMC COMM page (shown in Figure 12--2). This page can also be accessed by selecting **TAKEOFF** on the INIT/REF INDEX page.

Figures 12--17 and 12--18 show examples of how to display uplinked takeoff reference data from the company.

1. Push the MCDU **[FMC COMM]** key to display the FMC COMM page.
2. Push LSK **4L** (**TAKEOFF**), to display the TAKEOFF REF page, shown in Figure 12--17.

TAKEOFF REF Page 1/2
Figure 12--17

The relevant fields are explained in the following paragraphs.

D **REQUEST <SEND (5L)** If no takeoff reference uplink data is ready to be ACCEPTED or REJECTED, this field displays **SEND**. When the aircraft is airborne, SEND is blanked. Selecting SEND initiates a takeoff reference request downlink message to the company.

NOTE: An airline can choose to inhibit takeoff reference **REQUEST SEND** in field **5L**.

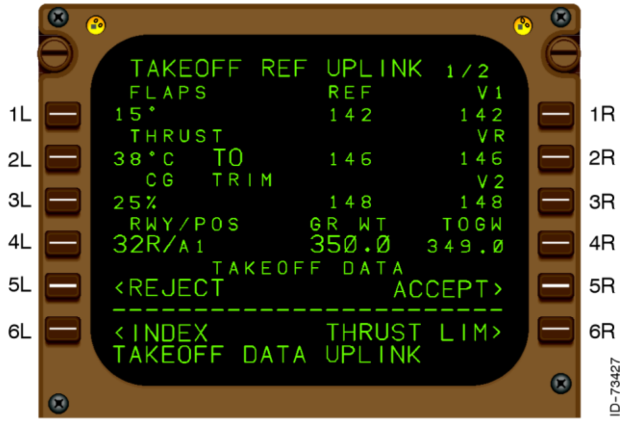
D **<REJECT(5L)** If a takeoff reference data uplink from the company is ready to be ACCEPTED or REJECTED, this field displays **REJECT**, as shown in Figure 12--18. Selecting REJECT:

Replaces the uplinked takeoff reference data with the previous data

Returns the TAKEOFF REF page display to normal (pre-uplink) format

Clears the **TAKEOFF DATA UPLINK** scratchpad message

Transmits a downlink reject message (if enabled) to inform of rejection.



TAKEOFF REF Page – Uplink Pending

Figure 12--18

D **ACCEPT> (5R)** If a takeoff reference data uplink from the company is ready to be ACCEPTED or REJECTED, this field displays **ACCEPT**, as shown in Figure 12--18. Selecting ACCEPT:

Displays the uplinked data in LARGE font

Replaces the previously displayed data with the uplinked data

Returns the page display to normal (pre-uplink) format

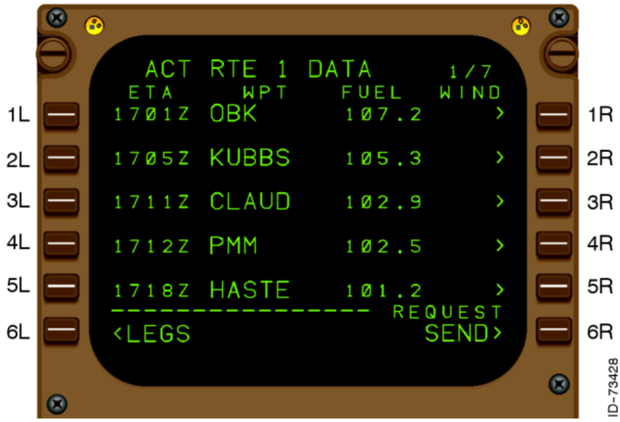
Clears the **TAKEOFF DATA UPLINK** scratchpad message

Transmits a downlink accept message (if enabled) to acknowledge acceptance.

RTE DATA PAGE

The RTE DATA page can be accessed from the FMC COMM page by pushing **5L**. This page can also be accessed by selecting **RTE DATA>** on line **6R** of the RTE LEGS page. The RTE DATA page can be used to load wind data that has been uplinked from the company and to request wind data.

Push LSK **5L** (**WIND**) on the FMC COMM page to display the ACT RTE DATA page, shown in Figure 12--19.



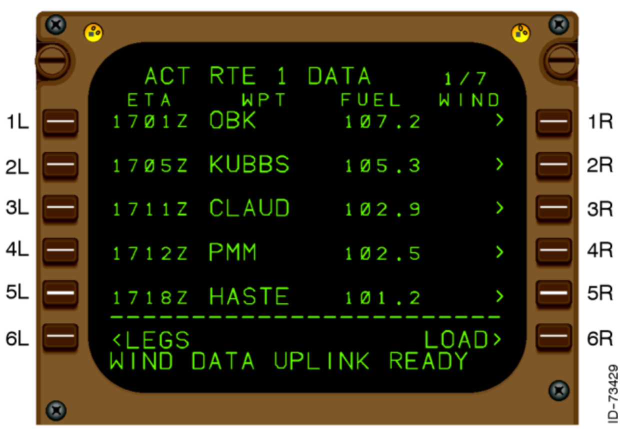
RTE DATA Page

Figure 12--19

D **REQUEST SEND> or LOAD> (6R)** If no en route wind data is ready to be loaded, this field displays **SEND**. SEND is blanked when the aircraft is in descent or on approach. Selection while SEND is displayed initiates a wind request downlink to the company.

NOTE: An airline can choose to inhibit **REQUEST SEND>**, in which case field **6R** would display **LEGS** and **6L** would display blanks.

LOAD (**6R**) is displayed in this field if an en route wind uplink from the company is ready to be loaded, as shown in Figure 12--20.



RTE DATA Page – Load Pending

Figure 12--20

Selecting **LOAD**:

Loads the uplinked en route winds for pilot review and creates a MOD RTE DATA page that permits for **ERASE** or **EXEC**ution of the loaded data uplink

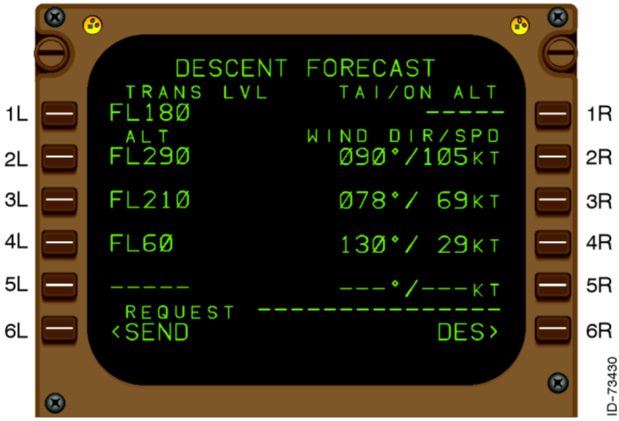
Clears the **WIND DATA UPLINK READY** scratchpad message.

On selecting **ERASE**, a downlink reject message is transmitted (if enabled) to inform of rejection. On selecting **EXEC**ute, a downlink accept message is transmitted (if enabled) to acknowledge acceptance.

DESCENT FORECAST PAGE

The DESCENT FORECAST page, shown in Figure 12--21, is accessed from the FMC COMM page by pushing **6L**. This page can also be accessed by selecting **FORECAST>** on line **5R** of the DESCENT page. The DESCENT FORECAST page can be used to load descent forecast wind data that has been uplinked from the company and to request descent forecast data.

Push LSK **6L** (**DESFORECAST**) on the FMC COMM page (see Figure 12--2).



DESCENT FORECAST Page

Figure 12--21

D **REQUEST <SEND or <LOAD (6L)** If no descent forecast uplink data is ready to be loaded, this field displays **SEND**. SEND is blanked when the aircraft is in descent or on approach. Selecting while **SEND** is displayed initiates a descent forecast request downlink to the company.

LOAD is displayed in this field if an en route wind uplink from the company is ready to be loaded, as shown in Figure 12--22.

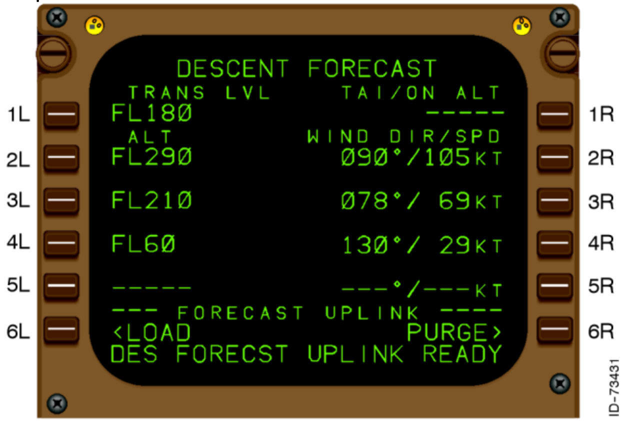
Selecting LOAD:

Loads the uplinked descent forecast data for pilot review

Clears the **DES FORECAST UPLINK READY** scratchpad message

Replaces previously displayed data with uplinked data

Transmits a downlink accept message (if enabled) to acknowledge acceptance.



DESCENT FORECAST Page – Load Pending

Figure 12--22

D **PURGE>(6R) PURGE** is displayed (shown in Figure 12--22) when a descent forecast uplink from the company is received by the FMC. Selecting PURGE:

Clears the uplinked descent forecast data from memory without the pilot examining the data

Clears the **DES FORECAST UPLINK READY** scratchpad message

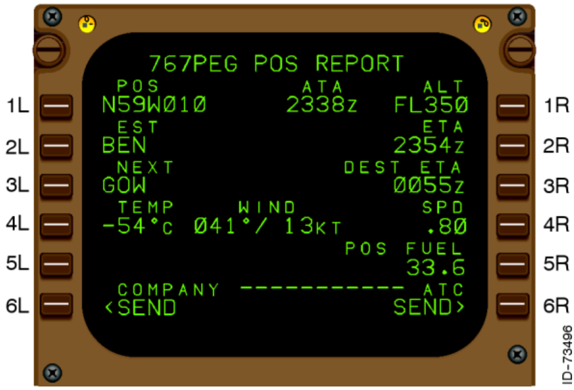
Preserves the existing descent forecast data

Transmits a downlink reject message (if enabled) to inform of rejection.

POS REPORT

The POS REPORT page, shown in Figure 12--23, is accessed from the FMC COMM page by pushing **1R**. This page can also be accessed by pushing LSK **6L** on the PROGRESS page. The POS REPORT page is used to send downlink position report messages to the company and ATC. See Section 17, ATS Datalink, POS REPORT, for details on the POS REPORT page.

NOTE: Data entered into fields **3L**, **4L**, **2R**, **3R**, or **4R** does not affect the data transmitted in a position report downlink to the company.



POS REPORT Page
Figure 12--23

13. FMS Flight Plan Wind Usage

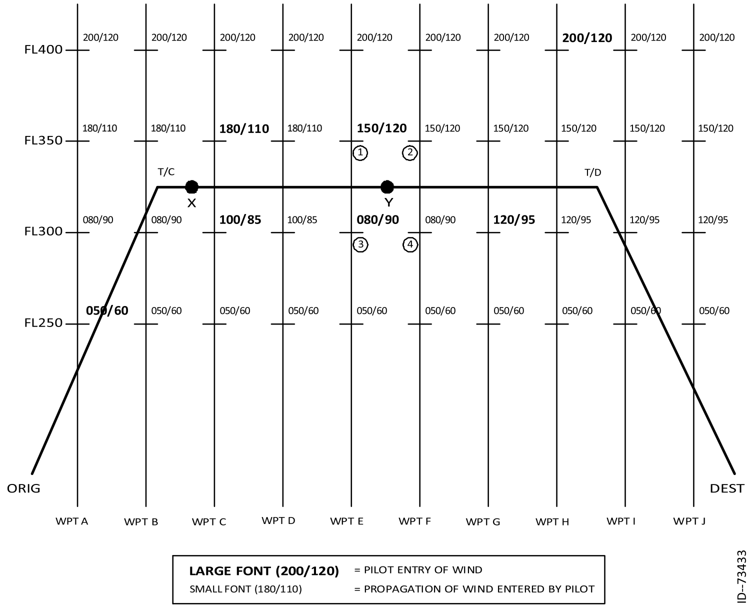
This section covers wind entry and propagation, the effect of flight plan wind modifications, wind mixing, and winds and step climbs.

ENTRY AND PROPAGATION OF FORECAST WINDS

To ease the discussion of wind propagation, this section refers to a typical flight plan. The flight plan consists of the origin, ten waypoints and the destination. The climb flight phase contains waypoints A and B. The cruise flight phase contains waypoints C, D, E, F, G, and H. The descent flight phase contains waypoints I and J. The discussion first addresses the initial entry and propagation of wind data.

Propagation and entry of wind values are the same for climb and cruise flight waypoints. While in navigation display (ND) map mode, selecting the (**RTE DATA**) line on any RTE LEGS page accesses the RTE DATA page. Selecting a waypoint on the RTE DATA page accesses the WIND DATA page. The WIND DATA page provides wind entry capability for up to four altitudes. The same four altitudes are applied to all waypoints in the flight plan. Wind propagation is performed for each altitude independently; there is no way a wind entry at one altitude can be propagated to another altitude. When an altitude has been entered, but no winds have been entered for that altitude, all of the winds for that altitude are dashed (**-- -- --/-- -- --**). When the first wind entry is made for that altitude it propagates forward and backward to all waypoints in the flight plan. This is the only time a wind is propagated backward to preceding waypoints, because any wind except dashes on the first waypoint in the flight plan is propagated forward to the next wind entry.

Additional winds entered on the WIND DATA pages are always propagated forward through the flight plan to the next wind entry. Considering these rules for entry and propagation of wind data, Figure 13--1 shows an example of a typical flight plan.



Entry and Propagation of Winds in Climb and Cruise Phase Figure 13--1

At FL400 a wind entry is entered on waypoint H. Although this wind is entered at the end of the cruise flight phase, it is the only wind entered at FL400; therefore, the wind entry is propagated backward to waypoints A, B, C, D, E, F, and G and forward to waypoints I and J.

Similarly, a wind entry at the first waypoint in the flight plan for FL250 is propagated to all the waypoints in the flight plan.

The first wind entry at FL350 is made at waypoint C and is propagated backward because it is the first wind entry at FL350; it is also propagated forward to all downpath waypoints until the wind entry at waypoint E is made. Once the wind entry at waypoint E is made it is propagated forward to the remaining waypoints. At this point the winds at FL350 are displayed as shown in Figure 13--1.

The SMALL font wind on waypoint A is being propagated to waypoint B, the wind on waypoint C is being propagated to waypoint D and the wind on waypoint E is being propagated to waypoints F, G, H, I, and J.

At FL300 three wind entries are made. The first, at waypoint E, is initially propagated to all waypoints in the flight plan: the second, at waypoint C, is propagated forward to waypoint D. The last wind entry at a waypoint G is propagated forward to the remaining waypoints, replacing the old value that was propagated from waypointE. Thewinds at FL300 are now displayed as shown in Figure 13--1.

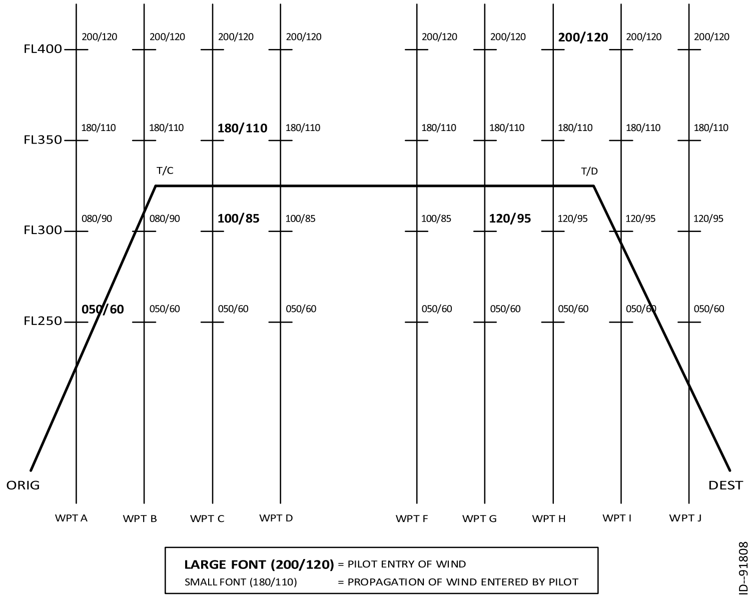
The SMALL font wind on waypoint A is propagated to B, the wind on waypoint C is propagated to D, the wind at E is propagated to F and the wind at G is propagated to H, I, and J. Note that the first wind entry made (when the winds are all dashes) ends up on the first waypoint, so the first wind entry should always be the one closest to the aircraft. To fix the winds at FL300 in Figure 13--1, the wind entry at waypoint C should be copied to waypoint A.

Note that the cruise altitude for the typical flight plan in Figure 13--1 lies between the entered wind altitudes. The FMC uses an interpolation factor based on the wind values bracketing the point of interest to determine the wind at that point. For example, if the FMC is at point X, and needs to predict the wind at point Y, it uses the winds at points 1, 2, 3, and 4 to estimate the wind at point Y. If all forecast wind entries are above the cruise altitude, the FMC interpolates from the lowest (altitude) entered wind value to a wind magnitude of zero at the origin altitude if in climb or the destination altitude if in cruise. If either the origin or destination altitude is not defined (that is, no destination is specified), zero altitude is used. If all forecast wind entries are below the cruise altitude, the FMC distributes the highest (altitude) wind entry up to the cruise altitude.

Selecting LSK **5R** (**FORECAST**) on the DES page (shown in Figure 7--2) gives access to the DESCENT FORECAST page (shown in Figure 6--47), which gives access to enter forecast winds for the descent flight phase. This page permits entry of up to four wind/altitude pairs. The winds entered on this page are mixed with the cruise winds to provide a smooth transition from cruise to descent flight phase. If no cruise winds exist and descent forecast winds have been entered, the highest (altitude) entered winds are distributed up to the cruise altitude. The lowest (altitude) descent wind is interpolated to a magnitude of zero at the destination altitude. If the destination altitude is not defined (that is, a destination has not been specified), zero altitude is used.

Effect of Flight Plan Modifications Wind Propagation

For the B767 FMC software, deleting a flight plan waypoint that is the single entry for a given flight level does not affect the wind profile propagation, because the wind on the first waypoint in the flight plan is being propagated forward. If waypoint A in Figure 13--1 were deleted, the wind on the remaining waypoints would be unchanged. If waypoint E were deleted from the flight plan shown in Figure 13--1, the wind propagation would be redistributed, as shown in Figure 13--2.



Effect of Flight Plan Changes on Wind Propagation Figure 13--2

Because waypoint E was deleted in this example, the entered wind at FL350 for waypoint C is now propagated to waypoint F, G, H, I, and J. In addition, the entered wind at FL300 for waypoint C is now propagated to waypoint F. The B767 retains wind propagation on all waypoints as waypoints are sequenced. For example, if the aircraft has passed waypoints A and B when waypoint E is deleted, the wind on the remaining waypoints would be unchanged.

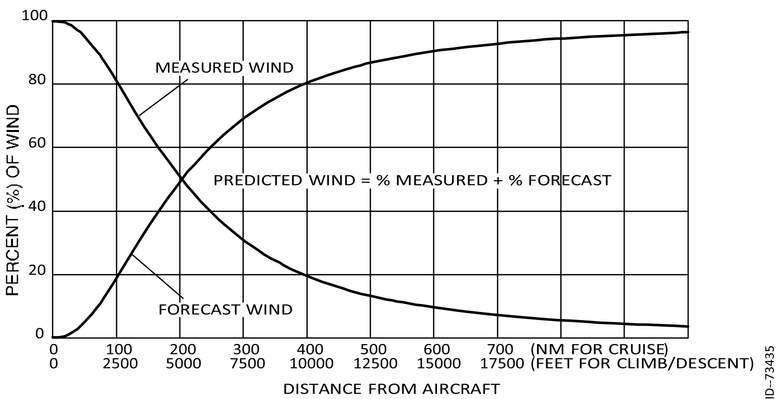
If waypoints are added to the flight plan, the added waypoints comply with the wind propagation rules outlined earlier in this section, in Entry and Propagation of Forecast Winds. If, for example, a waypoint is added between waypoints C and D in Figure 13--1 and wind values are placed at FL400 and FL300, the wind entry placed at FL400 propagates forward to waypoints D, E, F, and G. The pre-existing wind entry at waypoint H is now propagated only to waypoints I and J. Similarly, the wind entry at FL300 is propagated forward to waypoint D. The wind entry at FL300 on waypoint C now exists only on waypoint C.

When using the abeam function, the pilot-entered winds are retained on the new waypoints resulting from the abeam calculation.

NOTE: Abeam winds are retained up to a distance of 99 NM miles from the original waypoint abeam calculation. A distance over 99 NM abeam calculation deletes the wind.

Mixing Measured Winds With FMC Propagated/ Forecast Winds

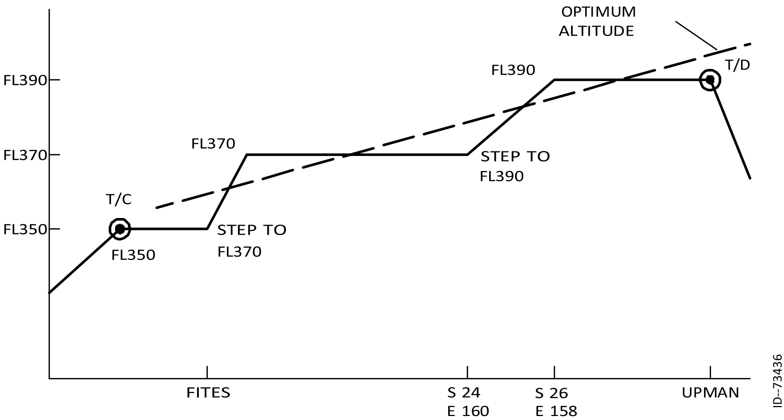
The FMC uses a mixing algorithm to determine the predicted wind at points in front of the aircraft. Figure 13--3 shows a graphical representation of the mixing effect. In the example shown in Figure 13--1, the predicted wind at point B is a mix of the forecast wind at point B (interpolated from winds around point B) and the measured wind at the aircraft position at point A. In Figure 13--3, the FMC is using 100% of the measured wind vector at the aircraft position; at 200 NM in front of the aircraft the FMC uses 50% of the measured wind vector and 50% forecast wind; at distances over 200 NM in front of the aircraft, the FMC uses successively less measured wind until the wind used is very near 100% forecast wind. In the climb and descent flight phases, the wind is mixed the same way except that the equal weight distance is 5,000 feet rather than 200 NM and the Distance from Aircraft axis is in feet rather than nautical miles.



Mixing Measured Wind With FMC Propagated/Forecast Winds Figure 13--3

STEP CLIMBS

The FMC calculated step climb points are based on the aircraft optimum altitude such that the optimum cruise profile matches the optimum altitude profile, as shown in Figure 13--4. The FMC computes optimum altitude as a function of the cost index, gross weight, and selected cruise mode Economy (ECON), Long-Range Cruise (LRC), Selected CAS (SEL CAS), or Selected MACH (SEL MACH). The FMC calculated step points result in minimum trip cost (cost index is used) for ECON mode and minimum trip fuel consumption (cost index is not used) for LRC, SEL CAS, and SEL MACH modes. Pilot entered forecast winds and temperatures are considered when the FMC calculates fuel and ETA predictions; these predictions also presume all FMC calculated and pilot-entered step climbs are completed on schedule. If a step point is passed without executing the step, the FMC fuel and ETA predictions are calculated presuming the step climb is initiated immediately.



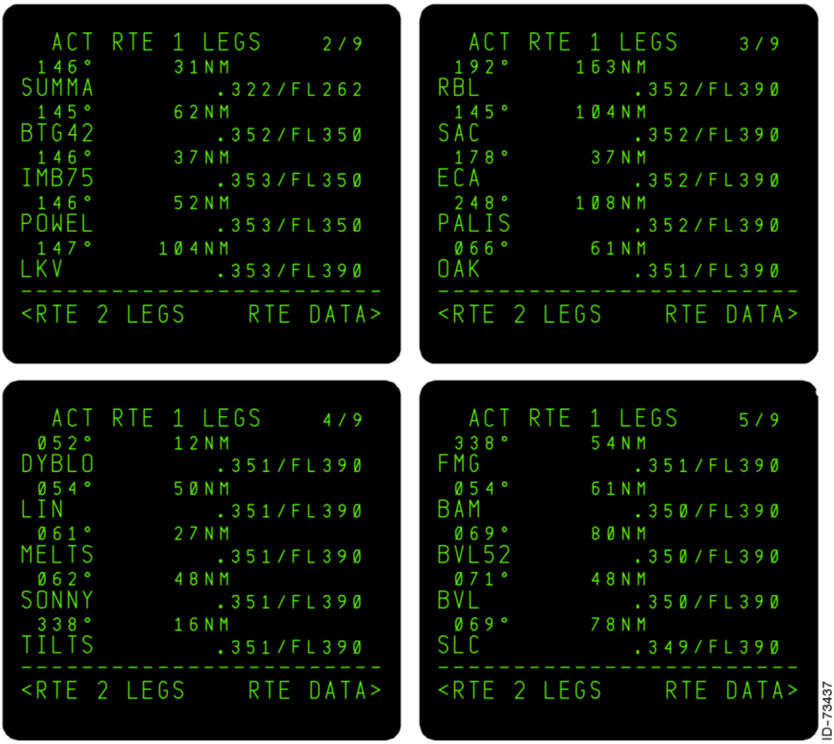
Optimum Vertical Flight Path Figure 13--4

Using the Step Climb Feature to Evaluate Wind Trade

Figure 13--5 shows an example of a LEGS page for an FMC recommended step to FL390 from FL350.

The performance initialization (PERF INIT) information for this example is:

Zero Fuel Weight:	260,000 lbs.
Fuel On-Board:	50,000 lbs.
Reserves:	12,500 lbs.
Cost Index:	80
Initial Cruise Altitude:	35,000 feet



LEGS Pages for Wind Trade Step (Step Climb) Example Figure 13--5

Initially, there are no winds entered and the FMC predicts destination ETA of **0633Z** and fuel at destination of **14,200 lbs**. The FMC recommends a step to FL390 and these predictions presume the pilot makes the step. Next, a wind value of 120 knots at 234 bearing is added on waypoints OAK, DYBLO, LIN, MELTS, SONNY, BAM, BVL52, BVL, and SLC at FL350; and a wind value of 120 knots at 054 bearing is added for the same waypoints at FL390. No other winds are added. These wind values provide a substantial tailwind at FL350 (the initial cruise altitude) and a substantial headwind at FL390. With these added wind values, the FMC now predicts a destination ETA of **0648Z** and fuel at destination of **9,500 lbs**; but keep in mind, the FMC is basing these predictions on the presumption that the step climb to FL390 is completed. To do a wind trade calculation to see the FMC predictions if the aircraft stays at FL350, a STEP SIZE of zero is entered on the CRZ page and the FMC calculates the destination ETA and fuel remaining. With a zero STEP SIZE, the FMC step climb predictions are disabled and the FMC calculates performance parameters presuming the aircraft stays at FL350. These new predictions are a destination ETA of **0627Z** and fuel at destination of **16,800 lbs**. So, the FMC can show the savings of staying at a lower altitude but with a substantial tailwind.

As a further example, consider the flight plan with winds given above, except that the headwind is at FL350, the tailwind is at FL390, and the initial cruise altitude is 37,000 feet. In this case, the FMC would recommend a step climb to 41,000 feet 1,243 NM into the flight; this step point is approximately halfway between BVL52 and BVL. The ETA and fuel at destination for this step climb are **0632Z** and **16,000 lbs**. However, this step climb recommendation is calculated based on the no-wind optimum altitude curve.

To determine if it can be more beneficial to take the step earlier in the flight, the pilot can use the specified step point function. Entering a410S altitude constraint on the BVL52 waypoint inserts the step climb at BVL52 rather than the point initially calculated by the FMC. There is no need to execute the flight plan modification; the FMC recalculates the ETA and fuel at destination and displays them **W/MOD**on the page. With this modification, the ETA is **0634Z** and the fuel at destination is **15,800 lbs**; so that taking the step at this point actually results in a time/fuel penalty rather than a savings. However, this flight plan modification can be erased and the process can be repeated on other waypoints in the flight plan.

By this method, the best step point with flight plan entered winds is found at the waypoint POWEL. When the 410S constraint is placed on this waypoint, the FMC predicts an ETA of **0629Z** and a fuel at destination of **16,800 lbs**; in addition, the step point is approximately 975 NM sooner in the flight. Now the flight plan modification can be executed and the pilot can plan for early ATC request for clearance to 41,000 feet at POWEL. Specified step points can also be entered on pilot-generated waypoints (for example, along track waypoints) so the step can be specified between route waypoints such as POWEL and LKV.

So, by using a STEP SIZE of zero and/or the specified step point function, the FMC can be used to plan and evaluate wind trade steps. When changing step size values, the FMC does not temporarily blank the speed/flight level predictions on the LEGS page but does temporarily blank ETA and fuel at destination predictions on the PROGRESS page; however, the specified step point entries temporarily blank displays on both the LEGS and PROG pages. The ETA and fuel at destination predictions are more accurate with as much reliable wind data as possible in the wind matrix shown in Figure 13--1.

NOTE: The step size zero technique eliminates all down-path step climbs. So, in situations where multiple step climbs are forecast, planning should account for the fact that all down-path step climbs are eliminated.

USE OF FLIGHT PLAN WIND AVERAGE

Which is better, using a single wind average or entering a wind on each waypoint? The easy way is using the single wind average, but it **is not** necessarily the most accurate.

The following information shows why using a single average is less accurate than entering a wind on each waypoint in the flight plan. The problem with attempting to compute an average headwind is demonstrated by this example:

A route starts at waypoint (A), goes 400 NM directly to a second waypoint (B), and then turns around and returns to waypoint A for a total distance of 800 NM (neglecting the turn). If the aircraft flies at a constant 400 knots TAS and there is a constant wind of 100 knots coming from the direction of waypoint B, there would be a headwind flying from A to B and a tailwind while flying from B to A.

The headwind and tailwind would seem to cancel out and give an average headwind of zero. Using a headwind of zero, the time required to fly from A to B and back to A is 2+00 hours (800 NM/400 knots).

However this is inaccurate. Because of the 100 knot wind, the aircraft would have a groundspeed of 300 knots flying from A to B, and a groundspeed of 500 knots flying from B to A. Therefore, the actual time required to fly from A to B is 1+20 hours (400 NM/300 knots) and the actual time required to fly from B to A is +48 minutes (400 NM/500 knots) making the total trip time of 2+08 hours.

NOTE: Because of the way the wind affects the groundspeed, a headwind hurts performance more than an equivalent tailwind helps performance.

Another example using a route with two legs:

The first leg is 400 NM with a wind of zero and the second leg is also 400 NM with a headwind of 200 knots. The actual flight time is 3+00 hours ([400 NM/400 knots] + [400 NM/200 knots]). If this example used an average wind of 100 knots, the estimated time en route (ETE)would be 2+40 to fly the 800 NM (800 NM/300 knots).

NOTE: If the wind magnitude and direction do not change much over the course of the route, then entering a single average wind would be fairly accurate. The more the wind magnitude or direction changes, the less accurate performance predictions are if a single average wind is entered.

14. Backup Functions

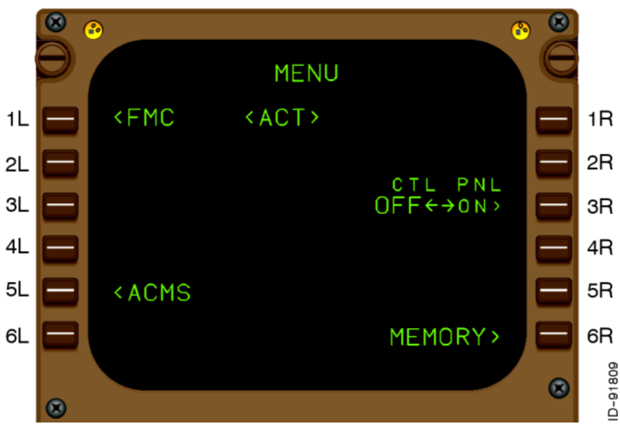
This section describes the reference information available for the backup functions supported by the MCDU.

EFIS CONTROL PANEL

The MCDU is an alternate way to control the functions of the EFIS control panel.

NOTE: The control callouts on the following pages correspond to the control names on the EFIS control panel. Explanations of the MCDU are the same as on the related control panels.

Push the MCDU **[MENU]** key to display the MENU page, shown in Figure 14--1.



MENU Page

Figure 14--1

EFIS CONTROL Page

The MENU page provides access for alternate control of the EFIS control panel (**CTLPNL**) for the PFD and the ND inthe eventof acontrol panel failure. Selected **ON** (in LARGE font) displays **EFIS CP SELECT** on line **1R**.

Push LSK **3R**, **CTL PNL**, to select **ON** and display **EFIS CP SELECT** at **1R**, shown in Figure 14--2.

MENU EFIS CTL

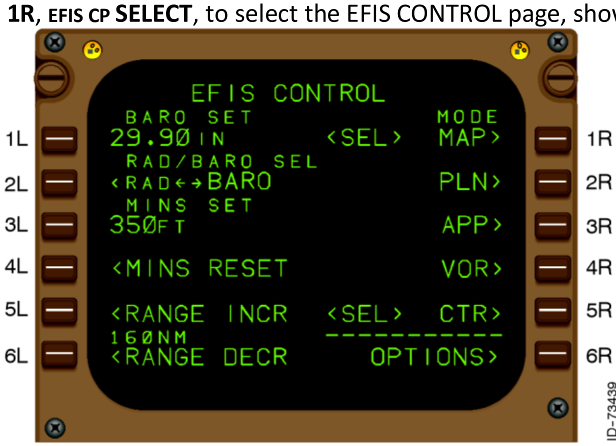
Figure 14--2

D **CTL PNL OFF** ↔ **ON (3R)** Pushing LSK **3R** changes **ON** to LARGE font. At the same time, **1R** displays **EFIS CP SELECT**.

D **EFIS CP SELECT (1R)** Pushing LSK **1R** transfers control of the EFIS from the EFIS CP to the MCDU. The left EFIS CP transfers to the left MCDU and the right EFIS CP transfers to the right MCDU.

NOTE: Selecting EFIS CP displays the EICAS advisory message **EFIS CONTROL PNL L** or **R**, depending on the MCDU being used.

Push LSK **1R**, **EFIS CP SELECT**, to select the EFIS CONTROL page, shown in Figure 14--3.



EFIS CONTROL Page

Figure 14--3

D **BARO SET (1L)** The backup altimeter barometer setting (BARO SET) is displayed in **1L**. The default value is the last value of barometer setting received from the EFIS control panel.

Valid entries consist of valid inches of mercuryor validhectopascals. A valid inches of mercury entry is a value between 22.00 and 32.00, 22 and 32, or 2200 and 3200. A valid hectopascals entry is a threeor four-digit integer between 745 and 1084. Valid entries are displayed with the suffix determined by the entry range, **IN** for inches of mercury or **HPA** for hectopascals.

I, **H**, **S**, or **STD** can also be entered into **1L**. Entering an **I** changes the display to inches of mercury. Entering an **H** changes the display format to hectopascals. Entering **S** or **STD**, or deleting an entered value, returns the display to the standard value (29.92 inches of mercury or 1013 hPa).

D **<RAD/BARO SEL (2L)** Pushing LSK **2L** alternately selects the radio altimeter or the barometric (BARO) altimeter as the minimums reference displayed on the PFD. The active selection is displayed in LARGE font.

D **MINS SET (3L)** Push LSK**3L**, minimums set, to insert the approach minimum setting for display on the respective PFD after typing it into the scratchpad.

BARO valid entries are 101 to 15,000 feet, inclusive, and RAD valid entries are 20 to 999 feet, inclusive. Baro defaults to 200 feet and RAD defaults to 100 feet.

D **<MINS RESET (4L)** Pushing LSK **4L** resets the minimums approach alert (usually set using the RESET SWITCH on the EFIS CP) on the respective PFD.

D **<RANGE INCR (5L)** Pushing LSK **5L**, range increase (INCR), increases the display range on the ND up to the next range. The default value is the last value of the display range received from the EFIS CP.

Pushing LSK **5L** increments the map display range by one value for 5, 10, 20, 40, 80, 160, 320, and 640 NM selections. The selected range is displayed between **5L** (INCR) and **6L** (DECR). The increase increment wraps around from 640 to 5 NM, and selecting DECR when the range is 5 wraps back to 640 NM.

D **<RANGE DECR (6L)** Pushing LSK **6L**, range decrease (DECR), decreases the display range on the ND down to the next range. The default value is the last value of the display range received from the EFIS CP. The step decrements are 640, 320, 160, 80, 40, 20, 10, and 5 NM. The decrement wraps around from 5 to 640 NM.

D **MODE (1R, 2R, 3R, 4R, 5R)** These LSKs contain the ND mode selectors. The ND selected mode shows the **<SEL>** annunciator adjacent to the mode field. Only one of these modes can be active at a time. The operation is the same as for the ND selector and CTR switch.

Selecting one of the following prompts duplicates the corresponding

EFIS CP ND modes:

MAP> (**1R**) -- Map displays the FMC-generated MAP.

PLN>(**2R**) -- Plan displays a North-up depiction of the route and enables the step function on the LEGS page.

APP> (**3R**) -- Approach selects the ILS or MLS display.

VOR>(**4R**) -- VOR selects the VOR display.

CTR>(**5R**) -- Center selects the center MAP mode if MAP is selected. Selects the full compass rose display of the VOR or APP displays. **<SEL>** is displayed when the center function is selected.

D **OPTIONS> (6R)** Pushing LSK **6R** displays the EFIS OPTIONS page, shown in Figure 14--4.

EFIS OPTIONS Page

The EFIS OPTIONS page gives an alternate method for PFD and ND control. Push LSK **6R**, **OPTIONS** (shown in Figure 14--3), to select the EFIS OPTIONS page, shown in Figure 14--4.

EFIS OPTIONS Page

Figure 14--4

D **ND MAP SWITCHES (1L, 2L, 3L, 4L, 5L, 6L, 1R, 2R, 3R, 4R, 5R, 6R)** Pushing an ND map switch LSK displays the selected information on the appropriate ND. The following paragraphs explain the fields:

<WXR (1L) -- Weather radar returns are displayed on the ND. Also results in the weather radar transmitting, if not already transmitting.

<POS (2L) -- The Position switch displays symbols on the respective ND that show the calculated positions of the navigation sources.

<MTRS (3L) -- The Meters switch displays (on the respective PFD) the aircraft altitude and the MCP selectedaltitude inmeters above the displayed altitude in feet.

<FPV (4L) -- Selecting the Flight Path Vector switch displays the flight path vector symbol on the PFD.

<TFC(5L) -- The ND Traffic switch displays air traffic information (traffic alert and collision avoidance system -- TCAS) on the ND. For air traffic to be displayed, the Mode S selector must be in either TA or TA/RA (Traffic Advisory/Resolution Advisory). **<TERR (6L)** -- The Terrain switch displays terrain information on the ND.

WPT>(1R)-- The Waypoints switch displays waypointsnot inthe active route if the ND range is 40 NM or less.

STA> (2R)-- The Stations switch displays the radio navigation aids on the ND. If the ND range is 40 NM or less, all navaids (high and low altitude) are displayed. If the ND range is 80 NM or greater, only high altitude navaids are displayed.

ARPT> (3R) -- The Airports switch displays airports on the ND.

DATA> (4R) -- The Data switch displays the FMC estimated time of arrival, altitude, and any altitude constraints at each waypoint.

SEL ADF/VOR> (5R) -- Pushing LSK **5R** resets the display of VOR or ADF information on the respective ND at the lower right and lower left corner. It sequentially selects ADF, VOR, or OFF for display.

- **ADF** displays the ADF pointers and frequency on the ND in all modes except PLAN.
- **VOR** displays the VOR pointer, frequency, and associated DME on the ND in all modes except PLAN.
- **OFF** removes ADF and VOR data from the ND.

The active state is displayed in LARGE font, while the two inactive states are displayed in SMALL font.

CONTROL> (6R) -- Pushing LSK **6R**, CONTROL, displays the EFIS CONTROL page, shown in Figure 14--3.

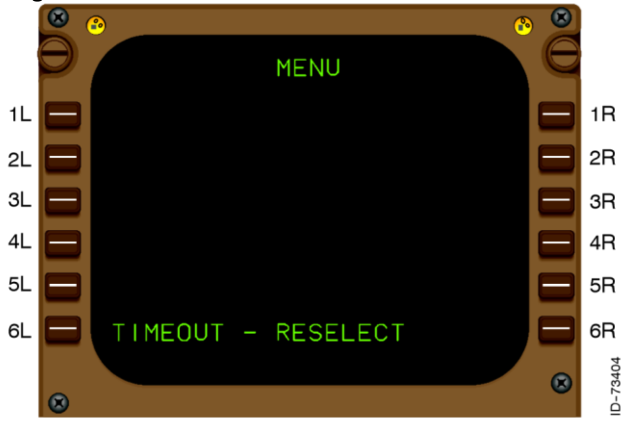
ALTERNATE NAVIGATION

If both FMCs fail, or the FMC manually selected as active fails, both MCDUs automatically initialize as a source of alternate navigation. The MCDUs are an alternate source of lateral navigation guidance to the AFDC and an alternate source of navigation radio tuning.

The loss of a single FMC displays the scratchpad message **SINGLE FMC L (R) OPERATION**, as shown in Figure 14--5.

SINGLE FMC OPERATION
Figure 14--5

A right FMC failure, as in the above situation, or a dual FMC failure, displays the page shown in Figure 14--6.



Dual FMC Failure Figure 14--6

The MCDUs can be used as an alternate navigation system if both FMCs fail. The MCDUs perform lateral navigation computations. LNAV and VNAV are not available.

During normal FMC operation, all system capabilities are contained within the FMCs. During alternate navigation operation, the MCDUs use their own internal memory and computing capability.

Each MCDU performs its calculations based on inputs from its own IRS and provides information for display independent of the other MCDU. Each MCDU can display its route on its respective map display without database symbology.

All MCDU computations are based on a great-circle course between waypoints. The MCDU does not accept undefined waypoints or conditional waypoints. Complete departure or arrival/approach procedures cannot be manually entered or crossloaded from the FMC if they contain undefined or conditional waypoints. The MCDU creates a discontinuity between such waypoints. However, individual legs of a procedure can be manually entered if they constitute a great-circle course.

Route changes are made on the IRS LEGS page in a manner similar to normal FMC operations. All courses between waypoints are direct routes. Modifying the active waypoint computes a present position direct course.

Only the active waypoint course can be referenced to magnetic north because the ADIRU provides magnetic variation only for present position. All subsequent waypoint courses are displayed as true courses.

The radio must be manually tuned on each MCDU in alternate navigation. The left MCDU tunes the left VOR, DME, ADF, and left and center ILS. The right MCDU tunes the right VOR, DME, ADF, and right ILS. In all cases, manual tuning is done on the NAV RADIO page.

The alternate navigation system operates from three MCDU pages:

D IRS LEGS

D IRS PROGRESS

D ALTN NAV RADIO.

These are the only pages available in the alternate navigation mode.

IRS LEGS Page

The IRS LEGS page provides complete information about each leg of the route. The route can be modified. Because VNAV is not available in alternate navigation, waypoint speed and altitude restrictions are not displayed.

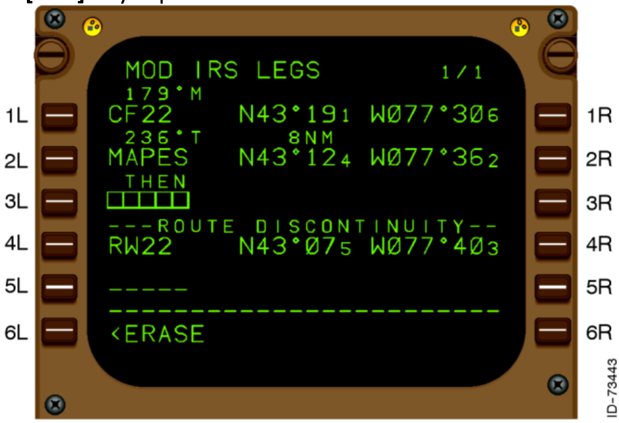
The page is displayed by pushing the **[LEGS]** key. Subsequent legs pages are selected by pushing the **[NEXT PAGE]** or **[PREV PAGE]** keys.

1. Push the MCDU **[LEGS]** key when the FMCs have failed. The page title ACT IRS LEGS is displayed, as shown in Figure 14--7.

ACT IRS LEGS Page

Figure 14--7

If the route is modified, MOD IRS LEGS is displayed, as shown in Figure 14--8, until the MCDU **[EXEC]** key is pushed.



MOD IRS LEGS

Figure 14--8

2. Push the MCDU **[EXEC]** key to execute the modification, shown in Figure 14--9.

ACT IRS LEGS Page

Figure 14--9

Only two types of fix entries are permitted into fields **1L** through **5L** on the ACT IRS LEGS page. The permitted entries are fix identifiers that are already in the flight plan (flight plan waypoints) and latitude/longitude waypoints. When a flight plan waypointis entered,the route is searched for the entered identifier. If the identifier is not found and the entry is not a latitude/longitude waypoint, the **INVALID ENTRY** scratchpad message is displayed.

Waypoint operations include:

D Adding new waypoints (latitude/longitude entry only)

D Removing existing waypoints

D Changing the sequence of existing waypoints D Correcting discontinuities.

The current active waypoint is displayed on the first line of the legs page. Modified waypoints (**MOD** in the title) remain so until the **[EXEC]** key is pushed.

COURSE/HEADING

The computed course information is displayed in the **1L** through **5L** header lines for each flight plan leg. The current desired course on the ACT IRS LEGS page displays relative to magnetic North (designated by **M**). The computed course for other than an activewaypoint isrelative to true North. The MCDU uses the same manual/automatic MAG/TRUE selection as the FMC does.

LEG DISTANCE

The distance from the previous waypoint to the leg termination is displayed in the **1C** through **5C** header lines. No distance is displayed for the active leg.

LATITUDE/LONGITUDE

Fields **1R** through **5R** contain the latitude and longitude of the corresponding fix identifier in degrees, minutes, and tenths of minutes.

IRS PROGRESS Page

The IRS PROGRESS page, shown in Figure 14--10, displays the current dynamic flight information relative to the progress of the flight. Access this page by pushing the MCDU **[PROG]** key when the FMCs have failed.

IRS PROGRESS
Figure 14--10

- **LAST (1L)** Displays information about the last (LAST) waypoint sequenced. The waypoint identifier is displayed in **1L**. The crossing altitude at the time of the leg sequence is displayed in standard MSL altitude format in field **1C**.

- **TO (2L, 2C, 2R)** Displays information relative to the active leg in the route. The fix identifier is displayed in field **2L** and the distance-to-go (**DTG**) is displayed in **2C**. The distance represents the distance along the flight plan to the point where the next leg sequence occurs.

  If the aircraft is off path, then the distance is measured from the point abeam the aircraft and on the flight plan. Time-to-go (**TTG**) is based on the current groundspeed and is displayed in field **2R**. The format is shown in hours and minutes. The TTG field is blank if the groundspeed or the aircraft position is invalid.

- **NEXT (3L, 3C, 3R)** Line **3L** contains information relative to the leg following the active waypoint. The DTG displayed in **3C** is the DTG to the active waypoint plus the great circle distance between the active and next active waypoints.

D **DEST (4L, 4C, 4R)** Line**4L** contains information relative to the destination (DEST) waypoint. The DTG **4C** and the TTG **4R** are displayed for the waypoint identifier located in **4L**.

A flight plan waypoint or a LAT/LON waypoint can be entered into **4L**. The header line of **4L** displays one of the following to indicate the information displayed for the destination:

DEST -- The route is not modified and no alternate destination has been selected. The data is relative to the along path distance from the aircraft to the displayed fix.

MOD-- A flight plan modification is in progress and the predicted data is relative to the modified flight plan. Following the **<ERASE** or **[EXEC]** of the modification, line **4L** changes to the destination of the active route.

DIR TO ALTERNATE -- A waypoint entry not in the active flight plan displays **DIR TO ALTERNATE**. The predictions are relative to flying direct from the aircraft present position to the alternate destination. Leaving the IRS PROGRESS page clears any alternate destination waypoint entered at **4L**. Also, modification of the route after entering an alternate destination clears the alternate destination.

ENROUTE WPT -- If the alternate destination is in the active flight plan, the predictions are relative to flying the active flight plan to the en route waypoint. Sequencing an en routealternative destination waypoint that was entered into **4L** reverts the display to the destination of the active route.

NOTE: If the en route waypoint exists more than once in the route, the predictions for the first occurrence in the route are used.

D **IRSL(5L)** Displays the present position information received from the ADIRU.

D **GS (5R)** Displays current groundspeed (GS). If the groundspeed goes invalid the field goes blank.

D **XTK ERROR (6L)** Displays crosstrack (XTK) error. This error indicates the computed distance, in nautical miles, that the aircraft is left or right of the active flight path.

D **DTK (6C)** DTK displays the desired track angle relative to the selected magnetic reference setting (**M**, Magnetic, or **T**, True).

D **TK (6R)** The track (TK) field displays the current track angle relative to the selected magnetic or true reference setting.

ALTN NAV RADIO Page

The alternate navigation radio page is an alternate way of tuning navigation radios (VOR, ADF, ILS). Alternate radio tuning is handled by the MCDU, using pilot-entered frequencies, in the event of failure of both FMCs. There is **NO autotuning** capability. All information is entered and displayed on the ALTN NAV RADIO page.

The ALTN NAV RADIO page, shown in Figure 14--11, is displayed by pushing the MCDU **[NAV RAD]** key when both FMCs have failed.

ALTN NAV RADIO Page

Figure 14--11

The FMC sends radio information to the MCDU each time a tuning change occurs. This permits the MCDU to initially tune the same stations the FMC was tuning at the time the failure occurred.

- **VOR (1L)** Displays VOR information for currently tuned frequencies. A valid entry is the VOR frequency or VOR frequency/course. This entry also tunes the associated DME frequency in the respective radio. Entering a valid frequency results in the manual **M** tuning of that frequency.

  The default value is the last selected frequency. Deletion of a displayed frequency returns the display to dashes.

- **CRS (2L)** Displays VOR course (CRS). Valid entries are course or VOR frequency/course. Deletion while a course is displayed clears the displayed course.

- **ADF (3L)** Displays ADF tuning data and the tuning mode status. Valid frequencies are followed by the tuning mode status ANT (antenna) or BFO (beat frequency oscillator), if the frequency entry is followed by **A** or **B**, or if **A** or **B** is entered with a frequency already displayed.

Deleting this field while the ADF tuning mode is active returns the display to dashes.

D **ILS--MLS (4L)** Displays ILS or MLS tuning information. **PARK** is displayed if the ILS/MLS is not tuned. Valid entries are:

ILS frequency

Frequency and front course (XXX.XX/YYY)

Front course, with frequency and course already entered (/YYY) MLS channel and azimuth.

Frequency entries are 108.10 to 119.95, inclusive. The tenths digit must be an odd integer and the hundredths digit is a 0 or a 5. Entering a 0 in the hundredths place is optional.

The default value is the last selected frequency/front course or **PARK**. The front course defaults to runway course if the runway is on the active route and only the frequency is entered. If the runway is not on the active route and only the frequency is entered, the front course defaults to 000_ or the last entered front course.

PARK is no longer displayed when the radio is tuned.

NOTES: 1. If the ILS was in autotune at the time of the FMC failure, the frequency and course are automatically cross-loaded to the ALTN NAV RADIO page.

2. **PARK** in the ILS frequency indicates that no frequency is tuned. Deleting the ILS frequency parks a tuned ILS.

D **PRESELECT (6L)** The PRESELECT fields permit the pilot to preselect an entry for any field on the ALTN NAV RADIO page. It can be one or two frequencies or frequency/course combinations. This permits the pilot to validate entry prior to making the entry. Once preselected, the entry can be selected to the scratchpad and then entered to the appropriate line on the ALTN NAV RADIO page to tune the navaid.

Valid entries are any tuning entry valid on any line of the ALTN NAV RADIO page.

15. FMS--MCDU Messages

Messages are generated by the flight management computer (FMC) when a condition exists that degrades the operation of the system or when an FMC datalink message is received. The messages are categorized as follows:

D Alerting messages

D Communications messages D
Advisory messages.

The messages are displayed in the scratchpad according to priority. Lower priority messages replace displayed messages as the MCDU **[CLR]** key is pushed or the condition is corrected.

FMC alerting messages cause the engine indication and crew alerting system (EICAS) advisory message S **FMC** to be displayed.

FMC communications messages cause the communications message S **FMC** to be displayed on the EICAS display.

All FMC messages light the MCDU message (**MSG**) light. Clearing the message or correcting the condition cancels the message.

FMC ALERTING MESSAGES

FMC alerting messages:

D Are displayed in the MCDU scratchpad

D Display the EICAS advisory message **FMC MESSAGE** D Light the
MCDU message (**MSG**) light.

An ATC uplink message cause an aural chime and display of the EICAS message S**ATC**. The EICAS message remains displayed until there are no messages in the ATC log with a status of NEW or OPEN.

The MCDU **[CLR]** key is used, or the condition responsible for the message is corrected, to permanently remove the message. The message is removed from display when manually entering data into the scratchpad and redisplayed when the data is removed from the scratchpad.

The FMC alerting messages are listed in Table 15--1. The advisory message **FMCMESSAGE** is displayed on the EICAS and the message text is displayed in the MCDU scratchpad.

Text	Message Cause
ABLISHED	The active ATC datalink connection is successfully established either following an initial logon or by a successful transfer of control.
MINATED	ATC COMM is terminated without a transfer of comm. This includes receipt of a valid END SERVICE uplink message with no transfer, termination due to an invalid transfer (attempt to transfer while open uplinks exist), termination due to 16 minutes of NO COMM, termination due to pilot selection of the ATC COMM OFF prompt, termination due to a flight number change, etc.
T FULL	Ten reports have been generated in response to report request or confirm request uplinks and these reports are awaiting transmission when an eleventh report or confirm request has been received.
	VNAV is selected when the aircraft is between the MCP window altitude and the VNAV target altitude. VNAV holds level flight.
POLICY	After loading a new airline modifiable information file, the FMC determines a parameter is invalid. The FMC uses the loaded value and notifies the flight crew of the differences. This is a maintenance function. **NOTE:** Once the scratchpad message is displayed and cleared, it is not displayed again for that load.

FMC Alerting Messages Table 15--1 (cont)

Message Text	Message Cause
RS OFF -NAV	ADIRU alignment has automatically restarted due to aircraft motion disturbing the alignment process, or due to the flight crew-entered initial position failing the alignment comparison test.
NT PATH DELETED	The last remaining altitude constraint required to define the descent profile is deleted. **NOTE:** Once the scratchpad message is displayed and cleared, it is not displayed again for that load.
NTINUITY	The route is not defined beyond the waypoint (except when the waypoint is followed by a manually terminated leg, such as FM, VM, HM, legs). D FM -- a course from a fix to a crew entered manual route termination. D VM -- a heading leg from a fix to a crew entered manual route termination. D HM -- a holding pattern to a crew entered manual route termination.
REQUIRED	The aircraft is unable to maintain the precomputed nominal descent path and stay within speed tolerances.
F OFFSET	The aircraft is two minutes prior to the offset termination point.
F ROUTE	The aircraft is passing the last route leg.
IRS POSITION	The flight crew-entered present position did not pass one of the ADIRU comparison checks, or the ADIRU is ready to transition to navigate mode and has not received a present position entry. The **[CLR]** key must be used to remove this message.

FMC Alerting Messages Table 15--1 (cont)

Text	Message Cause
TPUT	Single FMC transmitter and/or FMC output discrete(s) failure detected.
G 2	Totalizer (TOTL) fuel quantity and FMC computed (CALC) fuel quantity disagree by 3,000 pounds for more than 5 minutes.
UEL	Because of a change in flight conditions or the route, the computed route fuel burn exceeds the total fuel on board, less reserves.
LINK	An ATC uplink message received by the FMC contains format or other errors.
	An inertial unit has detected aircraft motion.
	The FMC has been without radio or GPS updating for a predetermined time.
	The aircraft is on the ground and one of the following conditions exist: D The inertial position entered on the POS INIT page differs from the position of the origin airport in the active route by more than 6 NM. D A route is activated and executed containing an origin airport with a position that differs from the current ADIRU inertial position by more than 6 NM.
X	The crew or FMC selected altitude is greater than the VNAV limit altitude.
	Attempt to select a sixth message element for inclusion in a downlink message.

FMC Alerting Messages Table 15--1 (cont)

Text	Message Cause

ATA OUT OF DATE	The clock calendar date exceeds the active navigation database valid calendar cycle.
VALID-TUNE XXXX	RNAV or VOR approach procedures require that a specific navaid be tuned. It is either not tuned or a valid signal is not being received.
TIVE ROUTE	No active FMC lateral route is available and LNAV is selected on the MCP.
UTE DATA	No active MCDU lateral route is available when operating in alternate navigation and LNAV is selected on the MCP.
L CLEARANCE D	The FMC loads only a portion of the loadable data contained in an ATC uplink message.
'NAV ILABLE	VNAV is selected on the MCP without gross weight, cost index, or cruise altitude entered.
GON TO ATC	An ATC logon message was sent from the aircraft and: D ATC did not respond within the required time (for initial logon) D Or the addressed ATC center sent a negative response message to the logon message (RESEND is displayed in 1R on ATC LOGON/ STATUS page) D Or, after 16 minutes of NO COMM, the ATC center is disconnected. D Also, a flight number changes while logon is pending (for the initial logon) D Or the tail number is changed with the MCDU D Or transfer of communication does not occur due to an erroneous transfer uplink message.

FMC Alerting Messages Table 15--1 (cont)

essage Text	Message Cause

	Displayed two minutes before the top of descent point when MCP altitude is still set at the current altitude.
TC	An ATC uplink is received and storage of the message results in the pending uplink storage to be full or an ATC uplink is received while the storage is full.
D	The RTA fix has been deleted from the MOD flight plan.
OR	(This message is inhibited when the scratchpad message ILS TUNE INHIBITED-MCP is displayed.) D The aircraft is within ILS automatic tuning range and the tuned ILS frequency does not match the frequency for the active arrival runway. Or D The FMC is not receiving valid course data from the same ILS that the FMC is using for frequency data.
RROR	(This message is inhibited when the scratchpad message ILS TUNE INHIBITED-MCP is displayed.) D The aircraft is within ILS automatic tuning range and the tuned ILS frequency does not match the frequency for the active arrival runway. Or D The FMC is not receiving valid frequency data from either ILS.

FMC Alerting Messages Table 15--1 (cont)

Text	Message Cause
TC TIME	When GPS UTC time disagrees with the captain s flight deck clock by more than 12 seconds at the entry of initial position on the POS INIT page and if both ATS and GPS functions are enabled. If the captain s clock is invalid then check the first officer clock.

RUST MODE -TO X	A takeoff data record that includes a takeoff thrust mode is accepted, and the accepted thrust mode is not the same as the thrust mode being received from the TMC.
FMC L TION	The right FMC is no longer operational.
FMC R TION	The left FMC is no longer operational.
RS OPERATION	An inertial unit is soft-faulted (resulting in change to number of inertial units used for navigation).
FF SPEEDS ED	New performance data is entered after the VSPEEDS have been entered on the TAKEOFF REF page, or a takeoff thrust selection change is entered after the VSPEEDS have been entered. The crew must select new VSPEEDS.
T REQUIRED	The autothrottle is not engaged and the aircraft is not able to maintain the VNAV descent path without increasing thrust.
E FLXXX AT RTA	The predicted crossing altitude at the RTA fix is less than FLXXX, but the predicted ETA is still within tolerance.
E NEXT ALT	VNAV is not able to meet the next climb restriction altitude.
E RTA	The RTA is not achievable within applicable arrival time tolerance.

FMC Alerting Messages Table 15--1 (cont)

essage Text	Message Cause
E TO LOAD ANCE	The FMC is unable to load any of the loadable data contained in an ATC uplink message.
E TO SEND MSG	FMC is unable to send a message after a manual initiation of a downlink.

N	The current FMC computation of aircraft present position is based on conflicting data. The possible conflicts are: D The left FMC position differs from the right FMC. D The GPS position, with GPS updating, differs from the FMC position. D The radio position, with radio updating, differs from the FMC position.
OS REF 2	The manually entered RNP exceeds the default RNP value for the current flight phase.
ALID	Flight conditions invalidate the pending alternate airport diversion via OFFSET.

FMC Alerting Messages Table 15--1

FMC COMMUNICATIONS MESSAGES

FMC communications messages:

D Are displayed in the MCDU scratchpad

D Cause the EICAS communications message S **FMC** to be displayed

D Light the MCDU (**MSG**) message light

D Result in the communications aural high-low chime to sound.

The FMC communications messages are listed in Table 15--2. The advisory message **FMC** is displayed on the EICAS and the message text is displayed in the MCDU scratchpad.

Message Text	Message Cause
ALTN UPLINK	Up to four company-preferred alternate airports and associated data have been received and are available for preview on the ALTN page.
ALTN INHIBIT UPLINK	A company list of alternate airports that will be inhibited from automatic selection and displayed on the ALTN page has been received and is available for preview on the ALTN page.

ALTN LIST UPLINK	A company list of up to 20 alternate airports has been received and is available on the ALTN LIST page.
DES FORECAST UPLINK READY	Descent forecast data has been received and is available for loading on the DESCENT FORECAST page.
FLT NUMBER UPLINK	A new flight number has been received and is available on the RTE page 1/X.
INVALID TAKEOFF XXX/YYY	Takeoff data for up to six runways or runway intersection pairs has been received but some data for one runway or runway intersection pair (RWXXX/YYY) is invalid.
PARTIAL ROUTE X UPLINK	A new route has been uplinked to the FMC but a portion of the route could not be loaded.

FMC Communications Messages Table 15--2 (cont)

Message Text	Message Cause
ERF INIT UPLINK	Performance initialization data has been received and is available for preview on the PERF INIT page.
OUTE X UPLINK READY	A new route or route modification has been received and is available for loading on the RTE X page.
AKEOFF DATA LOADED	An uplink that contains takeoff data matching the runway/pos entry on the takeoff page is available for preview (displayed only after an initial takeoff uplink has been received) or alternate thrust and/or flaps have been selected.
AKEOFF DATA UPLINK	An uplink that contains takeoff data matching the runway on the takeoff page is available for preview.
VIND DATA UPLINK EADY	Wind data has been received and is available for loading into the active route.

FMC Communications Messages Table 15--2

FMC ADVISORY MESSAGES

FMC advisory messages:

D Are displayed in the MCDU scratchpad D Light
the MCDU message (**MSG**) light.

The FMC advisory messages are listed in Table 15--3. The advisory message text is displayed in the MCDU scratchpad.

Message Text	Message Cause
CRS REVERSAL AT FA FIX	A conflict exists between the default final approach (FA) waypoint (result of a runway or VFR approach selection) and the flight plan before it.
DELETE	DELETE key pushed.
ENG OUT SID MOD	An engine failure is sensed after takeoff before the flaps are fully retracted; the FMC has automatically loaded an available engine out standard instrument departure as a route modification to the active route.
HOLD AT XXXX	A waypoint not contained in the active route is entered into the HOLD AT box on the RTE LEGS page, after selection of the HOLD function key. Selection of HOLD AT XXXX into a RTE LEGS page waypoint line makes a holding fix at the XXXX waypoint.
INVALID DELETE	Deletion of selected data is not allowed.
INVALID ENTRY	Entry format or range is incorrect for the selected field or the entered airway or TO waypoint does does not coincide with the navigation database.
INVALID ENTRY--RTA ACTIVE	Entry of an ECON cruise speed while RTA is active.
INVALID TUNE REQUEST	Attempt to remotely tune a VOR is not valid.

FMC Advisory Messages Table 15--3 (cont)

Message Text	Message Cause
UNCTION INOP	Selected mode key is inoperative.
JALLY TUNED	Attempt to remotely tune a VOR that is manually tuned.
ALT FLXXX	The altitude entry on any MCDU page is above the performance computed maximum altitude.
N DATA BASE	Data is not in the route or navigation database.
ON INTERCEPT NG	LNAV selected and the airplane is outside active capture criteria and the present heading will not intercept the active leg.
E FULL	The route is filled to the allowable capacity.
VAY N/A FOR	Selected runway not compatible with SID.
OBY ONE	The FMC requires more than 4 seconds to display data.
OUT--RESELECT	Communication between the FMC and the MCDU has failed. The flight crew must reselect FMC on the MCDU MENU page.
LE CRZ ALT	Performance predicts a zero cruise time at the entered cruise altitude.
Y RNP ENTRY	The entered RNP value exceeds the default RNP value for the current flight phase, or is less than the current actual navigation performance.

FMC Advisory Messages Table 15--3 (cont)

Message Text	Message Cause
VOR AAA INVALID	Signal is lost from remotely tuned VOR. AAA is the navaid identifier for the VOR.

XXXXX	Altitude set in the MCP window when VNAV is engaged, the CLB or CRZ page is displayed, and the altitude is above, within 4000 feet below, and not equal to the CRZ ALT.

FMC Advisory Messages Table 15--3

FMC Datalink Advisory Messages

The FMC datalink advisory messages are displayed the same as other FMC advisory messages but are associated with datalink operations and are listed in Table 15--4. The datalink advisory message text is displayed in the MCDU scratchpad.

Message Text	Message Cause
INVALID ALTN UPLINK	A company-preferred list of alternate airports and associated alternate data has been received but the data is not valid and cannot be displayed.
INVALID ALTN LIST UPLINK	A company list of up to 20 alternate airports has been received but the data is not valid and cannot be displayed.
INVALID FLT NO UPLINK	A new flight number has been received but the data is not valid and cannot be displayed.
INVALID FORECAST UPLINK	Descent forecast data has been received but the data is not valid and cannot be displayed.
INVALID PERF INIT UPLINK	Performance initialization data has been received but the data is not valid and cannot be displayed.

FMC Datalink Advisory Messages Table 15--4 (cont)

ssage Text	Message Cause
OUTE UPLINK	A new flight plan route or modification to the active flight plan route has been

	received but the data is not valid and cannot be displayed.
NVALID TAKEOFF UPLINK	Takeoff data for up to six runways or runway-intersection pairs has been received but the data is not valid and cannot be displayed.
NVALID WIND DATA UPLINK	En route wind data has been received but the data is not valid and cannot be displayed.
OUTE X UPLINK OADING	A new flight plan route or modification to the active flight plan route has been received and is being loaded after flight crew selection of the LOAD prompt.

FMC Datalink Advisory Messages Table 15--4

MCDU ANNUNCIATOR LIGHTS

Table 15--5 lists the annunciators that light when certain conditions exist.

Annunciator	Annunciator Cause
DSPY	The RTE, RTE LEGS, RTE DATA, or RTE HOLD page not containing the active leg or route segment is displayed, or a VNAV page (CLB, CRZ, or DES) not corresponding to the active VNAV mode is displayed.
FAIL	The associated FMC has failed.
MSG	An FMC message is awaiting display or is displayed (in the scratchpad).
OFST	An offset path has been entered and executed.

MCDU Annunciator Lights
Table 15--5

16. Additional Information

This section describes in more detail the use of cost index (CI) and how it is calculated for airline use. This section also covers the maintenance MCDU pages and how they are accessed.

COST INDEX

The FMS normally flies the aircraft in the economy (ECON) mode. The computed ECON speed results in minimum cost per mile flown or maximum distance per pound of fuel. ECON Mach is calculated within the performance database and is a function of gross weight, selected altitude, temperature, and CI. CI is a number that governs the speed the aircraft flies; the higher the number the faster the speed, which saves time, the lower the number the slower the speed, which saves fuel. Valid entries are 0 to 9999.

COST INDEX is defined as a RATIO of the flying time to the cost of fuel. It is determined by dividing the dollar cost per hour to operate the aircraft **excluding fuel**, by the cost of fuel in cents per pound.

Example:

1200 dollars per hour for flying time
10 cents per pound, cost of fuel Equals = a CI of 120

If the cost of fuel increases to 20 cents per pound the CI is 60. The aircraft would fly slower to save fuel.

If in the example, flying time per hour increased to 1500 dollars per hour, the CI would then be 150. The faster speed would save time.

Determining an airline s cost of flying time per hour depends on the airline s economic state and how they figure operating expenses. It can include insurance, crew costs, maintenance, passenger handling, etc. Each airline must decide its particular priorities and use a CI that achieves the desired results. Segment costs can vary with the direction of flight over a specific route, and whether the flight is domestic or international.

If an airline is not certain what CI to use over a new route segment, a good starting point is to select a CI that produces a cruise Mach number close to long-range cruise (LRC). This can be determined prior to departure by first entering a CI on the PERF INIT page and then checking the ACT CRZ page for the resultant Mach number. After flying the route several times, the CI can then be adjusted as needed to better fit the route segment in question.

Cost Index is **only** associated with ECON speed mode. When flying ECON speed, CI can vary the speed slightly due to changing wind conditions. This is a normal function of CI, since its major purpose is to constantly optimize economy of flight.

MAINTENANCE PAGES

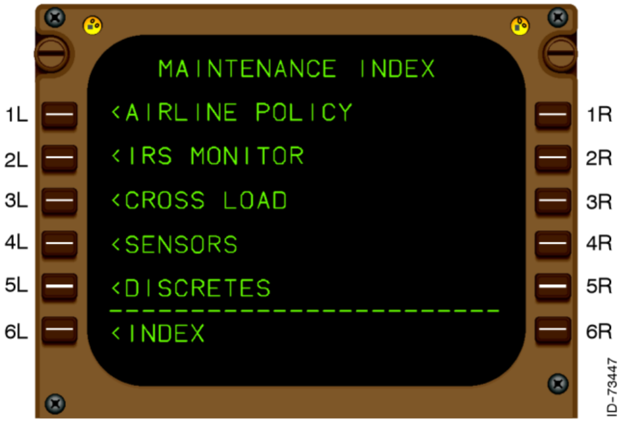
Access to the maintenance pages is permitted only while the aircraft is on the ground. These pages give access to the AIRLINE POLICY pages, the IRS MONITOR page, the CROSS LOAD pages, the SENSOR STATUS pages, and the ANALOG DISCRETES pages.

MAINTENANCE INDEX Page

The MAINTENANCE INDEX page gives access to data for maintenance personnel to examine the airline policy pages, evaluate IRS integrity, and have crossload operation of operational program configuration (OPC), navigation database (Nav Data), airline modifiable information (AMI), and flight data output (FDO).

The MAINTENANCE INDEX page displays prompts for pages used only on the ground. Access to the MAINTENANCE INDEX page is inhibited in flight.

1. Push the MCDU **[INIT REF]** key while on the ground.
2. Push LSK **6R**, **MAINT**, to display the MAINTENANCE INDEX page, shown in Figure 16--1.



MAINTENANCE INDEX Page

Figure 16--1

Pushing a line select key displays the selected page. Pushing **<INDEX** (**6L**) returns the display to the INIT/REF INDEX page.

AIRLINE POLICY Pages

The Airline Policy pages display operating parameters saved in the airline maintained file. The FMC first references this file for data values before computing FMC default values. These pages are not normally used by the flight crew.

1. Push the MCDU **[INIT REF]** key (while on the ground).

2. Push LSK **6R**, **MAINT** to display the MAINTENANCE INDEX page.

3. On the MAINTENANCE INDEX page, push LSK **1L**, **AIRLINE POLICY**, to display the AIRLINE POLICY page, shown in Figure 16--2.

AIRLINE POLICY Page 1/2 Figure 16--2

The airline policy pages display performance factors used to tailor performance optimization and takeoff performance/guidance factors for individual airline policy or aircraft characteristics.

- **MNVR MARGIN (3L)** The maneuver (MNVR) margin gives the value, in gravitational units, to be used when calculating speed limits, maneuver altitude, and maximum altitude. Valid entry is 1.20 to 1.30 for FAA configuration. Valid entry is 1.30 for CAA (JAR) configuration. The default value is the last entered value. If no value was previously entered, then 1.20 is displayed for FAA configuration and 1.30 is displayed for CAA configuration.

- **MIN CRZ TIME (4L)** The minimum cruise time (MIN CRZ) (in minutes) is used as a lower limit to the minimum cruise time extracted from the performance database for optimum altitude calculations. It is used only in the computation of the optimum altitude for short trips. The entry forces the displayed optimum altitude to be lower, if required, to provide the entered minimum cruise time. Valid entry is 1 to 20 minutes. Default value is the last entered value. If no value was previously entered, then 1 is displayed.

- **<INDEX (6L)** Push LSK **6L**, INDEX, to display the MAINTENANCE INDEX page, shown in Figure 16--1.

- **OPTION CODE (1R)** The option code in **1R** displays the current operational program configuration (OPC) authorized for use by the airline. Availability of additional options is coordinated through the Boeing Commercial Airplane Company.

- **R/C CLB (2R)** The minimum rate of climb for climb (R/C CLB) is displayed in this field. This is the residual rate of climb capability desired by the airline in a CLB mode at the thrust limited maximum altitude based on climb speed and climb thrust limits.

- **THR/CRZ (3R)** The first entry in **3R** thrust (THR) can be set to CLB/ or CRZ/ to indicate what default thrust limit is to be set by the FMC at cruise altitude capture.

  The second entry in **3R** R/C CRZ is the residual rate of climb capability desired by the airline at the thrust limited maximum altitude, based on cruise speed and the specified cruise thrust limit (CLB or CRZ as previously defined).

- **ACCEL HT (5R)** Acceleration height (ACCEL HT) displays all engine flap retraction heights (AGL), in feet above the origin airport, where acceleration begins in VNAV for flap retraction.

  The ACCL HT value is propagated to TAKEOFF REF page 2/2, shown in Figure 4--50.

- **AMI P/N (6R)** **6R** displays the AMI part number.

Push the MCDU **[NEXT PAGE]** key to display the AIRLINE POLICY 2/2 page, shown in Figure 16--3.

AIRLINE POLICY Page 2/2 Figure 16--3

- **SPD TRANS (1L)** Displays the specified speed and transition altitude.

D **ALTNRWYLGTH(2L)** The alternate minimumrunway lengthfield gives the minimum runway length to use in the Nav database search for alternate airports.

D **ALTN SPD (3L)** The default cruise speed mode provides the speed schedule for alternate cruise predictions. Selections are CAS/MACH, LRC, ECON, EO, EOLRC, and CO SPD.

D **CO SPD THR (4L)** The company speed thrust rating gives the thrust rating to be used when company speed is active.

D **CO SPD (5L)** The company speed in CAS is used in the engine out mode. The minimum value is 100 knots and the maximum value is 400 knots with a default value of 250 knots.

Company speed in MACH is used in the engine out mode. The minimum value is 0.100 Mach and the maximum value is 0.990 Mach with a default Mach of 0.800.

D **<INDEX (6L)** Push INDEX (**6L**) to display the MAINTENANCE INDEX page, shown in Figure 16--1.

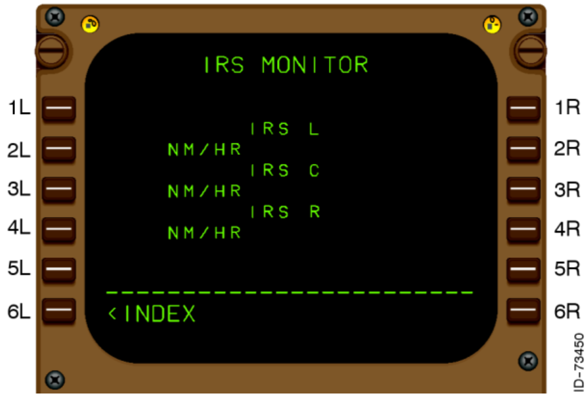
D **SPD RESTR (1R)** Displays the specified speed and restriction altitude.

D **ALTN ALT (2R)** Alternate altitude gives the default advisory altitude used in alternate flight plan predictions. If enabled, the alternate altitude specified must use a value of 1500 to 40,000 feet, inclusive, in the alternate altitude field.

D **DATALINK (3R)** Displays the AMI datalink option codes.

IRS MONITOR Page

1. To access the IRS MONITOR page, push the MCDU **[INIT REF]** key while on the ground.
2. Push LSK **6R**, **MAINT**, to display the MAINTENANCE INDEX page (shown in Figure 16--1).
3. Push LSK **2L**, **IRS MONITOR**, to display the IRS MONITOR page, shown in Figure 16--4.



IRS MONITOR Page

Figure 16--4

The relevant fields are explained in the following paragraphs.

- **IRS L, C, R (2L, 3L, 4L)** Displays the position error rate for each IRS position in the flight in nautical miles per hour, which is computed by dividing the computed distance from the FMC position to the IRS position occurring during the flight (liftoff to flight completion) by the total flight time. This value is computed on flight completion. The display is cleared when the aircraft is airborne.

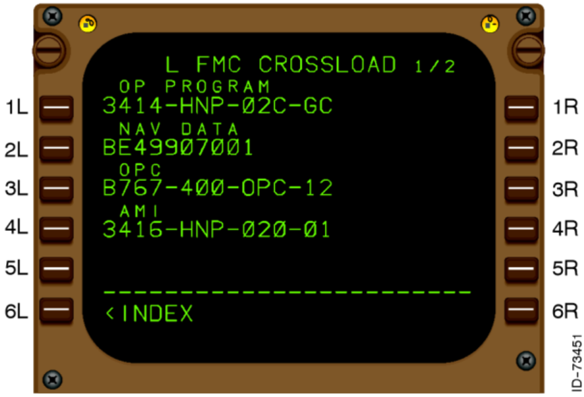
- **<INDEX (6L)** Push INDEX (**6L**) to display the MAINTENANCE INDEX page.

CROSSLOAD Pages

The CROSSLOAD pages are for the initiation and status display of a transfer of the OP program, navigation database (Nav Data), operational program configuration (OPC) data, airline modifiable information (AMI) data, and flight data output (FDO) data over the intersystem bus from one FMC to the other in a dual installation.

To access the CROSSLOAD pages:

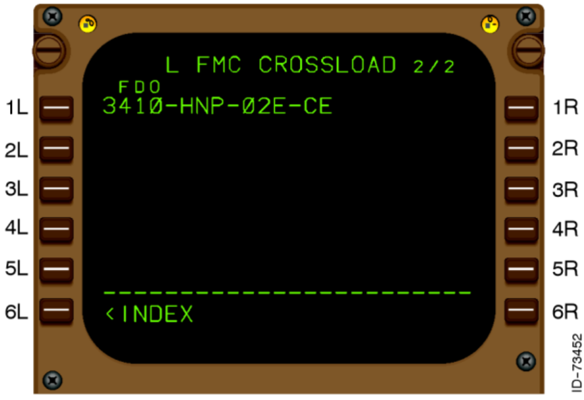
1. Push the MCDU **[INIT REF]** key while on the ground.
2. Push LSK **6R**, **MAINT**, to display the MAINTENANCE INDEX page (shown in Figure 16--1).
3. Push LSK **3L**, **CROSSLOAD**, to display the CROSSLOAD page, shown in Figure 16--5.



CROSSLOAD Page 1/2

Figure 16--5

4. Push the MCDU **[NEXT PAGE]** or **[PREV PAGE]** key to access CROSSLOAD page 2/2, shown in Figure 16--6.



CROSSLOAD Page 2/2

Figure 16--6

CROSSLOAD page 1/2 can be accessed again by pushing the **[NEXT PAGE]** or **[PREV PAGE]** key when on CROSSLOAD page 2/2.

The FMC CROSSLOAD page fields are described in the following paragraphs.

D **OP PROGRAM / FDO (1L, 1R)** CROSSLOAD page 1/2 displays the OP PROGRAM part number loaded in the FMC. The CROSSLOAD page 2/2 displays the FDO part number loaded in the FMC.

If the FMC detects that the OP program needs to be crossloaded, the **ARM>** prompt is displayed in data field **1R** on CROSSLOAD page 1/2. Pushing LSK **1R**, ARM, displays **ARMED**, as shown in

Figure 16--7.

NOTE: If the FMC detects that the OP program needs to be crossloaded, then no other ARM prompts are displayed until the OP program ARM prompt is pushed.

CROSSLOAD Page 1/2, OP Program ARMED Figure 16--7

If the FMC detects that the FDO needs to becrossloaded, the**ARM>** prompt is displayed in data field **1R** on CROSSLOAD page 2/2. Pushing LSK **1R**, ARM, displays **ARMED**, as shown in Figure 16--8.

CROSSLOAD Page 2/2, FDO ARMED Figure 16--8

D **NAV DATA (2L, 2R)** Data field **2L** displays the navigation database part number that is loaded in the FMC.

If the FMC detects that the navigation database needs to be crossloaded, an **ARM>** prompt is displayed in data field **2R**. Pushing LSK **2R**, ARM, displays **ARMED**, as shown in Figure 16--7.

D **OPC (3L, 3R)** Data field 3L displays the operational program configuration part number that is loaded in the FMC.

If the FMC detects that the OPC needs to be crossloaded, an **ARM>** prompt is displayed in data field **3R**. Pushing LSK **3R**, ARM, displays **ARMED**, as shown in Figure 16--7.

D **AMI (4L, 4R)** Data field 4L displays the Airline Modifiable Information part number that is loaded in the FMC.

If the FMC detects that the AMI needs to be crossloaded, an **ARM>** prompt is displayed in data field **4R**, as shown in Figure 16--7. Pushing LSK **4R**, ARM, displays **ARMED**.

D Status Field **5L 5L** displays the transfer status, as shown in Figure 16--9, as one of the following:

TRANSFER IN PROGRESS TRANSFER ABORTED

VALIDATING CROSSLOAD

TRANSFER COMPLETE

D **<DISARM, <INDEX, % COMPLETE (6L)** Field **6L** displays either prompts or transfer status percentage.

<DISARM is displayed when at least one item has been ARMED for crossload, as shown in Figure 16--7. Selection returns all ARMED items to the unarmed state (ARM prompt).

Pushing **<INDEX** displays the MAINTENANCE INDEX page, shown in Figure 16--1.

% COMPLETE is displayed when a crossload is in progress, as shown in Figure 16--9.

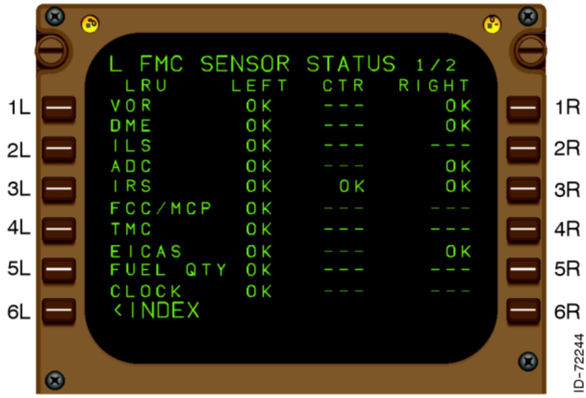
D **TRANSMIT> (6R)** The TRANSMIT prompt is displayed when at least one item has been ARMED for crossload, as shown in Figure 16--7. Push TRANSMIT to initiate a crossload of all ARMED items from the FMC where TRANSMIT was selected to the other FMC.

CROSSLOAD Page 1/2, Transfer in Progress Figure 16--9

SENSOR STATUS Pages

The SENSOR STATUS pages are for display of input sensor status. These pages are not normally used by the flight crew.

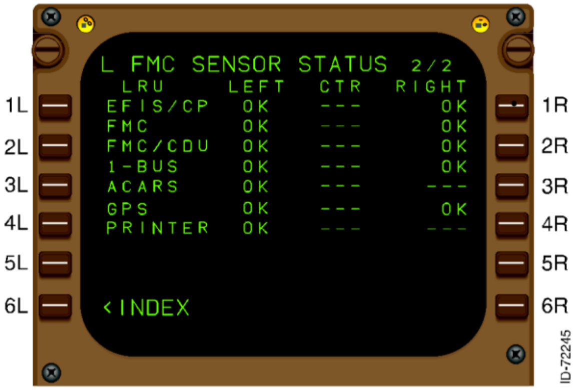
1. Push the MCDU **[INIT REF]** key while on the ground.
2. Push LSK **6R**, **MAINT**, to display the MAINTENANCE INDEX page.
3. Push LSK **4L**, **SENSORS**, to display the **FMC SENSOR STATUS** page, shown in Figure 16--10.



SENSOR STATUS Page 1/2
Figure 16--10

SENSOR STATUS page 1/2 can also be accessed by pushing the **[NEXT PAGE]** or **[PREV PAGE]** key on SENSOR STATUS page 2/2.

4. On SENSOR STATUS page 1/2, push the MCDU **[NEXT PAGE]** or **[PREV PAGE]** key to access SENSOR STATUS page 2/2, shown in
Figure 16--11.



SENSOR STATUS Page 2/2

Figure 16--11

5. Push LSK **6L**, **INDEX**, to display the MAINTENANCE INDEX page.

17. Air Traffic Services Datalink

This section contains a description of the automatic dependent surveillance (ADS) and air traffic control (ATC) functions contained within the FMC. This section describes each MCDU page that is used to log on to an ATC center, turn the ADS function on or off, display uplink messages, respond to uplink messages, request vertical clearances, speed clearances, lateral offsets, or route modifications, generate downlink reports, and declare or cancel emergencies.

D **ATC Key** -- Pushing the **[ATC]** key accesses the ATC datalink functions, ADS, and the logon function. The page that is displayed when this key is pushed depends on whether or not a datalink connection has been established.

If logged onto an ATC center, the ATC LOGON/STATUS page is displayed.

If logged onto an ATC center and no pending uplinks exist, the ATC INDEX page is displayed.

If no new or one pending uplink exists, the XXXXz ATC UPLINK page corresponding to that message is displayed.

If more than one new uplink or no new uplinks and more than one pending uplink exist, the ATC LOG page is displayed.

If an ATC connection exists, holding down the **[ATC]** key displays the EMERGENCY REPORT page. When no ATC datalink connection exists, the ATC/LOGON/STATUS page is displayed.

When the **[ATC]** key is not operational, a push of this key displays the **KEY/FUNCTION INOP** message in the MCDU scratchpad.

ESTABLISHING AND TERMINATING CONNECTIONS ATC LOGON/STATUS

The ATC LOGON/STATUS page, shown in Figure 17--1, can be accessed by pushing the MCDU **[ATC]** key when a logon to an ATC CENTER has not been successfully completed. The page can also be accessed by selecting **<LOGON/STATUS** on the ATC INDEX page
(shown in Figure 17--20).

The ATC LOGON/STATUS page is used by pilots to initiate an ATS facilities notification (AFN) downlink to a specified air traffic services (ATS) facility. This page also displays ADS status, ATC COMM status, and datalink status.

ATC LOGON/STATUS Page

Figure 17--1

D **LOGON TO (1L)** If the aircraft position is invalid, field **1L** is blank. When no ATC COMM connection exists and no ATC CENTER identifier has been entered, four box prompts are displayed. Valid ATS facility identifier entries are four alpha characters.

NOTE: Entering a four-character identifier over a four-character identifier resets field **1R** to **SEND>** if **SENDING**, **RESEND>**, **SENT**, **ACCEPTED**, or **REJECTED** was displayed.

After entering an ATC CENTER identifier, and until both a positive AFN acknowledgement (**ACCEPTED**) to the AFN logon downlink message and a valid ATC COMM connection request uplink are received, the entered identifier remains displayed in field **1L**.

After receipt of a valid ATC COMM connection request uplink and until a new ATC CENTER identifier is entered or the ATC COMM connection is terminated, dashes are displayed in field **1L**. This field can be deleted when an ATS facility identifier is displayed in field **1L**.

D **FLT NO (2L)** When the flight number is valid, it is displayed in field **2L**. When the flight number is not valid, ten box prompts are displayed. The flight number can be entered on the RTE page 1 or the ATC LOGON/STATUS page. The flight number consists of no more than ten alphanumeric characters. The flight number cannot be deleted.

NOTE: If an ATC connection exists, entering a valid flight number that is differentfrom the displayed flight number terminates all ATC COMM and any AFN process that is in progress at the time of entry.

D **TAIL NO (3L)** When the tail number is valid, it is displayed in field **3L** and no entry is required. When the tail number is not valid, seven box prompts are displayed. Entering the tail number into the box prompts is required in the EXACT format displayed on the placard. Tail numbers containing a dash must be entered with the dash. The tail number cannot be deleted.

NOTE: Once a valid tail number has been entered, it cannot be changed.

D **ATC COMM SELECT OFF (4L)** This field is blank if an AFN logon has not been completed or **ATC COMM SELECT OFF** has been selected (terminating ATC COMM).

NOTE: Selecting **ATC COMM SELECT OFF** does not abort a logon process in progress at the time of selection and has no effect on the display of fields **1L** or **1R**.

D **ADS SELECT OFF/ARM (5L)** When an ADS connection exists, **(ACT)** is displayed in the header line and **ARM** is displayed in LARGE font in the data line with **OFF** in SMALL font. When an ADS connection does not exist and the crew has not turned off ADS,**ARM** is displayed in LARGE font in the data line and **OFF** is displayed in SMALL font. When the crew has turned off ADS, **OFF** is displayed in the data line in LARGE font and **ARM** is displayed in the data line in SMALL font.

Selecting when **OFF** is SMALL font (**ARM** is LARGE font) terminates all ADS connections and ADS reporting. Selecting when **ARM** is SMALL font (**OFF** is LARGE font) arms ADS reporting.

D **<ATCINDEX(6L)** Selecting INDEX displays the ATC INDEX page (shown in Figure 17--20).

D **SEND> or RESEND> (1R)** The LSK **1R** field is blank until an ATS facility identifier, flight number, and tail number are displayed in fields **1L**, **2L**, and **3L**, respectively. Selecting **SEND** or **RESEND** starts the transmitting an AFN logon downlink message to the ATC center specified in field **1L**.

SENDING is displayed in this field after selecting **SEND** or **RESEND** and before receiving an acknowledgement from the network that the message has been received.

RESEND is displayed in this field if no acknowledgment is received from the network or if the AFN timer has expired without receiving a response.

SENT is displayed in this field after receiving an acknowledgment that the network has received the AFN downlink message.

ACCEPTED is displayed in this field after receiving a positive AFN response message and until a valid connection request uplink is received such that **1L**

changes from the ATC CENTER identifier to dashes, at which point this field changes from **ACCEPTED** to blanks.

REJECTED is displayed in this field after receiving a negative AFN response message.

NOTE: Selecting **ATC COMM SELECT OFF** or terminating the active ATC COMM connection by receiving an END SERVICE uplink (whether or not a transfer of comm occurs) **does not** abort a logon process at the time and has no effect on the display in field **1R**.

D **ACT CTR (3R)** When no ATC datalink connections exist, this field is blank. After an AFN logon has been successfully completed and a positive response to the AFN logon request message has been received, the header displays ACT CTR and the data line displays the four character identifier for the active ATS facility, if it exists.

D **NEXT CTR (4R)** When no ATC datalink connections exist, this field is blank. The next ACT CTR identifier is displayed in this field when an ATC datalink is available for communication and the next ATC center is known.

D **ADSEMERGSELECTOFF/ON(5R)** This field is displayed ifADS is ARMed or ACTive (as indicated in line **5L**). Selection when **ON** is displayed in SMALL font places ADS in the EMERGENCY mode. Selection when **OFF** is displayed in SMALL font terminates ADS emergency mode.

NOTE: ADS emergency mode is also initiated by transmitting an emergency message containing the **MAYDAY MAYDAY MAYDAY** message element. The ADS emergency mode is terminated by transmitting a **CANCEL EMERGENCY** message.

D **DATALINK STATUS (6R)** The datalink status field displays the current datalink status: READY, NO COMM, VOICE, or FAIL.

Logging on to ATC COMM

The flight crew has the capability to initiate communication with an ATS facility using an AFN downlink message. The crew must perform this logon if ATC Datalink is to be used during the flight. In addition, the crew may be required by particular ATS procedures to log on if ADS is to be used on the flight. The logon message is sent to a specified ATS facility, indicating that ADS and the ATC datalink areready andavailable foruse on the aircraft.

After receipt of a positive acknowledgement of theAFN logonmessage, **ACCEPTED** is displayed in the **1R** field. After the first ATC datalink message is received from the

ATS facility, the facility identifier, **KZNY** in this case, is displayed in the **3R** field and the **ATC COMM ESTABLISHED** scratchpad message is displayed.

Figures 17--2, 17--3, 17--4, 17--5, and 17--6 show the process of logging on to an ATS facility.

To log on to an ATS facility:

1. Push the MCDU **[ATC]** key.
2. Type the ATS facility identifier **KZNY** into the scratchpad, as shown in Figure 17--2.

ATC LOGON/STATUS Page – ATS Facility ID

Figure 17--2

3. Push LSK **1L** to enter the ATS facility identifier.
4. Type the flight number (**767PEG** in this example) into the scratchpad, as shown in Figure 17--3, (or verify the flight number that was propagated from the RTE page).

ATC LOGON/STATUS Page – Flight Number

Figure 17--3

5. Push LSK **2L** to enter the flight number.

6. If box prompts are displayed in **3L**, enter the tail number (as displayed on the placard) into the scratchpad and push LSK **3L**.

7. Push LSK **1R** to start transmitting the AFN logon downlink message to the ATC center, shown in Figure 17--4.

ATC LOGON/STATUS Page – Send Logon
Figure 17--4

8. Figure 17--5 shows that the AFN logon message has been accepted.

ATC LOGON/STATUS Page Positive Acknowledgement Received Figure 17--5

9. Figure 17--6 shows that the first ATC datalink message has beenreceived from the ATS facility (ATC COMM connection request uplink). The active center is displayed in line **3R** and a scratchpad message informs that the connection is established.

ATC LOGON/STATUS Page – Complete Logon

Figure 17--6

Terminating ATC COMM

The ATC datalink function gives the flight crew the capability to terminate ATC datalink communication.

With the ATC LOGON/STATUS page displayed, LSK **4L**, **ATC COMM SELECT OFF**, is pushed. This terminates the ATC datalink communication and enters a scratchpad message thatinforms theflight crew that ATC COMM has been terminated. The flight crew is required to re-logon to an ATS facility before ATC datalink communication can be reestablished.

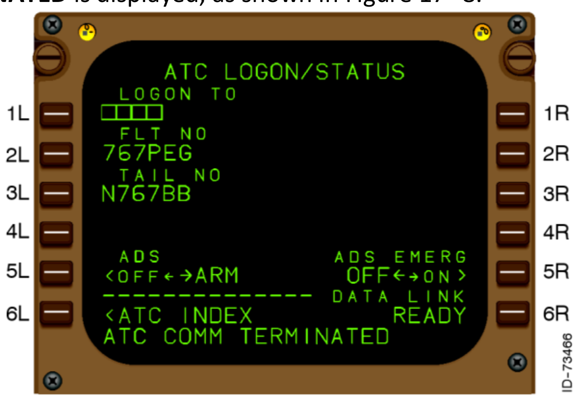
To terminate ATS datalink communications:

1. Push the MCDU **[ATC]** key.
2. The ATC INDEX page is displayed.
3. On the ATC INDEX page, push LSK **5L** to display the ATC LOGON/STATUS page, shown in Figure 17--7.

ATC LOGON/STATUS Page Ready to Terminate ATC COMM

Figure 17--7

4. Push LSK **4L** to terminate ATC COMM. The scratchpad message **ATC COMM TERMINATED** is displayed, as shown in Figure 17--8.



ATC LOGON/STATUS Page – Terminating ATC COMM

Figure 17--8

Transfer of ATC COMM

The ATC Datalink function gives the capability to transfer ATC Datalink Communication from one air traffic control center to the next air traffic control center.

The transfer of control by ATC from the active center to the next center is initiated by the ground and requires no initial input from the flight crew.
The ICAO identifier for the **NEXT CTR** is displayed on the ATC LOGON/STATUS page in field **4R** when the controller of the active ATC center starts the handoff procedure.

The active ATC center sends an uplink message containing the text **MONITOR** [next center] **CENTER ON** [frequency]. In order to continue the handoff procedure, the flight crew must acceptthe MONITORuplink message. After acceptance of the MONITOR uplink message, the transfer of control to a new active center is considered complete. This is indicated by the **ATCCOMM ESTABLISHED** message being issued in the scratchpad and the **ACT CTR** displayed in field **3R** on the ATC LOGON/STATUS page being updated to reflect the new ATC center. If the procedure is to send the MONITOR and END SERVICE uplink messages separately, there can be a small delay in the transfer of control being completed.

If an uplink message were in the OPEN state when the transfer of control was attempted, ATC COMM is terminated. This displays the **ATC COMM TERMINATED** scratchpad message.

If any downlink messages were in the OPEN state when the transfer of control was completed, the downlink messages are closed and the message status changes to **ABORTED**.

Figures 17--9, 17--10, and 17--11 show the transfer of ATC communication from the active ATC center to the next ATC center.

1. Push the MCDU **[ATC]** mode key.

2. The ATC INDEX page (shown in Figure 17--20) is displayed.

3. On the ATC INDEX page, push LSK **5L** to display the ATC LOGON/STATUS page, shown in Figure 17--9. Note that NEXT CTR **CZQX** is displayed in line **4R**.

ATC LOGON/STATUS Page – Handoff Initiated

Figure 17--9

4. When an uplink message is received and is ready for review, if thereis only one new or pending uplink message in the ATC LOG, pushing the MCDU **[ATC]** key displays the XXXXz ATC UPLINK page, shown in Figure 17--10. (Other ways to

access the XXXXz ATC UPLINK page are described later in this section in ATC Uplink Message Handling.)

5. Push LSK **5R** to ACCEPT the MONITOR [next center] CENTER ON [frequency] uplink message in line **2L**.

XXXXz ATC UPLINK Page – Handoff Uplink
Figure 17--10

6. Push the MCDU **[ATC]** mode key.

7. The ATC INDEX page is displayed.

8. On the ATC INDEX page, push LSK **5L** to display the ATC LOGON/STATUS page, shown in Figure 17--11, that shows **ATC COMM ESTABLISHED** with **ACT CTR CZQX**.

ATC LOGON/STATUS Page – Handoff Complete
Figure 17--11

AUTOMATIC DEPENDENT SURVEILLANCE

The automatic dependent surveillance (ADS) function can be turned on and off using the ATC LOGON/STATUS page. The state of the ADS function is displayed in field **5L**. The default state of the ADS function is armed and **ARM** is displayed in LARGE font in the data line of field **5L**. This means that no ATS facility or airline has requested ADS reporting, but the FMC begins transmitting ADS reports once ADS reporting has been requested by one or more ATS facilities.

Once a report contract has been established, the ADS state changes to active and **ADS (ACT)** is displayed in the data line of field **5L**.

When the state of the ADS function is armed or active, the function can be turned off. This stops all ADS reporting and prevents all ATS facilities from requesting ADS reporting.

Turning ADS OFF

ADS reporting can be turned off using the ATC LOGON/STATUS page. Figures 17--12 and 17--13 show turning ADS reporting off.

1. Push the MCDU **[ATC]** key to access the ATC INDEX page (shown in Figure 17--20).

2. On the ATC INDEX page, push LSK **5L** (**LOGON/STATUS**) to display the page shown in Figure 17--12.

ATC LOGON/STATUS Page – ADS Function Active

Figure 17--12

3. Push LSK **5L** to toggle ADS so that **OFF** is displayed in LARGE font, as shown Figure 17--13.

ATC LOGON/STATUS Page – ADS Turned OFF

Figure 17--13

Toggling **ADS OFF/ARM** to **OFF** terminates all ADS reporting. The **5L** data line field displays **<OFF ←→ ARM**.

Arming ADS

ADS reporting can be armed using the ATC LOGON/STATUS page. Figures 17--14 and 17--15 show turning ADS reporting on.

1. Push the MCDU **[ATC]** key to access the ATC INDEX page (shown in Figure 17--20).
2. On the ATC INDEX page, push LSK **5L**, **LOGON/STATUS**, to display the page shown in Figure 17--14.

ATC LOGON/STATUS Page – ADS Function OFF

Figure 17--14

3. Push LSK **5L** to toggle ADS so that **ARM** is displayed in LARGE font, as shown Figure 17--15.

ATC LOGON/STATUS Page ADS Armed

Figure 17--15

Toggling **ADS OFF/ARM** to **ARM** arms the FMC to begin transmitting ADS reports when an ATS facility requests ADS reporting. The **5L** data line field displays **<OFF** ←→ **ARM**.

Initiating ADS Emergency Mode

When ADS reporting is enabled, there are two methods to initiate the ADS emergency mode:

- Toggle LSK **5R** (ADS EMERG OFF/ON) to **ON**. The **5R** data line displays **OFF** ←→ **ON>** on the ATC LOGON/STATUS page, OR

- Transmit an emergency report downlink message that contains the **MAYDAY MAYDAY MAYDAY** downlink message (described in detail later in this section, Emergency Report Page).

Figures 17--16 and 17--17 show how to initiate ADS emergency mode.

1. If the ATC datalink connection does not exist, push and hold the MCDU **[ATC]** key to display the ATC LOGON/STATUS page, shown in Figure 17--16.

   If the ATC datalink connection exists, push the MCDU **[ATC]** key to access the ATC INDEX page, and then push LSK **5L**, **LOGON STATUS**, to display the ATC LOGON/STATUS page, shown in Figure 17--16.

ATC LOGON/STATUS Page – ADS Emergency OFF

Figure 17--16

2. Push LSK **5R** to toggle ADS EMER so that **ON** is displayed in LARGE font, as shown in Figure 17--17.

ATC LOGON/STATUS Page **ADS Emergency Mode Initiated**

Figure 17--17

Toggling **ADSEMERG OFF/ON** to **ON** initiates the ADS emergency mode. The **5R** data line field displays **OFF** ←→ **ON>**, as shown in Figure 17--17.

The ADS emergency mode can also be initiated by transmitting an ATC EMERGENCY report downlink (described later in this section, Emergency Report Page). If an ATC datalink connection exists, display the ATC INDEX page and push LSK **1L** (**EMERGENCY**). Then push LSK **1L** (the **MAYDAY** prompt) on the EMERGENCY REPORT page (shown in Figure 17--42). The VERIFY EMERGENCY page (shown in Figure 17--

43) is displayed. Push LSK **5R** (**SEND**). When transmitting, ADS reporting is put into ADS emergency mode.

Canceling ADS Emergency Mode

When ADS emergency mode is active, there are two methods to cancel the ADS emergency mode:

- By toggling LSK **5R**, ADS EMERG OFF/ON to **OFF**, on the ATC LOGON/STATUS page, shown in Figure 17--18, OR
- By transmitting an emergency report downlink message containing the **CANCELEMERGENCY** downlink message element(described in detail later in this section, Canceling an Emergency).

Figures 17--18 and 17--19 show how to cancel ADS emergency mode.

1. If the ATC datalink connection does not exists, push and hold theMCDU **[ATC]** key to display the ATC LOGON/STATUS page, shown in Figure 17--18.

   If the ATC datalink connection exists, access the ATC INDEX page (shown in Figure 17--20) by pushing the MCDU **[ATC]** key and then pushing LSK **5L**, **LOGON STATUS**, to display the page shown in
   Figure 17--18.

ATC LOGON/STATUS Page ADS Emergency Mode Active

Figure 17--18

2. Push LSK **5R** to toggle ADS EMER so that **OFF** is displayed in LARGE font, as shown in Figure 17--19.

ATC LOGON/STATUS Page ADS Emergency Mode Canceled

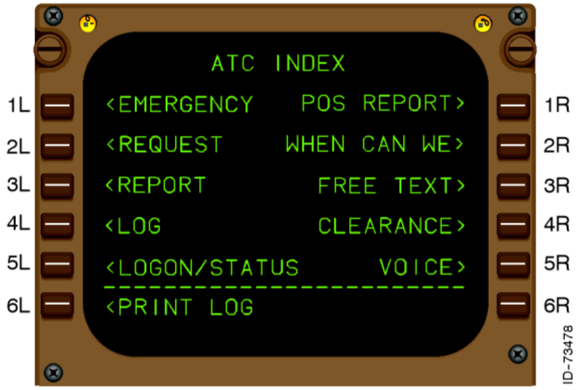
Figure 17--19

Toggling **ADS EMERG OFF/ON** to **OFF** cancels ADS emergency mode. The **5R** data line field displays **<OFF** ← → **ON**, as shown in Figure 17--19.

The ADS emergency mode can also be canceled by transmitting an ATC EMERGENCY report containing the **CANCEL EMERGENCY** downlink message (described later in this section, Canceling an Emergency). If an ATC datalink connection exists, push and hold the MCDU **[ATC]** key until the ATC EMERGENCY page (shown in Figure 17--48) is displayed. Then push LSK **5L**, **CANCEL EMERGENCY**. The VERIFY EMERGENCY page (shown in Figure 17--49) is displayed. Push LSK **5R**, **SEND**. As soon as transmission has begun, ADS reporting is put into ADS normal mode.

ATC INDEX PAGE

When the logon to an ATC center is completed successfully and no pending ATC uplinks exist, pushing the MCDU **[ATC]** key displays the ATC INDEX page, as shown in Figure 17--20.



ATC INDEX Page
Figure 17--20

The ATC INDEX page can also be accessed by selecting **<ATCINDEX** on the ATC LOGON/STATUS page, the EMERGENCY REPORT page, the ATC REQUEST page, the ATC REPORT page, the ATC LOG page, the WHEN CAN WE EXPECT page, the VERIFY REPORT page (when accessed by using the FREE TEXT prompt), or the VERIFY REQUEST page (when accessed by using either the CLEARANCE or the VOICE prompt).

The pilot uses the ATC INDEX page to access the ATC COMM function or to print the contents of the ATC LOG.

D **<EMERGENCY (1L)** Selecting EMERGENCY displays the EMERGENCY REPORT page (shown in Figure 17--42).

D **<REQUEST (2L)** Selecting REQUEST displays the ATC REQUEST page (shown in Figure 17--30).

D **<REPORT (3L)** Selecting REPORT displays the ATC REPORT page 1 (shown in Figure 17--38).

D **<LOG (4L)** Selecting LOG displays the ATC LOG page 1 (shown in Figure 17--51).

D **<LOGON/STATUS (5L)** Selecting LOGON/STATUS displays the ATC LOGON/STATUS page (see Figure 17--1).

D **<PRINT LOG (6L)** If the ATC log is empty, the PRINT LOG field is blank. Selecting PRINT LOG transmits the contents of the ATC log to the printer for a hard copy report. If PRINT LOG is not displayed, refer to the Printer Status section, Printer Status, Table 17--12, at the end of this section.

D **POS REPORT> (1R)** Selecting POS REPORT displays the POS REPORT page (shown in Figure 17--40).

D **WHEN CAN WE> (2R)** Selecting WHEN CAN WE displays the WHEN CAN WE EXPECT page (shown in Figure 17--35).

D **FREE TEXT (3R)** Selecting FREE TEXT displays the VERIFY REPORT page, with FREE TEST prompts (shown in Figure 17--39).

D **CLEARANCE> (4R)** Selecting CLEARANCE displays the VERIFY REQUEST page 1 for the CLEARANCE request (shown in Figure 17--27).

D **VOICE> (5R)** Selecting VOICE displays the VERIFY REQUEST page 1 for the VOICE CONTACT request (shown in Figure 17--29).

ATC UPLINK MESSAGE HANDLING

The XXXXz ATC UPLINK page is used to respond to ATC uplink messages, if required. This page is also used to print the uplink message, load clearances received from ATC, and ARM the corresponding downlink report messages to be triggered upon satisfying the uplink message criteria.

XXXXz ATC Uplink

When an uplink message is received and is ready for review,and ifthere is only one new or pending uplink message in the ATC LOG, pushing the MCDU **[ATC]** key displays the XXXXz ATC UPLINK pages shown in Figures 17--21 and 17--22.

XXXXz ATC UPLINK Page 1/2

Figure 17--21

XXXXz ATC UPLINK Page 2/2

Figure 17--22

An XXXXz ATC UPLINK page can also be accessed from the ATC LOG page by selecting the right LSK for the corresponding uplink message. It can also be accessed by selecting UPLINK on the VERIFY RESPONSE page, the REJECT DUE TO page, or the XXXXz ATC REQUEST page.

D **XXXXz ATC UPLINK** The ATC UPLINK page title displays the time the uplink message was received by the FMC.

D **<REQUEST (1L) REQUEST** is displayed on page 1/2 if the uplink message displayed is in response to a **WHEN CAN WE EXPECT** or a **REQUEST** downlink message currently contained in the ATC LOG. Selecting REQUEST displays the corresponding XXXXz ATC REQUEST page.

D **<STANDBY SEND (4L)** If a response is required, **STANDBY SEND** is displayed on the last uplink page only. Selecting this prompt sends the **STANDBY** response message to ATC.

The datalink status of NO COMM, VOICE, or FAIL is displayed in this field as described in the Datalink Status section, Datalink Status Definitions Table 17--11, at the end of this section.

To transmit a STANDBY message in response to an ATC uplink, follow these steps:

Display the last page of the XXXXz ATC UPLINK page.

Push LSK **4L**, **STANDBY SEND**.

NOTE: Transmitting a STANDBY response does not close the uplink message.

D **<REJECT (5L)** If UNABLE or NEGATIVE is a valid response to the uplink message, **REJECT** is displayed on the last uplink page only. Selecting REJECT displays the

REJECT DUE TO page. If REJECT is selected and **LOAD** was displayed in field **4R**, LOAD is blanked.

D **<PRINT (6L) PRINT** is displayed on the last uplink page only. Selecting PRINT prints the entire uplink message. If **PRINT** is not displayed, see Printer Status, Table 17--12, at the endof thissection.

NOTE: In some instances a message cannot be fully displayed on an XXXXz ATC UPLINK page (the Predeparture Clearance and Route Clearance message). To review the contents of the message, print it or load it into the flight plan.

D **STATUS(1R)** LSK**1R** displays the current status of the ATC uplink message on page 1/2. This status is identical to the status displayed on the ATC LOG page (shown in Figure 17--51). Refer to the ATC Uplink Message Status Table 17--9.

D **LOAD (4R)** If the uplink message contains loadable data, **LOAD** is displayed on the last uplink page only. Selecting LOAD loads the loadable parts of the displayed uplink message into the active route. The data creates a MOD in the active route. The MOD can be executed or erased. LOAD can be selected more than once.

NOTE: LOAD is not displayed while a route modification exists for RTE 1 or RTE 2. The LOAD line is blank if the uplink is rejected.

D **ACCEPT SEND> (5R)** If WILCO, ROGER, or AFFIRM is a valid response, **ACCEPT SEND** is displayed on the last uplink page only. Selecting ACCEPT SEND displays the appropriate WILCO, ROGER, or AFFIRM response message being sent to ATC.

The datalink status of NO COMM, VOICE, or FAIL is displayed in this field as described in the Datalink Status section, Datalink Status Definitions Table 17--11, at the end of this section.

To transmit an ACCEPT message in response to an ATC uplink:

Display the last page of the XXXXz ATC UPLINK page, shown in Figure 17--22.

Push LSK **5R**, **ACCEPT SEND**.

D **LOG/REPORT> (6R) LOG** is displayed if the displayed uplink message does not include a request for a report, confirmation, or when you can accept, or if the uplink does include a request for a report, confirmation, or when can we accept and the corresponding uplink is not in the Report List. Selecting LOG displays the ATC LOG page (shown in Figure 17--51).

REPORT is displayed if the displayed uplink message contains a report, confirmation, or when you can accept type request and the corresponding report is in the Report List. Selecting REPORT displays the ATC REPORT page 1.

NOTE: If the uplink message requires a response (ACCEPT or REJECT), the report list entry is not displayed on the ATC REPORT page until the FMC has received acknowledgement from the network that the positive response downlink message was received. The corresponding report is not displayed in the Report List if the report has been sent or deleted from the Report List.

D **MessageText** The uplink message text is displayed starting in line 2 on the first page. If a message requires more than one page to be displayed, use the MCDU **[NEXT PAGE]** and **[PREV PAGE]** keys to access the other pages.

D **ARM> ARM** is displayed on the right side of the page if the uplink message contains a report request that is ARMable and the uplink status is either OLD or ACCEPTED. Selecting ARM on this page or on the VERIFY REPORT page causes the ARMED FMC to trigger the associated report downlink message automatically when the reporting criteria is satisfied.

Four reports can be armed for automatic transmission: LEVEL [altitude], REACHING [altitude], LEAVING [altitude], and PASSING [position]. If the report is armed, the report is automatically transmitted when the associated trigger condition is satisfied.

An uplink message of **REPORT LEVEL** [altitude] is armable and triggers the **LEVEL** [altitude] downlink message when the trigger condition is satisfied.

An uplink message of **REPORTREACHING** [altitude] is armable and triggers the **REACHING** [altitude] downlink message when the trigger condition is satisfied.

An uplink message of **REPORT LEAVING** [altitude] is armable and triggers the **LEAVING** [altitude] downlink message when the trigger condition is satisfied.

An uplink message of **REPORT PASSING** [position] is armable and triggers the **PASSING** [position] downlink message when the trigger condition is satisfied.

If **ARM** has been selected, **ARMED** is indicated adjacent to the report request.

Deleting while **ARMED** is displayed disarms the trigger that would automatically initiate the downlink report.

D **RESPONSE** When the ACCEPT or REJECT downlink response message has been sent, the time the response message was sent is indicated in the first header line following the end of the uplink message text. The response text is displayed in the following lines.

Loading an Uplink Message

If an uplink message is loadable, **LOAD**, LSK **4R**, is displayed on the last XXXXz ATC UPLINK page required to display the message.

After selecting **LOAD**, if the FMC determines the uplink is no longer loadable, the **UNABLETO LOADCLEARANCE** message is displayed in the MCDU scratchpad. For example, if the uplinked clearance is for an offset and the aircraft is active in a departure procedure; the FMC does not permit creating an offset path when a procedure is active.

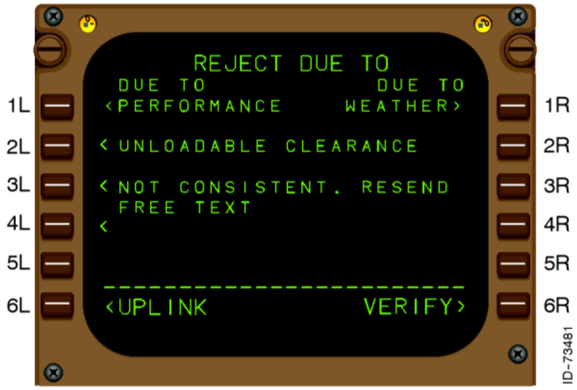
If the FMC determines that only a portion of the data contained in an uplink message is LOADable, the **PARTIAL CLEARANCE LOADED** message is displayed. For example, if the uplinked clearance includes a waypoint speed/altitude constraint and the speedconstraint isdefined as a MACH number. The FMC does not permit entering speed constraints in terms of MACH number.

After LOADing the clearance and before EXECuting the new or modified route, the loaded data should be compared against the clearance that is displayed in the XXXXz ATC UPLINK page or on a printout of the clearance. The loaded data can be found on the RTE, the RTE LEGS, the DEPARTURES, the ARRIVALS, the HOLD, or the RTA PROGRESS page. If the clearance is acceptable as loaded, the new or modified route can be executed. Otherwise, an unacceptable route modification should be erased.

REJECT DUE TO

The REJECT DUE TO page is accessed by selecting **REJECT** on the last page of the XXXXz ATC UPLINK page, shown in Figure 17--22. This page can also be accessed from the **REJECT DUE TO** line on the VERIFY RESPONSE page, shown in Figure 17--25.

The REJECT DUE TO page, shown in Figure 17--23, lets the pilot include reasons when rejecting an ATC uplink message.



REJECT DUE TO Page

Figure 17--23

- **DUE TO PERFORMANCE (1L)** Selecting DUE TO PERFORMANCE inserts DUE TO AIRCRAFT PERFORMANCE in the rejection response.

  The reason can be deselected by pushing the MCDU **[DEL]** key and then pushing LSK **1L**.

- **DUE TO WEATHER (1R)** Selecting DUE TO WEATHER inserts DUE TO WEATHER in the rejection response.

  The reason can be deselected by pushing the MCDU **[DEL]** key and then pushing LSK **1R**.

- **UNLOADABLE CLEARANCE (2L)** Selecting UNLOADABLE CLEARANCE inserts UNLOADABLE CLEARANCE in the rejection response.

  The reason can be deselected by pushing the MCDU **[DEL]** key and then pushing LSK **2L**.

- **NOT CONSISTENT. RESEND (3L)** Selecting NOT CONSISTENT. RESEND inserts NOT CONSISTENT. RESEND in the rejection response.

  The reason can be deselected by pushing the MCDU **[DEL]** key and then pushing LSK **3L**.

- **FREE TEXT (4L)** The pilot can also create a free text rejection by entering data into the scratchpad and pushing LSK **4L**. Text that is entered into the free text field is included with the response message.

  The free text can be deselected by pushing the MCDU **[DEL]** key and then pushing LSK **4L**.

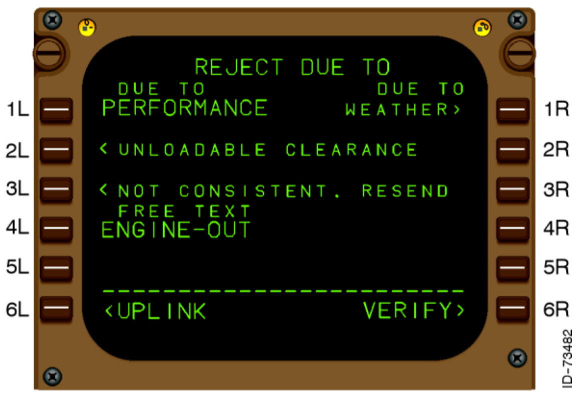
- **<UPLINK (6L)** Selecting UPLINK displays the corresponding XXXXz ATC UPLINK page.

D **VERIFY> (6R)** Selecting VERIFY displays the VERIFY RESPONSE page for the rejection response with all of the reasons from the REJECT DUE TO page displayed.

Figures 17--23 and 17--24 show how to create a negative response downlink message.

To create a negative downlink message:

1. Display the last page of the XXXXz ATC UPLINK page (see Figure 17--22).
2. Push LSK **5L**, **REJECT**, to display the REJECT DUE TO page (see Figure 17--23).
3. Push LSK **1L**, **DUE TO PERFORMANCE**.
4. In this example, **ENGINE--OUT** is typed into the scratchpad and LSK **4L** is pushed. The display is as shown in Figure 17--24.



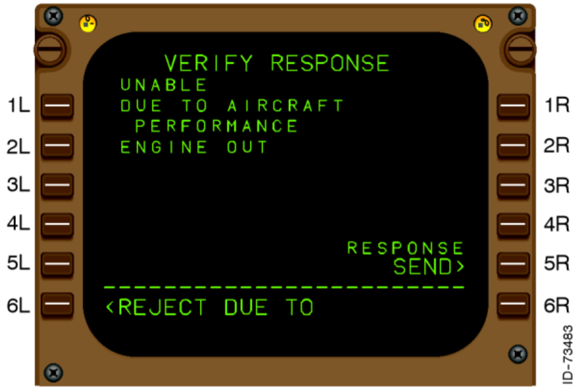
REJECT DUE TO Page – Reason Selection

Figure 17--24

VERIFY RESPONSE

The VERIFY RESPONSE page gives the pilot the opportunity to review the reject response message that has been built before sending the response to ATC.

Push LSK **6R**, **VERIFY**, on the REJECT DUE TO page to access the VERIFY RESPONSE page, shown in Figure 17--25.



VERIFY RESPONSE Page
Figure 17--25

D **Message Text** The message text is displayed starting in line 1.

D **<REJECT DUE TO/UPLINK (6L)** Selecting REJECT DUE TO displays the corresponding REJECT DUE TO page. **REJECT DUE TO** is displayed only before **SEND** is selected.

Selecting **UPLINK** displays the corresponding XXXXz ATC UPLINK page.

D **SEND> (5R)** Selecting SEND sends the response message to ATC.

Upon receiving acknowledgement from the network that the response message has been received, the MCDU page display changes from the VERIFY RESPONSE page to the XXXXz ATC UPLINK page.

The datalink status of NO COMM, VOICE, FAIL, or NO ATC COMM is displayed in this field as described in the Datalink Status section, Datalink Status Definitions Table 17--11, at the end of this section.

ATC REQUEST DOWNLINK MESSAGES

The ATC REQUEST pages are used to create request downlink messages for vertical and speed clearances, lateral offsets, and route changes.

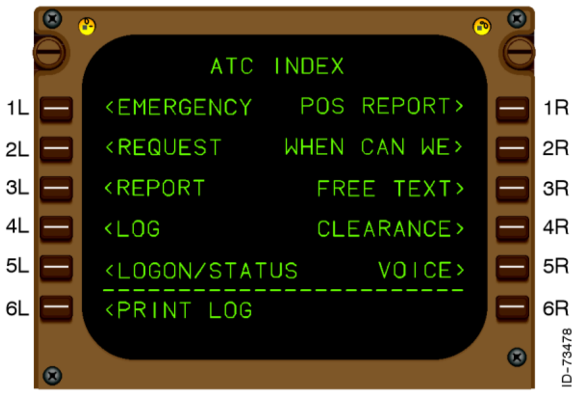
Pushing an LSK or entering anything into a field on any ATC REQUEST page that would cause more than five downlink message elements to be selected displays the **MESSAGE LIMIT EXCEEDED** scratchpad message. The message element is not selected or the entry is not accepted.

VOICE or CLEARANCE request downlink messages can be created via the ATC INDEX page. The WHEN CAN WE EXPECT page is used to create negotiation request downlink messages.

Clearance Requests

To create a REQUEST CLEARANCE downlink message, perform the following steps.

1. Push the MCDU **[ATC]** key to display the ATC INDEX page, as shown in Figure 17--26.



ATC INDEX Page – Clearance Selection

Figure 17--26

2. Push LSK **4R**, **CLEARANCE**, to display the VERIFY REQUEST page.

VERIFY REQUEST Page – Clearance Request

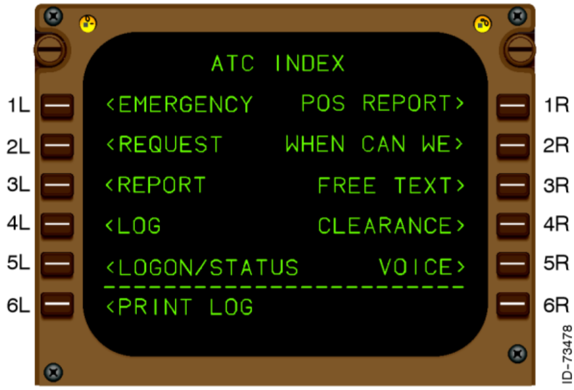
Figure 17--27

3. Push LSK **5R**, **SEND**, to send the request for clearance, shown in Figure 17--27.

Voice Requests

To create a REQUEST VOICE CONTACT downlink message, perform the following steps.

1. Push the MCDU **[ATC]** key to display the ATC INDEX page, shown in Figure 17--28.



ATC INDEX Page – Voice Selection

Figure 17--28

2. Push LSK **5R**, **VOICE**, to display the VERIFY REQUEST page, shown in Figure 17--29.

VERIFY REQUEST Page – Voice Request

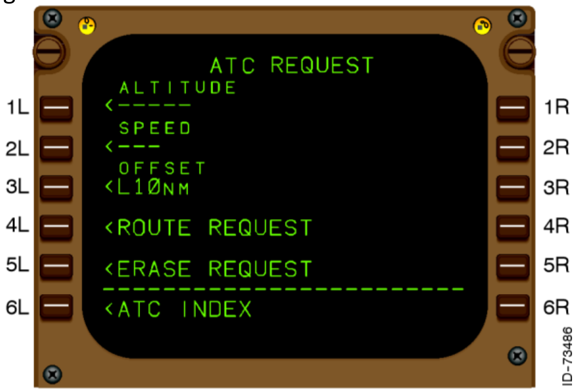
Figure 17--29

3. Push LSK **5R**, **SEND**, to send the request for voice contact.

ATC REQUEST

The ATC REQUEST page, shown in Figure 17--30, is accessed by pushing LSK **2L**, **REQUEST**, on the ATC INDEX page. This page is also accessed by pushing **REQUEST** on the ATC ALT REQUEST, the ATC SPEED REQUEST, the ATC OFFSET REQUEST, the ATC ROUTE REQUEST, or the VERIFY REQUEST page.

Fields **1L**, **2L**, **3L**, and **5L** are nonoperational while the request downlink message is in the SENDing state.



ATC REQUEST Page

Figure 17--30

- **ALTITUDE (1L)** Selecting LSK **1L** displays the ATC ALT REQUEST page, shown in Figure 17--31.

  Entering a valid altitude into field **1L** displays the ACT ALT REQUEST page with the entered altitude displayed in field **1L** on the ATC REQUEST page.

  Entering a block altitude in terms of feet or English flight level or a single altitude in terms of feet, English flight level, or meters, selects a message element requesting a block altitude, a level altitude, or a climb or descent clearance based on the type of entry and relative positions of the aircraft altitude and the entered altitude. (For example, if a single altitude is entered and the entered altitude is more than 150 feet above the aircraft altitude, the **REQUEST CLIMB TO** [altitude] message is selected.)

  The valid entry range for an altitude in terms of feet is 0 through 25,000 feet, inclusive. The valid entry range for an altitude in terms of English flight level is FL030 through the maximum certified altitude, inclusive. The valid entry range for an altitude in terms of meters is 0 through 16,000 meters, inclusive, and followed by an **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.

  This field can be deleted, which deselects the selected altitude request downlink element, as well as any reasons that were also selected: DUE TO WEATHER, DUE TO PERFORMANCE, MAINTAIN OWN SEPARATION/VMC, and/or AT PILOT DISCRETION.

- **SPEED (2L)** Selecting LSK **2L** displays the ATC SPEED REQUEST page (shown in Figure 17--32).

Valid speed entries consist of an IAS or MACH value. Entering a valid speed into field **2L** displays the ATC SPEED REQUEST page with the entered speed displayed in field **1L** on the ATC SPEED REQUEST page.

A valid IAS speed value is entered in the format of three numerics, ranging from 100--380, inclusive. IAS speed values are rounded to the nearest 10 kts.

A valid MACH value is entered in the format of one to three digits, preceded by a decimal point, .XXX, ranging from .61--.91, inclusive. MACH values are rounded to the nearest .01 MACH.

This field can be deleted, which deselects the selected speed request downlink element, as well as any reasons that were also selected: DUE TO WEATHER or DUE TO PERFORMANCE.

- **OFFSET (3L)** Selecting LSK **3L** displays the ATC OFFSET REQUEST page (shown in Figure 17--33).

  Valid offset entries consist of a direction followed by a distance in the format DNN, where D is either L or R and NN ranges from 1--99NM, inclusive. Entering a valid offset into field **3L** displays the ATC OFFSET REQUEST page with the entered offset displayed in field **1L**.

  This field can be deleted, which deselects the selected offset request downlink element.

- **<ROUTE REQUEST (4L)** Selecting ROUTE REQUEST displays the ATC ROUTE REQUEST page (shown in Figure 17--34).

- **<ERASE REQUEST (5L) ERASE REQUEST** is displayed if data has been selected or entered for inclusion in a downlink request message on the ATC REQUEST, ATC ALT REQUEST, ATC SPEED REQUEST, ATC OFFSET REQUEST, or ATC ROUTE REQUEST page. Selecting ERASE REQUEST erases the currently selected request data.

  Selecting ERASE REQUEST erases all request data entered or selected on the ATC REQUEST page, the ATC ALT REQUEST page, the ATC SPEED REQUEST page, the ATC OFFSET REQUEST page, or the ATC ROUTE REQUEST page.

- **<ATCINDEX(6L)** Selecting ATC INDEX displays the ATC INDEX page (see Figure 17--28).

- **VERIFY> (6R)** Selecting VERIFY displays the VERIFY REQUEST page, shown in Figure 17--36, which contains all of the selected request downlink elements.

Vertical Requests

Vertical request downlink messages can be created using the ATC REQUEST page and the ATC ALT REQUEST page.

NOTE: These vertical request messages are mutually exclusive.

Message Text	How To Create Message
REQUEST [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude into 1L that is within150 feet of current aircraft altitude. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
REQUEST BLOCK [altitude] TO [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter a block altitude into 1L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
REQUEST CLIMB TO [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet above current aircraft altitude into 1L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

Vertical Request Downlink Messages Table 17--1 (cont)

lessage Text	How To Create Message

T CRUISE O [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet above current aircraft altitude into 1L. 3. Push LSK 1R on the ATC ALT REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
T DESCENT ude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet below current aircraft altitude into 1L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
tion] REQUEST O [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet above current aircraft altitude into 1L. 3. Enter a valid position into 2L on theATC ALT REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.

Vertical Request Downlink Messages Table 17--1 (cont)

lessage Text	How To Create Message

tion] REQUEST T TO [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet below current aircraft altitude into 1L. 3. Enter a valid position into 2L on theATC ALT REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
e] REQUEST CLIMB ude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet above current aircraft altitude into 1L. 3. Enter a valid time into 2L on the ATCALT REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
e] REQUEST T TO [altitude]	1. Display the ATC REQUEST page orthe ATC ALT REQUEST page. 2. Enter an altitude that is more than 150 feet below current aircraft altitude into 1L. 3. Enter a valid time into 2L on the ATCALT REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.

Vertical Request Downlink Messages Table 17--1

ATC ALT REQUEST

The ATC ALT REQUEST page, shown in Figure 17--31, is accessed by pushing **1L** on the ATC REQUEST page (see Figure 17--30). This page can also be accessed by pushing the MCDU **[NEXT PAGE]** key from the ATC ROUTE REQUEST page or the MCDU **[PREV PAGE]** key from the ATC SPEED REQUEST page.

The ATC ALT REQUEST page is used to create vertical clearance request downlink messages.

Fields **1L**, **2L**, **4L**, **1R**, **2R**, **3R**, and **4R** are nonoperational while the request downlink message is in the SENDing state.

ATC ALT REQUEST Page

Figure 17--31

D **ALTITUDE(1L)** Entering a block altitude in terms of feet or English flight level or a single altitude in terms of feet, English flight level, or meters selects a message element requesting a block altitude, a level altitude, or a climb or descent clearance based on the type of entry and the relative positions of the aircraft altitude and the entered altitude (for example, if a single altitude is entered and the entered altitude is more than 150 feet above the aircraft altitude, the **REQUEST CLIMB TO** [altitude] message is selected).

The valid entry range for an altitude value in termsof feetis 0through 25,000 feet, inclusive. The valid entry range for an altitude value in terms of English flight level is FL030 through the maximum certified altitude, inclusive. The valid entry range for an altitude value in terms of meters is 0 through 16,000 meters, inclusive and followed by **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.

This field can be deleted, which deselects the message element requesting a block, climb, descent, or level altitude clearance and returns this field and field **1L** on the ATC REQUEST page to the default display. Any of the reasons that were also selected, such as
DUE TO WEATHER, DUE TO PERFORMANCE, MAINTAIN OWN SEPARATION/VMC, or AT PILOT DISCRETION are also deselected.

When no altitude entry is displayed in field **1L** (the data line displays **-- -- -- -- --** prompts), fields **2L**, **4L**, **1R**, **2R**, **3R**, and **4R** are blank.

D **STEP AT (2L)** A step at position or time value can be entered in this field only after entering a single altitude value in field **1L** that is greater than 150 feet above or below the current aircraft altitude and before selecting field **1R**.

A valid position identifier is defined as a fix name, navaid, airport, latitude/longitude, or place bearing distance. If the associated fix is a waypoint in the active route, then the active route waypoint is selected for inclusion in the corresponding downlink message element. If the position entry is not included in the active route, or a place bearing/distance (PBD) and the associated fix is not a waypoint in the active route and the entered fix name, navaid, or fix portion of the PBD has duplicates in the Nav database, then the SELECT DESIRED WPT page is displayed.

A valid time value is entered in hhmm format, where hh ranges from 00--23, inclusive, and mm ranges from 00--59, inclusive. The step at value can be deleted. This deselects the request at a time or position and reselects the REQUEST [altitude], REQUEST CLIMB TO [altitude], or REQUEST DESCENT TO [altitude] message element, as appropriate.

D **<AT PILOT DISC (4L)** This field is blank until an altitude value is displayed in field **1L**. Pushing LSK **4L** inserts AT PILOTS DISCRETION in the downlink request.

This field can be deleted, which deselects the AT PILOTS DISCRETION downlink element.

D **<REQUEST (6L)** Selecting REQUEST displays the ATC REQUEST page (see Figure 17--30).

D **<REQUEST CRZ CLB >** Selecting REQUEST CRZ CLB creates the downlink request message text **REQUEST CRUISE CLIMBTO** [altitude], using the altitude value displayed in field **1L**. This message can be created only when field **2L** displays dashes and field **1L** displays a single altitude value that is greater than 150 feet above the current aircraft altitude.
This field can be deleted, which deselects the REQUEST CRUISE CLIMB TO [altitude] downlink message element and reselects the REQUEST CLIMB TO [altitude] message element.

D **MAINTAIN OWN SEPARATION/VMC> (2R)** This field is blank until an altitude is displayed in field **1L**. Selecting LSK **2R** inserts the message text, **MAINTAIN OWN SEPARATION AND VMC**, in the downlink request.

This field can be deleted, which deselects the MAINTAIN OWN SEPARATION AND VMC downlink element.

D **DUE TO PERFORMANCE> (3R)** This field is blank until an altitude value is displayed in field **1L**. Selecting LSK **3R** inserts the message text, **DUE TO AIRCRAFT PERFORMANCE**, in the downlink request.

This field can be deleted, which deselects the DUE TO AIRCRAFT PERFORMANCE downlink element.

D **DUETO WEATHER> (4R)** This field is blank until an altitude value is displayed in field **1L**. Selecting LSK **4R** inserts the message text, **DUE TO WEATHER**, in the downlink request.

This field can be deleted, which deselects the DUE TO WEATHER downlink element.

D **VERIFY> (6R)** Selecting VERIFY displays the VERIFY REQUEST page, shown in Figure 17--36, which contains all of the selected request downlink elements.

Speed Requests

Speed request downlink messages can be created using the ATC REQUEST page and the ATC SPEED REQUEST page. Table 17--2 shows how to create a speed request downlink message.

Message Text	How To Create Message
REQUEST [speed]	1. Display the ATC REQUEST page or theATC SPEED REQUEST page. 2. Enter a valid speed into 2L on the ATCREQUEST page or a valid speed into 1L on the ATC SPEED REQUEST page. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

Speed Request Downlink Messages
Table 17--2

The ATC SPEED REQUEST page is used to create speed request downlink messages.

The ATC SPEED REQUEST page, shown in Figure 17--32, is accessed by selecting LSK **2L** or making an entry into field **2L** on the ATC REQUEST page (see Figure 17--30). This page can also be accessed by pushing the MCDU **[NEXT PAGE]** key on the ATC ALT REQUEST page or the MCDU **[PREV PAGE]** key on the ATC OFFSET REQUEST page.

Fields **1L**, **3R**, and **4R** are nonoperational while the request downlink message is in the SENDing state.

ATC SPEED REQUEST Page

Figure 17--32

- **SPEED(1L)** Valid speed entries consist of an IAS or MACH value. A valid IAS speed value is entered in the format of three numerals, ranging from 100--380, inclusive. A valid IAS speed value is rounded to the nearest 10 kts.

  A valid MACH value is entered in the format of one to three digits, preceded by a decimal point, .XXX, ranging from .61--.91, inclusive. MACH values are rounded to the nearest .01 MACH.

  Entry into this field inserts the message text **REQUEST** [speed] into the downlink request.

  This field can be deleted, which deselects the speed request downlink element, as well as any reasons that were also selected:
  DUE TO WEATHER or DUE TO AIRCRAFT PERFORMANCE.

- **<REQUEST (6L)** Selecting REQUEST displays the ATC REQUEST page (see Figure 17--30).

- **DUE TO PERFORMANCE> (3R)** This field is blank until a speed value is displayed in field **1L**. Selecting DUE TO PERFORMANCE inserts the message text **DUE TO AIRCRAFT PERFORMANCE** into the downlink request.

  This field can be deleted, which deselects the DUE TO AIRCRAFT PERFORMANCE request downlink message element.

- **DUE TO WEATHER> (4R)** This field is blank until a speed value is displayed in field **1L**. Selecting DUE TO WEATHER inserts the message text **DUE TO WEATHER** in the downlink request message.

  This field can be deleted, which deselects the DUE TO WEATHER request downlink message element.

D **VERIFY> (6R)** Selecting VERIFY displays the VERIFY REQUEST page, shown in Figure 17--36, which contains all of the selected request downlink elements.

Lateral Offset Requests

Lateral offset request downlink messages can be created using the ATC REQUEST page and the ATC OFFSET REQUEST page.

NOTE: These vertical request messages are mutually exclusive.

Message Text	How To Create Message
REQUEST OFFSET [speed]	1. Display the ATC REQUEST page orthe ATC OFFSET REQUEST page. 2. Enter an offset into 3L on the ATCREQUEST page or an offset into 1L on the ATC OFFSET REQUEST page. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
AT [position] REQUEST OFFSET [offset]	1. Display the ATC REQUEST page orthe ATC OFFSET REQUEST page. 2. Enter an offset into 3L on the ATCREQUEST page or an offset into 1L on the ATC OFFSET REQUEST page. 3. Enter a valid position into 2L on theATC OFFSET REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.

Lateral Offset Request Downlink Messages Table 17--3 (cont)

Message Text	How To Create Message

ime] REQUEST ET [offset]	1. Display the ATC REQUEST page orthe ATC OFFSET REQUEST page. 2. Enter an offset into 3L on the ATCREQUEST page or into 1L on the ATC OFFSET REQUEST page. 3. Enter a valid time into 2L on the ATCOFFSET REQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
UEST WEATHER ATION UP TO et]	1. Display the ATC REQUEST page orthe ATC OFFSET REQUEST page. 2. Enter an offset into 3L on the ATCREQUEST page or into 1L on the ATC OFFSET REQUEST page. 3. Press LSK 4R on the ATC OFFSETREQUEST page. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.

Lateral Offset Request Downlink Messages Table 17--3

ATC OFFSET REQUEST

The ATC OFFSET REQUEST page, shown in Figure 17--33, is accessed by selecting LSK **3L** or making an entry into field **3L** on the ATC REQUEST page (see Figure 17--30). This page can also be accessed by pushing the MCDU **[NEXTPAGE]** key from the ATC SPEED REQUEST page or the MCDU **[PREV PAGE]** key from the ATC ROUTE REQUEST page.

The ATC OFFSET REQUEST page is used to create offset request downlink messages.

Fields **1L**, **2L**, and **4R** are nonoperational while the request downlink message is in the SENDing state.

ATC OFFSET REQUEST Page Figure 17--33

D **OFFSET (1L)** Valid offset entries consist of a direction followed by a distance in the format DNN, where D is either L or Rand NNranges from 1--99NM, inclusive. Valid entry selects a request offset downlink message element.

This field can be deleted, which deselects the selected offset request downlink element.

D **OFFSET AT (2L)** An offset at a position or time value can be entered in this field only after entering an offset value in field **1L** and when **4R** is not selected.

A valid position identifier is defined as a fix name, navaid, airport, latitude/longitude, or a place bearing distance. If the associated fix is a waypoint in the active route, then the active route waypoint is selected for inclusion in the corresponding downlink message element. If the position entry is not included in the active route, or a PBD and the associated fix is not a waypoint in the active route, and the entered fix name, navaid, or fix portion of the PBD has duplicates in the NDB, then the SELECT DESIRED WPT page is displayed (see Figure 4--28).

A valid time value is entered in hhmm format, where hh ranges from 00--23, inclusive, and mm ranges from 00--59, inclusive.

Deleting a step at value is permitted and this deselects the request offset at a time or position and reselects the REQUEST [offset] message element.

D **<REQUEST (6L)** Selecting REQUEST displays the ATC REQUEST page (see Figure 17--30).

D **DUE TO WEATHER (4R)** This field is blank until an offset value is displayed in field **1L** or a time value is entered into field **2L**. Selecting DUE TO WEATHER inserts the message text **REQUEST WEATHER DEVIATION UP TO** [offset] in the downlink request message.

This field can be deleted, which deselects the REQUEST WEATHER DEVIATION UP TO [offset] in the downlink request message and reverts to REQUEST OFFSET [offset].

- **VERIFY> (6R)** Selecting VERIFY displays the VERIFY REQUEST page, shown in Figure 17--36, which contains all of the selected request downlink elements.

Route Clearance Requests

Route clearance request downlink messages can be created using the ATC REQUEST page, shown in Figure 17--30, and the ATC ROUTE REQUEST page, shown in Figure 17--34.

Message Text	How To Create Message
REQUEST [procedure name]	1. Display the ATC REQUEST page. 2. Push LSK 4L to display the ATC ROUTE REQUEST page. 3. Push LSK 5L if the desired procedurename (procedure.transition) is displayed. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
	1. Display the ATC REQUEST page. 2. Push LSK 4L to display the ATC ROUTE REQUEST page. 3. Enter the procedure name (or procedure.transition) into 5L. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.

Route Clearance Request Downlink Messages Table 17--4 (cont)

Message Text	How To Create Message
QUEST ute clearance]	1. Display the ATC REQUEST page. 2. Push LSK 4L to display the ATC ROUTE REQUEST page. 3. Push LSK 3L if RTE 1 contains thedesired requested route. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
	1. Display the ATC REQUEST page. 2. Push LSK 4L to display the ATC ROUTE REQUEST page. 3. Push LSK 3R if RTE 2 contains thedesired requested route. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.
QUEST osition]	1. Display the ATC REQUEST page. 2. Push LSK 4L to display the ATC ROUTE REQUEST page. 3. Enter a valid position into field 1L. 4. Push the VERIFY prompt. 5. Push the SEND prompt on the VERIFYREQUEST page.

Route Clearance Request Downlink Messages Table 17--4 (cont)

Message Text	How To Create Message

QUEST GROUND ACK [degrees]	1. Display the ATC ROUTE REQUESTpage. 2. Enter a valid ground track into field 2R. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
QUEST HEADING egrees]	1. Display the ATC ROUTE REQUESTpage. 2. Enter a valid heading into field 1R. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

Route Clearance Request Downlink Messages Table 17--4

ATC ROUTE REQUEST

The ATC ROUTE REQUEST page, shown in Figure 17--34, is accessed by pushing LSK **4L** on the ATC REQUEST page (see Figure 17--30). This page can also be accessed by pushing the MCDU **[NEXT PAGE]** key from the ATC OFFSET REQUEST page or the MCDU **[PREV PAGE]** key from the ATC ALT REQUEST page.

The ATC ROUTE REQUEST page is used to create requests for direct to clearances, full routes, departure, approach, and arrival procedures and transitions, and heading and ground track clearances.

Fields **1L**, **3L**, **5L**, **1R**, **2R**, and **3R** are nonoperational while the request downlink message is in the SENDing state.

ATC ROUTE REQUEST Page

Figure 17--34

- **DIRECTTO (1L)** A valid position identifier is defined as a fix name, navaid, airport, latitude/longitude, or a place bearing distance. If the associated fix is a waypoint in the active route, then the active route waypoint is selected for inclusion in the corresponding downlink message element. If the position entry is not included in the active route, or a PBD and the associated fix is not a waypoint in the active route, and the entered fix name, navaid or fix portion of the PBD has duplicates in the Nav database, then the SELECT DESIRED WPT page is displayed (see Figure 4--28).

  This field can be deleted, which deselects the selected downlink message element.

- **REQUEST <RTE 1 (3L)** Selecting REQUEST RTE 1 inserts the downlink request message element **REQUEST ROUTE CLEARANCE** containing the flight plan data from RTE 1. If RTE 1 has a pending modification, then provisional RTE 1 is selected. This field is blank if RTE 2 is selected.
  This field can be deleted, which deselects the REQUEST ROUTE CLEARANCE downlink message element.

- **REQUEST DEP/ARR (5L)** If the aircraft is on the ground and a departure procedure or departure procedure and transition have been selected on the DEPARTURES page, then that selected departure or departure procedure and transition are displayed with a prompt.

  If the aircraft is in the air and an approach or arrival procedure or an approach or arrival procedure and transition have been selected on the ARRIVALS page, then that selected arrival or approach procedure or procedure and transition is displayed with a prompt.

  If the aircraft is in the air and both an approach and arrival procedure have been selected, then the selected arrival procedure or arrival procedure and transition is displayed with a prompt.

  Selecting the default or entering a procedure or a procedure and transition selects the message element requesting the selected or entered procedure or procedure and transition.

  This field can be deleted, which deselects the REQUEST PROCEDURE downlink message element.

  If no selections are made on the DEP/ARR page, or if an approach procedure has been selected on the ARRIVALS page and the procedure name is more than six characters (where the fifth character is a space), dashes are displayed.

D **<REQUEST (6L)** Selecting REQUEST displays the ATC REQUEST page (see Figure 17--30).

D **HEADING(1R)** A valid heading value is entered in the formatXXX, where XXX ranges from 000--360, inclusive. Entry into this field inserts the message text **REQUEST HEADING** [degrees] in the request downlink message.

This field can be deleted, which deselects the REQUEST HEADING [degrees] downlink message element.

D **GROUNDTRACK(1R)** A valid ground track value is entered in the format XXX, where XXX ranges from 000--360, inclusive. Entry into this field inserts the message text **REQUEST GROUND TRACK** [degrees] in the request downlink message.

This field can be deleted, which deselects the REQUEST GROUND TRACK [degrees] downlink message element.

D **REQUEST <RTE 2 (3L)** Selecting REQUEST RTE 2 inserts the downlink request message element **REQUEST ROUTE CLEARANCE** containing the flight plan data from RTE 2. If RTE 2 has a pending modification, then provisional RTE 2 is selected. This field is blank if RTE 1 is selected.

D **VERIFY> (6R)** Selecting VERIFY displays the VERIFY REQUEST page, shown in Figure 17--36, containing all of the selected request downlink elements.

Negotiation Requests

Negotiation request downlink messages can be created using the ATC INDEX page (see Figure 17--20) and the WHEN CAN WE EXPECT page, shown in Figure 17--35.

Message Text	How To Create Message
WHEN CAN WE EXPECT ON ROUTE	1. Display the WHEN CAN WE EXPECTpage. 2. Push LSK 4R. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

WHEN CAN WE EXPECT CLIMB TO [altitude]	1. Display the WHEN CAN WE EXPECTpage. 2. Enter a valid altitude into field 2L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

Negotiation Request Downlink Messages Table 17--5 (cont)

Message Text	How To Create Message
N CAN WE CT CRUISE B TO [altitude]	1. Display the WHEN CAN WE EXPECTpage. 2. Enter a valid altitude into field 1L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
N CAN WE CT DESCENT ltitude]	1. Display the WHEN CAN WE EXPECTpage. 2. Enter a valid altitude into field 3L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
N CAN WE CT HIGHER UDE	1. Display the WHEN CAN WE EXPECTpage. 2. Push LSK 2R. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

Negotiation Request Downlink Messages Table 17--5 (cont)

Message Text	How To Create Message

N CAN WE CT LOWER UDE	1. Display the WHEN CAN WE EXPECTpage. 2. Push LSK 3R. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.
N CAN WE CT [speed]	1. Display the WHEN CAN WE EXPECTpage. 2. Enter a valid speed into field 4L. 3. Push the VERIFY prompt. 4. Push the SEND prompt on the VERIFYREQUEST page.

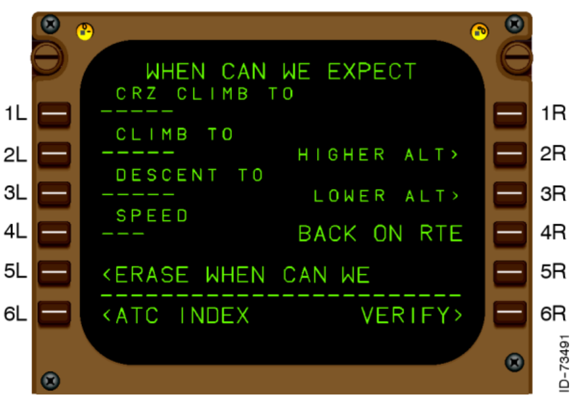
Negotiation Request Downlink Messages Table 17--5

WHEN CAN WE EXPECT

The WHEN CAN WE EXPECT page, shown in Figure 17--35, is accessed by pushing LSK **2R**, WHEN CAN WE, on the ATC INDEX page (see Figure 17--20). This page can also be accessed by selecting WHEN CAN WE (**6L**, REQUEST/WHEN CAN WE/INDEX) on the VERIFY REQUEST page, shown in Figure 17--36.

The WHEN CAN WE EXPECT page is used to create negotiation request downlink messages.

Fields **1L**, **2L**, **3L**, **4L**, **5L**, **2R**, **3R**, and **4R** are nonoperational while the request downlink message is in the SENDing state.



WHEN CAN WE REQUEST Page
Figure 17--35

D **CRZ CLIMBTO (1L)** This field is blank if a value has been entered into fields **2L** or **3L**, or if **2R** or **3R** has been selected. Entries can be made into this field when dashes or data are displayed. Valid entry into this field inserts the message text **WHEN CAN WE EXPECT CRUISE CLIMB TO** [altitude] in the downlink message.

The valid entry range for an altitude value in termsof feetis 0through 25,000 feet, inclusive. The valid entry range for an altitude value in terms of English flight level is FL030 through the maximum certified altitude, inclusive. The valid entry range for an altitude value in terms of meters is 0 through 16,000 meters, inclusive and followed by **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.

This field can be deleted, which deselects the WHEN CAN WE EXPECT CRUISE CLIMB TO [altitude] downlink message element.

D **CLIMB TO (2L)** This field is blank if a value has been entered into fields **1L** or **3L**, or if **2R** or **3R** has been selected. Entries can be made into this field when dashes or data are displayed. Valid entry into this field inserts the message text **WHEN CAN WE EXPECT CLIMB TO** [altitude] in the downlink message.

The valid entry range for an altitude value in termsof feetis 0through 25,000 feet, inclusive. The valid entry range for an altitude value in terms of English flight level is FL030 through the maximum certified altitude, inclusive. The valid entry range for an altitude value in terms of meters is 0 through 16,000 meters, inclusive and followed by **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.

This field can be deleted, which deselects the WHEN CAN WE EXPECT CLIMB TO [altitude] downlink message element.

D **DESCENT TO (3L)** This field is blank if a value has been entered into fields **1L** or **2L**, or if **2R** or **3R** has been selected. Entries can be made into this field when dashes or data are displayed. Valid entry into this field inserts the message text **WHEN CAN WE EXPECT DESCENT TO** [altitude] in the downlink message.

The valid entry range for an altitude value in termsof feetis 0through 25,000 feet, inclusive. The valid entry range for an altitude value in terms of English flight level is FL030 through the maximum certified altitude, inclusive. The valid entry range for an altitude value in terms of meters is 0 through 16,000 meters, inclusive and followed by **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.

This field can be deleted, which deselects the WHEN CAN WE EXPECT DESCENT TO [altitude] downlink message element.

D **SPEED (4L)** Entry into this field inserts the message text **WHEN CAN WE EXPECT** [speed] in the downlink message.

A valid IAS speed value is entered in the format of three numerals, ranging from 100 through 380, inclusive. IAS speed values are rounded to the nearest 10kts.

A valid MACH value is entered in the format of one to three digits, preceded by a decimal point, .XXX, ranging from .61--.91, inclusive. MACH values are rounded to the nearest .01 MACH.

This field can be deleted, which deselects the WHEN CAN WE EXPECT [speed] downlink message element.

D **<ERASE WHEN CAN WE (5L) ERASE WHEN CAN WE** is displayed only when entries have been made in fields **1L** through **4L** on this page or **2R** through **4R** are selected. Selecting ERASE WHEN CAN WE erases any previously entered or selected items on this page.

D **<ATCINDEX(6L)** Selecting ATC INDEX displays the ATC INDEX page (see Figure 17--20).

D **HIGHER ALT> (2R)** This field is blank if a value has been entered into fields **1L** through **3L** or if **3R** has been selected. Selecting HIGHER ALT includes the message text **WHENCAN WEEXPECT HIGHER ALTITUDE** in the downlink message.

This field can be deleted, which deselects the WHEN CAN WE EXPECT HIGHER ALTITUDE downlink message element.

D **LOWER ALT> (3R)** This field is blank if a value has been entered into fields **1L** through **3L** or if **2R** has been selected. Selecting LOWER ALT includes the message text **WHEN CAN WE EXPECT LOWER ALTITUDE** in the downlink message.

This field can be deleted, which deselects the WHEN CAN WE EXPECT LOWER ALTITUDE downlink message element.

D **BACK ON RTE> (4R)** Selecting BACK ON RTE includes the message text **WHEN CAN WE EXPECT BACK ON ROUTE** in the downlink message.

This field can be deleted, which deselects the WHEN CAN WE EXPECT BACK ON ROUTE downlink message element.

D **VERIFY> (6R)** Selecting VERIFY displays the VERIFY REQUEST page, shown in Figure 17--36, containing all of the selected request downlink elements.

VERIFY REQUEST

The VERIFY REQUEST page, shown in Figure 17--36, can be accessed by selecting **VERIFY** on the ATC REQUEST page, or the ATC ALT REQUEST, ATC SPEED REQUEST, ATC OFFSET REQUEST, ATC ROUTE REQUEST, or WHEN CAN WE EXPECT pages. The VERIFY REQUEST page can also be accessed from the ATC INDEX page by selecting **VOICE** or the CLEARANCE prompt.

The VERIFY REQUEST page displays the request in clearance language, gives the capability to review the downlink before it is sent, and gives the capability to include free text in the downlink message.

The VERIFY REQUEST page is used to review the message elements selected for a request or when can we expect downlink message before sending the message to ATC. This page is also used to SEND the downlink message to ATC.

VERIFY REQUEST Page

Figure 17--36

D **MESSAGE TEXT** The message text that has been selected for inclusion in the downlink message is displayed starting in line 1.

If this page is accessed by selecting VERIFY on the WHEN CAN WE EXPECT page, then only those message elements associated with the WHEN CAN WE EXPECT query are displayed.

If this page is accessed by selecting VERIFY on the ATC REQUEST, ATC ALT REQUEST, ATC SPEED REQUEST, ATC OFFSET REQUEST, or ATC ROUTE REQUEST page, then only those message elements associated with requests formulated by these pages are displayed.

If this page is accessed by selecting VOICE on the ATC INDEX page, then only the message element associated with the voice contact request is displayed.

If this page is accessed by selecting CLEARANCE on the ATC INDEX page, then only the message element associated with the clearance request is displayed.

- **FREE TEXT** Free text requests can also be created. If message text has been selected for inclusion in the downlink message, there is at least one line of free text available. If no other message text has been selected for inclusion in the downlink request message, lines 1 through 4 are available for free text entry. Free text is entered into the scratchpad and then line selected into the available free text fields. Any text entered in a free text field is selected for inclusion with the downlink request.

- **REQUEST/WHEN CAN WE/ATC INDEX (6L)**

  Selecting REQUEST redisplays the ATC REQUEST page.

  Selecting WHEN CAN WE redisplays the WHEN CAN WE EXPECT page.

  Selecting ATC INDEX redisplays the ATC INDEX page.

- **SEND> (5R) SEND** is displayed on the last page of the VERIFY REQUEST pages. Selecting SEND sends the downlink request message to ATC.

  Upon receiving acknowledgement from the network that the request message has been received, the MCDU page display changes from the VERIFY REQUEST page to the XXXXz ATC REQUEST page.

  The datalink status of NO COMM, VOICE, FAIL, or NO ATC COMM is displayed in this field as described in the Datalink Status section, Datalink Status Definitions Table 17--11, at the end of this section.

XXXXz ATC REQUEST

The XXXXz ATC REQUEST page, shown in Figure 17--37, is accessed from the ATC LOG page by selecting the right LSK that is adjacent to the corresponding request message. The XXXXz ATC REQUEST page can also be accessed by selecting REQUEST on an XXXXz ATC UPLINK page that corresponds to the downlink message. The XXXXz ATC REQUEST page is accessed when an acknowledgement is received from the network while the VERIFY REQUEST page is displayed or the network acknowledgement timer expires for the request downlink while the VERIFY REQUEST page is displayed.

The XXXXz ATC REQUEST page displays the transmitted request in clearance language.

XXXXz ATC REQUEST Page Figure 17--37

D **PAGE TITLE** The title of the page displays the time the request downlink message was sent from the FMC.

D **<UPLINK (1L) UPLINK** is displayed on page 1/1 if an uplink message has been received (and is contained in thelog) inresponse to the WHEN CAN WE EXPECT or REQUEST downlink message that is currently displayed. Selecting UPLINK displays the corresponding XXXXz ATC UPLINK page.

D **MESSAGE TEXT** The request downlink message text is displayed starting in line 2 on the first page. If more than one page is necessary to display the request downlink message text, **CONTINUED** is displayed in line 6.

D **RESPONSE** When an uplink response to the message displayed on this page has been received, the time the uplink was received is indicated in the RESPONSE XXXXz line following the end of the request downlink message.

D **<PRINT (6L) PRINT** is displayed on the last request page only. Selecting PRINT prints the displayed request message in its entirety. If **PRINT** is not displayed, see Printer Status, Table 17--12, at the end of this section.

D **STATUS (1R)** LSK**1R** displays the current status of the request downlink. This status is identical to the status displayed on the ATC LOG page, shown in Figure 17--51. Refer to ATC Downlink Message Status Table 17--10.

D **<LOG (6R)** Selecting LOG displays the ATC LOG page 1, shown in Figure 17--51.

ATC REPORT DOWNLINK MESSAGES

The FMC formats reports in response to requests from an ATS facility for reports or confirmations. These reports can be accessed from the ATC REPORT page, shown in Figure 17--38, and are displayed for review or modification on the VERIFY REPORT page, shown in Figure 17--39. The FMC also permits generating POSITION REPORTS and FREE TEXT reports using the ATC INDEX page.

The ATC datalink function creates and manages a list of up to ten requested reports. ATC report list entries are not added to the list until the associated uplink message is non-pending. When there are ten requested reports in the list, any attempt to add a new report request to the list displays the **ATC REPORT LIST FULL** scratchpad message on the MCDU.

Table 17--6 gives directions for creating responses to requests for reports or confirmations.

Message Text	How To Create Response
CONFIRM ALTITUDE	PRESENT ALTITUDE [altitude] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMALTITUDE. The altitude value displayed in field 1L defaults to the current aircraft altitude. This value can be overwritten with a valid altitude entry. 3. If the MCP altitude is greater than 150 feetabove or below the current aircraft altitude, the CLIMBING TO [altitude] or DESCENDING TO [altitude] message element is also included. This value can be overwritten with a valid altitude entry. 4. If the report is correct, push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response

	ASSIGNED ALTITUDE [altitude] ASSIGNED BLOCK [altitude] TO [altitude] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMASSIGNED ALTITUDE. The altitude value displayed in field 1L defaults to the current MCP altitude, if it exists. This value can be overwritten with a valid altitude entry. If box prompts are displayed, entry is required to send the downlink. 3. If an altitude value is displayed in field 1L, thendashes are displayed in field 2L. Entering a valid altitude into field 2L creates the ASSIGNED BLOCK [altitude] TO [altitude] downlink message. 4. If the report is correct, push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
ROUTE	ASSIGNED ROUTE [route clearance] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMASSIGNED ROUTE. The route data that is chosen is the active route. If no route is active, a downlink report with this data cannot be generated. 3. If the FMC is currently active on an offsetroute, the DEVIATING [offset] OF ROUTE message is appended to the downlink message. Attempted entry over the offset value results in the INVALID ENTRY scratchpad message. 4. Push LSK 5R (SEND).

SPEED	ASSIGNED SPEED [speed] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMASSIGNED SPEED. 3. The speed value in field 1L defaults to thecurrent MACH or CAS value, if one exists. This value can be overwritten with a valid speed entry. If box prompts are displayed, entry is required to send the downlink. 4. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
ATIS	ATIS [ATIS code] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRM ATISCODE. A box prompt is displayed in field 1L. 3. Enter a valid ATIS code into LSK 1L. Thedownlink report cannot be sent before a valid ATIS code is entered. 4. Push LSK 5R (SEND).

.	ENSUING WAYPOINT [position] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to ENSUINGWAYPOINT. The displayed [position] value can be overwritten by a valid position entry. If no active route exists, field 1L displays blanks. 3. If the FMC is currently active on an offsetroute, the DEVIATING [offset] OF ROUTE message is appended to the downlink message. Attempted entry over the offset value results in the INVALID ENTRY scratchpad message. 4. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
RACK	PRESENT GROUND TRACK [degrees] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMGROUND TRACK. The [degrees] value defaults to the master FMC computed ground track. This value can be overwritten by a valid degrees entry. If box prompts are displayed, entry is required to send the downlink. 3. Push LSK 5R (SEND).
	PRESENT HEADING [degrees] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMHEADING. The [degrees] value defaults to the master FMC computed heading. This value can be overwritten by a valid degrees entry. If box prompts are displayed, entry is required to send the downlink. 3. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
NEXT -	NEXT WAYPOINT [position] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMNEXT WAYPOINT. The displayed [position] value can be overwritten by a valid position entry. If no active route exists, field 1L displays blanks. 3. If the FMC is currently active on an offsetroute, the DEVIATING [offset] OF ROUTE message is appended to the downlink message. Attempted entry over the offset value results in the INVALID ENTRY scratchpad message. 4. Push LSK 5R (SEND).
NEXT ETA	NEXT WAYPOINT ETA [time] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMNEXT WAYPOINT ETA. The displayed [time] value can be overwritten by a valid time value. If box prompts are displayed in field 1L, entry is required to send the downlink report. 3. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response

	PRESENT POSITION [position] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMPOSITION. The displayed [position] value can be overwritten by a valid position entry. If box prompts are displayed, entry is required to send the downlink report. 3. Push LSK 5R (SEND).
	REPORTED WAYPOINT [position] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMREPORTED WAYPOINT. The displayed [position] value is the last sequenced waypoint, if it exists. The displayed [position] value can be overwritten by a valid position entry. If box prompts are displayed, entry is required to send the downlink report. 3. Push LSK 5R (SEND).
SPEED	PRESENT SPEED [speed] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMSPEED. The speed value in field 1L defaults to the current MACH or CAS value, if one exists. If box prompts are displayed, entry is required to send the downlink report. 3. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response

	SQUAWKING [beacon code] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMSQUAWK. Box prompts are displayed in field 1L. 3. Entering a valid beacon code is required inorder to send the downlink report. 4. Push LSK 5R (SEND).
TIME -	REPORTED WAYPOINT ATA [time] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to CONFIRMTIME OVER REPORTED WAYPOINT. Entering a time value in field 1L is permitted. If box prompts are displayed, entry is required in order to send the downlink report. 3. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
G FUEL BOARD	[remaining fuel] OF FUEL REMAINING AND [souls on board] SOULS ON BOARD 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REPORT REMAINING FUEL AND SOULS ON BOARD. Entering a remaining fuel value in field 1L is permitted. If box prompts are displayed, entry is required to send the downlink report. 3. Entering a souls on board value in field 2L isrequired. 4. Push LSK 5R (SEND).

ACK ON	BACK ON ROUTE 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REPORT BACKON ROUTE. 3. Push LSK 5R (SEND).

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
TO	AT [time] [distance] TO or FROM [position] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REPORT DISTANCE TO/FROM [position]. Entering a time value in field 1L is permitted. Entering a distance value in field 2L is permitted. If box prompts are displayed, entry is required in order to send the downlink report. 3. Push LSK 5R (SEND). Attempted entry into field 3L results in display of the INVALID ENTRY scratchpad message.

	LEAVING [position] This report is armable on either the XXXXz ATC UPLINK or the VERIFY REPORT page by selecting ARM. 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to the REPORTLEAVING [altitude] prompt. 3. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
VEL	LEVEL [altitude] This report is armable on either the XXXXz ATC UPLINK or the VERIFY REPORT page by selecting the ARM prompt. 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to the REPORTLEVEL [altitude] prompt. 3. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

	PASSING [position] This report is armable on either the XXXXz ATC UPLINK or VERIFY REPORT page by selecting ARM. 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REPORT PASSING [position]. 3. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
TO	REACHING BLOCK [altitude] TO [altitude] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REPORT REACHING BLOCK [altitude] TO [altitude]. 3. Push LSK 5R (SEND). Attempted entry into fields 1L and 2L results in display of the INVALID ENTRY scratchpad message.

	REACHING [altitude] This report is armable on either the XXXXz ATC UPLINK or the VERIFY REPORT page by selecting ARM. 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REPORT REACHING [altitude]. 3. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
REPORT	POSITION REPORT 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to REQUESTPOSITION REPORT. 3. Push LSK 6R (SEND) on the POS REPORTpage. If the FMS is currently active on an offset route, the DEVIATING [offset] OF ROUTE message is appended to the downlink message.

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
N PT	WE CAN ACCEPT [altitude] AT [time] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to WHEN CANYOU ACCEPT [altitude]. Box prompts are displayed in field 2L. 3. Enter a valid time into field 2L. 4. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.
	WE CANNOT ACCEPT [altitude] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to WHEN CANYOU ACCEPT [altitude]. 3. Push LSK 3L (CANNOT ACCEPT). 4. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response

ATC Report Downlink Messages Table 17--6 (cont)

Text	How To Create Response
N PT	WE CAN ACCEPT [offset] AT [time] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to WHEN CANYOU ACCEPT [offset]. Box prompts are displayed in field 2L. 3. Enter a valid time into field 2L. 4. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.
	WE CANNOT ACCEPT [offset] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to WHEN CANYOU ACCEPT [offset]. 3. Push LSK 3L (CANNOT ACCEPT). 4. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

N PT	WE CAN ACCEPT [speed] AT [time] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to WHEN CANYOU ACCEPT [speed]. Box prompts are displayed in field 2L. 3. Enter a valid time into field 2L. 4. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.
	WE CANNOT ACCEPT [speed] 1. Display the ATC REPORT page. 2. Push the left LSK adjacent to WHEN CANYOU ACCEPT [speed]. 3. Push LSK 3L (CANNOT ACCEPT) . 4. Push LSK 5R (SEND). Attempted entry into field 1L results in display of the INVALID ENTRY scratchpad message.

ATC Report Downlink Messages Table 17--6

Table 17--7 gives valid entry formats and ranges for report downlink messages.

Data	Entry Format and Range

ALTITUDE	Valid altitudes are entered in feet, English flight level, or meters. An altitude value in feet ranges from 0 through 25,000, inclusive. An altitude value in English flight level ranges from FL030 through maximum certified altitude, inclusive. An altitude in meters ranges from 0 through 16,000 inclusive, followed by **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.
ATIS CODE	Valid entries consist of a single character other than a space.
BEACON CODE	Valid entries consists of a four-digit integer, where each digit ranges from 0 through 7, inclusive.
DEGREES	Valid entries consists of a three-digit value ranging from 000 through 360, inclusive.
DISTANCE	Valid entry consists of a one to five-digit number ranging from 0 through 999.9, inclusive.
POSITION	Valid entry of a position consists of a fix name, navaid, or airport contained in the active route, or the fix portion of a PBD entry contained in the active route.
REMAINING FUEL	Valid entry of fuel remaining is in the format hh+mm, where hh ranges from 00 through 23, inclusive, and mm ranges from 00 through 59, inclusive.
REMAINING SOULS	Valid entry consists of a one to three-digit integer.

Valid Entry Formats and Ranges Table 17--7 (cont)

Data	Entry Format and Range

	Valid speed entry consists of a three-digit integer (CAS) between 100 and 380, inclusive, or a one to three-digit MACH value ranging from .61 through .91, inclusive. A CAS entry is rounded to the nearest 10 kts. A MACH entry is rounded to the nearest hundredth of MACH.
	Valid entries consist of four digits in the format hhmm, where hh ranges from 00 through 23, inclusive, and mm ranges from 00 through 59, inclusive.

Valid Entry Formats and Ranges Table 17--7

ATC REPORT

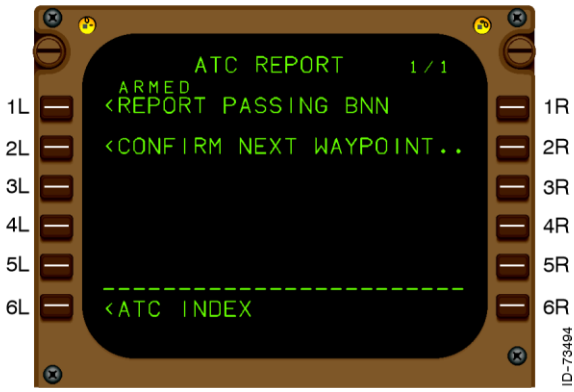
The ATC REPORT page, shown in Figure 17--38, can be accessed by selecting REPORT on the ATC INDEX page, the VERIFY REPORT page, or the XXXXz ATC UPLINK page.

The ATC REPORT page is also automatically displayed when the VERIFY REPORT page is displayed and the corresponding report list entry is deleted using the other MCDU.

The report list entry is added to the ATC REPORT page when a closure response is not required for the corresponding XXXXZ ATC UPLINK page or a positive closure response has been sent and received by the network.

When the network has received the ATC report downlink message or the network acknowledgement timer for the ATC report downlink message has expired, the corresponding report list entry is removed from the ATC report list. If the downlink was a POSITION REPORT downlink, the oldest position report list entry is removed.

The ATC REPORT page is used to create downlink report messages.



ATC REPORT Page

Figure 17--38

D

REPORTLISTENTRIES Up to ten report list entries are permitted on the ATC REPORT page. The oldest report list is displayed in line 1 of page 1, and each succeeding report list entry is displayed on the next available line.

If a report has been armed for automatic transmission, the text **ARMED** is displayed in the left header of the line corresponding to the armed report.

Selecting the left LSK adjacent to a report list entry displays the VERIFY REPORT page corresponding to the report list entry, unless the report list entry corresponds to a position report, in which case the POS REPORT page is displayed.

A report list entry can be deleted by selecting the appropriate left LSK when DELETE is displayed in the scratchpad.

D **<ATCINDEX(6L)** Selecting ATC INDEX displays the ATC INDEX page (see Figure 17--20).

VERIFY REPORT

The VERIFY REPORT page, shown in Figure 17--39, is accessed by selecting the corresponding ATC report list entry (left LSK) on the ATC REPORT page (see Figure 17--38). This page can also be accessed by selecting FREE TEXT on the ATC INDEX page (see Figure 17--20).

Deleting a report list entry while the corresponding VERIFY REPORT page is displayed on the other MCDU displays the ATC REPORT page.

The VERIFY REPORT page displays the report in clearance language, provides the capability to review and modify the data portion of the message before it is sent, and provides the capability to include freetext in the downlink.

VERIFY REPORT Page

Figure 17--39

D **REPORT DATA (1L, 2L, 3L, 4L)** The text of the report message is displayed beginning in line 1.

At least one line is always available for free text entry on the VERIFY REPORT page.

Deleting entered data returns the FMC default data or box prompts.

D **<CANNOT ACCEPT (3L) CANNOT ACCEPT** is displayed when the report downlink is in response to a WHEN CAN YOU ACCEPT request. Selecting CANNOT ACCEPT selects the corresponding **WE CANNOT ACCEPT** message element.

This field can be deleted, which deselects the corresponding WE CANNOT ACCEPT message element. **<REPORT/ATCINDEX(6L)** Selecting REPORT displays the ATC REPORT page 1 (see Figure 17--38).

D Selecting ATC INDEX displays the ATC INDEX page (see Figure 17--20.

D **ARM> (1R) ARM** is displayed if the displayed VERIFY REPORT page is for a report that can be armed. Selecting ARM on this page or on the corresponding XXXXZ ATC UPLINK page (see Figure 17--21), arms the report for transmission when the trigger condition is satisfied.

Four reports can be armed for automatic transmission: LEVEL [altitude], REACHING [altitude], LEAVING [altitude], and PASSING [position]. If the report is armed, the report is automatically transmitted when the associated trigger condition is satisfied.

An uplink message of **REPORT LEVEL** [altitude] can be armed and triggers the **LEVEL** [altitude] downlink message when the trigger condition is satisfied.

An uplink message of **REPORT REACHING** [altitude] can be armed and triggers the **REACHING** [altitude] downlink message when the trigger condition is satisfied.

An uplink message of **REPORT LEAVING** [altitude] can be armed and triggers the **LEAVING** [altitude] downlink message when the trigger condition is satisfied.

An uplink message of **REPORT PASSING** [position] can be armed and triggers the **PASSING** [position] downlink message when the trigger condition is satisfied.

If **ARM** has been selected, **ARMED** is indicated adjacent to the report request.

Deleting while **ARMED** is displayed disarms the trigger that would automatically initiate the downlink report.

D **SEND> (5R)** Selecting SEND sends the downlink report message to ATC.

The datalink status of NO COMM, VOICE, FAIL, or NO ATC COMM is displayed in this field as described in Datalink Status Definitions, Table 17--11, at the end of this section.

POS REPORT

The POS REPORT page, shown in Figure 17--40, can be accessed by selecting POS REPORT on the ATC INDEX page (see Figure 17--20). If an uplink message

containing a position report request has been received, the POS REPORT page can also be accessed by selecting REQUEST POSITION REPORT on the ATC REPORT page (see
Figure 17--38).

The POS REPORT page can also be accessed by pushing LSK **6L** on PROGRESS page 1/3 (see Figure 6--17), or LSK **1R** on the FMC COMM page (see Figure 12--2).

The POS REPORT page is used to create and send downlink position report messages. An ATC position report should be downlinked whenever an ATC reporting point is passed over (or passed abeam when an offset flight is in progress).

POS REPORT Page

Figure 17--40

- **POS(1L)** The POS (position) field displaysthe identifierfor thelast sequenced flight plan waypoint. Data cannot be entered into this field.
- **ATA (1C)** The ATA field displays the actual-time-of-arrival at the sequenced waypoint displayed in field **1L**. Data cannot be entered into this field.

NOTE: The **EST** and **NEXT** fields can have data entered to support position reports of compulsory reporting points. These changes DO NOT affect the flight of the aircraft and are for datalink reporting only.

EST (2L) The EST (estimate) field displays the active waypoint identifier for the for the ETA displayed in **3R**. For ATC position report downlinks, data can be entered in this field. A valid entry is an identifier for a waypoint that is contained in the active route.

D

- **NEXT (3L)** The NEXT field displays the identifier for the next waypoint after the active waypoint. For ATC position report downlinks, data can be entered in this field. A valid entry is an identifier for a waypoint that is contained in the active route.
- **TEMP (4L)** The TEMP field displays the current static air temperature from the ADC. Data cannot be entered into this field.
- **WIND (4C)** The WIND field displays the current wind bearing in degrees TRUE and speed information in knots.
- **COMPANY <SEND (6L)** Selecting while SEND is displayed initiates a position report downlink message to the company.

  NOTE: Data that is entered into fields **2L**, **3L**, **1R**, **2R**, **3R**, or **4R** does not affect the data transmitted in a position report downlink to the company.

- **ALT(1R)** The ALT (altitude) field displays the current altitude.Data cannot be entered into this field.
- **ETA (2R)** The ETA field displays the estimated-time-of-arrival at the waypoint displayed in field **2L**. For ATC position report downlinks, data can be entered in this field. A valid time value is entered in hhmm format, where hh ranges from 00--23, inclusive, and mm ranges from 00--59, inclusive.
- **DEST ETA (3R)** The DEST ETA field displays the estimated-time-of-arrival at the destination. For ATC position report downlinks, data can be entered in this field. A valid time value is entered in hhmm format, where hh ranges from 00--23, inclusive, and mm ranges from 00--59, inclusive.
- **SPD(4R)** The SPD field displays the current MACH speed targets as displayed on the speed tape, rounded to the nearest hundredths digit. For ATC position report downlinks, data can be entered in this field. A valid entry is one to two digits in the range from .61 to .91.
- **POS FUEL (5R)** The POS FUEL field displays the amount of fuel remaining on the aircraft as of the position displayed in field **1L**, as the lesser of either the calculated or totalizer values on PROGRESS page 2/3 (see Figure 6--18). The fuel weight is displayed in thousands of pounds or thousands of kilograms, basedon theoption code. Data cannot be entered into this field.

  NOTE: The fuel remaining is not included in an ATC position report downlink message.

- **ATC SEND> (6R)** Selecting SEND sends the response message to ATC. The datalink status of NO COMM, VOICE, FAIL, or NO ATC COMM is displayed in this field as described in Datalink Status Definitions Table 17--11.

If an offset is active when the POSITION REPORT message is transmitted, the message element **DEVIATING** [offset] **OF ROUTE** is included in the downlink message. If the MCP altitude is more than 150 feet above or below the current aircraft altitude, the **CLIMBING TO** [altitude] or **DESCENDING TO** [altitude] message is also included in the downlink message.

XXXXz ATC REPORT

The XXXXz ATC REPORT page, shown in Figure 17--41, is accessed from the ATC LOG page (shown in Figure 17--51) by selecting the right LSK adjacent to the desired report message.

XXXXz ATC REPORT Page

Figure 17--41

D **Page TITLE** The title of the page displays the time the report downlink message was sent from the FMC.

D **MESSAGE TEXT** The report downlink message text is displayed starting in line 2.

D **<PRINT (6L)** Selecting PRINT prints the displayed report message. If PRINT is not displayed, see Printer Status, Table 17--12, at the end of this section.

D **STATUS (1R)** The message status field in line **1R** displays the current status of the report downlink. This status is identical to the status displayed on the ATC LOG page, shown in Figure 17--51. Refer to the ATC Downlink Message Status Table 17--10.

D **LOG> (6R)** Selecting LOG displays the ATC LOG page 1, shown in Figure 17--51.

ATC Emergency Downlink Messages

The aircraft is considered to be in emergency mode from the time the FMC receives an acknowledgement from the network that it has received the emergency downlink message until the time the FMC receives an acknowledgement from the network that it has received the **CANCEL EMERGENCY** downlink message or until both ATC COMM connections are terminated.

Selecting an LSK or an entry into a field on the EMERGENCY REPORT page that would cause more than five downlink message elements to be selected displays the **MESSAGE LIMIT EXCEEDED** scratchpad message, and the message element is not selected.

Emergency report downlink messages can be created using the ATC EMERGENCY REPORT page, shown in Figure 17--42.

Table 17--8 gives directions for creating emergency report downlink messages.

Message Text	How To Create Message
MAYDAY MAYDAY MAYDAY	1. Display the EMERGENCY REPORTpage. 2. Push LSK 1L. 3. Push the SEND prompt.
DIVERTING TO [position]	1. Display the EMERGENCY REPORTpage. 2. Enter into LSK 2L a valid fix name,navaid, airport, lat/lon, or PBD that is not in the active or modified active route. 3. Push the VERIFY prompt. 4. Push the SEND prompt.

Emergency Report Downlink Messages Table 17--8 (cont)

Message Text	How To Create Message

Emergency Report Downlink Messages Table 17--8 (cont)

Message Text	How To Create Message
TING TO on] VIA [route nce]	1. Display the EMERGENCY REPORTpage. 2. Push LSK 2L to select the active destination airport, enter the active destination airport identifier, waypoint in the active route, modified active route destination airport identifier, or a waypoint in the modified active route into LSK 2L. 3. Push the VERIFY prompt. 4. Push the SEND prompt.
TTING [offset]	1. Display the EMERGENCY REPORTpage. 2. Enter an offset value into LSK 3L. 3. Push the VERIFY prompt. 4. Push the SEND prompt.
NDING TO de]	1. Display the EMERGENCY REPORTpage. 2. Push LSK 4L or enter an altitude intoLSK 4L. 3. Push the VERIFY prompt. 4. Push the SEND prompt.
	1. Display the EMERGENCY REPORTpage. 2. Push LSK 1L when the altitude displayed in field 4L is more than 150 feet below the current aircraft altitude. 3. Push the SEND prompt.

L GENCY	1. If an emergency exists, display theEMERGENCY REPORT page. 2. Push LSK 5L (CANCELEMERGENCYprompt). 3. Push the VERIFY prompt. 4. Push the SEND prompt.
AN PAN	1. Display the EMERGENCY REPORTpage. 2. Push LSK 1R. 3. Push the SEND prompt.
ning fuel] OF EMAINING emaining souls] ULS ON)	1. Display the EMERGENCY REPORTpage. 2. Enter the number of souls on board intoLSK 2R 3. Ensure that the remaining fuel valueexists in HH+MM format in field 3R. 4. Push the VERIFY prompt. 5. Push the SEND prompt.
ext]	1. Display the EMERGENCY REPORTpage. 2. Push the VERIFY prompt. 3. Enter free text on the VERIFY EMERGENCY page. 4. Push the SEND prompt.

Emergency Report Downlink Messages Table 17--8

EMERGENCY REPORT Page

The EMERGENCY REPORT page, shown in Figure 17--42, is accessed by selecting EMERGENCY on the ATC INDEX page or the VERIFY EMERGENCY page.

The EMERGENCY REPORT page gives the capability to create downlink messages to alert the ATS facility to an aircraft emergency and to the lateral and vertical maneuvers the flight crew intends to execute.

Fields **1L** through **5L** and fields **1R** through **3R** are nonoperational while the emergency report downlink is in the SENDing state.

ATC EMERGENCY REPORT Page

Figure 17--42

D **<MAYDAY (1L)** Selecting MAYDAY selects the **MAYDAY MAYDAY MAYDAY** message element and an abbreviated POSITION REPORT message element for inclusion in the emergency report downlink message and the display of the VERIFY EMERGENCY page. If the current aircraft altitude is more than 150 feet above the altitude displayed in field **4L** when MAYDAY is selected, then the **DESCENDING TO** [altitude] message element is selected as well.

This field can be deleted, which deselects the MAYDAY MAYDAY MAYDAY message element, the POSITION REPORT message element, and the DESCENDING TO message element. The MAYDAY field is blank if LSK **1R** has been selected.

D **DIVERT TO** The DIVERT TO field defaults to the identifier of the destination airport for the active route, if it exists.

Selecting the default destination airport, or entering the active or modified active destination airport, inserts the message text **DIVERTING TO** [destination airport] **VIA ROUTE CLEARANCE** in the emergency report downlink, where the active route or modified active route, as appropriate, is included in the route clearance.

Entering a fix name, navaid, airport, latitude/longitude, or PBD that is in the active or modified active route inserts the message text **DIVERTING TO** [position] **VIA ROUTE CLEARANCE** in the emergency report downlink, where the active route or modified active route, as appropriate, is included in the route clearance data.

Entering a fix name, navaid, airport, latitude/longitude, or PBD that is not in the active or modified active route selects the message element indicating the intention to proceed direct to the entered position and inserts the message text **DIVERTING TO** [position] with no route clearance data included. If the entry is non-unique in the NDB, then the SELECT DESIRED WPT page is displayed.

This field can be deleted, which deselects the DIVERTING TO [position] VIA ROUTE CLEARANCE downlink message element.

- **OFFSET (3L)** Valid offset entries consist of a direction followed by a distance in the format DNN, where D is either L or Rand NNranges from 1 through 99, inclusive. Entry into this field inserts the message text **OFFSETTING** [offset] in the emergency report downlink.

  This field can be deleted, which deselects the OFFSETTING [offset] downlink message element.

- **DESCEND TO (4L)** The DESCEND TO field defaults to the MCP window altitude. Selecting the default value or entering a valid altitude inserts the message text **DESCENDING TO** [altitude] in the emergency report downlink.

  If the displayed altitude is below the current aircraft altitude by more than 150 feet, then the message element is automatically selected when the emergency report message includes the MAYDAY MAYDAY MAYDAY message element.

  The valid entry range for an altitude value in termsof feetis 0through 25,000 feet, inclusive. The valid entry range for an altitude value in terms of English flight level is FL030 through the maximum certified altitude, inclusive. The valid entry range for an altitude value in terms of meters is 0 through 16,000 meters, inclusive and followed by an **M**. The altitude values entered in terms of feet or English flight level are displayed in standard altitude format.

  This field can be deleted, which deselects the DESCENDING TO [altitude] message element.

- **<ERASE EMERGENCY/CANCEL EMERGENCY (5L) ERASE EMERGENCY** is displayed when at least one item has been selected for inclusion in an emergency report downlink message. Selecting ERASE EMERGENCY erases the downlink message text that was selected for inclusion in the emergency report downlink message.

  CANCEL EMERGENCY is displayed when ATC COMM is in emergency mode and no message text has been selected for inclusion in an emergency report downlink message. Selecting CANCEL EMERGENCY inserts the message text **CANCEL EMERGENCY** in the emergency report downlink message.

  This field can be deleted when CANCEL EMERGENCY is selected. This deselects the CANCEL EMERGENCY message element.

D **<ATCINDEX(6L)** Selecting ATC INDEX displays the ATC INDEX page, shown in Figure 17--20.

D **PAN> (1R)** Selecting PAN inserts the message text **PAN PAN PAN** in the emergency report downlink message and display of the VERIFY EMERGENCY page.

This field can be deleted, which deselects the PAN PAN PAN downlink message element.

The PAN field is blank if **1L** has been selected.

D **SOB(2R)** Entering the number of souls on board the aircraft along with a fuel remaining value in field **3R** inserts the **HH+MM REMAINING FUEL AND XXX SOULS ON BOARD** downlink message element.

This field can be deleted, which deselects the HH+MM REMAINING FUEL AND XXX SOULS ON BOARD downlink message element.

D **FUEL REMAINING (3R)** The FUEL REMAINING field displays blanks until a valid SOB value has been entered into field **2R**. When an SOB value is displayed in field **2R**, the field defaults to the FMS computed fuel remaining, displayed in HH+MM (hours+minutes) format. The remaining fuel expressed in terms of thousands of pounds or thousands of kilograms is displayed to the left of the hours+minutes fuel remaining display.

If an SOB value is displayed in field **2R** and both the totalizer and FMS computed remaining fuel are invalid, box prompts are displayed until a valid entry is made. Valid entering fuel remaining is in the format HH+MM, where HH ranges from 00--23, inclusive, and MM ranges from 00--59, inclusive.
This field can be deleted, which deselects the HH+MM REMAINING FUEL AND XXX SOULS ON BOARD downlink message element.

D **VERIFY> (6R)** Selecting VERIFY displays the VERIFY RESPONSE page for the rejection response with all of the reasons from the REJECT DUE TO page displayed.

VERIFY EMERGENCY Page

The VERIFY EMERGENCY page, shown in Figure 17--43, is accessed by selecting MAYDAY, PAN, or VERIFY on the EMERGENCY REPORT page (see Figure 17--42).

The VERIFY EMERGENCY page gives the capability to review the downlink before it is sent and to include free text in the downlink.

VERIFY EMERGENCY Page

Figure 17--43

- **MESSAGE TEXT** The message text selected for inclusion in the downlink message is displayed starting in line 1.
- **FREE TEXT** At least one line is available to enter a free text message in the emergency report downlink message. Free text only emergency reports are permitted. If no other message text has been selected for inclusion in the downlink message, lines 1 through 4 are available for free text entry. Free text is entered into the scratchpad and then line selected into the available free text fields.
- **<EMERGENCY (6L)** Selecting EMERGENCY displays the EMERGENCY REPORT page (see Figure 17--42).
- **SEND> (5R)** SEND is displayed on the last page of the VERIFY EMERGENCY pages. Selecting SEND or RESEND sends the downlink request message to ATC.

  The datalink status of NO COMM, VOICE, FAIL, or NO ATC COMM is displayed in this field as described in Datalink Status Definitions, Table 17--11, at the end of this section.

XXXXz EMERGENCY Page

The XXXXz EMERGENCY page, shown in Figure 17--44, is accessed from the ATC LOG page (shown in Figure 17--51), by selecting the right LSK adjacent to the desired emergency report message.

XXXXz EMERGENCY Page

Figure 17--44

- **PAGETITLE** The title of the page displays the time the emergency report downlink message was sent from the FMC
- **MESSAGE TEXT** The emergency downlink message text is displayed starting in line 2 on the first page. If more than one page is necessary to display the emergency downlink message text, **CONTINUED** is displayed in the line 6 header.
- **<PRINT(6L)** PRINT is displayed on the last emergency page only. Selecting PRINT prints the displayed emergency message. If PRINT is not displayed, see Printer Status, Table 17--12, at the end of this section.
- **STATUS (1R)** LSK**1R** displays the current status of the emergency report downlink. This status is identical to the status displayed on the ATC LOG page (shown in Figure 17--51). Refer to the ATC Downlink Message Status Table 17--10.
- **<LOG (6R)** Selecting LOG displays the ATC LOG (shown in Figure 17--51).

Declaring an Emergency

Figures 17--45, 17--46, and 17--47 show how to create and send a basic emergency downlink message.

To access the EMERGENCY REPORT:

1. Push the MCDU **[ATC]** key to display the ATC LOG page (shown in Figure 17--51).
2. On the ATC LOG page, push LSK **6L**, **ATC INDEX**, to display the ATC INDEX page (see Figure 17--20).

3. On the ATC INDEX page, push LSK **1L**, **EMERGENCY**, to display the EMERGENCY REPORT page, shown in Figure 17--45.

ATC EMERGENCY REPORT Page
Figure 17--45

4. Selecting MAYDAY (LSK **1L**), shown in Figure 17--45, displays the VERIFY EMERGENCY page, with the **MAYDAY MAYDAY MAYDAY** message element displayed in line 1, shown in Figure 17--46.

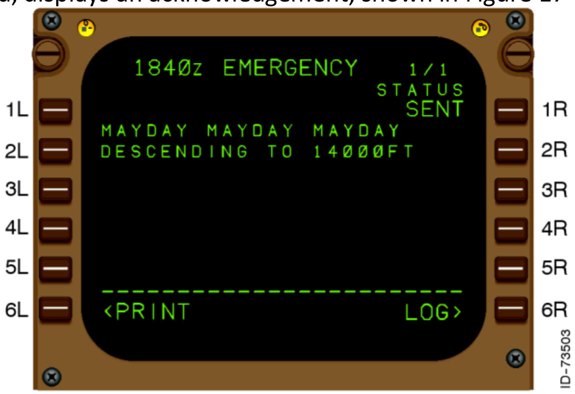
VERIFY EMERGENCY Page – Mayday Selected
Figure 17--46

If the current aircraft altitude is more than 150 feet higher than the current MCP altitude, the **DESCENDING TO** [altitude] message element is included in the emergency report downlink message.

An abbreviated position report is transmitted with any emergency report downlink message that includes **MAYDAY MAYDAY MAYDAY**. This position report specifies current altitude, current time, current speed, and current position.

Free text can be entered into the scratchpad and then line selected to any field containing a free text entry prompt. The entered text is appended to the emergency report when **SEND** is selected.

5. Pushing **5R** (**SEND**) transmits the emergency report downlink message and, when received, displays an acknowledgement, shown in Figure 17--47.



XXXXz EMERGENCY Page – Acknowledgement Received

Figure 17--47

Canceling an Emergency

Figures 17--48, 17--49, and 17--50 show canceling an ATC emergency.

1. Access the EMERGENCY REPORT page by pushing and holdingthe MCDU **[ATC]** key (when an ATC datalink connection exists) until the ATC EMERGENCY page, shown in Figure 17--48, is displayed.

ATC EMERGENCY Page

Figure 17--48

2. Push LSK **5L**, **CANCEL EMERGENCY**.

3. Push LSK **6R**, **VERIFY**, to display the VERIFY EMERGENCY page, shown in Figure 17--49.

VERIFY EMERGENCY Page – Cancel Selected

Figure 17--49

4. Select **SEND** (LSK **5R**) to transmit the cancel emergency downlink message and to display an acknowledgement when it is received, as shown in Figure 17--50.

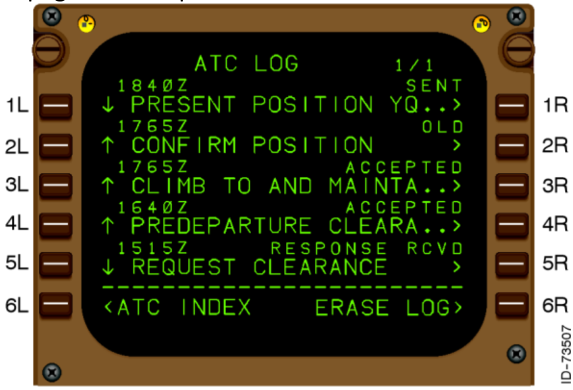
XXXXz EMERGENCY Page – Acknowledgement Received

Figure 17--50

ATC LOG

The ATC LOG page, shown in Figure 17--51, is accessed by pushing the MCDU **[ATC]** mode key when more than one new uplink message exists or when no new uplinks exist but more than one pending uplink exists. This page can also be accessed by selecting LOG on the ATC INDEX, XXXXZ ATC REPORT, XXXXZ ATC REQUEST, XXXXZ ATC UPLINK, or XXXXZ EMERGENCY pages.

The ATC LOG page lists all uplinks and downlinks stored in the ATC LOG.



ATC LOG Page

Figure 17--51

D **Log Entries** The ATC log entries are displayed in chronological order, based on time receipt of the uplink or time of transmission of the downlink. The newest message is displayed in line 1 on page 1 and each successive log entry is displayed in the next available data line.

For each ATC log entry, the following data is given:

The time the uplink was received or the downlink was transmitted is displayed in the left header line of each log entry.

An up arrow indicates the message is an uplink message. A down arrow indicates the message is a downlink message.

The first 19--21 characters of message text are displayed in the data line of the log entry.

The message status is displayed in the right header line of each log entry.

Selecting a right LSK adjacent to a log entry accesses the corresponding uplink or downlink page.

Selecting a left LSK adjacent to a log entry while DELETE is displayed in the scratchpad deletes that log entry from the ATC LOG.

D **<ATCINDEX(6L)** Selecting ATC INDEX displays the ATC INDEX page, shown in Figure 17--20.

D **ERASE LOG/CONFIRM (6R)** When no closed entries exist in the ATC LOG or while the ATC LOG is being printed, this field is blank. Erasing the ATC LOG is a two-step process.

The **ERASELOG** prompt is displayed initially. Selecting ERASE LOG arms for deletion all non-pending messages in the ATC log and displays **CONFIRM**.

Selecting CONFIRM deletes all non-pending messages.

NOTE: Leaving the ATC LOG page without selecting CONFIRM returns the initial display.

ATC LOG Status

The ATC uplink message status is listed in Table 17--9. The status text is displayed on the ATC LOG and XXXXZ ATC UPLINK pages.

Status Text	Status Description
ABORTED	Message was pending when both ATC COMM connections were terminated or a transfer of COMM was performed.
ACCEPTED	Message has been reviewed, the message requires a response, a positive closure response was sent, and the FMC has received acknowledgement from the network that it has received the closure response.
NEW	Message has not been reviewed.
OLD	Message has been reviewed and does not require a response.
OPEN	Message has been reviewed, the message requires a response, and either a closure response has not been sent (STANDBY is not a closure response) or the closure response was sent but the FMC has not received acknowledgement from the network that the response message was received.

REJECTED	Message has been reviewed, the message requires a response, a negative closure response was sent, and the FMC has received acknowledgement from the network that it has received the closure response.

Uplink Message Status Table 17--9

The ATC downlink message status is listed in Table 17--10. The status text is displayed on the ATC LOG, XXXXZ ATC REQUEST, XXXXZ ATC REPORT, and XXXXZ EMERGENCY pages.

Status Text	Status Description
ABORTED	The message was pending when both ATC COMM connections were terminated or when an ATC COMM transfer of control was performed.
DEFERRED	SEND has been selected, network acknowledgement has been received, the message requires a response, and a response of REQUEST DEFERRED was received.
OPEN	SEND has been selected, network acknowledgement has been received, the message requires a response, and either the response has not been received or the response was STANDBY.
RESPONSE RCVD	SEND has been selected, network acknowledgement has been received, the message requires a response, and a response other than STANDBY or REQUEST DEFERRED was received.
SENDING	SEND has been selected, the network acknowledgement has not been received, and the timer has not expired.
SENT	SEND has been selected, the network acknowledgement has been received, and the message does not require a response.

Downlink Message Status Table 17--10

ATC LOG Management

The ATC LOG contains memory to store logged messages, and the FMC automatically deletes old messages from the log when the log becomes full. When the portion of the ATC LOG that is dedicated to storing pending uplink messages becomes full, the FMC rejects any new uplink message. To avoid a log full condition, the crew should delete logged messages that are no longer needed.

The ATC LOG can retain 75 non-pending uplinks and downlinks (five of which can contain two ROUTE CLEARANCE variables in the message), 10 pending (status of NEW or OPEN) uplinks (two of which can contain two ROUTE CLEARANCE variables in the message). On receipt of the tenth pending uplink message, the **RESPOND TO ATC UPLINKS** scratchpad message is displayed. Within these ten messages, only two occurrences of a message containing the ROUTE CLEARANCE message text are permitted. Subsequent uplink messages containing the ROUTE CLEARANCE message text are considered invalid ATC uplinks.

CREW INTERACTION LOG MANAGEMENT

The ATC LOG can be managed by deleting individual messages or all non-pending messages contained in the log.

Individual messages are deleted from the log using the ATC LOG page. While on the ATC LOG page, pushing the left LSK with **DELETE** in the scratchpad deletes the corresponding log entry from the ATC LOG.

The non-pending messages can be deleted from the log using the ATC LOG page. Selecting **ERASE LOG** and then selecting **CONFIRM** deletes all non-pending messages from the ATC LOG.

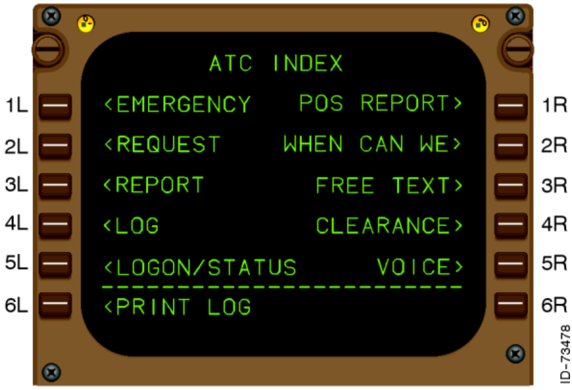
AUTOMATIC LOG MANAGEMENT

If the status of an uplink message changes from pending to non-pending (that is, the pilot responds to the uplink message) or a downlink message is transmitted and insufficient log storage capacity exists to store the message, the oldest message is deleted from the log.

Ten minutes after flight completion the ATC log is cleared.

ATC LOG Printing

The ATC LOG contents can be printed by selecting LSK **6L**, **PRINT LOG**, on the ATC INDEX page, shown in Figure 17--52. The ATC LOG is cleared ten minutes after flight completion.



ATC INDEX Page Print LOG

Figure 17--52

MISCELLANEOUS Datalink Status

The datalink status is indicated in field **5R** on the last page of the VERIFY RESPONSE, VERIFY REQUEST, VERIFY REPORT, and VERIFY EMERGENCY pages. Table 17--11 defines the different display conditions.

Display	Definition
BLANKS	The datalink status is READY, a connection with ATC COMM is established, and no elements have been selected.
NO ATC COMM	The datalink status is READY, but a connection with ATC COMM is not established.
NO COMM VOICE FAIL	The datalink status is NO COMM, VOICE, or FAIL, respectively.
SEND>	The datalink status is READY, a connection with ATC COMM is established, at least one element has been selected, and SEND has not been selected.
SENDING	The datalink status is READY, a connection with ATC COMM is established, SEND was selected, and the network acknowledgement timer has not expired.

Datalink Status Definitions Table 17--11

Printer Status

PRINT LOG is displayed in line **6L** on the ATC INDEX page, shown in Figure 17--52. **PRINT** is displayed in line **6L** on the last page of the XXXXZ ATC UPLINK, XXXXZ ATC REQUEST, XXXXZ ATC REPORT, and XXXXZ EMERGENCY pages. Table 17--12 defines possibleprinter conditions.

Display	Cause
PRINT BUSY	The printer is busy printing data and the print was not initiated on the page that is displayed.

PRINT FAIL	The FMC has determined the printer has failed. This could be an indication that the printer is out of paper or the printer door is open.
<PRINT LOG or <PRINT	The printer is ready to print data.
<PRINT ERROR	<PRINT LOG or <PRINT has been selected and an error has occurred while attempting to print data.
PRINTING	The printer is busy printing data and PRINT was selected on the page that is displayed.

Printer Status
Table 17--12

Acronyms and Abbreviations

Abbreviations used in this manual are defined as follows:

TERMS	DEFINITION
ACCEL HT	acceleration height
ACT	active
ADC	air data computer
ADF	automatic direction finder
ADIRS	air data/inertial reference system
ADIRU	air data inertial reference unit
ADS	automatic dependent surveillance
AFDC	autopilot flight director computer
AFDS	autopilot flight director system
AFN	ATS facilities notification
AGL	above ground level
ALT	altitude
ALTN	alternate
AMI	airline modifiable information
ANP	actual navigation performance
ANR	automatic navigation realignment
AOC	airline operational communication
APPR	approach
ARPT	airport
ARR	arrival
ATA	actual--time--of--arrival
ATC	air traffic control
ATC DL	air traffic control data link
ATS	air traffic services
AVAIL	available
BARO	barometer
BFO	beat frequency oscillator
BM	back course marker
BRG	bearing
BRT	bright
C	Celsius
CAA	Civil Aviation Administration

TERMS	DEFINITION
CALC	calculated
CAS	calibrated airspeed
CDU	control display unit
CF	final approach course fix
CG	center of gravity
CI	cost index
CLB	climb
CLR	clear
CNS/ATM	communication navigation surveillance /air traffic management
CO DATA	company data
CO ROUTE	company route
COMM	communication
CON	continuous
COND	condition
CP	control panel
CPDLC	controller pilot data link communication
CRS	course
CRT	cathode ray tube
CRZ	cruise
CRZ ALT	cruise altitude
CRZ CG	cruise center of gravity
CTL PNL	control panel
CTR	center
D	down
D/D	drift down
DADC	digital air data computer
DECR	decrease
DEL	delete
DEP	departure
DES	descent
DES DIR	descend direct
DEST	destination
DIR	direct
	direction
DIS	distance

TERMS	DEFINITION
DIST	distance
DME	distance measuring equipment
DSP	display select panel
DSPY	display
DTG	distance to go
DTK	desired track
E	east
E/D	end of descent
EADI	electronic attitude director indicator
ECON	economy
EFC	expect further clearance
EFIS	electronic flight instrument system
EGT	exhaust gas temperature
EICAS	engine indication and crew alerting system
ENG	engine
EO	engine out
EPR	engine pressure rate
EST	estimate
ETA	estimated time of arrival
EXEC	execution
F	Fahrenheit
FA	VFR approach fix
FAA	Federal Aviation Administration
FAF	final approach fix
FCC	flight control computer
FD	flight director
FDO	flight data output
FF	fuel flow final
	approach fix
FIR	flight information region
FIX INFO	fix information
FL	flight level
FLCH	flight level change
FLT	flight
FMC	flight management computer
FMCS	flight management computer system

TERMS	DEFINITION
FMF	flight management function
FMS	flight management system
FPA	flight path angle
FPV	flight path vector
FQIS	fuel quantity indicating system
FREQ	frequency
GA	go--around
GPS	global positioning system
GR WT	gross weight
GS	groundspeed
H	headwind
HDG	heading
HFOM	horizontal figure of merit
HPA	Hectopascals
HT	height
IAF	initial approach fix
ICAO	International Civil Aviation Organization
IDENT	identification
IF	initial approach fix
ILS	instrument landing system
IM	inner marker
IN	inches
INBD	inbound
INCR	increase
INFO	information
INIT	initialization
INTC	intercept
IRMP	inertial reference mode panel
IRS	inertial reference system
IRU	inertial reference unit
ISB	intersystem bus
JAR	joint airworthiness requirement

TERMS	DEFINITION
kgs	kilograms
kts	knots
L	left left crosswind
LAT/LON	latitude/longitude
LAT/LONG	latitude/longitude
lbs	pounds
LFDS	large format display system
LGTH	length
LIM	limit limited
LNAV	lateral navigation
LOC	localizer
LRC	long--range cruise
LRU	line replaceable unit
LSK	line select key
LVL	level
M	magnetic
MA	missed approach point
MAG VAR	magnetic variation
MAN THR	manual thrust
MAP	missed approach procedure
MAX	maximum
MCDU	multifunction control display unit
MCP	mode control panel
MD	minimum descent altitude
MINS	minimums
MLS	microwave landing system
MM	middle marker
MMR	multi--mode receiver
MNVR	maneuver
MOD	modified modification
MSG	message
MTRS	meters

TERMS	DEFINITION
N	north
N1	compressor speed
NAV RAD	navigation radio
NAV, nav	navigation
NAVAID	navaid navigation aid
ND	navigation display
NDB	nondirectional beacon
NM	nautical miles
NO	number
OAT	outside air temperature
OFST	offset
OM	outer marker
OPC	operational program control operational program configuration
OPT	optimum
P/N	part number
P/P	present/position
PB/D	place bearing/distance
PB/PB	place bearing/place bearing
PBD	place bearing distance
PDB	performance database
PERF	performance
PERF INIT	performance initialization
PFD	primary flight display
PLN	plan
POS	position
POS INIT	position initialization
POS REF	position reference
PPOS	present position
PRED	predicted
PREV	previous
PRI	primary
PROG	progress

TERMS	DEFINITION
PTS	points
QTY	quantity
QUAD	quadrant
R	right right crosswind
R/C	rate of climb
RAD	radio
RECMD	recommended
REF	reference
RESTR	restriction
RNP	required navigation performance
RTA	required time of arrival
RTE	route
RW	runway threshold
RWY	runway
RWY EXT	runway extension
RX	runway extension fix
S	step south
S/C	step climb
SAT	static air temperature
SATCOM	satellite communications
SEL	selected
SG	symbol generator
SID	standard instrument departure
SOB	souls on board
SP	scratchpad
SPD	speed
STA	stations
STAR	standard terminal arrival route
STD	standard
T	tailwind true
T/C	top of climb

TERMS	DEFINITION
T/D	top of descent
TACAN	tactical air navigation
TAI	thermal anti--ice
TAS	true air speed
TD	touchdown point inboard of threshold
TERR	terrain
TFC	traffic
TGT	target
THR	thrust
THR HOLD	throttle hold
TK	track
TMC	thrust management computer
TMF	thrust management function
TO	takeoff
TOGA	takeoff/go around
TOGW	takeoff gross weight
TOT	total
TRANS	transition
TRANS LVL	transition level
U	up
UIR	upper (flight) information region
UTC	coordinated universal time
V	vertical
VSPD	vertical speed
V/B	vertical bearing
V/S	vertical speed
VFR	visual flight rules flap retract speed
VHF	very high frequency
VNAV	vertical navigation
VOR	VHF omnidirectional radio range
VORTAC	combined VOR and TACAN stations
VREF	reference speed
VTK	vertical track

TERMS	**DEFINITION**
W	wind west
WPT	waypoint
WT	weight
WXR	weather
X/WIND	crosswind
XTK	cross track
ZFW	zero fuel weight

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