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4MCU
FMC UPDATE 10.0 through 10.4
and
LCDCDU UPDATE 1 and 2

FMCS GUIDE

THIS PRODUCT ORIENTATION AND TRAINING DOCUMENT IS NOT A FLIGHT MANUAL. Refer to the Boeing Airplane Company 737-300/400/500 operations manual or the 737-600/700/800 operations manual for operating instructions for the Flight Management Computer System.

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FLIGHT MANAGEMENT COMPUTER SYSTEM GUIDE

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GLOSSARY OF ABBREVIATIONS

AA	Autoflight Annunciator
ACARS	Aircraft Communications Addressing and Reporting System
ADC	Air Data Computer
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADL	Airborne Data Loader
AFDS	Autopilot Flight Director System
AGL	Above Ground Level
ALT	Altitude
ATA	Actual Time of Arrival
A/T	Autothrottle
ATC	Air Traffic Control
BIT	Built-In Test
BITE	Built-In Test Equipment
BRG	Bearing
CAS	Calibrated Airspeed
CDS	Common Display System
CDU	Control/Display Unit
CLB	Climb
CLR	Clear
COMM	Communication
CRT	Cathode Ray Tube
CRZ	Cruise
DEL	Delete
DES	Descent
DEST	Destination
DEV	Deviation
DME	Distance Measuring Equipment
DNTK	Downtrack
DTG	Distance To Go
EADI	Electronic Attitude Director Indicator
E/D	End of Descent
ECON	Economy
EFC	Expected Further Clearance
EFCP	Electronic Flight Instrument Control Panel

GLOSSARY OF ABBREVIATIONS

EFIS	Electronic Flight Instrument System
EHSI	Electronic Horizontal Situation Indicator
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
FCC	Flight Control Computer (AFDS)
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMCS	Flight Management Computer System
FMS	Flight Management System
FPA	Flight Path Angle
FPTOS	First Principles Takeoff Speeds
FO	Fly-Over
FPM	Feet Per Minute
GA	Go Around
GMT	Greenwich Mean Time
GS	Ground Speed or ILS Ground Slope
GP	Glide Path
GPS	Global Positioning System (IRS)
HDG	Heading
HSI	Horizontal Situation Indicator
IAF	Initial Approach Fix
ILS	Instrument Landing System
INIT	Initialization
INS	Inertial Reference System
INTC	Intercept
ISA	International Standard Atmosphere
ISDU	Inertial Sensor Display Unit (IRS)
KTS	Knots
LAT	Latitude, Lateral
LBS	Pounds
LCD	Liquid Crystal Display
LNAV	Lateral Navigation or Guidance
LOC	ILS Localizer
LON	Longitude
LONG	Longitude
LSK	Line Select Key
MAC	Mean Aerodynamic Cord

GLOSSARY OF ABBREVIATIONS

MACH	MACH number
MASI	Mach/Airspeed Indicator
MCDU	Multi-Purpose Control/Display Unit
MCP	Mode Control Panel
MSG	Message
N_1	Low-pressure Compressor Turbine Rotor Speed
NDB	Navigation Data Base
NFO	Non-Fly-Over
NM	Nautical Miles
OAT	Outside Air Temperature
OPT	Optional
PBD	Point Bearing Distance
POS	Position
PPOS	Present Position
PROG	Progress
QNE	Standard Day Sea Level Altimeter Setting
QNH	Destination Altimeter Setting (corrected to Sea Level)
QRH	Quick Reference Handbook
QUAD	Quadrant
REF	Reference
REST	Restriction
RTA	Required Time of Arrival
RTE	Route
SEC	Second
SID	Standard Instrument Departure
SK–R	Skid Resistant
STAR	Standard Terminal Arrival Route
T/C	Top of Climb
T/D	Top of Descent
TAI	Thermal Anti-Icing
TAT	Total Air Temperature
TMA	Thrust Mode Annunciator
TRANS	Transition
V/B	Vertical Bearing
V/S	Vertical Speed
VERT	Vertical

VNAV	Vertical Navigation or Guidance
VOR	VHF Omnidirectional Range
WPT	Waypoint
XTE	Cross Track Error
Z	Zulu (as in Zulu or GMT time)

PREFACE

Several updated versions of the FMCS are currently in service. This guide covers the Update 10.0 through 10.3 versions of the FMC flight software, and Update 2 of the LCDCDU flight software.

Part 1 of this guide contains an introduction to the FMCS with some explanations of the concepts behind what it does.

Part 2 explains normal operation and is broken down into system prompts and usage hints, a quick reference checklist, and a detailed operation description. The quick reference checklist is arranged by phase of flight over a U.S. route from Chicago to St. Louis. The detailed operation description covers the CDU display, keys, and annunciators, and explains system operation for a normal flight with AFDS and A/T integration. The detailed operation description is arranged by phase of flight over an example route between London, England, and Frankfurt, Germany.

Part 3 covers non-normal operation such as power loss, sensor failure, and alert and advisory messages.

Part 4 consists of a detailed system description and a design summary. The sequence of operations for a typical flight profile is shown on pages 4–43 through 4–54.

Update 10.0 combines the operational characteristics of Update 7.4 and Update 8.4 series into a single software program, with the Update 8 features now enabled and disabled via the Software Options codes. The SW OPTIONS page has been added to provide a convenient display of the enabled options available to the aircrew. In addition to the Update 7.4 and Update 8.4 operational characteristics, Update 10.0 includes the following features:

- Enhanced File System Download recording capability.
- VNAV operation with failed Fuel Summation Unit.
- SELECT DESIRED WPT page expanded to two pages (12 waypoints maximum). Waypoints are listed in order of increasing distance from the reference point, and include the navaid type in the header.
- Make use of the OVERFLY flag in the NDB to determine if a forced overfly of the runway waypoint is required prior to sequencing to lateral guidance to the missed approach.
- The ENG OUT mode is advisory only and can no longer be executed, eliminating the loss of VNAV guidance.
- Added 150 Knots Speed Constraint Restriction to all Final Approach Fix points for all approach types.
- The default Software Options Code is changed to enable the manual RNP option.

- The software is compatible with the year 2000 roll–over of the NDB.
- Improved navigation accuracy.
  - Improved ANP calculations.
  - Replaced spherical earth model with WGS–84 Earth Model.
  - Improved NDB latitude and longitude resolution to 6 feet.
  - Updated magnetic variation model (program pin dependent on 737–300/400/500 aircraft).
- Incorporates fixed radius turn legs to allow any geographic point to be used as the turn center for enroute legs, legs in SIDs and STARs, and approaches.
- Incorporates DME Arc radius turn legs to allow any DME to be used as the turn center for legs in SIDs, STARs, and approaches.
- RNP values for each leg are stored in the NDB.
- Selection of an approach when multiple approaches of the same type exist.
- Allows LNAV control at takeoff (Dual FMS only).

  NOTE: Requires Autopilot modification in 737–300/400/500 aircraft.
- Allows VNAV controlled descents below the MCP altitude.

  NOTE: Requires Autopilot modification in 737–300/400/500 aircraft.
- Added RTA AT/BEFORE and AT/AFTER windows.
- Changed the prompt CAPTURE to DESCEND NOW.
- Reduction in the number of DISCOs.
  - Provide more tolerant bypasses.
  - Allow for path overshoot in adverse wind conditions.
  - Climb speed restrictions as low as 100 kts may be manually entered.
- The following features were added to support the 737–600/700/800 (new generation) aircraft:
  - Loadable Performance Data Base.
  - First Principles Takeoff Speeds (FPTOS) calculations are incorporated.
  - VREF–based flaps maneuver speeds replaced fixed GW increment flap block speeds.

The primary purpose for Update 10.1 is to add operational capability for the 737–800 aircraft. In addition, this update provides increased compatibility between 737–300/400/500/700/800 aircraft with the Boeing 10–62225–003 (SI Model 2907A4) FMC installed.

Update 10.1 includes the following features:

- THRUST BUMP FEATURE – The Thrust Bump feature has been added to allow the air crew to select (bump to) the next higher engine thrust rating when more output is desired for operational reasons. The Thrust Bump selection is made on the N1 LIMITS page. This feature is initially available for use on all 737–800 models. The Thrust Bump selection may also be uploaded via the ACARS function.
- TAKEOFF REF AND N1 LIMITS PAGE CHANGES – The TAKEOFF REF and N1 LIMITS pages have been modified to accommodate the Thrust Bump feature and to provide commonality among Boeing aircraft. Several display items have been re–located between the TAKEOFF REF pages and the N1 LIMITS page. In addition, the following new features and changes have been included:
  - WET SKID RESISTANT Runway FEATURE – The WET SKID Resistant (SK–R) runway condition feature has been added to the TAKEOFF REF page. SK–R is selectable just as the WET and DRY conditions and is functional for all 737–600/700/800 aircraft.
  - The TAKEOFF SPEEDS DELETED message is displayed independently of the ACARS function – When the active departure runway, runway wind, runway slope, runway heading, takeoff flaps, runway condition, takeoff outside air temperature, selected temperature, or engine thrust rating are changed, the TAKEOFF SPEEDS DELETE message will be displayed in the scratch pad for all 737–600/700/800 aircraft.
  - DEFAULT FLAPS VALUE – A default flaps value is no longer required. If a valid flaps default value does not exist, the TAKEOFF REF page will display BOX prompts to alert the air crew that flaps data is a required entry.

  NOTE: Refer to the TAKEOFF REF and N1 LIMITS pages for the changes listed above.
- DEFAULT NAVIGATION DATA BASE SIZE – The default size of the Navigation Data Base (NDB) has been changed from 256K bytes to 1M bytes.
- USE OF NDB RUNWAY OVERFLY INDICATOR – An OVERFLY indicator is contained in the NDB to adjust MISSED APPROACH sequencing. If the OVERFLY indicator is set, then

the runway must be flown over prior to sequencing the missed approach. If the OVERFLY indicator in the NDB is not set, lateral guidance will be provided direct to the missed approach once active.

The primary purpose for Update 10.2 is to add operational capability for the 737–600 aircraft. In addition, this update provides increased compatibility between 737–300/400/500/600/700/800 aircraft with the Boeing 10–62225–003 (SI Model 2907A4) FMC installed.

UPDATE 10.2 is replaced by UPDATE 10.2A:

UPDATE 10.2A includes the following features:

- Addition of Color to FMS Displays for the LCD CDU – The FMS software has been updated to make use of color displays when the new Smiths Industries Model 2584A series LCD CDU is installed. The new LCD CDU is being introduced as standard production fit for 737 deliveries and is a form/fit/function replacement for the existing SI Model 2577 series Cathode Ray Tube based CDUs. Section 2 provides a description of the color guidelines currently incorporated.
- High Altitude Maneuvering – A bank angle limiting algorithm has been added for high altitude and high weight conditions. Prior to this update, bank angle limit was set at 25 degrees for most turns, even at high altitudes. With this update, the turns will be limited to the computed bank angle which can be achieved for the current weight and altitude condition of the airplane. The new computed limit may vary between 5 and 25 degrees based on weight and altitude.
- Updated Altitude Mismatch logic for Approaches and Transitions – When encountering two differing altitudes at the same point for the last segment of an approach transition and the first leg of the final approach, this change ensures use of the more conservative of the two altitudes encountered in the Navigation Data Base. This also applies to STARs and STARs transitions.
- Inhibit Runway Offset Updates when GPS Data is Valid – This change inhibits the operator from performing manual runway offset updates when the FMS is receiving valid GPS data.
- Add LDA, SDF, and IGS Approaches – The use of Localizer Directional Aid (LDA), Simplified Directional Facility (SDF), and Instrument Guidance System (IGS) approach types have been added to the software.
- Add Quadrant/Radial and Altitude on the Hold Page – This change supports addition of a Quad/Radial field to the HOLD page to allow direct entry of holding quadrant and radial in ATC

clearance language. The radial is the reciprocal of the inbound course, except for the special case of a hold placed on a place bearing distance (PBD) waypoint from a VHF Navaid. An altitude field is also added to the HOLD page which is a duplicate of the altitude field opposite the “hold at” waypoint on the LEGS page.

NOTE: Refer to the HOLD page.

- Navigation Data Base Size – The default size of the Navigation Data Base size has been increased from 1 Mega–words to 2.5 Mega–words.

UPDATE 10.3 includes the following features:

- RTE Page – the following changes and added capability have been made to the ROUTE pages:
  - RTE Page 1 now contains airport data and prompts only. Procedure data, Airways data, and Enroute data are now displayed beginning on page 2.
  - Flight Plan data is increased from 100 waypoints to 150 waypoints.
  - The Supplemental Waypoint database is increased from 20 waypoints to 40 waypoints.
- Engine–Out Advisory – the ENG OUT page is now a reference oriented page. Selection of the ENG OUT prompt on the CLIMB or CRUISE page will not cause a change to the vertical path construction.
- Polar Navigation – navigation capability added to allow flights over the earth’s poles:
  - Added GPS Track data to the PROGRESS page to provide aircraft heading data at the poles if both IRUs fail.
  - GPS position is used as the center point on the EFIS POS SHIFT display if both IRU’s fail.
- Multiple Localizer Approaches To Same Runway – the Navigation Database may now contain more than one localizer approach to the same runway, and are crew selectable at the CDU.
- PROGRESS Page – changes to the PROGRESS page are as follows:
  - GPS Track data added for polar navigation.
  - Lateral Steering Crosstrack data is expanded to include a one hundredths digit position. The Lateral Steering Crosstrack now references the lateral path instead of the straight leg segments.
- LEGS page – The Vertical Angle display data is expanded to include a one hundredths digit position.

- VNAV Disengagement During RNP Operations – during RNP operations, VNAV may now remain engaged within the allowable 2 X RNP Crosstrack Deviation window, or when LNAV is engaged.
- Takeoff To Climb Transition – the FMS now automatically transitions to the CLB page when on the TAKEOFF REF page and weight goes off wheels
- Block Operating Speeds (737–300, 400, 500) – programmed block operating speeds for these aircraft have been increased as follows:

FLAPS POSITION	<117 KLBS	117 KLBS TO 138.5 KLBS	>138.5 KLBS
5 Deg	180 KTS	190 KTS	200 KTS
10 Deg	170 KTS	180 KTS	190 KTS

- Alternate Navigation – GPS Alternate Navigation capability added which allows the FMC to transmit up to 60 waypoints of the current active flight plan to the CDU for alternate navigation operation (function is currently unique to the Boeing business Jet using the SI LCD CDU with Update 2 Operational Program loaded).
- Message Change – The IRS NAV ONLY message is eliminated and the UNABLE REQD NAV PERF–RNP message is displayed when ANP exceeds RNP for the specified delay time.
- FMC RNP Approach Operations – VNAV will no longer be disconnected at the GSI point unless the FCC G/S Mode is armed.
- CLB N1 Display – CLB N1 Limit values are now displayed as well as Derate CLB N1 values. On previous updates, only the Derate CLB N1 values were displayed.
- EFIS Mapping During Missed approach – the runway symbol on the EFIS map remains displayed during a missed approach operation, even after it has been sequenced.
- PERF INIT Page – Planned Fuel values are now retained during the test on the ECS packs.
- Pilot Defined Company Routes Option – enables the user to:
  - Load the Flight Plan Navigation Database (FPND) from disk using the Flightstar software, and retrieve any routes and waypoints stored in the FPND while onboard the aircraft.
  - Save up to 10 routes in a Supplemental database using the CDU onboard the aircraft. The saved routes are retained by the FMS until manually deleted. Terminal procedures,

airways, and user defined waypoints can be saved. Certain restrictions apply; manually entered HOLDs and Altitude/ Speed Restrictions are not retained.

  - Allows the Enroute portion of a flight plan displayed on the CDU to be reversed. This creates a MOD flight plan with the Origin and Destination points reversed along with any airways and enroute waypoints. Certain restrictions apply; terminal procedures, manually entered HOLDs, and Altitude/ Speed Restrictions are not retained.

- Geometric Path Descent Option – allows flying along a computed gradient path from one altitude restriction to the next during DESCENT. The NDB Gradient may be maintained via edits on the CDU, including inserting waypoints and deleting altitude restrictions on the gradient legs.
- Quiet Climb Option – supports noise abatement procedures during Climb phase by providing a quiet climb cutback N1 target between a pre–programmed thrust reduction altitude and the restoration altitude. The default thrust reduction and restoration altitudes are provided in the Model/Engine Database (MEDB) and may be changed through the Loadable Performance Defaults Database (LDDB), manually changed at the CDU, or uplinked via ACARS.
- ENG–OUT SIDs Option – provides a display of the Standard Instrument Departures (SIDs) from the NDB that are tailored for Engine Out (EO) operation. EO SIDs may be selected from the DEPARTURES page. In some instances, the EO SIDs are automatically inserted into the flight plan when certain criteria are met.

UPDATE 10.4 includes the following features:

- Model 2907C1 & 2907A4 FMC Compatibility – Update 10.4 software is compatible with the existing Model 2907A4 FMC and the new Model 2907C1 FMC.
- Increases Nav Data Base Size to 3.5 Mega–Words – software re–allocates memory usage to expand the Navigation Data Base Size to 3.5 Mega–Words for either the Model 2907A4 FMC or new Model 2907C1 FMC Computer. The previous size supported by Update 10.3 was 2.5 Mega–Words.
- Increase Model/Engine Data Base Size to 1.5 Mega–Words – software re–allocates memory usage to expand the Model/Engine Data Base Size to 1.5 Mega–Words for either the Model 2907A4 FMC or new Model 2907C1 FMC Computer. The previous size supported by Update 10.3 was 1.0 Mega–Word.
- Display VNAV Disconnect Message if A/P Disconnects during Approach – the VNAV DISCONNECT message is displayed if

VNAV is valid, VNAV becomes disengaged, and the underspeed flag is set on approach.

- When XTK exceeds RNP for idle descent legs and computed gradient legs, VNAV will remain in Path Mode versus switching to Speed Mode.
- When exiting speed intervention during descent, VNAV will switch to Path Mode if it is not already the active mode.
- Resize Hold Pattern for Descent Altitudes – includes the ability to size and resize a hold pattern with a default leg time based upon the altitude of the hold fix waypoint. The hold pattern leg time is based on the predicted altitude of the hold fix waypoint until the hold entry waypoint becomes the go–to waypoint and lateral guidance is doing a final update on the reference path buffer. At this point the resize logic will use system altitude to resize leg time. Climbing or descending through the altitude threshold of 14,200 feet will be the trigger for determining whether the leg time will be 1.0 min. or 1.5 min.

  NOTE: The leg length will only be resized if leg time or leg length have not been manually entered on the hold page.

- HOLD EXIT Prompt Improvements – includes the ability to display a HOLD EXIT prompt after an in–hold edit has been executed. The execution of an IN–HOLD edit results in the creation of a new hold. The title, ACT HOLD is displayed on the HOLD page, even though the aircraft has not yet entered the new hold pattern. The HOLD EXIT prompt is made available before the new hold is actually entered. Subsequent selection of the HOLD EXIT prompt will delete the new hold.
- ALT CONSTRAINT XXXXX Message Improvements – when a Flight Plan edit results in an altitude conflict with the existing CRZ ALT, (other than manually entering an altitude constraint), the FMC CRZ ALT will automatically be changed to the highest constraint in the MOD plan. The resulting MOD plan will be executable, with a new alerting level message, CRZ ALT CHANGED TO XXXXX, displayed. Previously, the modified flight plan could not be executed until the flight crew manually resolved the altitude conflict.
- New Outputs for CDS VSD and HUD (737–600, 700, 800) – several new parameters have been added to the EFIS output buses for usage by the Common Display System (CDS) Vertical Situation Display (VSD), Head–Up Display (HUD) System, and the Enhanced Ground Proximity Warning System (EGPWS). The new parameters are primarily related to Approach, Missed Approach, and Runway information.

- Clock Source Switching Improvements – clock selection when the GPS with Integrity option is set to OFF and the Captain's or First Officer's clock is being used is modified. Automatic switching between the Captain's and First Officer's clocks once the source is selected at FMC power–up is prevented. When the selected source fails after power–up, the FMC will retain the last valid clock value received from the selected source, and increment system time based on this value using it's own internal clock.
- Navigation Improvements – Adds GPS reasonableness checks in addition to using GPS fault indications to further protect the navigation solution from unreasonable input data. In addition, IRS reasonableness checks have been improved in dual FMC installations such that both FMCs are better able to identify and reject a badly drifting IRS.
- Add FLAP/SPD Entry on APPROACH REF Page – A new FLAP/SPD field has been added to the APPROACH REF page at location 4R. Selection of a VREF speed in fields 1R–3R will result in the selection appearing in the 4R field. Location of approach frequency and identifier along with front course information is now located in the 4L field, and the GA N1 field has been removed.
- Use of Small Font on RTE HOLD Page for Default Entries – Default entries for QUAD/RADIAL, INBD CRS/DIR, and LEG TIME are now displayed in small font. Large font is used to denote when the entry is either pilot entered or extracted from the navigation database.
- Added RW/APP TUNE DISAGREE and RW/APP CRS ERROR messages for conditions where a tuned frequency or MCP selected course does not match the FMC flight plan data.
- Output Vref Data on the General Output Bus – Vref data is now being displayed.
- Various problems detected and reported in U10.3 were corrected in U10.4 including the intermittent blanking of the map on the EFIS display
- The following changes/additions to software options have been made:
    - Automatic Engine–Out SID Selection – When the Engine–Out Standard Instrument Departure (SID) software option is enabled, the FMC will look for an engine–out indication from the Autothrottle. When the FMC receives this indication while the aircraft is in climb and flaps are still extended, the FMC will automatically create a mod flight plan containing the engine–out SID for the departure runway. The automatic selection is only available on the 737–600/700/800 air-

craft with certain Autothrottles installed. All others must manually select the Engine–Out SID from the DEPARTURES page on the CDU.

- Display Missed Approach on Map in Cyan – When this software option is enabled, the missed approach path is displayed in cyan rather than magenta on the map display prior to being active.
- Inhibit Gross Weight entry on PERF INIT page – When this software option is enabled, the entry or deletion of Gross Weight (GW) in field 1L of the PERF INIT page is inhibited and the operator must enter Zero Fuel Weight (ZFW). When the option is disabled, there is no change from present operation in that the operator has the choice of entering either GW or ZFW.
- Disable Takeoff Derates – When this software option is enabled, Takeoff Derate selections on the N1 LIMIT page are blanked and disabled.

The UPDATE 2 LCD MCDU (refered to as the ALT NAV MCDU) ands two functional capabilities beond performing as a normal MCDU.

- Provides an alternate navigation solution (requires the on–side GPS to be operational) regardless of the status of the FMC(s). The Alternate Navigation Function added to this guide requires an ALT NAV LCD MCDU and the ALT NAV function enabled. The ALT NAV function requires an ARINC 755 MMR to supply inputs to the ALT NAV MCDU.
- Provides capability to up–load and display Graphical Weather Data Maps. This function requires an ACARS/Weathermap system be installed and the graphics capability to be enabled.
- The Update 2 LCD CDU requires it's own Software Options disk to enable these capabilities.

PART 1–1

INTRODUCTION

WHY AN FMS?

The Flight Management System (FMS) combines previous aircraft avionics capabilities with digital computers to ease your workload and allow you to devote more time to safely managing the aircraft. The FMS provides information for continuous automatic navigation, guidance, and performance management.

Previously, you had to refer to maps, performance documents, charts, tables, or calculators for navigation and performance information. Much of this information is now stored in the Flight Management Computer (FMC) and is accessible to you by the pressing of a key (or keys) on the Control/Display Unit (CDU).

The FMC and the CDU make up the Flight Management Computer System (FMCS). The FMC stores, in its memory, data equivalent to Jeppesen air navigation charts (called the navigation data base or NDB) and an airplane performance manual (called the performance data base). You will use the CDU to communicate with the computer (using ATC language) to call up or retrieve navigation and performance data quickly and easily.

Not only does the FMCS provide fast and efficient data retrieval and calculations, but it can manage full-time flight-path (lateral, vertical, and speed) tracking, relieving you of menial tasks such as minor speed and heading adjustments that would otherwise consume a significant portion of your time.

WHAT CAN AN FMCS DO?

When you tell the FMCS where it is (origin), where it is going (destination), and by what route, the FMCS computes accurate present position and guides the aircraft from origin to destination. When you tell the FMCS the aircraft's initial weight and performance requirements, the FMCS computes the most economical speed and altitude to use in getting from the origin to the destination. Thrust limit values are continuously computed during the flight.

HOW DOES THE FMCS DO THIS?

As previously stated, you communicate with the FMCS through the CDU using ATC language.

The FMCS navigates by computing accurate present position and velocity from GP/IRS, VOR/DME, and LOC inputs.

The FMCS guides the aircraft laterally and vertically by providing steering commands to the autopilot flight director system (AFDS).

The FMCS maintains economical speeds and altitudes by providing speed commands and thrust targets and limits to the autopilot and autothrottle (A/T).

The FMCS provides you with a complete range of airplane navigation, guidance, flight planning, and performance data. This information is presented to you on the CDU, the Horizontal Situation Indicator (HSI), and the speed and thrust limit cursors on the Mach Airspeed Indicator (MASI) and N_1 indicators, respectively.

The EFIS and CDS options replace the HSIs and ADIs with multicolor displays of EHSI and EADI information and a MAP and a PLAN mode driven by the FMC showing a graphical presentation of the flight plan path, waypoints, and additional map data from the NDB.

A Multi–Purpose Control/Display Unit (MCDU) and Future Air Navigation Multi–Purpose Control Display Unit (FANS MCDU) variation of the standard CDU are also available. The MCDUs are capable of acting as the Control/Display Unit for any ARINC 739-compatible system as well as operating as a control display unit for the FMCS.

The addition of color enhances operation of the FMCS by providing the aircrew with color annunciations of key information displayed on specified pages.

The FMCS also provides the aircrew with commonality between the different 737 aircraft platforms.

PART 2

NORMAL OPERATION

SYSTEM PROMPTS – QUICK REFERENCE

This section provides quick reference material for use by one familiar with the FMCS. For detailed information, refer to Detailed Operation, which begins on page 2–81. Refer to the figure on page 2–94 for CDU key locations.

INITIALIZATION

When on the ground, the FMCS provides a logical progression of display pages for initializing the system. It does this by placing a prompt for the next logical page required at the bottom right position of the display (Line Select Key (LSK) 6R). Pressing the LSK next to the prompt will display the next required page for initialization entries. When initialization is complete, pressing LSK 6R adjacent to the TAKEOFF prompt will display the TAKEOFF REF page with the PRE–FLT STATUS line changing to PRE-FLT COMPLETE. The POS INIT prompt is displayed on the ground as a reminder that an IRS realignment is usually beneficial prior to every flight.

SCRATCH PAD – DATA MOVEMENTS

Crew data entries are keyboard alphanumerics which are entered into the display scratch pad (bottom line) using the keyboard and then line-selected to the appropriate data field using the appropriate LSK. Duplicating or moving existing data is accomplished by pressing the LSK adjacent to the data, which moves it to the scratch pad. Pressing the LSK adjacent to the desired location moves the data to that line. Entries in the scratch pad carry over to other pages when a new page is selected.

BOX PROMPTS

Whenever box prompts (□□□) appear on a display page, a data entry is required for that item.

DASH PROMPTS

Fields where data entries are allowed but are not essential for FMCS predictions, are indicated by dashes (– – –) or, in some cases, a default value which can be overwritten. Dash prompt entries enable the FMC to provide the most accurate computation and predictions.

INVALID ENTRY

If an entry is attempted into a field which does not allow that entry or if the entry is of the wrong format or out of range, an INVALID ENTRY message is displayed in the scratch pad.

SLASH KEY and SLASH RULE

The slash key (/) is used to separate data entered as pairs in the same field, such as airspeed and mach number (280/.720), wind direction and speed (104/100), or airspeed and altitude (250/10000), among others. Airspeed or mach number can be entered individually without using the slash key.

A single leading entry of other pairs may be followed by the slash if it alone is entered or re-entered, while the trailing entry of the pair may be preceded by the slash. If no slash is used with a single entry, it will be inserted into the field nearest the line select key; i.e., the first entry for a pair on the left side of the CDU and the second entry for a pair on the right side of the CDU.

If a color control display unit is installed, refer to the paragraphs on color displays on page 2–3.

DATA ACTIVATION (EXEC KEY)

The EXEC key is used to accept entries made to the flight plan, guidance mode, or the navigation data base. When data entries have been activated (by pressing the lighted EXEC key), the page status title ACT appears in front of the page title.

If the active data is being modified, the page status title MOD appears in front of the page title. MOD is displayed in reverse video highlighting. Until MOD is made active, the FMCS still uses the previous ACT data, even though it is not displayed. The MOD state will be accompanied by the EXEC key being lighted unless the MOD has created an impossible situation; e.g., an altitude constraint in the flight plan higher than cruise altitude.

If a color control display unit is installed, refer to the paragraphs on color displays on page 2–3.

ERASE

Whenever a MOD is made to active data, an ERASE prompt will appear. Pressing the ERASE LSK erases the modification and returns the display to the active page.

NEXT PAGE / PREV PAGE keys

When a display consists of multiple pages, the additional pages may be displayed by using the NEXT PAGE or PREV PAGE keys. Multiple page displays wrap around from first page to the last page and vice versa (for example from page 5/5 to page1/5).

ALTITUDE/FLIGHT LEVELS

Altitude or flight level is accepted by the system in various forms. An altitude entered with three digits or less is interpreted to be a flight level; for example, 300 will be interpreted and displayed as FL300. Entries of low altitudes (less than 1000 feet) may be made with leading zeros to avoid confusion with flight levels; for example, 0300 for 300 feet or 0030 for 30 feet. Generally, if the entry is at or above the transition altitude, it will be displayed as a flight level; otherwise, it will be displayed in feet. Three exceptions to this rule are:

- TRANS ALT — always displayed in feet.
- TRANS LVL — always displayed as a flight level.
- ELEV — always displayed in feet.

COLOR DISPLAYS

When the FMC is connected to a color control display unit and the Color Software Option is enabled, certain functions and data are annunciated using color in the displays. In the remainder of this guide, color is indicated in bold text on pages identified as Update 10.2A (U10.2A).

Displays are colorized according the following guidelines.

– The following are displayed in large font **shaded–white** text.
  - ABEAM PTS prompt when selected (until executed or cancelled).
  - ACARS prompts (other than ACCEPT/REJECT)when selected and until message is delivered to the ACARS MU or FMC is unable to deliver the down link to the ACARS MU (3 seconds minimum).
  - EXIT ARMED prompt after EXIT HOLD prompt is executed.
  - LT ENG OUT or RT ENG OUT prompt on the ENG OUT CLB page when selected (these prompts work as a toggle).
  - MOD when it appears in the page title.
  - Modification entries manually entered or from ACARS uplinks (including entries which are propagated onto pages other than the page entered on) until executed or cancelled.
  - Navigation position selected on the POS SHIFT page (until executed or cancelled).

– Prior to activation, RTE, RTE LEGS, RTE DATA, and HOLD page titles are displayed in large font **cyan**.

– The following are displayed in large font **magenta** when the route is active:
  - Active FMC waypoint on RTE, RTE LEGS, RTE DATA, and HOLD pages.

- Active FMC target altitude (RTE LEGS page) (font size rules apply).
- AT when displayed speed/altitude or altitude is the current FMC target speed/altitude or altitude unless the displayed E/D ALT or speed/altitude is the result of a subsequent restriction on CLB and DES pages.
- BEST SPEED when displayed speed is current FMC target speed.
- CRZ ALT when displayed value is the current FMC target value.
- E/D ALT when displayed altitude is active FMC target altitude.
- QUAD/RADIAL when the aircraft is active in the hold (font size rules apply).
- INBD CRS/DIR when the aircraft is active in the hold (font size rules apply).
- LEG TIME when the aircraft is active in the hold (font size rules apply).
- LEG DIST when the aircraft is active in the hold.
- RTA SPEED when displayed speed is current FMC target speed or or active speed restriction.
- RTA time when displayed (RTA Mode active).
- RTA WPT when it is the active waypoint.
- SPD REST when displayed speed is the current FMC target speed.

  NOTE: When CAS and MACH are displayed together, only the active measurement standard is displayed in magenta, i.e., in normal descent, the MACH value is displayed in magenta until the CAS/MACH transition point is reached, then the CAS value is displayed in magenta.

- TGT SPD when displayed speed is the current FMC target speed.

  NOTE: When CAS and MACH are displayed together, only the active measurement standard is displayed in magenta, i.e., in normal descent, the MACH value is displayed in magenta until the CAS/MACH transition point is reached, then the CAS value is displayed in magenta.

– The following are displayed in large font **green** text.

  - Actively tuned VOR, ILS, or DME data (frequency, station ID, and course) on NAV STATUS page, when the navaid is used in the navigation solution.
  - Active state (ON/OFF) of alternate navaids on the NAV OPTIONS page.
  - LANDING REF (QNH/QFE) toggle selected mode.
  - RW COND (DRY/WET SK–R) toggle selected mode(s).
  - TAKEOFF REF (QNH/QFE) toggle selected mode.

– Map pages are displayed in full color.

– All other data and headers not affected by specific colorization are displayed in white text.

MESSAGES

The system displays messages in the scratch pad which are worded to allow easy identification and corrective action if required. When a message is received, the MSG annunciator on the CDU lights. High priority messages also cause the FMC annunciator on the FMA to light. Any data displayed in the scratch pad has priority over messages. Messages are prioritized, with the highest priority message displayed first.

NOTE: DELETE is treated as a message.

Messages may be cleared by pressing the CLR key. Some messages will be cleared automatically when no longer appropriate.

Alerting and advisory messages are covered in detail in Non-Normal Operation, Part 3.

TYPICAL FLIGHT – QUICK REFERENCE

The following section contains a quick-reference checklist arranged by phase of flight over a U.S. route. A route from Chicago (KORD) to St. Louis (KSTL) is shown for all FMC displays. This section is intended to provide you with the basic information needed to use each of the CDU pages. The navigation and performance data shown on the following pages are intended only to provide a general description of system operation. These displays are typical, but not necessarily representative of any specific airline operator. Each page is tabbed to provide quick access to the needed information. If you find that not enough information is provided on these pages, turn to the corresponding page(s) in the DETAILED OPERATION section, which are referenced at the bottom of each page if applicable.

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Performance Initialization	PERF INIT	2–11
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Takeoff Reference (U10.1 and later version)	TAKEOFF REF	2–20.1
Departure Selection	DEPARTURES	2–21
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IDENT

<u>PAGE ACCESS</u> page 1

- Displayed automatically on power up
- INIT/REF INDEX page IDENT prompt (LSK 1L)
- Displayed automatically after a computer restart

```
        IDENT                 1/2
  MODEL              ENG RATING
 737-600                    22K
  NAV DATA               ACTIVE
MON1930501  APR07MAY04/99

            MAY05JUN01/99
  OP PROGRAM
 549849-006 (U10.2A)
                      SUPP DATA
                   APR 14/99

 <INDEX              POS INIT>
```

PRE U10.3

```
        IDENT                 1/3
  MODEL              ENG RATING
 737-600                    22K
  NAV DATA               ACTIVE
MON1930501  APR07MAY04/00

            MAY05JUN01/00
  OP PROGRAM
 549849-007 (U10.3)
                      SUPP DATA
                   APR 14/00

 <INDEX              POS INIT>
```

POST U10.3

No required entries

Current effective Nav Data Base date (LSK 3R) may be line selected to the active data base line (LSK 2R) <u>only</u> when on the ground. Doing so clears any previously selected flight plan entries.

Verify:

- Airplane model
- Active Nav Data Base selection
- FMC operational program number and
- Corresponding software update ID
- Engine thrust rating in pounds

For a more detailed discussion, see page 2–101.

PAGE ACCESS page 2 NEXT PAGE or PREV PAGE

```
        IDENT             2 / 2
  PERF DEFAULTS
DEFAULT03P
  SW OPTIONS
DEFAULT05O
  QRH T/O SPEEDS
DEFAULT01Q
  DATALINK CONFIG
DEFAULT02D
  MODEL/ENGINE DATA
BCG–005–0Z

<INDEX           POS INIT>
```

PRE U10.3

```
        IDENT             2 / 3
  PERF DEFAULTS
DEFAULT04P
  SW OPTIONS
DEFAULT05O
  QRH T/O SPEEDS
DEFAULT01Q
  DATALINK CONFIG
DEFAULT02D
  MODEL/ENGINE DATA
BCG–005–0Z

<INDEX           POS INIT>
```

POST U10.3

This page identifies the databases that have been loaded for the PERF DEFAULTS, SOFTWARE OPTIONS, QRH TAKEOFF SPEEDS, DATALINK CONFIG, and MODEL/ENGINE DATA options.

PAGE ACCESS page 3 NEXT PAGE or PREV PAGE

```
        IDENT             3 / 3
  FLIGHT PLAN NAV DATA
01FEB–13:00







<INDEX           POS INIT>
```

POST U10.3 (OPTION)

When the Pilot Defined Co–Route option is enabled, page 3 is available.

If a flight plan has been loaded into the Flight Plan Navigation Data Base, the date and time stamp is displayed, otherwise the header is blanked.

PAGE ACCESS page 1/3

- When on the ground and any IRS is in align mode INIT REF
- INIT/REF INDEX page POS prompt (LSK 2L)
- IDENT page POS INIT prompt (LSK 6R)
- TAKEOFF REF page POS INIT prompt (LSK 4L) (when POS INIT has not been accomplished)
- POS REF page 2/3 PREV PAGE
- POS SHIFT page 3/3 NEXT PAGE

```
        POS INIT       1/3
                   LAST POS
        N41°57.9 W087°54.3
 REF AIRPORT
KORD    N41°58.7 W087°54.2
 GATE
-----
                SET IRS POS
        □□□°□□.□ □□□□°□□.□
 GMT-MON/DY     SET IRS HDG
1357.2z 06/17         ---°
------------------------
<INDEX              ROUTE>
```

Box prompts: The IRS needs present position longitude and latitude.

- Enter present position via:
  - Keyboard entry
  - Line select LAST POS
  - Line select REF AIRPORT or GATE
  - Line select Transfer data from POS REF pages 2/3 into scratch pad, then press LSK 4R

NOTE: SET IRS POS and box prompts are displayed when either IRS is in align mode, while on the ground.

For a more detailed discussion, see page 2–103.

Dash prompts:

- The gate may be entered (if it is in the data base) to provide gate latitude and longitude.
- SET IRS HDG and dash prompts are displayed when either IRS is in the attitude mode. Dash prompts are used to enter or update magnetic heading for any IRS that has been placed in the attitude mode.

<u>PAGE ACCESS</u> page 1/2

- Press RTE key
- POS INIT page ROUTE prompt (LSK 6R)
- TAKEOFF REF page ROUTE prompt (LSK 4R)
- DEPARTURES page ROUTE prompt (LSK 6R)
- ARRIVALS page ROUTE prompt (LSK 6R)
- Selection of waypoint from SELECT DESIRED WPT page

When ALTN DEST option is selected

```
        RTE              1/2
 ORIGIN                 DEST
KORD                    KSTL
 CO ROUTE            FLT NO.
ORDSTL              --------
 RUNWAY
32L
 VIA                      TO
COMN4W                  VAIN

DIRECT                   RBS
------------------------
<ALTN DEST         ACTIVATE>
```

When ACARS option is selected

```
        RTE              1/2
 ORIGIN                 DEST
KORD                    KSTL
 CO ROUTE            FLT NO.
ORDSTL              --------
 RUNWAY             FLT PLAN
32L                 REQUEST>
 VIA                      TO
COMN4W                  VAIN

DIRECT                   RBS
------------------------
                   ACTIVATE>
```

<u>SELECT A COMPANY ROUTE:</u>

- Enter company route identifier on CO ROUTE line
- Select ACTIVATE (LSK 6R)
- Press EXEC Key

For a more detailed discussion, see page 2–105.

MANUALLY SELECT ROUTE:

Enter origin and destination airports

- Dash prompts:
  - Enter runway (optional).
  - Enter flight number (airline selectable option).
  - Enter valid waypoint or identifier on TO line.

    NOTE: DIRECT automatically appears in adjacent VIA field.
  - Enter VIA field with valid airway, or leave DIRECT entry.
- Go to DEP/ARR page for terminal area procedure selection.
- Select ACTIVATE (LSK 6R) after all route entries are made.
- Press EXEC Key

RTE
POST U10.3

<u>PAGE ACCESS</u> page 1

- Press RTE key
- POS INIT page ROUTE prompt (LSK 6R)
- TAKEOFF REF page ROUTE prompt (LSK 4R)
- DEPARTURES page ROUTE prompt (LSK 6R)
- ARRIVALS page ROUTE prompt (LSK 6R)
- Selection of waypoint from SELECT DESIRED WPT page

```
        RTE                1/2
 ORIGIN                   DEST
KORD                      KSTL
 CO ROUTE              FLT NO.
ORDSTL                --------
 RUNWAY
32L
------------------------------



<ALTN DEST           ACTIVATE>
```

With ALTN DEST (option)

```
        RTE                1/2
 ORIGIN                   DEST
KORD                      KSTL
 CO ROUTE              FLT NO.
ORDSTL                --------
 RUNWAY               FLT PLAN
32L                   REQUEST>
------------------------------



                     ACTIVATE>
```

With ACARS (option)

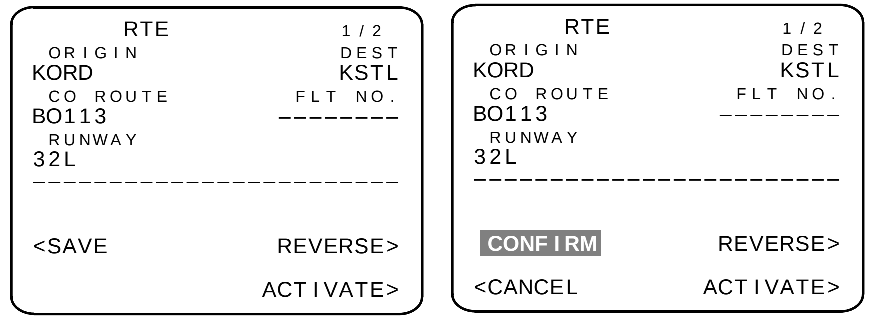
<u>MANUALLY SELECT ROUTE:</u>

Enter origin and destination airports

- Dash prompts:
  - Enter runway (optional).
  - Enter flight number (airline selectable option).
- Go to DEP/ARR page for terminal area procedure selection.
- Select ACTIVATE (LSK 6R) after all route entries are made.
- Press EXEC Key

<u>SELECT A COMPANY ROUTE:</u>

- Enter company route identifier on CO ROUTE line or upload from ACARS REQUEST prompt.
- Select ACTIVATE (LSK 6R)
- Press EXEC Key



With PILOT ENTERED CO–RTE (option)

ENTER A COMPANY ROUTE:

- Enter a route identifier on CO ROUTE line (after minimum required waypoints are entered).
- Select SAVE (LSK 5L).
- CONFIRM (LSK 5L) the save or CANCEL (LSK 6L)
- Select ACTIVATE (LSK 6R)
- Press EXEC Key

REVERSE displayed when a minimum flight plan exists.

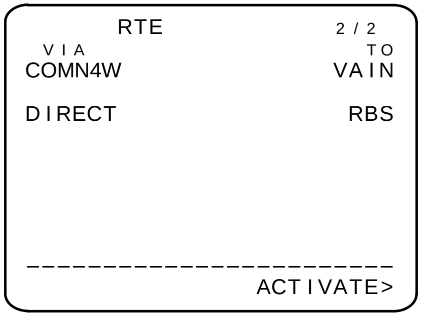
– Creates reversed flight plan with discontinuity preceding the first fix (in–air) or direct–to first fix (on–ground).

– Reversed flight plan will not contain the following:
  - Terminal area procedures
  - Speed and altitude constraints
  - Holding patterns
  - Lateral offsets
  - RTAs
  - Company route identifier
  - Abeam points
  - Manually entered CRZ winds

For a more detailed discussion, see page 2–105.

PAGE ACCESS page 2

- RTE page 1 NEXT PAGE
- RTE page X PREV PAGE



PERF INIT

<u>PAGE ACCESS</u> page 1/2

– Press INIT REF key (on the ground and IRS initialized)

– INIT REF INDEX page PERF prompt (LSK 3L)

– ACT RTE page PERF INIT prompt (LSK 6R) (on the ground)

– TAKEOFF REF page PERF INIT prompt (LSK 5L) (prior to pre-flight complete)

– PERF LIMITS page 2/2 PREV PAGE or NEXT PAGE

When PLAN/FUEL entry option selected

```
        PERF INIT      1/2
 GW/CRZ CG   TRIP/CRZ ALT
 47.6/23.0%   FL315/FL290
 PLAN/FUEL       CRZ WIND
     / 6.7        ---°/---
 ZFW              ISA DEV
 40.9       ---°F ---°C
 RESERVES         T/C OAT
 3.2        ---°F ---°C
 COST INDEX     TRANS ALT
 20                 18000
------------------------
<INDEX         TAKEOFF>
```

U10.0

```
        PERF INIT      1/2
 GW/CRZ CG   TRIP/CRZ ALT
 47.6/23.0%   FL315/FL290
 PLAN/FUEL       CRZ WIND
     / 6.7        ---°/---
 ZFW              ISA DEV
 40.9       ---°F ---°C
 RESERVES         T/C OAT
 3.2        ---°F ---°C
 COST INDEX     TRANS ALT
 20                 18000
------------------------
<INDEX         N1 LIMIT>
```

U10.1 and later

When ACARS option selected

```
        PERF INIT      1/2
 GW/CRZ CG   TRIP/CRZ ALT
 47.6/23.0%   FL315/FL290
 FUEL            CRZ WIND
 6.7              ---°/---
 ZFW              T/C OAT
 40.9       ---°F ---°C
 RESERVES       TRANS ALT
 3.2                18000
 COST INDEX     PERF INIT
 20              REQUEST>
------------------------
<INDEX         TAKEOFF>
```

U10.0

```
        PERF INIT      1/2
 GW/CRZ CG   TRIP/CRZ ALT
 47.6/23.0%   FL315/FL290
 FUEL            CRZ WIND
 6.7              ---°/---
 ZFW              T/C OAT
 40.9       ---°F ---°C
 RESERVES       TRANS ALT
 3.2                18000
 COST INDEX     PERF INIT
 20              REQUEST>
------------------------
<INDEX         N1 LIMIT>
```

U10.1 and later

Box prompts: Enter data necessary to compute performance targets.

For a more detailed discussion, see page 2–107.

- Entering either gross wt (GW) or zero fuel weight (ZFW) causes display of the other. Wt entries can be in kilograms (option).
- COST INDEX and/or CRZ ALT may be automatically initialized by CO ROUTE entry on RTE page.

  NOTE: TRIP ALT (LSK 1R) is the predicted minimum cost altitude (for crew reference) for point-to-point total distance, including airport SPD/ALT restrictions, and will provide the minimum cruise time (airline selectable).

- Press EXEC after required entries are made.

  NOTE: The EXEC pushbutton will not light until all box prompt entries are made.

Dash prompts: Optional entries which improve performance target calculations

- CRZ WIND, if entered, initializes wind at all cruise waypoints and is cleared at flight completion.
- PLAN FUEL may be entered to generate accurate predictions before the aircraft is fueled.
- TRANS ALT may be entered to override the default transition altitude.
- FUEL values may be entered if Fuel Summation Unit fails.

PERF LIMITS

PAGE ACCESS PAGE 2/2

– PERF INIT page 1/2 [PREV PAGE] or [NEXT PAGE]

– RTA PROGRESS page LIMITS prompt (LSK 6L)

Without ACARS option selected

```
     PERF LIMITS     2/2
 TIME ERROR TOLERANCE
  30 SEC AT RTA WPT
 MIN SPD --CLB-- MAX SPD
210/.400         340/.820
         --CRZ--
210/.400         340/.820
         --DES--
210/.400         340/.820


------------------------
<INDEX               RTA>
```

No required entries

With ACARS option selected

```
     PERF LIMITS     2/2
 TIME ERROR TOLERANCE
  30 SEC AT RTA WPT
 MIN SPD --CLB-- MAX SPD
210/.400         340/.820
         --CRZ--
210/.400         340/.820
         --DES--
210/.400         340/.820
 PERF LIM        PERF LIM
<REPORT          REQUEST>
------------------------
<INDEX               RTA>
```

No required entries

- TIME ERROR TOLERANCE specifies the allowable ETA tolerance at the RTA waypoint. Range is 5 to 30 seconds with has a default of 30 seconds.

For a more detailed discussion, see page 2–109.

- Performance limits are for ECON and RTA modes. Make entries in speed and/or mach values.
  - For 737-300/400/500 aircraft; minimum speeds have default of 210/.400 which is also lower limit. Maximum speeds have default of 340/.820 which is also upper limit.
  - For 737-600/700/800 aircraft; the minimum and maximum speeds are stored in the MODEL/ENGINE database.
- After entering any desired changes, press EXEC .

TAKEOFF REF

Without TAKEOFF SPEEDS option selected
(airline selectable option)
(U10.0 VERSION)

PAGE ACCESS page 1/2

- PERF INIT page TAKEOFF prompt (LSK 6R)
- ACT RTE page TAKEOFF prompt (LSK 6R)
  (on ground and PERF INIT completed)
- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)

```
       TAKEOFF REF    1/2
 OAT                   V1
+15°C +59°F         ---KT
 SEL TEMP              VR
---°C ---°F         ---KT
 22K N1                V2
 89.5/ 89.5%        ---KT
-----PRE-FLT STATUS-----
<POS INIT          ROUTE>

<PERF INIT     DEPARTURE>
------------------------
<INDEX
```

Box prompts: Enter actual OAT for takeoff N_1 limit calculations except if airplane has aspirated TAT probe, in which case OAT from the probe is displayed.

Dash prompts: SEL TEMP — enter assumed temperature. If this reduces takeoff thrust, N_1 changes, with label of RED 22K N_1; climb N_1 may reduce, too. Same items duplicated on page 2/2.

PRE-FLT STATUS changes to PRE-FLT COMPLETE, with prompts (LSK 4L, LSK 5L, LSK 4R, LSK 5R) blanked, when all entries completed.

For a more detailed discussion, see page 2–111.

PAGE ACCESS page 2/2

– TAKEOFF REF page 1/2 press PREV PAGE or NEXT PAGE

```
          TAKEOFF REF    2/2




 SEL TEMP           RED 22K N1
+32°C +90°F   92.0/ 92.0%
20K DERATE   18.5K DERATE
 88.7/88.7%    85.2/85.2%
------------------------
<INDEX
```

- 20K DERATE and 18.5K DERATE select thrust rating of next lower or 2nd lower model engine. These fixed derates may be selected in conjunction with the assumed temperature reduction method.

TAKEOFF REF
With TAKEOFF SPEEDS option selected
(airline selectable option)
(U10.0 VERSION)

PAGE ACCESS page 1/2

- PERF INIT page TAKEOFF prompt (LSK 6R)
- ACT RTE page TAKEOFF prompt (LSK 6R)
  (on ground and PERF INIT completed)
- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)

With QRH SPEEDS option selected

```
      TAKEOFF REF      1/2
 SEL/OAT          QRH    V1
----°C +23°C      129> ---
 22K N1                  VR
 94.6/ 94.6%      131> ---
 FLAPS                   V2
 5°               139> ---
                 GW  /  TOW
                110.0/
 RUNWAY         FMC POS UPD
RW19L               RW31L>
-----------------SELECT
<INDEX            QRH OFF>
```

For a more detailed discussion, see page 2–116.

TAKEOFF REF

<u>With</u> ACARS option selected
(airline selectable option)
(U10.0 VERSION)

```
        TAKEOFF REF    1/2
 SEL/OAT            QRH    V1
----°C +23°C        129> ---
 22K N1                    VR
 94.6/ 94.6%        131> ---
 FLAPS                     V2
 5°                 139> ---
 TAKEOFF DATA   GW   /  TOW
<REQUEST      110.0/
              FMC POS UPD
                     RW31L>
-----------------SELECT
<INDEX              QRH OFF>
```

Box prompts: Enter actual OAT for takeoff N_1 limit calculations except if airplane has aspirated TAT probe, in which case OAT from the probe is displayed.

Dash prompts: SEL TEMP — enter assumed temperature. If this reduces takeoff thrust, N_1 changes, with label of RED 22K N_1; climb N_1 may reduce, too. Same items duplicated on page 2/2.

FLAPS may be changed to the following setting:

- For 737-300; 1°, 5°, or 15°.
- For 737-400 and 737-500; 5° or 15°.
- For 737-600, 737-700, and 737-800; possible flap entries are defined in the MODEL/ENGINE database.

Prior to pre-flight completion, INDEX prompt is replaced as follows:

- POS INIT – Displayed prior to initialization
- PERF INIT – Displayed until RESERVES, COST INDEX, GW, and CRZ ALT are entered.
- ROUTE – Displayed after POS INIT and PERF INIT are completed and flight plan is not yet active.

V_1, V_R, and V_2 may be overwritten. V_1 and V_R must be overwritten (LSK 1R, LSK 2R) to display on the EFIS speed tape (option).

QRH OFF (LSK 6R) toggles the quick reference handbook takeoff speeds ON and OFF.

FMC POS UPDATE (or RWY REMAIN or T/O SHIFT, depending on option selected) is provided to allow an update of the FMCS position at takeoff when the departure runway has been defined. Activation of the TO/GA switch performs an update if the TOGA RW POS UPD option is selected (airline option).

PAGE ACCESS page 2/2

– TAKEOFF REF page 1/2 PREV PAGE or NEXT PAGE

```
        TAKEOFF REF    2/2
 RW WIND               CG
---°/---             --.-%
 RW SLOPE/HDG     RW COND
--.--%/330°       DRY/WET
 TAKEOFF REF
<QFE/QNH
 SEL TEMP          22K N1
---°C/---°F  94.6/ 94.6%
20K DERATE  18.5K DERATE
88.7/ 88.7%  86.2/ 86.2%
------------------------
<INDEX
```

RW WIND and RW SLOPE/HDG may be entered to improve the accuracy of the takeoff speed calculation.

CG may be entered to allow the FMCS to calculate the T/O stabilizer trim setting when the gross weight entry is valid.

RW COND is displayed when the CAA QRH SPD (for 737–300, 737–400, 737–500) or FAA (for 737–600, 737–700, 737–800) QRH SPD option is selected (airline option) the RW COND DRY/WET toggle is also provided.

20K DERATE and 18.5K DERATE select thrust rating of next lower or 2nd lower model engine. These fixed derates may be selected in conjunction with the assumed temperature reduction method.

For 737-600, 737-700, and 737-800; TAKEOFF REF of QFE or QNH can be selected. The currently selected reference is highlighted (airline option).

TAKEOFF REF
Without TAKEOFF SPEEDS option selected
(airline selectable option)
WITH THRUST BUMP
(U10.1 AND LATER VERSIONS)

PAGE ACCESS page 1/2

- N1 LIMIT page TAKEOFF prompt (LSK 6R)
- ACT RTE page TAKEOFF prompt (LSK 6R)
  (on ground and PERF INIT completed)
- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)

U10.1

```
      TAKEOFF REF      1/2
 FLAPS                  V1
 5°                  ---KT
23.5K N1                VR
 98.0/98.0           ---KT
 CG                     V2
22.5%                ---KT
-----PRE-FLT STATUS-----
<POS INIT           ROUTE>

<PERF INIT      DEPARTURE>
--------------------------
<INDEX
```

737–300/400/500

```
      TAKEOFF REF      1/2
 FLAPS                  V1
 1°                  ---KT
26K BUMP N1             VR
102.5/102.5          ---KT
 CG                     V2
22.5%                ---KT
-----PRE-FLT STATUS-----
<POS INIT           ROUTE>

<PERF INIT      DEPARTURE>
--------------------------
<INDEX
```

737–600/700/800

U10.2A

```
      TAKEOFF REF      1/2
 FLAPS                  V1
 5°                  ---KT
23.5K N1                VR
 98.0/98.0           ---KT
 CG                     V2
22.5%                ---KT
-----PRE-FLT STATUS-----
<N1 LIMIT           ROUTE>

<PERF INIT      DEPARTURE>
--------------------------
<INDEX
```

737–300/400/500

```
      TAKEOFF REF      1/2
 FLAPS                  V1
 1°                  ---KT
26K BUMP N1             VR
102.5/102.5          ---KT
 CG                     V2
22.5%                ---KT
-----PRE-FLT STATUS-----
<N1 LIMIT           ROUTE>

<PERF INIT      DEPARTURE>
--------------------------
<INDEX
```

737–600/700/800

Box prompts: FLAPS – enter default takeoff FLAPS value.

For a more detailed discussion, see page 2–116.1.

Dash prompts: CG – enter CG as a percentage of MACH. Once entered TRIM is calculated and displayed.

CG may be entered to allow the FMCS to calculate the TO stabilizer trim setting when the gross weight entry is valid.

Default FLAPS values are determined by the aircraft model.

PRE-FLT STATUS changes to PRE-FLT COMPLETE, with page prompts blanked, when all pre–flight entries are completed.

TAKEOFF REF
Without TAKEOFF SPEEDS option selected (airline selectable option) WITH THRUST BUMP (U10.1 AND LATER VERSIONS)

PAGE ACCESS page 2/2

– TAKEOFF REF page 1/2 press PREV PAGE or NEXT PAGE

U10.1

```
         TAKEOFF REF    2/2




 SEL/OAT             23.5K N1
----/ +6ØF       98.Ø/ 98.Ø
                  THR REDUCTION
                 CLB      8ØØAGL
------------------------
<INDEX
```

737–300/400/500

```
         TAKEOFF REF    2/2



 TAKEOFF REF
<QFE/QNH
 SEL/OAT          26K BUMP N1
    / +6ØF      1Ø2.5/1Ø2.5
                  THR REDUCTION
                 CLB      8ØØAGL
------------------------
<INDEX
```

737–600/700/800

U10.2A

```
         TAKEOFF REF    2/2




 SEL/OAT             23.5K N1
----/ +6ØF       98.Ø/ 98.Ø
                  THR REDUCTION
                 CLB      8ØØAGL
------------------------
<INDEX
```

737–300/400/500

```
         TAKEOFF REF    2/2



 TAKEOFF REF
<QFE/QNH
 SEL/OAT          26K BUMP N1
    / +6ØF      1Ø2.5/1Ø2.5
                  THR REDUCTION
                 CLB      8ØØAGL
------------------------
<INDEX
```

737–600/700/800

Box prompts: Enter actual OAT for takeoff N_1 limit calculations except if airplane has aspirated TAT probe, in which case OAT from the probe is displayed.

Dash prompts: SEL TEMP — enter assumed temperature. If this reduces takeoff thrust, N_1 changes, with label of RED 23.5K N_1; climb N_1 may also be reduced.

NOTE: Selecting BUMP N1 blanks the assumed OAT (SEL) entry and prevents further entries to this field.

TAKEOFF REF of QFE or QNH can be selected. The currently selected reference is highlighted (airline option).

Thrust reduction altitude (T/R ALT) may be overwritten. Default is 1500 ft. AGL for origin airport. (Displayed when Takeoff Profile option is selected).

TAKEOFF REF
With TAKEOFF SPEEDS and CERTIFIED SPEEDS options selected
(airline selectable options)

WITH THRUST BUMP
(U10.1 AND LATER VERSIONS)

PAGE ACCESS page 1/2

- N1 LIMIT page TAKEOFF prompt (LSK 6R)
- ACT RTE page TAKEOFF prompt (LSK 6R)
  (on ground and PERF INIT completed)
- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)

737–300/400/500

```
      TAKEOFF REF   1/2
 FLAPS          QRH    V1
 5°            133>  ---
23.5 N1                VR
 98.0/ 98.0    135>  ---
 CG     TRIM           V2
22.5%   5.25   140>  ---
              GW  /  TOW
           135.0/
 INTERSECT      TO SHIFT
__/RW13R      RW13R -00>
------------------SELECT
<INDEX          QRH OFF>
```

With QRH SPEEDS

```
      TAKEOFF REF   1/2
 FLAPS        VSPDS    V1
 5°            133>  ---
23.5 N1                VR
 98.0/ 98.0    135>  ---
 CG     TRIM           V2
22.5%   5.25   140>  ---
              GW  /  TOW
           135.0/
 RUNWAY         TO SHIFT
RW13R         RW13R -00>
------------------SELECT
<INDEX        VSPDS OFF>
```

With VSPEEDS

737–600/700/800

```
      TAKEOFF REF   1/2
 FLAPS          QRH    V1
 1°            133>  ---
26K BUMP N1            VR
102.5/102.5    135>  ---
 CG     TRIM           V2
22.5%   5.25   140>  ---
              GW  /  TOW
           135.0/
 INTERSECT      TO SHIFT
__/RW13R      RW13R -00>
------------------SELECT
<INDEX          QRH OFF>
```

With QRH SPEEDS

```
      TAKEOFF REF   1/2
 FLAPS        VSPDS    V1
 1°            133>  ---
26K BUMP N1            VR
102.5/102.5    135>  ---
 CG     TRIM           V2
22.5%   5.25   140>  ---
              GW  /  TOW
           135.0/
 RUNWAY         TO SHIFT
RW13R         RW13R -00>
------------------SELECT
<INDEX        VSPDS OFF>
```

With VSPEEDS

Box prompts: FLAPS – enter default takeoff FLAPS value.

For a more detailed discussion, see page 2–116.

Dash prompts: CG – enter CG as a percentage of MACH. Once entered, TRIM is calculated and displayed.

CG may be entered to allow the FMCS to calculate the TO stabilizer trim setting when the gross weight entry is valid.

Default FLAPS values are determined by the aircraft model.

QRH OFF/QRH ON or VSPDS OFF/ON (LSK 6R) toggles the quick reference handbook takeoff speeds or takeoff speeds OFF and ON.

TAKEOFF REF
With TAKEOFF SPEEDS and CERTIFIED SPEEDS options selected (airline selectable options) WITH THRUST BUMP (U10.1 AND LATER VERSIONS)

PAGE ACCESS page 2/2

– TAKEOFF REF page 1/2 press PREV PAGE or NEXT PAGE

U10.1

```
        TAKEOFF REF    2/2
 RW WIND           RW COND
---°/---          DRY/WET>
 RW SLOPE/HDG
--.-%/13Ø°


 SEL/OAT           23.5 N1
----/ +6ØF     98.Ø/ 98.Ø
           THR REDUCTION
           CLB      8ØØAGL
------------------------
<INDEX
```

737–300/400/500

```
        TAKEOFF REF    2/2
 RW WIND           RW COND
---°/---     DRY/WET SK-R>
 RW SLOPE/HDG
--.-%/13Ø°
 TAKEOFF REF
<QFE/QNH
 SEL/OAT       26K BUMP N1
    / +6ØF   1Ø2.5/1Ø2.5
           THR REDUCTION
           CLB      8ØØAGL
------------------------
<INDEX
```

737–600/700/800

U10.2A

```
        TAKEOFF REF    2/2
 RW WIND           RW COND
---°/---          DRY/WET>
 RW SLOPE/HDG
--.-%/13Ø°


 SEL/OAT           23.5 N1
----/ +6ØF     98.Ø/ 98.Ø
           THR REDUCTION
           CLB      8ØØAGL
------------------------
<INDEX
```

737–300/400/500

```
        TAKEOFF REF    2/2
 RW WIND           RW COND
---°/---     DRY/WET SK-R>
 RW SLOPE/HDG
--.-%/13Ø°
 TAKEOFF REF
<QFE/QNH
 SEL/OAT       26K BUMP N1
    / +6ØF   1Ø2.5/1Ø2.5
           THR REDUCTION
           CLB      8ØØAGL
------------------------
<INDEX
```

737–600/700/800

RW WIND and RW SLOPE/HDG may be entered to improve the accuracy of the takeoff speed calculation.

When the RW COND (DRY/WET/SK–R) QRH SPD option is enabled (airline option), the RW COND toggle (LSK 1R) allows selection.

When the TAKEOFF REF of QFE or QNH option is enabled (airline option), the currently selected reference is highlighted.

QRH OFF/QRH ON or VSPDS OFF/ON (LSK 6R) toggles the quick reference handbook takeoff speeds or takeoff speeds OFF and ON.

Thrust reduction altitude (T/R ALT) may be overwritten. Default is 1500 ft. AGL for origin airport. (Displayed when Takeoff Profile option is selected).

TAKEOFF REF
With TAKEOFF SPEEDS and CERTIFIED SPEEDS options selected (airline selectable options) WITH THRUST BUMP AND ACARS (U10.1 AND LATER VERSIONS)

PAGE ACCESS page 1/2

- N1 LIMIT page TAKEOFF prompt (LSK 6R)
- ACT RTE page TAKEOFF prompt (LSK 6R) (on ground and PERF INIT completed)
- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)

737–300/400/500

```
      TAKEOFF REF    1/2
 FLAPS           QRH    V1
 5°              133> ---
23.5 N1                 VR
 98.0/ 98.0      135> ---
 CG     TRIM            V2
22.5%   5.25     140> ---
 TAKEOFF DATA   GW  /  TOW
<REQUEST      135.0/
 INTERSECT       TO SHIFT
__/RW13R       RW13R -00>
------------------SELECT
<INDEX          QRH OFF>
```

With QRH SPEEDS

```
      TAKEOFF REF    1/2
 FLAPS         VSPDS    V1
 5°              133> ---
23.5 N1                 VR
 98.0/ 98.0      135> ---
 CG     TRIM            V2
22.5%   5.25     140> ---
 TAKEOFF DATA   GW  /  TOW
<REQUEST      135.0/
 RUNWAY          TO SHIFT
RW13R          RW13R -00>
------------------SELECT
<INDEX        VSPDS OFF>
```

With VSPEEDS

737–600/700/800

```
      TAKEOFF REF    1/2
 FLAPS           QRH    V1
 1°              133> ---
26K BUMP N1             VR
102.5/102.5      135> ---
 CG     TRIM            V2
22.5%   5.25     140> ---
 TAKEOFF DATA   GW  /  TOW
<REQUEST      135.0/
 INTERSECT       TO SHIFT
__/RW13R       RW13R -00>
------------------SELECT
<INDEX          QRH OFF>
```

With QRH SPEEDS

```
      TAKEOFF REF    1/2
 FLAPS         VSPDS    V1
 1°              133> ---
26K BUMP N1             VR
102.5/102.5      135> ---
 CG     TRIM            V2
22.5%   5.25     140> ---
 TAKEOFF DATA   GW  /  TOW
<REQUEST      135.0/
 RUNWAY          TO SHIFT
RW13R          RW13R -00>
------------------SELECT
<INDEX        VSPDS OFF>
```

With VSPEEDS

Box prompts: FLAPS – enter default takeoff FLAPS value.

For a more detailed discussion, see page 2–116.

Dash prompts: CG – enter CG as a percentage of MACH. Once entered, TRIM is calculated and displayed.

CG may be entered to allow the FMCS to calculate the TO stabilizer trim setting when the gross weight entry is valid.

Default FLAPS values are determined by the aircraft model.

Thrust reduction altitude (T/R ALT) may be overwritten. Default is 1500 ft. AGL for origin airport. (Displayed when Takeoff Profile option is selected).

TAKEOFF REF
With THRUST BUMP and QUIET CLIMB SYSTEM options selected (airline selectable options) (U10.3)

PAGE ACCESS page 2/2

– TAKEOFF REF page 1/2 press PREV PAGE or NEXT PAGE

U10.3

```
          TAKEOFF  REF      2/2



                      CUTBACK  N1
                      80.5/ 80.5
 SEL/OAT            27K  BUMP  N1
     °/  +15°C     102.5/102.5
REDUCTION     THR       RESTORE
 800AGL       CLB        300AGL
-----------------------CUTBACK
<INDEX                   ON/OFF
```

REDUCTION – blanked until temperature is available. Clears to dashes at flight completion. Value always displayed in feet. Default value is displayed in small font.

NOTE: When CUTBACK is toggled ON – displays the cutback reduction altitude. When CUTBACK is toggled OFF – displays the takeoff profile reduction altitude.

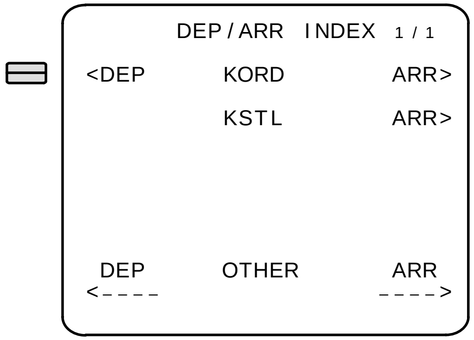
RESTORE – displayed when CUTBACK is toggled ON. Default value is displayed in small font.

CUTBACK – default state for CUTBACK toggle is OFF. Currently selected mode is displayed in in large font.

DEPARTURES

PAGE ACCESS page 1/1

– Press DEP ARR key



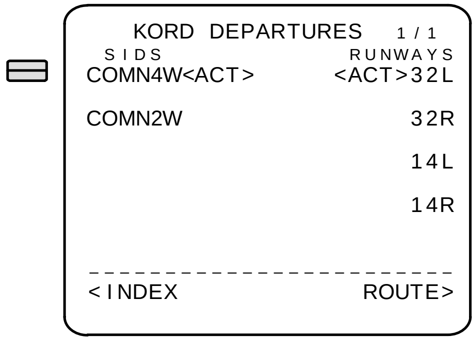
- Press LSK 1L for origin airport

  or
- Press LSK 6L for another airport after entering the airport identifier.

PAGE ACCESS page 1/1

– DEP/ARR INDEX page DEP prompts

– TAKEOFF REF page DEPARTURE prompt (LSK 5R) (If runway is not entered on RTE page 1)

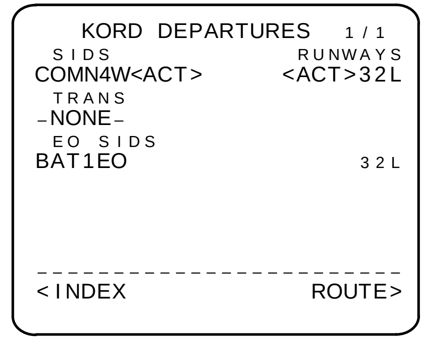


Departures page displays SIDS and runways for selected airport. An <ACT> prompt indicates the active flight plan departure. Line selection

For a more detailed discussion, see pages 2–117 and 2–119.

of a SID, runway, or transition displays a condensed list of departures associated with just the selected entity.

ENG OUT SIDS option U10.3



If ENGINE OUT SIDS option is enabled, a complete list of engine out SIDS listed in the Navigation Database for the selected airport will be listed.

<u>PAGE ACCESS</u> page 1/3

– RTE DATA page LEGS prompt:
  – ACARS option not selected (LSK 6R)
  – ACARS option selected (LSK 6L)

```
  ACT RTE   LEGS      1/3
 203°       7.2NM
VLA                262/FL234
 246°        27NM
KUBIK              262/13479
 245°       8.0NM
RESOW              262/10406
 187°       8.9NM
TOY                250/ 7116
 109°        12NM
FONTI              250/ 4500A
 RNP/ACTUAL-------------
1.70/0.15NM       RTE DATA>
```

No required entries

Page 1/3 always displays the active waypoint in reverse video on line 1.

Waypoint entries assume direct great circle routes.

Predicted speeds and altitudes are displayed in small font.

The following modifications to the flight plan are allowed:

- Waypoints can be entered and deleted
- Speed/altitude constraints can be entered or altered

Required and actual navigation performance can be manually entered and deleted.

Gradient legs are identified by as GPX.X°.

Arc legs are identified as XX.X ARC Y

– XX.X is the leg distance in nautical miles
– Y is the turn direction (R or L)

Box prompts: Identify route discontinuities.

Floating waypoints are enclosed in parentheses, and are not selectable or editable.

For a more detailed discussion, see page 2–123.

```
   ACT RTE    LEGS      1/3
 203°       7.2NM
VLA                262/ FL234
 246°        27NM
KUBIK     <CTR>262/ 13479
 245°       8.0NM
RESOW              262/ 10406
 187°       8.9NM
TOY                250/ 7116
 109°        12NM
FONTI              250/ 4500A
 RNP/ACTUAL------MAP CTR
1.70/0.15NM           STEP>
```

No required entries

The <CTR> indicator and STEP prompt (LSK 6R) are used for centering the EFIS map display.

RTE DATA

<u>PAGE ACCESS</u> page 1/3

- Press LEGS key
- Corresponding RTE LEGS page RTE DATA prompt (LSK 6R)

Without ACARS option selected

```
  ACT RTE   DATA      1/3
             ETA         WIND
VLA         1313Z  000°/    0

KUBIK       1316Z

RESOW       1317Z

TOY         1318Z

FONTI       1320Z
------------------------
                     LEGS>
```

With ACARS option selected

```
  ACT RTE  DATA       1/3
             ETA         WIND
VLA         1313Z  000°/    0

KUBIK       1316Z

RESOW       1317Z

TOY         1318Z

FONTI       1320Z
-------------------WINDS
<LEGS            REQUEST>
```

No required entries

RTE DATA page displays additional RTE LEGS data for corresponding waypoints.

Forecast wind entries for cruise waypoint can be made to help optimize performance calculations.

NOTE: CRZ wind entries made on the PERF INIT page propagate to waypoints preceding top-of-descent.

Cruise waypoint wind entries made on this page propagate to all downpath cruise waypoints. Non-cruise waypoints have blank wind fields.

For a more detailed discussion, see page 2–125.

PAGE ACCESS page 1/1

– Press CLB key

– Press VNAV key when climb is the active performance mode (FANS MCDU ONLY)
– NEXT PAGE key from DES page (FANS MCDU ONLY)
– PREV PAGE key from CRZ page (FANS MCDU ONLY)
– Automatically displayed from TAKEOFF REF page after takeoff (U10.3)

```
  ACT ECON CLB          1/1
 CRZ ALT
FL310
 TGT SPD           TO FL310
284/.731     1347.3Z/ 82NM
 SPD REST
250/10000
------------      CLB-1 N1
                88.5/ 88.5%
              ------------
<MAX RATE         ENG OUT>

<MAX ANGLE            RTA>
```

U10.0 and U10.1

```
  ACT ECON CLB          1/1
 CRZ ALT
FL310
 TGT SPD           TO FL310
284/.731     1347.3Z/ 82NM
 SPD REST
250/10000
------------      CLB-1 N1
                88.5/ 88.5%
              ------------
<MAX RATE         ENG OUT>

<MAX ANGLE            RTA>
```

U10.2A

No required entries

- CLB page defaults to ECON CLB.
- Eight climb modes are available:
  - ECON – economy
  - Manual – selectable target speed entry
  - MAX RATE – maximum rate
  - MAX ANGLE – maximum angle
  - RTA – required time of arrival
  - RTA CRZ – required time of arrival to cruise

For a more detailed discussion, see page 2–127.

- ENG OUT – engine out (ADVISORY ONLY)
  In U10.2A and earlier, the Engine Out Mode predictions are propagated throughout subsequent climb segments and into the cruise segments.
  In U10.3 the Engine Out Mode is for reference only.
- CRZ – cruise climb

- The commanding speed is highlighted on active climb pages.
- Pre-plan a climb mode by selecting and executing.
- Speed/altitude constraints in the SPD REST field (LSK 3L) can be entered or modified.
- RTA selection calls RTA PROGRESS page for further entries.

NOTE: This display indicates a reduced climb mode has been generated by the FMC.

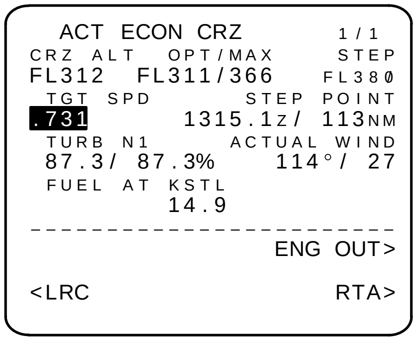
PAGE ACCESS page 1/1

– Press CRZ key

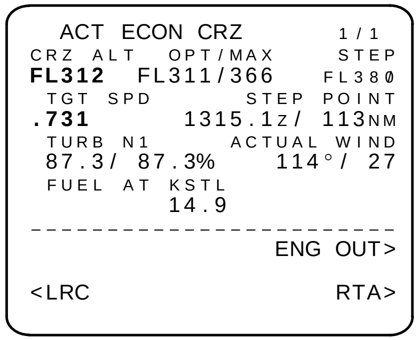
– Press VNAV key when cruise is the active performance mode (FANS MCDU ONLY)

– NEXT PAGE key from CLB page (FANS MCDU ONLY)

– PREV PAGE key from DES page (FANS MCDU ONLY)



U10.0 and U10.1



U10.2A

No required entries

- CRZ page defaults to ECON.
- Five cruise modes are available:
  - ECON
  - LRC
  - RTA
  - ENG OUT (ADVISORY ONLY)
  - SELECTABLE SPEED (manual entry of target speed)
- The active target speed is highlighted on active cruise page.
- Entering a new CRZ ALT on an active cruise page displays the CRZ CLB or CRZ DES page as applicable.
- Enter STEP altitude to review step climb or descent. STEP POINT data will be displayed when present position is greater than 100 nm from top-of-descent.
- RTA selection calls RTA PROGRESS page for further entries.

NOTE: STEP blanks when within 100 nm of top-of-descent or when mode is RTA.

For a more detailed discussion, see page 2–129.

DIR/INTC

PAGE ACCESS page 1/3

– Press [DIR INTC] key with route active (CDU ONLY)

```
  ACT  RTE     LEGS       1/3
 246°        7.2NM
KUBIK               262/13485
 245°        8.0NM
RESOW               262/10409
 187°        8.9NM
TOY                 266/ 7116
 226°         12NM
FONTI               262/ 4500A
 299°        3.9NM
JOICE               262/ 3300
 DIRECT TO------INTC LEG
□□□□□              TO □□□□□
```

DIRECT TO A WAYPOINT

Box prompts: Enter waypoint identifier on DIRECT TO line (LSK 6L). The entered waypoint identifier moves to line 1.

NOTE: Line selecting a waypoint identifier to LSK 1L on LEGS is interpreted as a DIRECT TO without pressing [DIR INTC].

Press [EXEC] to activate the route modification.

NOTE: All intermediate waypoints are deleted when proceeding direct to a waypoint in the flight plan.

INTERCEPT A LEG TO A WAYPOINT (IN THE ROUTE)

Box prompts: Enter waypoint identifier on INTC LEG TO line (LSK 6R). The entered waypoint identifier and the defined course move to line 1.

Press [EXEC] to activate the route modification.

NOTE: All intermediate waypoints are deleted. NOT ON INTERCEPT HEADING is displayed if unable to intercept the course to the entered waypoint leg (and LNAV is requested).

For a more detailed discussion, see pages 2–131 and 2–133.

PAGE ACCESS page 1/3

– Press PROG key

```
  UAL12149 PROGRESS 1/3
  FROM          ALT   ATA    FUEL
RBS           FL312  1253z  15.3
  213°          DTG   ETA    FUEL
VLA               5  1312z  15.2
  246°
KUBIK            32  1314z  15.1

KSTL             90  1319z  14.9
  TO T/D                FUEL QTY
1316z/   75NM               15.2
  WIND
104°/27KT          NAV STATUS>
```

No required entries

DISPLAYS:

– ALT, ATA, and FUEL at last waypoint passed in ACT flight plan.

– DTG, ETA, and predicted fuel remaining for the active and next waypoints, and at the destination (with MOD RTE, destination predictions are for the MOD).

– Current fuel quantity.

– Wind direction and speed

– Altitude change-point ETA and distance advisories:

  – TO T/C — TOP OF CLIMB

  – TO T/D — TOP OF DESCENT

  – TO E/D — END OF DESCENT

  – TO STEP POINT (IF STEP TO ENTERED ON CRZ PAGE AND MORE THAN 100 NM TO T/D)

For a more detailed discussion, see page 2–135.

RTA PROGRESS

PAGE ACCESS page 2/3

– PROGRESS page 1/3 NEXT PAGE

– PROGRESS page 3/3 PREV PAGE

– RTA line prompt from CLB, CRZ, or DES pages.

```
  ACT RTA PROGRESS       2/3
  RTA WPT                 RTA
EDOF                1500:00z
  RTA SPD          TIME ERROR
330/.800              ON TIME
  SPD REST                GMT
250/10000           1448:45z
DIST----TO EDOF    ----ETA
  257NM             1520:00z
FIRST--RTA WINDOW---LAST
1518:46z            1533:19z
------------------------
<LIMITS
```

Entries required only to enter Required Time Of Arrival (RTA) mode

- Initially, dash prompts shown for RTA WAYPOINT. If valid waypoint entered, then default RTA in MOD plan will be predicted ETA. Entry of new RTA will cause estimation of necessary cost index (of ECON mode) to make predicted ETA equal to desired ETA.
- While on ground, recommended take-off time will be displayed based on cost index entered on PERF INIT. Advisory T/O WINDOW shows T/O time extremes possible (based on brake release times) for slowest and fastest speed schedules to RTA waypoint.
- When in air, any current speed restriction will be displayed. Advisory RTA WINDOW shows RTA time extremes possible for fastest and slowest speed schedules to RTA waypoint. New RTA entry will cause cost index adjustment for new speed schedule and ETA.

For a more detailed discussion, see page 2–135.

PAGE ACCESS page 3/3

– PROGRESS page 2/3 NEXT PAGE

Without ACARS option selected

```
       PROGRESS        3 / 3
 HEADWIND          CROSSWIND
27KT                  R  3KT
 WIND            SAT/ISA DEV
104°/ 27        –40°C/   0°C
 XTK ERROR          VERT DEV
L 0.1NM                 12HI
                         TAS
                       426KT
```

U10.2A and earlier

```
       PROGRESS        3 / 3
 HEADWIND          CROSSWIND
27KT                  R  3KT
 WIND            SAT/ISA DEV
104°/ 27        –40°C/   0°C
 XTK ERROR          VERT DEV
L 0.01NM                12HI
 GPS–L TRK               TAS
305°T                  426KT
```

U10.3

With ACARS option selected

```
       PROGRESS        3 / 3
 HEADWIND          CROSSWIND
27KT                  R  3KT
 WIND            SAT/ISA DEV
104°/ 27        –40°C/   0°C
 XTK ERROR          VERT DEV
L 0.1NM                 12HI
                         TAS
                       426KT
 PRE–FLIGHT         PROGRESS
<REPORT              REPORT>
 WEATHER            POSITION
<REQUEST             REPORT>
```

U10.2A and earlier

```
       PROGRESS        3 / 3
 HEADWIND          CROSSWIND
27KT                  R  3KT
 WIND            SAT/ISA DEV
104°/ 27        –40°C/   0°C
 XTK ERROR          VERT DEV
L 0.01NM                12HI
 GPS–L TRK               TAS
305°T                  426KT
 PRE–FLIGHT         PROGRESS
<REPORT              REPORT>
 WEATHER            POSITION
<REQUEST             REPORT>
```

U10.3

Displays provide the following information:

- Wind Information
- Temperature
- Cross Track Error
- True Airspeed
- Vertical Deviation (PATH DES only)
- GPS Track (U10.3) (GPS with Integrety, airlines selectable option)

PAGE ACCESS page 1/2

– Press FIX key inflight

```
       FIX INFO        1/2
 FIX   RAD/DIS FR
PIA      111/29
RAD/ DIS ETA    DTG   ALT
130/54  1304.5  10  12000

180/26  1308.9  32  FL190

---
 ABEAM
150/23  1306.5  18  15500
```

Box prompts: Enter valid navaid or waypoint FIX identifier. The radial and distance from the entered identifier is displayed.

Dash prompts: Enter either radial and/or distance from entered FIX using slash rule (130 or 130/ = radial, /130 = distance). The intersection of the entered radial or circular arc distance with the flight plan is calculated and displayed. When the circular arc has two intersections with the flight plan, the first is displayed.

Press LSK 5L (ABEAM) to display the location of the point where the flight plan passes abeam of the entered FIX identifier.

To enter a calculated location as a new waypoint:

- Line select the intersection into the scratch pad using left LSKs.
- Transfer to desired RTE LEGS page and enter.

A second FIX INFO page is available for calculating fixes from a second fix waypoint.

The page format will change when an active lateral offset exists in the flight plan. The page title will change to OFFSET FIX INFO and the fix points will not be selectable into the scratchpad.

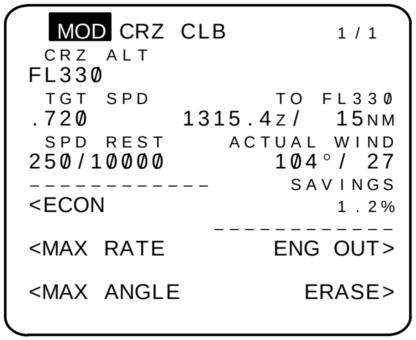
For a more detailed discussion, see page 2–139.

CRZ CLB
(PRE U10.3)

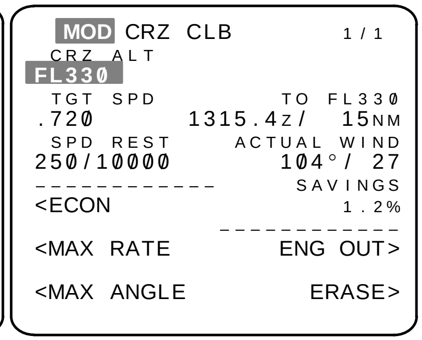
PAGE ACCESS page 1/1

– Entering a higher CRZ ALT on a cruise page during active cruise.

– Press CLB key when a CRZ CLB is MOD or ACT.



U10.0 and U10.1



U10.2A

No required entries

Provides cruise climb to entered CRZ ALT.

During active cruise:

- Enter valid higher CRZ ALT (on CRZ page)
- Press EXEC key

Cruise climbs are performed at selected cruise mode cruise speeds and climb N_1 thrust settings.

NOTE: ENG OUT is advisory only.

For a more detailed discussion, see page 2–129.

CRZ CLB
(POST U10.3)

PAGE ACCESS page 1/1

– Entering a higher CRZ ALT on a cruise page during active cruise.

– Press CLB key when a CRZ CLB is MOD or ACT.

```
 MOD CRZ CLB                1/1
  CRZ ALT
FL330
  TGT SPD               TO FL330
.720         1315.4z/   15NM
  SPD REST          ACTUAL WIND
250/10000            104°/ 27
------------            SAVINGS
<ECON                      1.2%
                   ------------
<MAX RATE              ENG OUT>

<MAX ANGLE               ERASE>
```

No required entries

Provides cruise climb to entered CRZ ALT.

During active cruise:

- Enter valid higher CRZ ALT (on CRZ page)
- Press EXEC key

Cruise climbs are performed at selected cruise mode cruise speeds and climb N_1 thrust settings.

NOTE: ENG OUT is advisory only.

For a more detailed discussion, see page 2–129.

CRZ DES

PAGE ACCESS page 1/1

- Entering a lower CRZ ALT on an active cruise page during cruise.
- Press DES key when CRZ DES is active.

```
 MOD CRZ DES                1/1
  CRZ ALT
FL290
  TGT SPD              TO FL290
.720         1318.4z/ 28NM
  SPD REST             EST WIND
240/10000            104°/ 98
                        SAVINGS
                           1.7%
------------------------------
                   PLANNED DES>

<FORECAST               ERASE>
```

No required entries

Provides cruise descent to entered CRZ ALT.

During active cruise:

- Enter valid lower CRZ ALT (on CRZ page)
- Press EXEC key

Cruise descents are performed at selected cruise mode speed and at a 1000-FPM rate of descent.

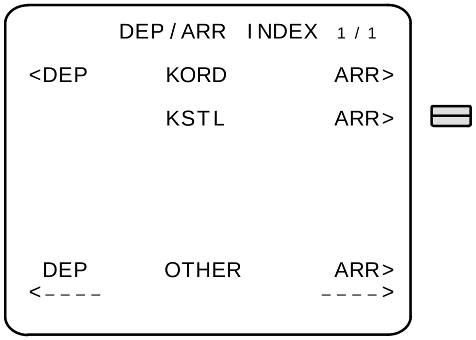
The savings or penalty for the cruise descent is displayed prior to executing.

For a more detailed discussion, see page 2–129.

ARRIVALS

PAGE ACCESS page 1/1

– Press DEP ARR key

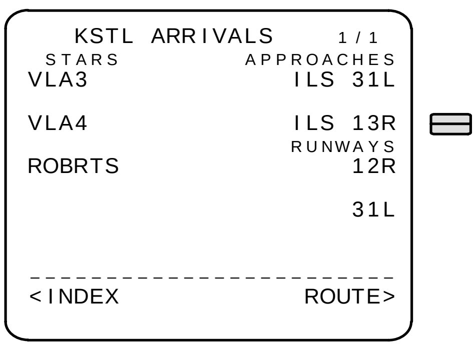


- Press LSK 2R for destination airport

  or
- Press LSK 1R or 6R for origin or other airport.
- Other airport requires identifier in scratch pad, then press LSK 6R.

PAGE ACCESS page 1/1

– DEP/ARR INDEX page ARR prompts



ARRIVALS page displays the STARS, APPROACHES, and RUNWAYS for the selected airport. An <ACT> prompt indicates the active flight

For a more detailed discussion, see pages 2–117 and 2–121.

plan arrival. Line selection of a STAR, approach, or runway displays a condensed list of arrivals associated with just the selected entity.

```
   KSTL ARRIVALS     1/1
 STARS          APPROACHES
VLA3         <SEL>ILS 13R
                     TRANS
ROBRTS              -NONE-
                   RUNWAYS



------------------------
<INDEX              ROUTE>
```

PAGE ACCESS page 1/1

– Press DES Key

– Press VNAV key when descent is the active performance mode (FANS MCDU ONLY)

– NEXT PAGE key from CLB page (FANS MCDU ONLY)

– PREV PAGE key from DES page (FANS MCDU ONLY)

– Automatically displayed at top of descent when the following conditions are present:

  – An active CRZ page is displayed

  – Path descent mode is available

  – MCP altitude is set below cruise altitude

– CRZ DES page PLANNED DES prompt (LSK 5R)

```
 ACT ECON PATH DES   1/1
  E/D ALT          AT FONTI
2400                  4500A
  TGT SPD          TO FONTI
.731/262  1318.5z/   10NM
  SPD REST          WPT/ALT
240/10000     FONTI/4500A
VERT DEV     FPA  V/B   V/S
   0         2.6  2.2  2100
---------------------------
                     SPEED>

<FORECAST              RTA>
```

U10.0 and U10.1

```
 ACT ECON PATH DES   1/1
  E/D ALT          AT FONTI
2400                  4500A
  TGT SPD          TO FONTI
.731/262  1318.5z/   10NM
  SPD REST          WPT/ALT
240/10000     FONTI/4500A
VERT DEV     FPA  V/B   V/S
   0         2.6  2.2  2100
---------------------------
                     SPEED>

<FORECAST              RTA>
```

U10.2A

No required entries

DES page defaults to ECON PATH DES

3 DES modes available:

- ECON
- RTA
- SELECTED SPEED (manual entry)

Path or speed descents are available.

The commanded speed is reverse video highlighted on active descent pages.

For a more detailed discussion, see page 2–141.

Speed/altitude constraints can be deleted or modified.

Constraints on the waypoint in 1R can be deleted. The deletion is also reflected on the LEGS page.

Reference information for the waypoint adjacent to LSK 3R is displayed, including:

- Vertical bearing (V/B) along a great circle to the waypoint.
- Vertical speed (V/S) required to achieve the displayed V/B.

Reference information for the path is displayed, including:

- Current flight path angle (FPA)
- End of descent altitude (E/D ALT)
- Target speed (TGT SPD)
- Speed restrictions (SPD REST)
- Vertical deviation (VERT DEV)
- Next altitude restriction (adjacent to LSK 1R)

PAGE ACCESS page 1/1

- DES page FORECAST prompt (LSK 6L)
- CRZ DES page FORECAST prompt (LSK 6L)

Without ACARS option

```
  ACT DES FORECASTS 1/1
 TRANS LVL        TAI ON/OFF
FL180           -----/-----
 CABIN RATE     ISA DEV/QNH
480FPM          ---°C/-----
 ALT-----WIND----DIR/SPD
-----             ---°/---KT

-----             ---°/---KT

-----             ---°/---KT
```

No required entries

With ACARS option

```
  ACT DES FORECASTS 1/1
 TRANS LVL        TAI ON/OFF
FL180           -----/-----
 CABIN RATE     ISA DEV/QNH
480FPM          ---°C/-----
 ALT-----WIND----DIR/SPD
-----             ---°/---KT

-----             ---°/---KT

-----             ---°/---KT
 DES WINDS
<REQUEST
```

No required entries

Dash prompts: Enter forecast values to better define the descent profile. Entries include:

- TRANS LVL – transition level displays the value for the destination stored in the Nav Data Base or defaults to FL180 but may be overwritten.
- TAI ON/OFF – the expected altitudes for anti-ice usage.

For a more detailed discussion, see page 2–145.

- QNH – destination altimeter setting.
- ISA DEV – average ISA deviation for descent only.
- WIND ALT and DIR/SPD – altitude, direction, and speed of up to three forecasted winds with linear interpolation between entries.

Cabin rate is displayed for reference.

NOTE: DES forecasts page is made active when the vertical flight plan becomes active.

RTE HOLD
(U10.0 AND U10.1 VERSIONS)

PAGE ACCESS page 1/3

– Press HOLD key

– RTE HOLD page NEXT HOLD prompt

With no existing HOLD

```
 ACT RTE    LEGS      1/3
 246°        7.2NM
KUBIK             262/13484
 245°        8.0NM
RESOW             262/10408
 187°        8.9NM
TOY               262/ 7118
 226°         12NM
FONTI             262/ 4500A
 299°        3.9NM
JOICE             262/ 3300
--------HOLD AT---------
□□□□□                 PPOS>
```

Box prompts: Enter valid waypoint to HOLD AT in scratch pad. Displays MOD RTE HOLD page when line selected.

PPOS prompts:Select and press EXEC to hold at present position.

NOTE: Downtrack fixes will utilize charted holding pattern data automatically when available from the Nav Data Base. Otherwise, a R-turn on the inbound course is the default with 1.5 min leg above 14,000 ft and 1 min leg at or below 14,000 ft.

With PRE-PLANNED HOLD

```
 ACT RTE    HOLD      1/3
 FIX                TGT SPD
LOGEN                 210KT
 TURN DIR           FIX ETA
R                   1424.5Z
 INBD CRS          EFC TIME
210°                  ----Z
 LEG TIME        HOLD AVAIL
1.5MIN                 0+48
 LEG DIST        BEST SPEED
--.-NM                220KT
------------------------
<NEXT HOLD       EXIT HOLD>
```

For a more detailed discussion, see page 2–147.

Review or revise holding pattern details. ACT RTE HOLD must be manually exited by:

- Pressing LSK 6R (EXIT HOLD>)

NOTE: Displays EXIT ARMED in reverse video highlighting.

- Pressing key to activate flight back to the holding fix, departure from the holding pattern, and return to the active route. EXIT ARMED is reverse video highlighted until the hold exit is completed.

RTE HOLD
With QUAD RADIAL
(U10.2A THRU U10.4 VERSIONS)

PAGE ACCESS page 1/3

– Press HOLD key

With no existing HOLD

```
  ACT RTE    LEGS      1/3
  246°       7.2NM
KUBIK            262/13484
  245°       8.0NM
RESOW            262/10408
  187°       8.9NM
TOY              262/ 7118
  226°        12NM
FONTI            262/ 4500A
  299°       3.9NM
JOICE            262/ 3300
--------HOLD AT----------
□□□□□                PPOS>
```

Box prompts: Enter valid waypoint to HOLD AT in scratch pad. Displays MOD RTE HOLD page when line selected.

PPOS prompts:Select and press EXEC to hold at present position.

NOTE: Downtrack fixes will utilize charted holding pattern data automatically when available from the Nav Data Base.

With PRE-PLANNED HOLD

```
  ACT RTE    HOLD      1/3
 FIX          SPD/TGT ALT
LOGEN          210/FL230
 QUAD/RADIAL     FIX ETA
NE/030°          1424.5z
 INBD CRS/DIR    EFC TIME
210°/R TURN        ----z
 LEG TIME      HOLD AVAIL
1.5MIN              0+48
 LEG DIST      BEST SPEED
--.-NM             220KT
------------------------
<NEXT HOLD    EXIT HOLD>
```

A right-turn on the inbound course is the default when not specified.

For a more detailed discussion, see page 2–150.1.

For U10.2A and U10.3, the default LEG TIME is 1.5 min above 14,000 ft and 1 min at or below 14,000 ft.

For U10.4, the default LEG TIME is 1.5 min above 14,200 ft and 1 min at or below 14,200 ft.

QUAD/RADIAL – INBD CRS is updated after entering a quadrent and radial.

Review or revise holding pattern details. ACT RTE HOLD must be manually exited by:

- Pressing LSK 6R (EXIT HOLD>)

  NOTE: Displays EXIT ARMED in shaded–white.

- Pressing key to activate flight back to the holding fix, departure from the holding pattern, and return to the active route. EXIT ARMED is highlighted until the hold exit is completed.

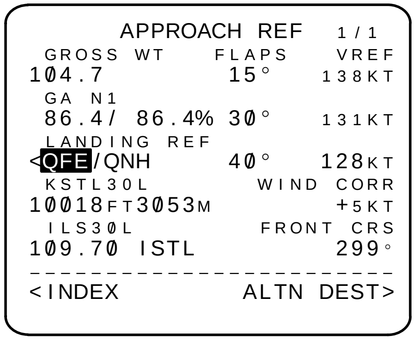
Enter SPD and TGT ALT constraints when required.

PAGE ACCESS page 1/1

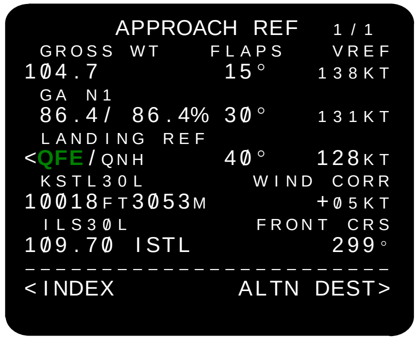
– INIT REF index page APPROACH prompt (LSK 5L)

– Press INIT REF key inflight

With ALTN DEST option selected

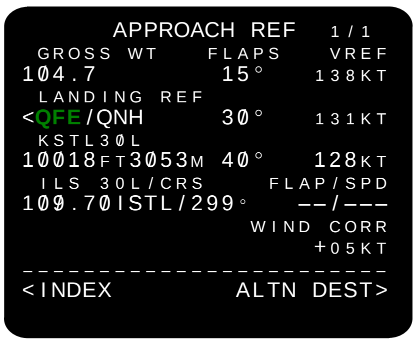


U10.0 and U10.1



U10.2A and U10.3

With ALTN DEST option selected



U10.4

Destination airport approach reference information is displayed.

Displayed information includes:

- Gross weight – Box prompts are displayed if computed gross weight is invalid.
- For 737-600, 737-700, and 737-800 – Landing Reference
- Go-around N_1 limits for current TEMP/ALT.
- Runway length (if in active flight plan).

For a more detailed discussion, see page 2–151.

- ILS approach procedure navaid data.
- VREF landing speeds.

NOTE: VREF landing speed is displayed on EFIS speed tape (option) by manual entry of speed on selected flaps line. Also, VREF speeds are based on origin airport until cruise phase is active.

- Vref increment for the landing flaps target speed.

NOTE: Landing flaps target speed equals VREF speed plus Vref increment and is displayed on the EFIS speed tape when VREF is selected. Landing flaps target speed is also displayed on LEGS page for the final approach fix and all legs up to and including the runway.

- ILS front course.

INIT/REF INDEX

<u>PAGE ACCESS</u> page 1/1

- All pages with an INDEX prompt (LSK 6L)
- Press INIT REF key

On the ground (737–300/400/500).

```
     INIT/REF INDEX      1/1
<IDENT              NAV DATA>
<POS              MSG RECALL>
<PERF              ALTN DEST>
<TAKEOFF
<APPROACH            IRS NAV>
<OFFSET                MAINT>
```

On the ground (737–600/700/800).

```
     INIT/REF INDEX      1/1
<IDENT              NAV DATA>
<POS              MSG RECALL>
<PERF              ALTN DEST>
<TAKEOFF
<APPROACH        SEL CONFIG>
<OFFSET                MAINT>
```

In the air.

```
     INIT/REF INDEX      1/1
<IDENT              NAV DATA>
<POS              MSG RECALL>
<PERF              ALTN DEST>
<TAKEOFF
<APPROACH
<OFFSET           NAV STATUS>
```

No required entries

INIT/REF index page provides access to the following pages:

- IDENT
- POS INIT
- PERF INIT
- TAKEOFF REF
- APPROACH REF
- LATERAL OFFSET
  (Available in 737-300/400/500 with EFIS installed)
  (Available in 737-600/700/800)
- NAV DATA
  - REF NAV DATA
  - SUPP NAV DATA
    (When on the ground)

    NOTE: Enter SUPP in scratch pad prior to selection of NAV DATA.
- MESSAGE RECALL
  (airlines selectable option)
- ALTN DEST
  (airlines selectable option)
- ACARS
  (airlines selectable option)
- NAV STATUS
  (When in the air)
- MAINT
  (When on the ground for maintenance personnel)
- SEL CONFIG
  (When on the ground for maintenance personnel)
  (Available in 737-600/700/800)
- IRS NAV
  (When on the ground for maintenance personnel)
  (Available in 737-300/400/500 and an ANCDU is installed)

POS REF

<u>PAGE ACCESS</u> page 2/3

– POS INIT page 1/3 NEXT PAGE

– POS INIT page 3/3 PREV PAGE

```
      POS REF            2/3
 FMC POS                   GS
N47°31.3 W122°18.7 253KT
 IRS L
N47°31.2 W122°18.9 253KT
 IRS R
N47°31.3 W122°18.9 254KT
 GPS L
N47°31.6 W122°18.7
 GPS R
N47°31.7 W122°18.8
 RADIO
N47°31.8 W122°18.2
```

No required entries

Displays present position and ground speed as computed by the FMCS.

Displays present position derived from IRS when IRS is in NAV.

Displays present position derived from GPS when GPS data is certified and GPS is not inhibited.

Displays present position derived from radio navaid(s).

Position can be selected into scratch pad for transfer to POS INIT page 1/1.

For a more detailed discussion, see page 2–153.

POS SHIFT

<u>PAGE ACCESS</u> page 3/3

– POS INIT page 1/3 PREV PAGE

– POS INIT page 2/3 NEXT PAGE

```
        POS SHIFT          3/3
  FMC-L                  FMC-R
<235°/0.0NM      235°/0.0NM>
  GPS-L     GPS(L)      GPS-R
<211°/1.4NM      212°/1.3NM>
  IRS-L     IRS(2)      IRS-R
<254°/1.0NM      091°/0.0NM>
  RNP/ACTUAL            RADIO
1.70/0.25NM      084°/0.1NM>
-----UPDATE COMPLETE----
                 NAV STATUS>

<INDEX
```

Displays bearing and range from FMCS position to each available sensor.

Displays bearing and range from primary FMC position to secondary FMC in dual mode.

Displays bearing and range from FMCS position to each GPS when GPS data is certified and GPS is not inhibited.

FMCS position can be updated by selecting the desired sensor bearing/range and pressing the EXEC key.

After update, FMCS position will display selected bearing/range data and all sensor positions will be updated accordingly.

REF NAV DATA

PAGE ACCESS

– INIT/REF INDEX page NAV DATA prompt (LSK 1R)
– REF NAV WPT page INDEX prompt (LSK 6L)
– REF NAV NAVAID page INDEX prompt (LSK 6L)
– REF NAV AIRPORT page INDEX prompt (LSK 6L)

```
     REF NAV DATA
 WPT IDENT    NAVAID IDENT
-----                 ----
 AIRPORT IDENT
----              SUMMARY>

                 FLT PLNS>  *




------------
<INDEX        NAV OPTIONS>
```

* – Pilot Defined Company Route option (U10.3)

REFERENCE EXISTING DATA BASE ITEMS

Select SUMMARY prompt (LSK 2R) to view;

– All currently defined Supplemental Data Base items
– All currently defined Temporary NAV Data Base items

Enter waypoint, airport, or navaid identifier. Data for entered identifier is automatically displayed.

Display runway data as follows:

– Enter runway identifier in WPT IDENT (LSK 1L), AIRPORT IDENT will change to box prompt.
– Enter airport identifier into AIRPORT IDENT (LSK 2L)

NOTE: Procedure-specified waypoints not having fixed geographic locations cannot be accessed.

FLT PLNS – displays the FLIGHT PLANS SUMMARY page(s)

For a more detailed discussion, see page 2–155.

ENTER TEMPORARY DATA BASE ITEM

Enter identifier.

- Runway data may not be entered.
- Pilot-defined waypoints on RTE and LEGS pages are stored in the temporary data base.
- A box prompt will be displayed if entry is not defined. Enter the required data when this occurs.

Press EXEC to store entry into temporary data base.

DELETE TEMPORARY DATA BASE ITEM

Enter identifier.

Press DEL key.

Press EXEC key

NOTE: All temporary data base items are automatically deleted at end of flight.

DISPLAY FLIGHT PLAN DATABASE

To select the Flight Plan Database (airlines selectable option) SUMMARY page, select the FLT PLNS prompt (LSK 3R) when present. The Flight Plan Database may hold up to 20 pilot defined company routes.

SUPP NAV DATA

PAGE ACCESS

- INIT/REF INDEX page NAV DATA prompt (LSK 1R) with SUPP entered in scratch pad
- SUPP NAV WPT page INDEX prompt (LSK 6L)
- SUPP NAV NAVAID page INDEX prompt (LSK 6L)
- SUPP NAV AIRPORT page INDEX prompt (LSK 6L)

Without ACARS option selected

```
   SUPP NAV DATA
 WPT IDENT     NAVAID IDENT
-----                  ----
 AIRPORT IDENT
----               SUMMARY>
           EFF FRM MON DY/YR
                   □□□ □□/□□




------------
<INDEX
```

With ACARS option selected

```
   SUPP NAV DATA
 WPT IDENT     NAVAID IDENT
-----                  ----
 AIRPORT IDENT
----               SUMMARY>
           EFF FRM MON DY/YR
                   □□□ □□/□□
 SUPP NAV          SUPP NAV
<REPORT            REQUEST>


------------
<INDEX
```

REFERENCE EXISTING DATA BASE ITEMS

Select SUMMARY prompt (LSK 2R) to view;

- All currently defined Supplemental Data Base items
- All currently defined NAV Data Base items

Dash prompts: Enter waypoint, airport, or navaid identifier. Data for entered identifier is automatically displayed.

For a more detailed discussion, see page 2–159.

Display runway data as follows:

Enter runway identifier in WPT IDENT (LSK 1L), AIRPORT IDENT will change to box prompt.

Enter airport identifier into AIRPORT IDENT (LSK 2L)

NOTE: Procedure-specified waypoints not having fixed geographic locations cannot be accessed.

<u>ENTER TEMPORARY DATA BASE ITEM</u>

Enter identifier.

- Runway data may not be entered.
- Pilot-defined waypoints on RTE and LEGS pages are stored in the temporary data base.
- A box prompt will be displayed if entry is not defined. Enter the required data when this occurs.

Press EXEC to store entry into temporary data base.

<u>DELETE TEMPORARY DATA BASE ITEM</u>

To delete one item:

Enter identifier.

Press DEL key.

Press EXEC key

To delete all items:

Select DELETE ALL SUPP DATA prompt (LSK 6R).

NOTE: All temporary data base items are automatically deleted at end of flight.

SELECT DESIRED WPT

PAGE ACCESS

– Automatic when entering a non-unique waypoint identifier.

```
   SELECT DESIRED WPT  1/1
  ENO   VOR
114.8 N40°38.0 W064°31.5
  ENO   DME
112.4 N44°27.4 E101°15.7
  ENO   VORTAC
118.6 N50°45.2 W070°12.2
```

No required entries

Waypoints are displayed in order from closest to farthest from the reference point.

Selecting a waypoint will return the display to the original page, and insert the selected waypoint in place of the entered waypoint. Up to 2 pages may be provided.

For a more detailed discussion, see page 2–161.

SELECT DESIRED RTE

(U10.3) PILOT DEFINED COMPANY ROUTE OPTION

PAGE ACCESS

– Automatic when entering a non-unique route identifier.

```
   SELECT DESIRED RTE 1/1
  PERMANENT NAV DATA
BFISFO
  FLIGHT PLAN NAV DATA
BFISFO
  SUPP NAV DATA
BFISFO
```

No required entries

Routes are displayed in the appropriate line depending on where they are stored.

Selecting a route will return the display to the RTE page, and insert the selected route in the CO ROUTE line.

For a more detailed discussion, see page 2–162.

N_1 LIMIT
(U10.0 VERSION)

PAGE ACCESS page 1/1

– Press [N1 LIMIT] key

```
        N1 LIMIT          1/1
                       T/R ALT
 AUTO <ACT>             1642FT

 GA              91.7/ 91.7%

 CON             89.5/ 89.5%

 CLB             89.5/ 89.5%

 CRZ             87.5/ 87.5%
------REDUCED CLB-------
CLB-1 <SEL>            CLB-2
```

No required entries

Provides manual selection of N_1 LIMIT data and reduced climb thrust.

Thrust reduction altitude (T/R ALT) may be overwritten. Default is 1500 ft. AGL for origin airport. (Displayed when Takeoff Profile option is selected).

Current N_1 LIMIT values are displayed as:

- GA – Go Around
- CON – Maximum Continuous
- CLB – Climb
- CRZ – Cruise

Automatic N_1 LIMIT selection is the default mode.

Two reduced climb selections are available.

The appropriate reduced CLB is automatically selected when a large reduced thrust takeoff is selected on the TAKEOFF REF page. This results in a takeoff N_1 which is less than the full CLB limit to avoid throttle advance on takeoff to CLB transition.

For a more detailed discussion, see page 2–163.

N_1 LIMIT
(U10.1 AND LATER VERSIONS)

<u>PAGE ACCESS</u> page 1/1

- Press [N1 LIMIT] key
- PERF INIT page N1 LIMIT prompt (LSK 6L) (U10.1 and later)
- TAKEOFF REF page N1 LIMIT prompt (LSK 6R) (U10.2A)

```
      N1 LIMIT         1/1
 SEL/OAT        26K BUMP N1
   / +15°C     102.5/102.5
 26K
<TO           <SEL>   CLB>
 24K DERATE
<TO-1                CLB-1>
 22K DERATE
<TO-2                CLB-2>
 26K BUMP
<TO-B <ACT>
--------------------------
<PERF INIT        TAKEOFF>
```

ON THE GROUND

```
      N1 LIMIT         1/1
<AUTO <ACT>

<GA            101.6/101.6

<CON            99.8/ 99.8

<CLB            89.8/ 89.8

<CRZ            83.8/ 83.8
------REDUCED CLB-------
<CLB-1               CLB-2>
```

IN THE AIR

No required entries

Provides manual selection of N_1 LIMIT data and reduced climb thrust.

Current N_1 LIMIT values are displayed as:

- GA – Go Around
- CON – Maximum Continuous
- CLB – Climb
- CRZ – Cruise

Automatic N_1 LIMIT selection is the default mode.

Takeoff thrust bump selection is available while on the ground (737–600/700/800).

Two reduced climb selections are available.

The appropriate reduced CLB is automatically selected when a large reduced thrust takeoff is selected on the TAKEOFF REF page. This results in a takeoff N_1 which is less than the full CLB limit to avoid throttle advance on takeoff to CLB transition.

For a more detailed discussion, see page 2–164.1.

ALTN DESTS
(AIRLINE SELECTABLE OPTION)

<u>PAGE ACCESS</u> page 1/6

– INIT/REF INDEX page ALTN DEST prompt (LSK 3R)
– APPROACH REF page ALTN DEST prompt (LSK 6R)
– RTE page ALTN DEST prompt (LSK 6R) while in air
– NEAREST ARPTS page PREVIOUS prompt (LSK 6R)

Without ACARS option selected

```
    ALTERNATE DESTS    1/6
ALTN VIA DTG   ETA    FUEL
KRNO  D   30  1007z   9.8>

KFAT  D  194  1033z   7.9>

EMS   D   89  1017z   9.1>

ELSS  D  120  1023z   8.8>

CF03  D  352  1055z   6.2>

           NEAREST APRTS>
```

With ACARS option selected

```
    ALTERNATE DESTS    1/6
ALTN VIA DTG   ETA    FUEL
KRNO  D   30  1007z   9.8>

KFAT  D  194  1033z   7.9>

EMS   D   89  1017z   9.1>

ELSS  D  120  1023z   8.8>

CF03  D  352  1055z   6.2>
 WEATHER
<REQUEST   NEAREST APRTS>
```

Add alternates to this list by entering the airport or waypoint identifier into the scratch pad and then line select to desired position.

NOTE: The dash prompt appears when an alternate is not entered.

NOTE: If an alternate is line selected to a position that already contains data, the old data is overwritten.

Line select (LSK 1R through LSK 6R) the desired alternate to review or alter its parameters.

For a more detailed discussion, see page 2–165.

PAGE ACCESS page 2/6

– ALTERNATE DESTS page 1/6, alternate one (LSK 1R)

– Use NEXT PAGE/PREVIOUS PAGE keys to cycle through the six pages.

```
    ALTERNATE DESTS   2/6
 ALTN     VIA        TRIP ALT
KRNO    DIRECT          FL2ØØ
 DTG              ACTUAL WIND
  3Ø                   Ø°/   Ø
 ETA
1ØØ7z
 FUEL
 9.8

<MISSED APP

<INDEX      NEAREST APRTS>
```

The following parameters may be altered to more accurately define the route to the alternate:

- TRIP ALT
- WIND
- VIA (toggle selection using LSK 5L)
  - DIRECT
  - MISSED APPROACH
- DTG – enter data into scratch pad and line select as follows:
  - DIRECT-To – 2L
  - MISSED APPROACH – 3R

Dash prompts: Wind changes to dash prompt when alternate is specified via the missed approach.

PAGE ACCESS page 1/6

– ALTERNATE DESTS page 1/6 NEAREST ARPTS prompt (LSK 6R)

```
     NEAREST  ARPTS      1/6
 ALTN  VIA  DTG    ETA    FUEL
 KRNO   D     30  1007z   9.8>

 KLJS   D     60  1018z   9.6>

 KATH   D     88  1022z   9.2>

 KSMF   D    116  1028z   8.7>

 KSCK   D    144  1033z   8.5>

                      PREVIOUS>
```

Displays five airports nearest to PPOS.

Listed by distance with nearest airport first.

Line select (LSK 1R through LSK 6R) the desired airport to review or alter parameters used for fuel prediction and ETA.

For a more detailed discussion, see page 2–165.

PAGE ACCESS page 2/6 through 6/6

– NEAREST ARPTS page 1/6, airport one (LSK 1R)
– Use NEXT PAGE/PREVIOUS PAGE keys to cycle through the six pages.

```
      NEAREST ARPTS   2/6
 ALTN     VIA      TRIP ALT
KRNO    DIRECT        FL200
 DTG           ACTUAL WIND
  30                0°/  0
 ETA
1007Z
 FUEL
 9.8

<MISSED APP

<INDEX           PREVIOUS>
```

The following parameters may be altered to investigate selection of an airport as an alternate:

- TRIP ALT
- WIND
- VIA (toggle selection using LSK 5L)
  - DIRECT
  - MISSED APPROACH
- DTG – enter data into scratch pad and line select as follows:
  - DIRECT-To – 2L
  - MISSED APPROACH – 3R

Dash prompts: Wind changes to dash prompt when airport is specified via the missed approach.

MESSAGE RECALL
(AIRLINE SELECTABLE OPTION)

PAGE ACCESS page 1/x

– INIT/REF INDEX page MSG RECALL prompt (LSK 2R)

```
      MESSAGE RECALL   1/1
NAV DATA OUT OF DATE
UNABLE CRZ ALTITUDE
SCANNING DME FAIL



<INDEX
```

No required entries

Lists all alerting and advising messages when applicable display criteria is true.

PAGE ACCESS page x/x

– Press NEXT PAGE key to display subsequent pages when they are available.

– Press PREV PAGE key to display previous pages.

For a more detailed discussion, see page 2–167.

SUMMARY

PAGE ACCESS page 1/2

- REF NAV DATA page SUMMARY prompt (LSK 2R)
- SUPP NAV SUMMARY page 2/2 – press PREV PAGE key

```
  TEMP NAV SUMMARY  1/2
 WAYPOINTS
WPT01 N45°00.0 W120°00.0
ORT01 ORTIN 200/1.0
ORT02 ORT01 120/1.0
 NAVAIDS
YKI   N45°00.0 W154°00.0
 AIRPORTS
KXXX  N47°00.0 W122°00.0



<INDEX
```

No required entries

PAGE ACCESS page 2/2

- SUPP NAV DATA page SUMMARY prompt (LSK 2R)
- TEMP NAV SUMMARY page 1/1 – press NEXT PAGE key

```
  SUPP NAV SUMMARY  2/2
 WAYPOINTS
WPT11 N45°00.0 W121°00.0
WPT12 N45°00.0 W122°00.0
WPT13 N45°00.0 W123°00.0
 NAVAIDS
AA33  N45°12.2 W154°05.2
AA34  N45°12.2 W155°05.2
AA35  N45°12.2 W156°05.2
 AIRPORTS
KAAA  N41°03.1 W122°03.3
KAAB  N41°03.1 W122°03.3
<INDEX
```

For a more detailed discussion, see page 2–169.

SUMMARY CONT.
(U10.3 PILOT DEFINED COMPANY ROUTE OPTION)

FLIGHT PLAN SUMMARY

PAGE ACCESS page 1

– REF NAV DATA page FLT PLNS prompt (LSK 3R)

```
FLIGHT PLAN SUMMARY 1/1
 SUPP NAV DATA
ROUTE1

ROUTE2
 FLIGHT PLAN NAV DATA
GRRSEA

GRRSTL


------------------------
<INDEX
```

No required entries

Displays the identifiers for Pilot Defined Company Routes stored in the Supplimental and Flight Plan Nav Data bases. Identifiers are selectable to the scratchpad for entry into the RTE page.

Entries in the Supplimental Navigation Database are deletable.

NAV STATUS

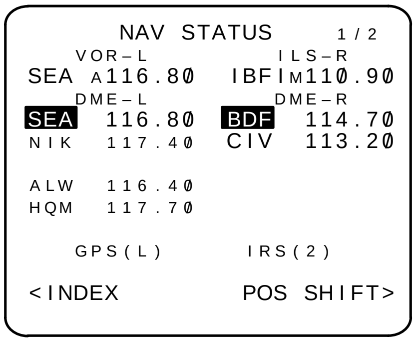
<u>PAGE ACCESS</u> page 1/2

– POS SHIFT page NAV STATUS prompt (LSK 5R)

– PROGRESS page NAV STATUS prompt (LSK 6R)

– INIT/REF INDEX page NAV STATUS prompt (LSK 6R) in air

– NAV OPTIONS page – press NEXT PAGE or PREV PAGE keys



No required entries

Displays the following information:

- The following items when they correspond to the VHF/NAV control panel frequency:
  - DME
  - VOR
  - ILS
  - Identifiers
  - Frequencies
- Data used in the navigation solution
- Status of data reception
- Tuning mode
- The currently selected GPS and IRS

For a more detailed discussion, see page 2–171.

NAV OPTIONS

<u>PAGE ACCESS</u> page 2/2

– REF NAV DATA page NAV OPTIONS prompt (LSK 6R)

– NAV STATUS page 1/1 – press NEXT PAGE or PREV PAGE keys

```
        NAV OPTIONS   2/2
         DME INHIBIT
----                  ----
         VOR INHIBIT
----                  ----
 DME UPDATE   GPS UPDATE
<ON/OFF          ON/OFF>
 VOR UPDATE
<ON/OFF


<INDEX
```

U10.0 and U10.1

```
        NAV OPTIONS   2/2
         DME INHIBIT
----                  ----
         VOR INHIBIT
----                  ----
 DME UPDATE   GPS UPDATE
<ON/OFF          ON/OFF>
 VOR UPDATE
<ON/OFF


<INDEX
```

U10.2A

Displays the following:

- Specific navaids inhibited from navigation solution.
- Update status for VOR and GPS.

Dash prompts: Identifier(s) can be written into these fields.

Existing identifier(s) may be overwritten.

Toggle select the update prompts to enable/disable updates using LSK 3L, LSK 4L, or LSK 3R as appropriate.

NOTE: The update options default to ON.

For a more detailed discussion, see page 2–173.

LATERAL OFFSET(OFFSET)

<u>PAGE ACCESS</u> page 1/1

- RTE page OFFSET prompt (LSK 6L) in air
- INIT/REF INDEX page OFFSET prompt (LSK 5L)

```
    ACT LATERAL OFFSET 1/1

 OFFSET DIST
---.-
 START WAYPOINT
------
 END WAYPOINT
------
```

The LATERAL OFFSET page provides for the input and display of lateral offset information.

Dash prompts: OFFSET DIST – offset path distance to left or right of active flight path. Maximum offset distance is 99.9 nm. Dashes are blank when an offset is not available.

Dash prompts: START WAYPOINT – allows entry of a starting waypoint. Field and header are blank until valid OFFSET DIST is entered.

Dash prompts: END WAYPOINT – allows entry of an ending waypoint. Field and header are blank until valid OFFSET DIST is entered.

The LATERAL OFFSET may be cancelled by deleting the offset distance.

NOTE: Available in 737-300/400/500 aircraft with EFIS installed, and all 737-600/700/800 aircraft.

For a more detailed discussion, see page 2–175.

ALT NAV LEGS
(LCD MCDU UPDATE 2 ONLY)

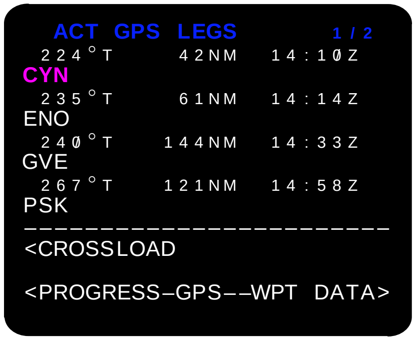
PAGE ACCESS page 1

– MENU page ALT NAV prompt (LSK 6L)

– ALT NAV WPT DATA page LEGS prompt (LSK 6L)

– ALT NAV PROGRESS page LEGS prompt (LSK 6L)

– Displayed when FMC fails and ALT NAV Flight Plan is not already available



No required entries

– Displays
  - Waypoint identifier
  - Leg direction
  - Leg distance
  - ETA

– FMC flight plan may be crossloaded to the ALT NAV plan using the CROSSLOAD prompt (LSK 5L).

NOTE: If the FMC fails, the CROSSLOAD prompt changes to the LAST FMC PLAN prompt. This will use the last valid flight plan received by the FMC.

– Flight plan modifications may be made as usual.

– Inspect waypoints and data to confirm flight plan.

Page title includes the naviagtion data source, i.e., GPS LEGS or IRS LEGS.

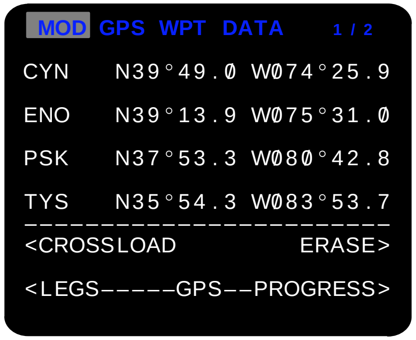
For more detailed discussion, see page 2–178.1

ALT NAV WPT DATA
(LCD MCDU UPDATE 2 ONLY)

<u>PAGE ACCESS</u> page 1

– GPS LEGS page WPT DATA prompt (LSK 6R)

– GPS PROGRESS page WPT DATA prompt (LSK 6R)



No required entries

– Displays
  - Waypoint identifier
  - Latitude
  - Longitude

– FMC flight plan may be crossloaded to the ALT NAV plan using the CROSSLOAD prompt (LSK 5L).

NOTE: If the FMC fails, the CROSSLOAD prompt changes to the LAST FMC PLAN prompt. This will use the last valid flight plan received by the FMC.

– Flight plan modifications may be made as usual.

– Inspect waypoints and data to confirm flight plan.

Page title includes the naviagtion data source, i.e., GPS WPT DATA or IRS WPT DATA.

For more detailed discussion, see page 2–178.3

ALT NAV PROGRESS
(LCD MCDU UPDATE 2 ONLY)

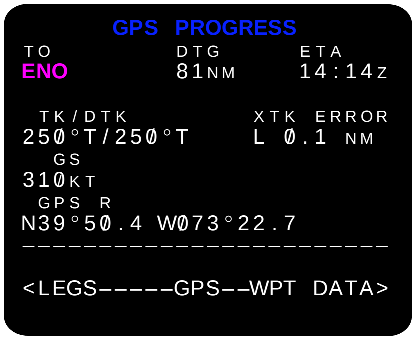
<u>PAGE ACCESS</u>

– MENU page ALT NAV prompt (LSK 6L)
  (ALT NAV Flight Plan is already available)

  NOTE: MENU page is automatically displayed when the FMC fails.

– ALT NAV LEGS page PROGRESS prompt (LSK 6L)

– ALT NAV WPT DATA page PROGRESS prompt (LSK 6R)



No required entries

– Displays
  - Current TO waypoint
  - Distance to the TO waypoint (DTG)
  - Estimated time of arrival to the waypoint
  - True and desired tracks
  - Cross–track error
  - Current GPS ground speed
  - Receiver in use and position

Page title includes the naviagtion data source, i.e., GPS PROGRESS or IRS PROGRESS.

For more detailed discussion, see page 2–178.5

MENU
(MCDU ONLY)

PAGE ACCESS

– Press MENU key

```
            MENU
<FMC       <ACT>
<ACARS     <HLD>
<DFDAU



 ACARS
<LOGOFF
```

```
            MENU
<FMC       <ACT>
<ACARS
<DFDAU



 ACARS
<HOLD
```

No required entries

Allows selection of system for which the MCDU will be active in providing the control/display function.

Line select system to be made active.

HOLD – line selected (LSK 6L) to suspend control of active system.

LOGOFF – line selected (LSK 6L) to terminate control of an active system

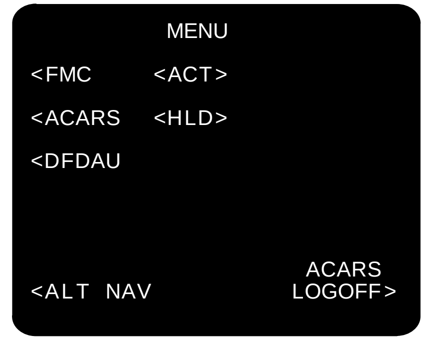
NOTE: HOLD and LOGOFF are operational for any system except the FMC.

For a more detailed discussion, see page 2–177.

MENU
(LCD MCDU UPDATE 2 ONLY)

PAGE ACCESS

– Press MENU key



No required entries

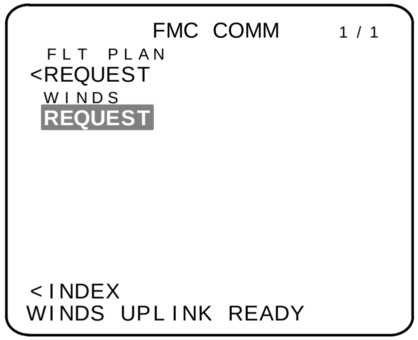
Selecting the ALT NAV prompt displays the GPS LEGS page.

All other operations are the same as previously described.

FMC COMM
(FANS MCDU ONLY)
(U10.2A AND LATER)

<u>PAGE ACCESS</u>

– Press FMC COMM key



Allows the aircrew to initiate ACARS datalinks.

Allows selection of user defined ACARS prompts. If user prompts are not defined, FLT PLAN and WINDS (or MOD WINDS) are the defaults.

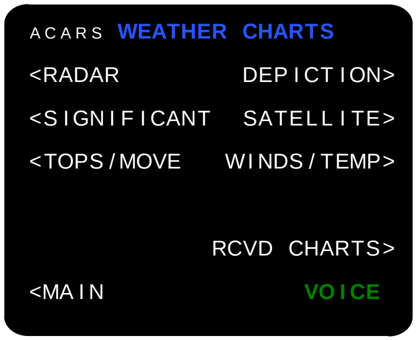
WEATHER MAPS
(LCDCDU MCDU/FANS MCDU WITH U2 ONLY)

<u>PAGE ACCESS</u>

– MENU page ACARS prompt (LSK 2L)

NOTE: To exit the weathermaps, select any mode key to return to an FMC page.

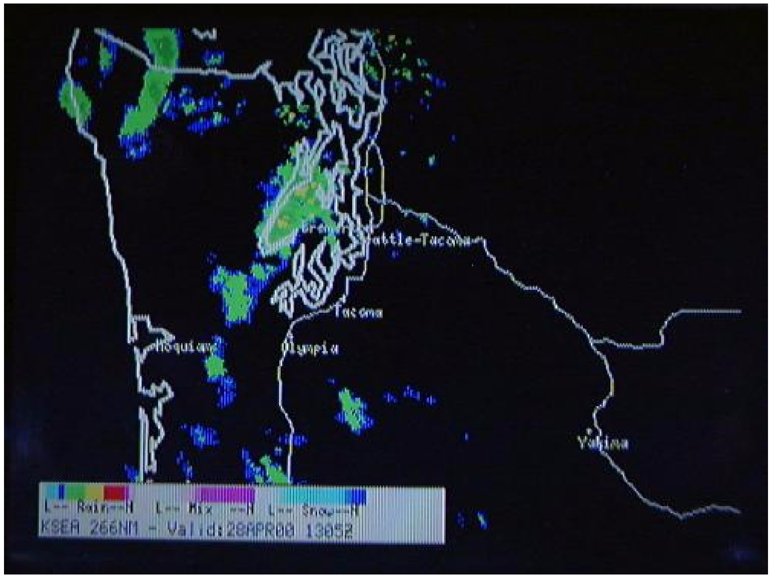
The WEATHER MAPS pages provide the crew with up–to–date weather information that may be displayed on the MCDU. For detailed operation of the display functions, refer to the systems operations manual.



Typical examples of different types of weather maps and charts available are shown on the following pages.

WEATHER MAPS (CONT.)
(LCDCDU MCDU/FANS MCDU WITH U2 ONLY)

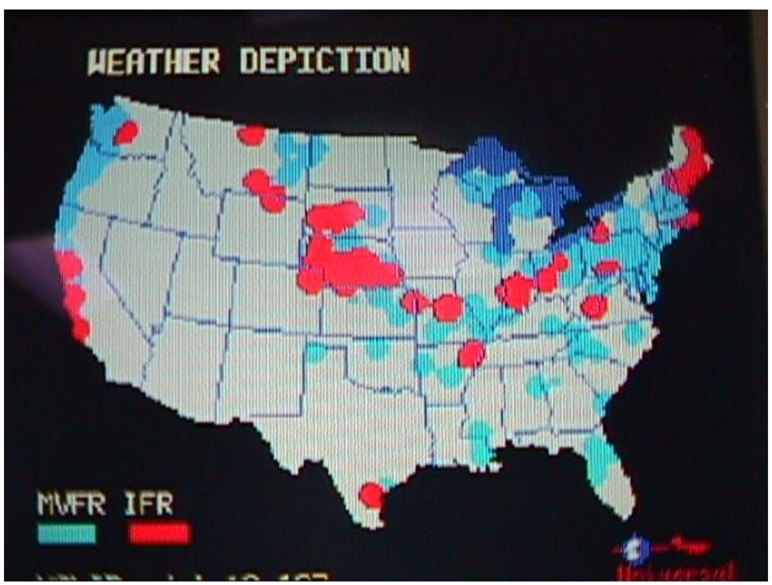
Radar Image



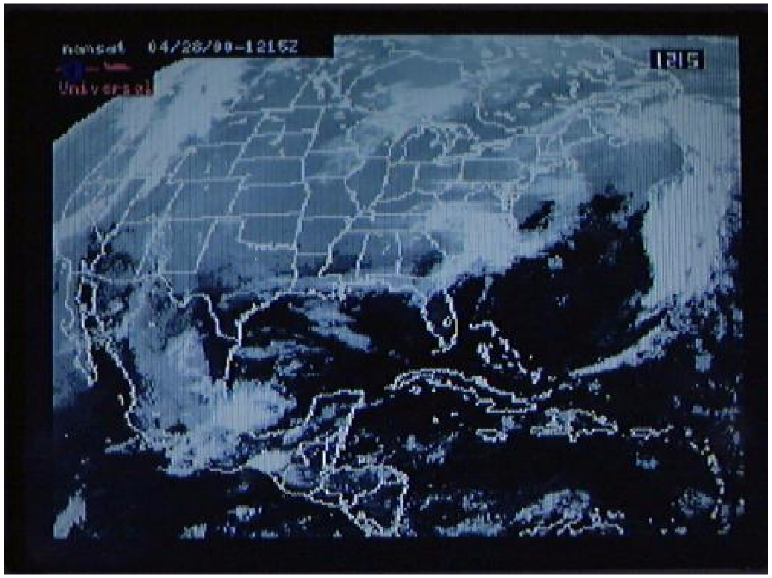
Significant Image

Tops/Move

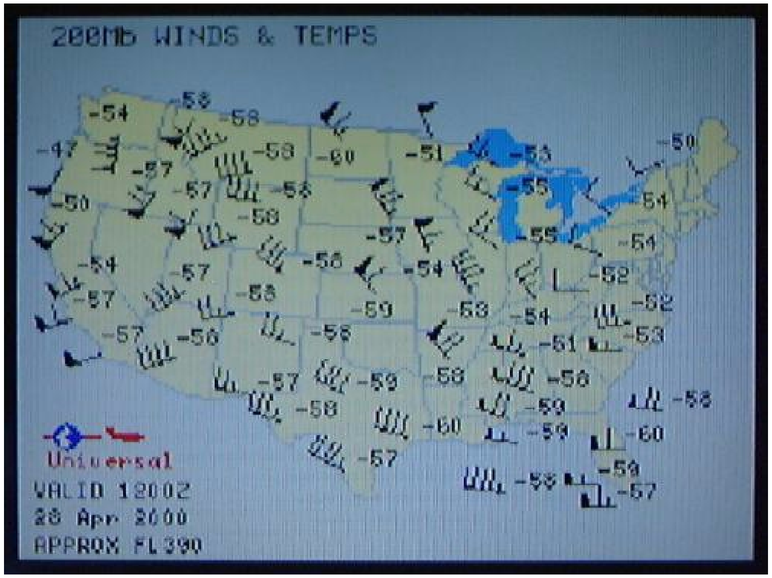
Depiction



Satellite Image



Wind/Temp Charts



DETAILED OPERATION

The following paragraphs describe in detail the operation of the FMCS for a variety of typical route and flight conditions. The methods are applicable to the basic configuration of the system. Weights in this example flight are given in kilograms or metric tons. The standard FMCS displays weight in pounds.

DUAL FMC CONFIGURATION

In a dual configuration the FMCS includes two identical interconnected FMCs operating as two independent navigators. Based on the position of the source select switch, one FMC is the driver and decision maker and is designated the primary FMC. The other FMC is the follower and is designated the secondary FMC.

The source select switch has the following positions:

- NORMAL
- BOTH ON LEFT
- BOTH ON RIGHT

Table 2-2 shows which FMC each LRU is interfaced with based on the switch position. Note that in the NORMAL position all right LRUs interface with the right FMC except for the right CDU.

Table 2–2 FMC Source Switch Settings

LRU	FMC INTERFACES BASED ON THE SWITCH POSITION		
	BOTH ON L	NORMAL	BOTH ON R
AUTOTHRTL	FMC – L	FMC – L	FMC – R
ADIRU – L[2]	FMC – L	FMC – L	FMC – R
ADIRU – R[2]	FMC – L	FMC – R	FMC – R
FCC – A	FMC – L	FMC – L	FMC – R
FCC – B	FMC – L	FMC – R	FMC – R
DAA – L[1]	FMC – L	FMC – L	FMC – R
DAA – R[1]	FMC – L	FMC – R	FMC – R
DME – L	FMC – L	FMC – L	FMC – R
DME – R	FMC – L	FMC – R	FMC – R
VHF NAV – L	FMC – L	FMC – L	FMC – R
VHF NAV – R	FMC – L	FMC – R	FMC – R

NOTES: 1. 737-300, 737-400, and 737-500 only.
2. 737-600, 737-700, and 737-800 only.

LRU	FMC INTERFACES BASED ON THE SWITCH POSITION		
	BOTH ON L	NORMAL	BOTH ON R
IRU – L[1]	FMC – L	FMC – L	FMC – R
IRU – R[1]	FMC – L	FMC – R	FMC – R
DLU	FMC – L	FMC – L	FMC – R
ACARS MU	FMC – L	FMC – L	FMC – R
CDU – L	FMC – L	FMC – L	FMC – R
CDU – R	FMC – L	FMC – L	FMC – R
EFIS – L[1]	FMC – L	FMC – L	FMC – R
EFIS – R[1]	FMC – L	FMC – R	FMC – R
CDS – L[2]	FMC – L	FMC – L	FMC – R
CDS – R[2]	FMC – L	FMC – R	FMC – R

NOTES: 1. 737-300, 737-400, and 737-500 only.
2. 737-600, 737-700, and 737-800 only.

If a situation such as a failure of the primary FMC occurs, the source select switch selection may be changed to put aircraft control with the remaining healthy FMC.

With respect to navigation, the primary FMC is again the master. The navigation master is determined by the position of the source select switch as follows:

SOURCE SELECT SWITCH POSITION	NAVIGATION MASTER	NAVIGATION SLAVE
NORMAL	FMC – L	FMC – R
BOTH ON L	FMC – L	FMC – R
BOTH ON R	FMC – R	FMC – L

The navigation master selects the navaids for tuning, allocates navaids to each FMC, determines the navigation update sensors, and transmits the initial position to the IRS.

If the FMCs OFP program, nav data,model/engine data, software option code data, or performance data do not compare, then the CROSSLOAD page will be displayed (on ground only). Crossload may then be performed via manual selection on the CROSSLOAD page. Upon power up, the FMC will attempt re-synchronization. Continuous monitoring and re-synchronization is performed using a high speed (RS-422) intersystem bus (ISB).

If synchronization cannot be maintained in flight, SINGLE FMC OPERATION message will be displayed. Dual operation may be restored by moving the position of the source switch select switch.

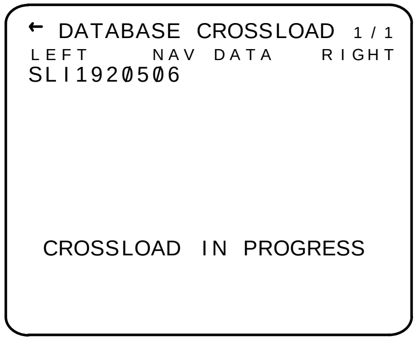
- Moving from BOTH-ON-RIGHT to any other position causes a memory copy from FMC-R to FMC-L.
- Otherwise memory copy is from FMC-L to FMC-R.
- If re-synchronization is successful, then message DUAL FMC OP RESTORED replaces message SINGLE FMC OPERATION.
- In addition to restoring dual operation through movement of the source select switch, an attempt will be made to automatically restore dual operation after 5 minutes if the source select switch is in either BOTH-ON-RIGHT or BOTH-ON-LEFT and the source select switch HAS NOT been changed since the down-mode.
- DATABASE CROSSLOAD page displayed upon power up if nav data is different:

```
← DATABASE CROSSLOAD 1/1
LEFT      NAV DATA     RIGHT
SLI1920506     ASA1930701



COPY FROM          COPY FROM
<LEFT                 RIGHT>

<INDEX
```

- Select “update from LEFT” to crossload nav data from left FMC to right FMC:

```
← DATABASE CROSSLOAD 1/1
LEFT      NAV DATA     RIGHT
SLI1920506     ASA1930701



 CROSSLOAD LEFT TO RIGHT

<CANCEL
```

- Press EXEC key to display CROSSLOAD IN PROGRESS:



CONTROL/DISPLAY UNITs (CDUs)

The arrangement of the front panel of the CDUs is illustrated in Figure 2–1, which may be unfolded outward for easy reference. The standard installation of the FMCS includes a single CDU. A second CDU is a customer option. The Captain's and First Officer's (if installed) CDUs are physically and functionally identical. Each CDU can be used independently or both simultaneously for the control and display tasks required in the course of a typical flight. When functional interfaces occur – as, for example, when one of the two CDUs is being used to modify the active flight plan – the ability of the second CDU to perform the same function will not be inhibited. Either CDU may be used to enter system data. Data entered on one CDU will appear on the corresponding display page of the other CDU when it is viewed. In the event different entries are made on the CDUs, the last entry is the one used for the flight plan.

DISPLAYS

The CDU's data displays are presented in a 5-inch viewing area. The general format of the display is given in Figure 2–1. The basic display format consists of an array of fourteen 24-character lines. A variety of alphanumeric characters and symbols can be presented on each line. The basic display format is partitioned into specifically defined data display areas. For example:

- The first five character spaces of the first line of the display are reserved for a data status block which indicates whether the information currently on the display is active (ACT) or a modification (MOD) to the active plan. If this block is blank, the data on display is either not plan specific or it is not active.

- The next 14 character spaces of the first line of display are reserved for an identifying title for the display.
- The remaining five character spaces of the first line form the page number for each display.
- The 24 character spaces of the bottom line of the display are used as a scratch pad block for entry of data from the keyboard, or for display of failure messages, operational alerts, and advisory prompts. When a message appears, it is to alert you to the occurrence of system or external sensor failures, performance limitations, and errors in manual data entry routines. The messages are covered in Part 3. The messages are assigned priorities, which are also explained in Part 3. All messages which appear in the scratch pad can be cleared by using the CLR key of the CDU. Messages will always be accompanied by the lighting of the MSG annunciator at the right side of the CDU panel, which will go out when the message is cleared from the scratch pad.

The remainder of the display (twelve 24-character lines) is available for use in displaying data. The data can consist of information directly applicable to operation of the aircraft, a menu allowing selection of system functional options, or a combination of the two.

KEY GROUPS

The keys on the lighted switch panel of the CDUs perform various functions and may be broken down into four key groups:

– Alphanumeric Keys – Pressing any alphanumeric key generates that character in the scratch pad.

– Function and Mode Keys – Provide access to operations such as:

  - Initialize the system
  - Access flight plan functions and status
  - Select operational modes for pre-flight planning or modification

– In the pages that follow, PAGE EXIT lists the exit using displayed prompts, and are selectable. The Mode keys may also be used to exit pages at any time.

CLB CLB (climb) – displays current or alternate climb mode for assessment and selection. Cruise altitude is enterable, as is a speed/altitude restriction.

CRZ CRZ (cruise) – displays current or alternate cruise mode for assessment and selection. Information about optimum altitude, stepclimb savings, and turbulence penetration N_1 targets is also available.

DES DES (descent) – displays current or alternate descent mode for assessment and selection. Target speed is enterable, as is a speed/altitude restriction. Flight path angle (FPA), vertical speed (V/S), and vertical bearing (V/B) information is provided for crew reference.

INIT REF INIT/REF (initialization/reference index) – accesses data pages required for start-up of the FMC and IRS. The operator may select various reference data and maintenance pages.

N1 LIMIT N_1 LIMIT – permits manual command of the active N_1 limit and selection of any reduced climb N_1 limit that may apply.

DEP ARR DEP/ARR (departures/arrivals) – allows selection of procedures and runways for the origin and destination airports.

RTE RTE (route) – allows flight plan data entries and access to lateral offsets. Displays flight plan route for observation.

LEGS LEGS (route legs) – displays and accepts entries of detailed data concerning each leg of the flight plan, for both the lateral and vertical paths.

HOLD HOLD – allows planning or initiation of holds at a designated waypoint or at present position.

DIR INTC DIR/INTC (direct/intercept) – (CDU/ANCDU) provides capability to proceed directly to any waypoint desired, or to intercept any leg presently in the flight plan.

MENU MENU – (MCDU/FANS MCDU) provides access to the MENU page which allows the MCDU to become the control/display unit for up to three other systems (up to five in the LCD CDU MCDU versions). Other systems are manually enabled/disabled as required.

FIX FIX (fix information) – displays range and bearing data, in radial/DME format, from the entered fix. Facilitates creation of fixes for use in flight planning.

PROG PROG (flight progress) – displays current flight status information such as ETA, fuel remaining at waypoint and destination. Provides access to navigation radio tuning status, wind, and path errors.

ATC ATC –(FANS MCDU) Not operational at this time.

FMC COMM FMC COMM (FMC communitcations) – (FANS MCDU) provides access to ACARS data uplink and download functions when the ACARS option is enabled.

VNAV (vertical navigation) – (FANS MCDU) displays the active performance page (climb, cruise, or descent) for the currently active phase and allows access to the other pages using the NEXT PAGE and PREV PAGE keys. If none of the phases are currently active, the display defaults to the climb page.

EXEC (execute) – used to incorporate data displayed on the CDU as part of the active flight plan. The execute key is operable only when its annunciator bar is lit. The following functions require the execute key:

Activate the flight plan.
Incorporate changes to the active flight plan.
Change the active guidance mode.
Insert data that affects the active flight plan, guidance mode, or data base.

– Page control keys – provide a means to navigate through multiple-page displays as follows:

NEXT PAGE – advances the display to the next higher page, or to the first page when on the last page.

PREV PAGE – advances the display to the next lower page, or to the last page when on the first page.

– Data manipulation keys – provide capability to change, delete, move, and add data.

LSK (line select key) – twelve line select keys allow data to be moved from the scratch pad area to one of the writable locations on the page. Using the LSK next to a data line allows the data to be duplicated in the scratch pad area.

CLR (clear) – clears the scratch pad area of the display. A brief depression of the clear key will delete the last character in the entry. Holding the clear key for at least 1 second clears the entire entry (including advisory and alerting messages).

+/– (sign) – Change Sign Key – changes data in the scratch pad from positive to negative and back again. May also be used to insert a hyphen for specialized data entries.

DEL (delete) – the delete key is used to remove data from a display (and thus a flight plan). If the scratch pad is empty, depression of the DEL key writes DELETE into the scratch pad. The delete process is then completed by line-selecting (by LSK) the data item to be removed. If the deletion is a valid one, the data field reverts to its default value (box prompts, dashes, or a system-generated value). The system prevents invalid use of the delete key. Pressing the wrong LSK on a page having a parameter that cannot be deleted displays INVALID DELETE in the scratch pad. The delete key must be pressed once for each parameter to be deleted. Pressing the delete key when the displayed page has no valid delete operation causes no response.

NOTE: System default values cannot be deleted. The delete key is used to remove crew entries from the system.

The delete key also performs the long delete function used to suspend a current ACARS UPLINK operation (MCDU only).

Most items that can be entered or selected can also be deleted. These items, listed in Table 2–3 by function, are the enterable data items which CANNOT be deleted. Instead of being deleted, these items must be changed by an overwriting entry from the scratch pad.

Table 2–3 Nondeletable Entries

<u>IDENT</u>

- Navigation data base effectivity date

<u>POS INIT</u>

- REF AIRPORT
- SET IRS POS
- GATE
- SET IRS HDG
- GMT

<u>REF NAV DATA</u>

- LATITUDE
- LONGITUDE
- CLASS[1]
- FREQ
- MAG VAR
- ELEVATION

<u>SUPP NAV DATA</u>

- LATITUDE
- LONGITUDE
- CLASS[1]
- EFF DATE
- FREQ
- MAG VAR
- ELEVATION

NOTE: 1. See page 2–111 for allowable entries.

Table 2–3 Nondeletable Entries (Cont.)

PERF INIT	
• GROSS WT	• COST INDEX
• ZFW	• CRZ ALT
• RESERVES	• TRANS ALT
• FUEL	
TAKEOFF REF	
• OAT	• V–SPEEDS[2]
RTE[3]	
• ORIGIN	• CO ROUTE
• DEST	• TO WAYPOINT
RTE HOLD	
• INBD COURSE	• LEG DIST
• LEG TIME	• TURN DIR
CLB	
• CRZ ALT	• TGT SPEED
CRZ	
• CRZ ALT	• TGT SPEED
DES	
• TGT SPEED	
DES FORECASTS	
• TRANS LEVEL	• QNH
• CABIN RATE	

NOTE: 2. Automatic V–SPEEDS option entries are deletable.

NOTE: 3. RTE data will automatically be deleted by cycling the Navigation Data Base effectivity date while on the ground.

More specific information concerning system usage of the items listed in Table 2-3 is discussed in the following sections of this guide.

Lighted Annunciators

There are two annunciators on the front panel of the CDUs (Ref Figure 2-1). These are defined in Table 2-4.

Table 2–4 CDU Annunciators

LABEL	ANCDU	CDU	MCDU	DEFINITION
DSPY	X	X		Not used.
CALL			X	Indicates a system not currently under control of the MCDU is requesting service.
MSG	X	X	X	Indicates an alerting/advisory message or pending messages.
FAIL		X	X	FMC failure detected.
	X			FMC and IRS failure detected.
OFST	X	X	X	Indicates an offset path is being flown.

ACARS DATALINK

Definition

The FMCS interface with the Aircraft Communication, Addressing, and Reporting System (ACARS) provides a datalink capability between the aircraft and a ground station. This enables transmitting flight information and requesting/receiving flight information. It is important to note that a ground station may be defined as either ATC or an airline facility. The destination for each type of data transmission is pre-defined by the airline.

Page Displays

Several display page locations are reserved to accommodate data requesting and reporting. The reserved locations are identified in Table 2-5.

Table 2–5 ACARS REQUEST/REPORT Reserved Fields

PAGE	FIELD(S)
• INIT/REF INDEX	4R
• PERF INIT	5R
• TAKEOFF REF	4L
• RTE	3R
• ACT RTE DATA	6R
• ACT DES FORECASTS	6L
• SUPP NAV DATA	4L, 4R
• PERF LIMITS	5L, 5R
• ALTERNATE DESTS	6L
• MOD RTE DATA	6R
• PROGRESS 3/3	5L, 5R, 6L, 6R
• FMC COMM (airline selectable option)	1L through 5L 1R through 6R

The contents of these reserved fields are determined by the airline. The action of the FMC when the associated line select key is selected, is also determined by the airline. If the interface between the ACARS and the FMC has failed, the prompt caret for each datalink field is removed, and the associated field will display either DATALINK FAIL, DATALINK NO COMM, or DATALINK VOICE. The failure display for each of the datalink fields is defined by the airline.

Ground Station Information Received

When the FMC receives information from the ground station which would cause a MOD plan condition if entered, a scratch pad message is displayed to indicate the type of information that was uplinked and that it is ready to be loaded. The crew is then required to go to the associated display page to load the uplink into the FMCs memory. For example, if the airline uplinked route information, ROUTE UPLINK READY would be displayed in the scratch pad. The operator would then go to the RTE page and select the LOAD prompt to load the information into the FMC. As the data is loading into the FMC, an XXXXX UPLINK LOADING message is displayed in the scratch pad, where XXXXX defines the type of data being loaded. In our example, ROUTE UPLINK LOADING would be displayed. While the data is loading, all MCDU pushbuttons, with the exception of the DEL key, are ignored. See the Long Delete Function discussion below for a description of how the DEL key is interpreted during loading.

Once the FMC has completed its processing of the uplink, a message is displayed in the scratch pad to indicate the status of the uplink. If the entire contents of the uplink was accepted by the FMC, an XXXXX DATA UPLINK message is displayed, where XXXXX defines the type of data. In our RTE uplink example, a ROUTE DATA UPLINK message would be displayed. If only some of the uplinked data could be used by the FMC, a PARTIAL XXXXX UPLINK message would be displayed. Finally, if none of the uplinked data could be used, then an INVALID XXXXX UPLINK message would be displayed.

Once the uplinked data is loaded, the operator should review the data. In most cases, the uplinked information pending operator approval is displayed in small font on the display pages. If the uplinked data is acceptable, the operator may accept the data by executing the MOD flight plan. The accepted data is then displayed in large font. The operator may also edit the uplinked data and then accept it. Finally, the operator may reject the entire uplink by erasing the uplink generated mod plan.

FANS VNAV

When the VNAV key on the FANS MCDU is pressed, the FANS MCDU displays the current active vertical guidance phase performance page (CLB, CRZ, or DEZ). If a vertical guidance phase is not currently active the default display is the CLB page. The NEXT PAGE and PREV PAGE key are then used to maneuver between these pages. The pages will then operate in their normal fashion. Selecting the RTA prompt (LSK 6R) on any one of the displayed VNAV pages displays the RTA PROGRESS page. Entries may then be made and executed, causing the RTA Mode to become the active mode.

Long Delete Function (MCDU and FANS MCDU)

As previously stated, CDU buttons are ignored while an uplink is loading into the FMC. However, the uplink may be suspended by pressing, and holding down, the DEL key for at least 1 second. For all uplinks, with the exception of SUPP NAV DATA uplinks, the loaded data is then removed from the flight plan and placed back into the “ready to be loaded” state. Uplinks that do not generate a mod plan are reloaded when there has been no CDU pushbutton activity for 30 seconds. Uplinks that do cause a mod plan can be reloaded via the LOAD prompt on the appropriate page. When a long delete is performed during a SUPP NAV DATA load, the uplink is suspended but the data loaded up to that point remains in the Supplemental NDB. After 30 seconds of keyboard inactivity, the remaining portion of the SUPP NAV DATA uplink is loaded into the Supplemental NDB.

The long delete function can also be used to move an “already loaded/mod pending” uplink back to a “ready to be loaded” state. That is, if an uplink has been loaded into the FMC, and the FMC is still in a MOD state, the operator could, by performing a long delete, erase the mod and place the uplink back in the queue. The LOAD prompt would again be displayed on the appropriate page.

Default Configuration

The FMC is delivered to the airline with a default datalink configuration. This default definition is described during the discussion of each display later in this section. It is important to note however, that each airline has the capability of modifying this default data to meet their individual needs. Therefore, those display discussions that follow may not precisely describe your datalink configuration.

ALTERNATE NAVIGATION FUNCTION (ALT NAV MCDU ONLY)

Alternate Navigation Operation

The ALT NAV function operates in the background providing there is a GPS input (from the on–side GPS).

- With the FMC(s) operational, the ALT NAV MCDU operates as a regular MCDU with the FMC(s) providing the navigation solution and guidance.
- With the FMC(s) operational and the ALT NAV function enabled, the ALT NAV MCDU provides an alternate independant navigation solution which may be viewed at any time (displayed on the ALT NAV pages), to cross–check other subsystems. The FMC(s) still provide the navigation solution and guidance.

- If the FMC(s) fail, and the ALT NAV function is enabled, the ALT NAV MCDU can continue to provide guidance information to the ESAI and EHSIs.

ALT NAV MCDU Keyboard Operation

The ALT NAV MCDU keyboard is identical to the normal MCDU keyboard, however, depending on the pages displayed, responses to particular keystrokes can be different. Only the differences are covered here.

The following keys may be used as usual while the ALT NAV MCDU is displaying the ALT NAV pages:

- EXECute
- PREV PAGE and NEXT PAGE keys
- Line select keys
- Alphanumeric keys (including CLR, SP, /, •, and +/–)

The function and mode keys operate as follows:

- The MENU key will always display the MENU page while displaying FMS pages or ALT NAV pages.
- While displaying FMS pages – function and mode keys operate as a normal MCDU.
- While displaying the ALT NAV pages and the FMC(s) are operational – pressing any of the function or mode keys will exit the ALT NAV page and display the selected FMS page.
- While displaying the ALT NAV pages and the FMC(s) are not operational – the function and mode keys will not have an affect.

ALT NAV Page Access

The ALT NAV pages may be manually selected for display at any time, and under specific conditions, will automatically be displayed.

NOTE: The ALT NAV function is not available if the ALT NAV MCDU determines that the on–side GPS data is not valid, or the receiver is not communicating data.

The ALT NAV pages may be manually accessed via the ALT NAV prompt (LSK 6L) on the MENU page at any time. If an FMC failure occurs, the MENU page is displayed providing access to the ALT NAV function via the ALT NAV prompt.

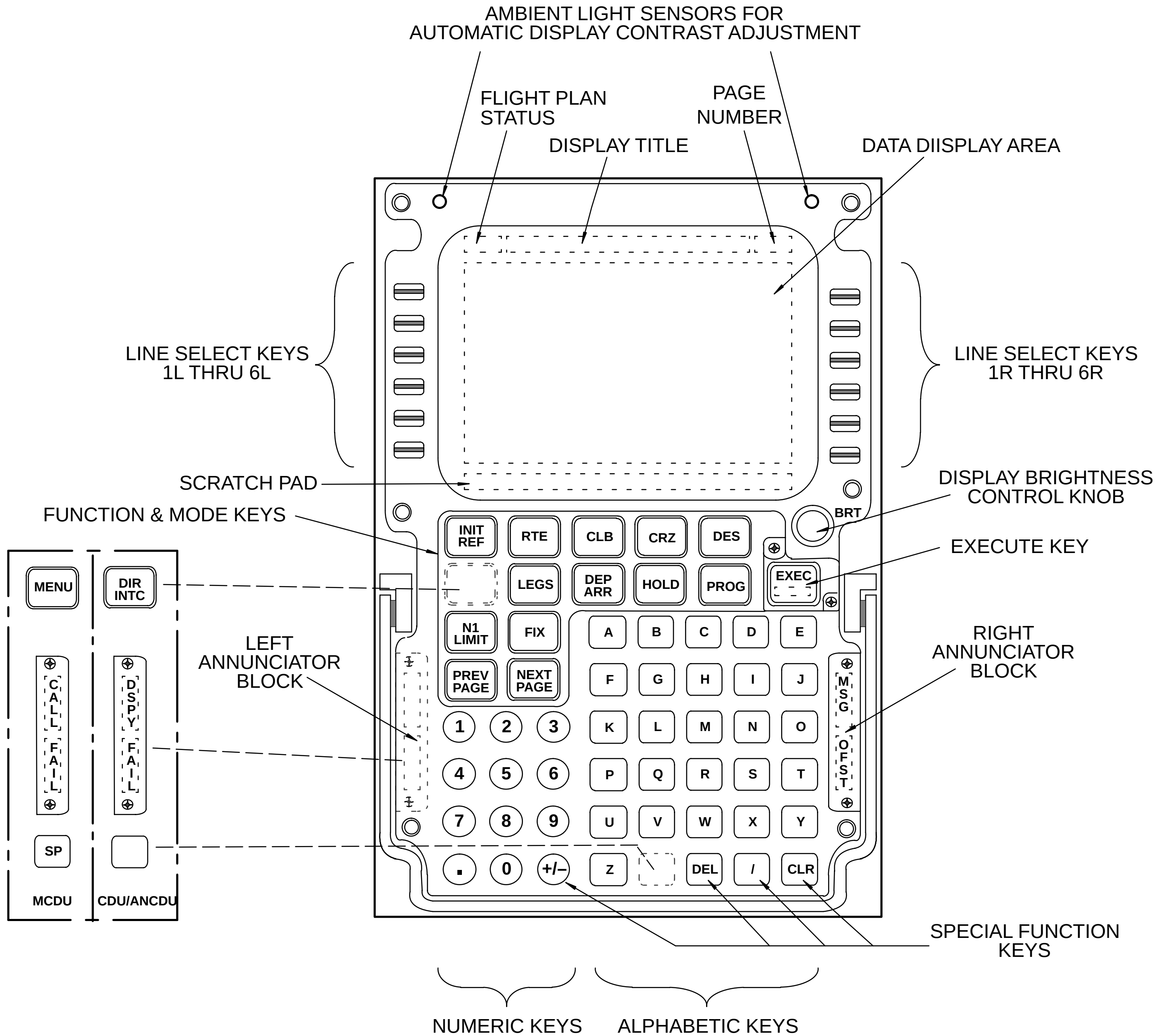


Figure 2–1 Control/Display Unit – CDU/MCDU

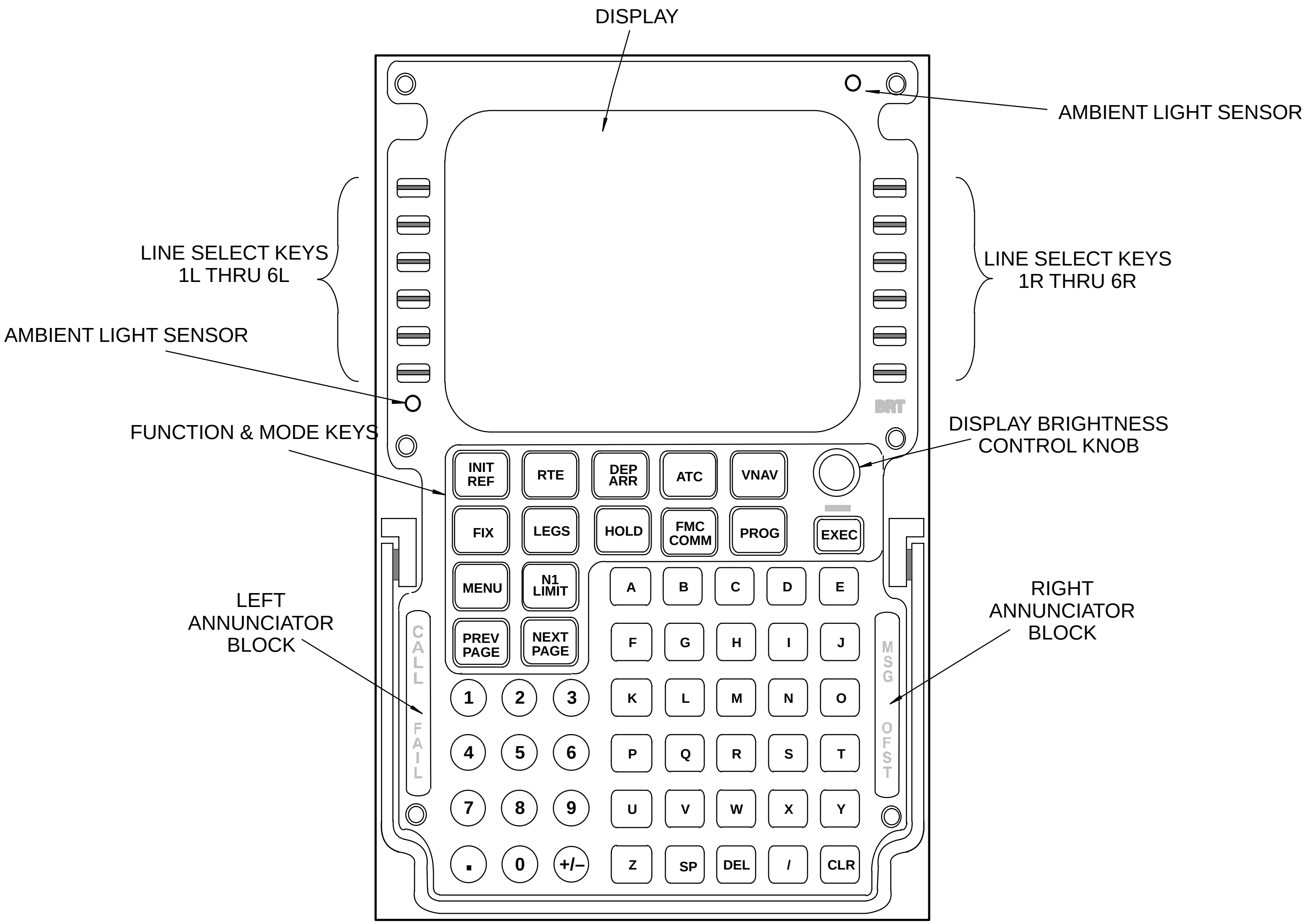


Figure 2–2 Control/Display Unit – FANS MCDU

BASIC SYSTEM OPERATION

This section concentrates on the basic pages used to define the flight plan requirements. The various system functions require some data entries for a complete definition of the intended route and corresponding predictions. Data entries are made by using the various LSKs. Required pilot entries before any performance computations can be made are: GROSS WEIGHT, or ZERO FUEL WEIGHT, CRUISE ALTITUDE, COST INDEX, FUEL RESERVES, and DESTINATION AIRPORT. Required entries are indicated on the displays by box prompts. Other fields where data entries are allowed but not essential for FMCS predictions are indicated by dashes or, in some cases, a default numerical value which can be overwritten. If an entry is attempted into a field which does not permit that entry, an INVALID ENTRY message will appear in the scratch pad. This message will also appear if an entry is of the wrong format or out of the range of the field selected.

A fictitious trip between London, England (EGLL) and Frankfurt, Germany (EDDF) is used in the following discussion. Where weights are presented in the description or in illustrations of the system's CDU displays, they are given in thousands of kilograms (metric tons). Figure 2–2 depicts the example route and its associated vertical profile.

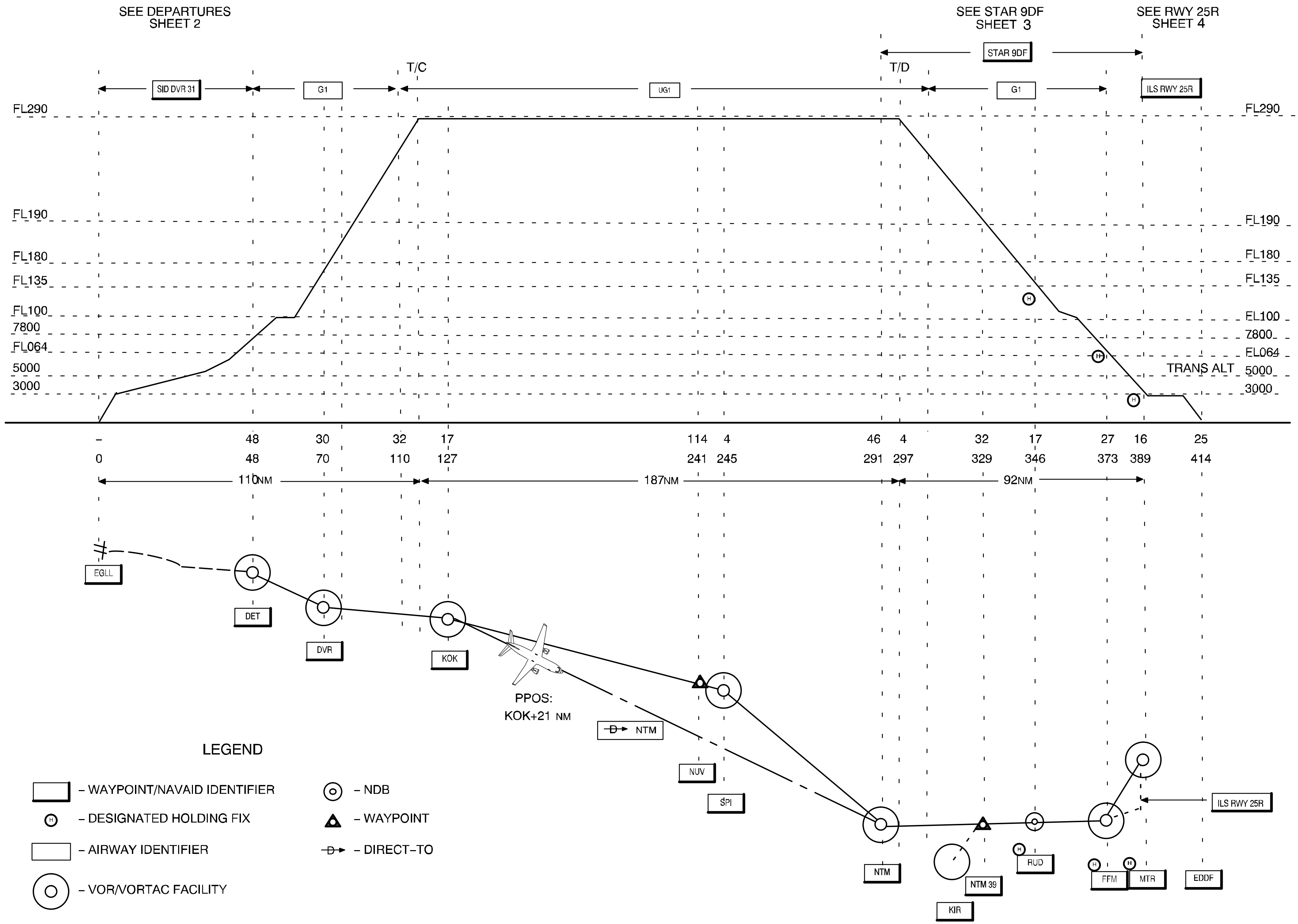


Figure 2–3 Example Flight Plan – London to Frankfurt (Sheet 1)

SID DVR31

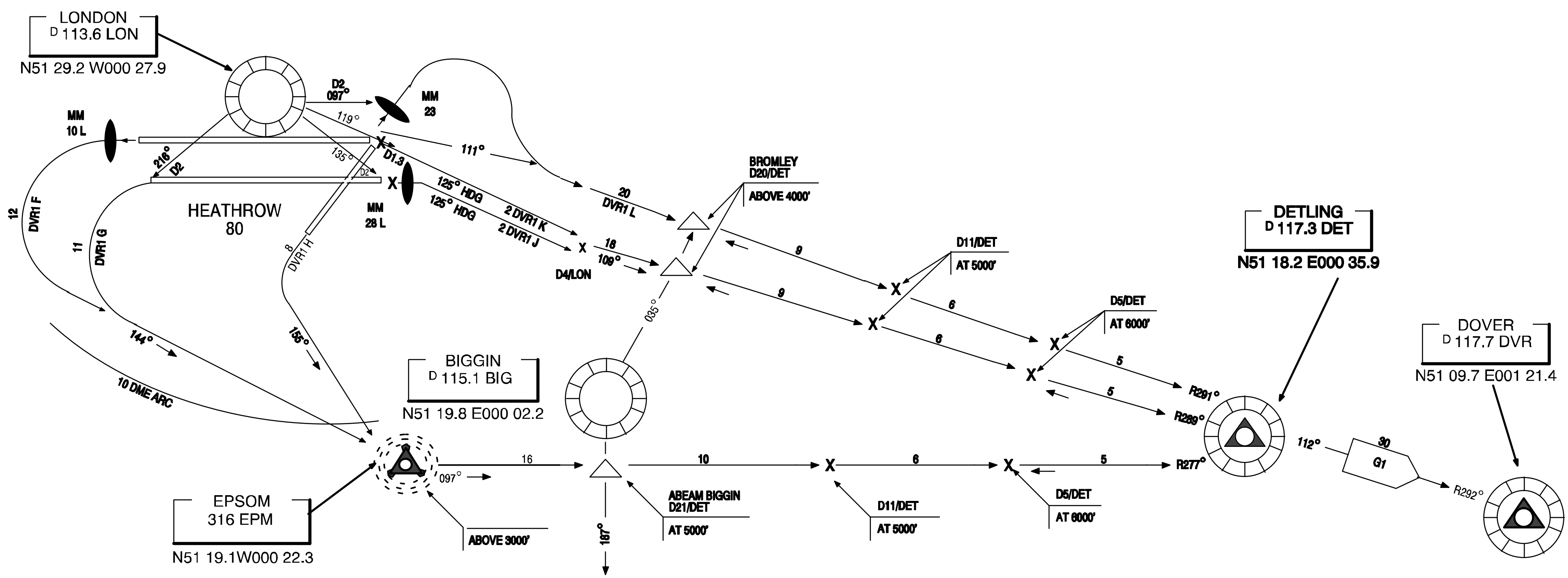


Figure 2–2 Example Flight Plan – London to Frankfurt (Sheet 2)

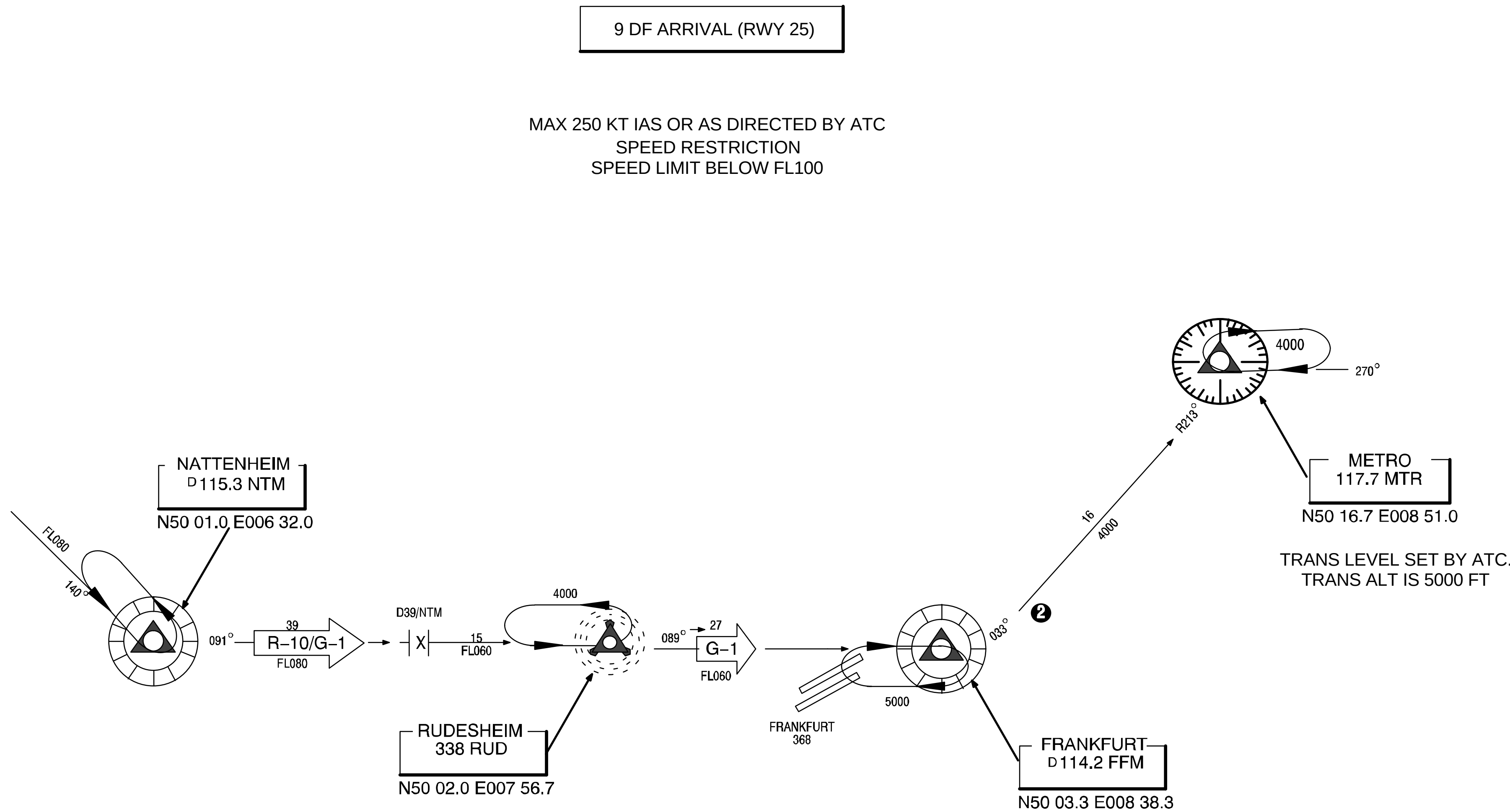


Figure 2–2 Example Flight Plan – London to Frankfurt (Sheet 3)

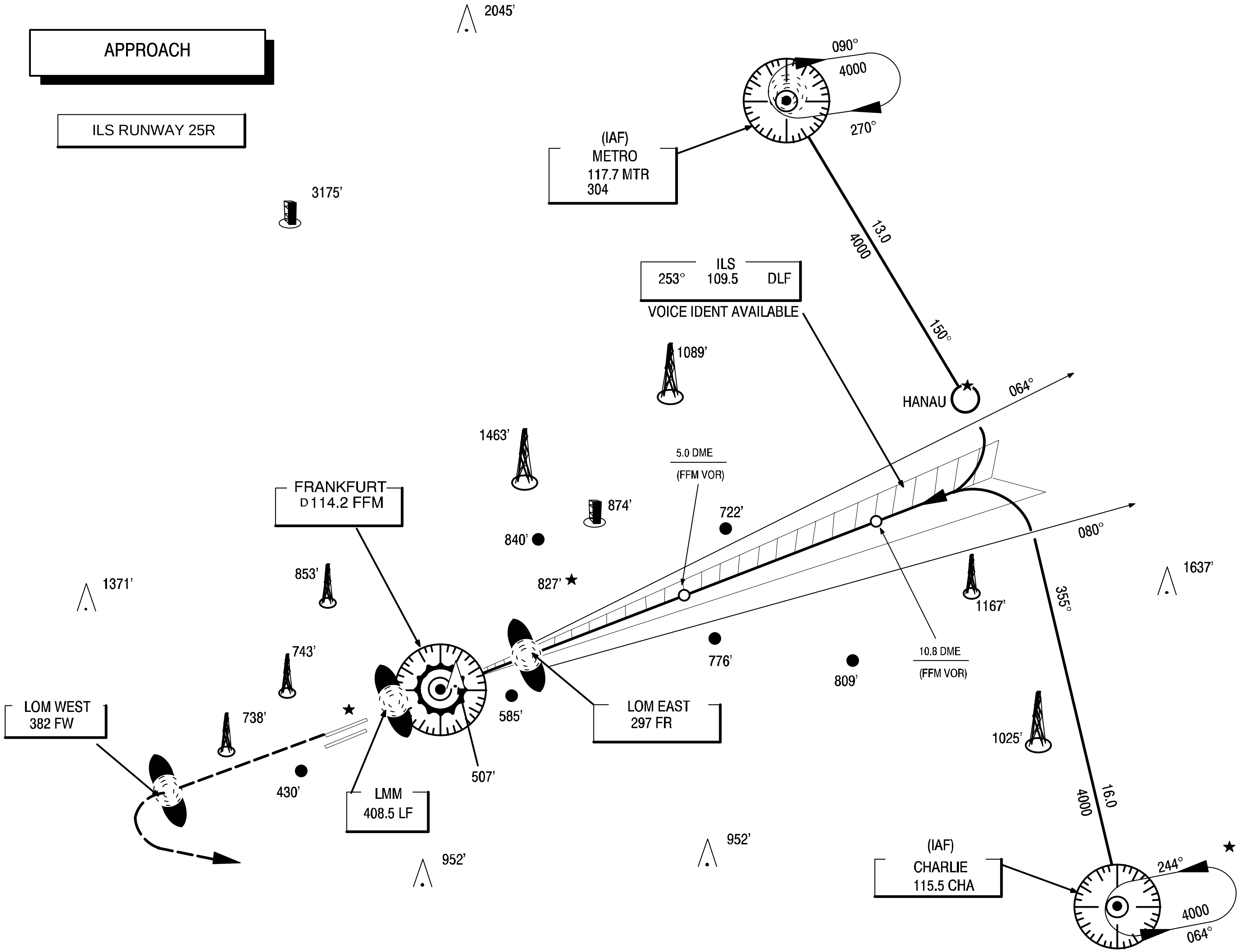


Figure 2–2 Example Flight Plan – London to Frankfurt (Sheet 4)

CONFIGURATION IDENTIFICATION (IDENT)

The IDENT page 1/2 provides confirmation of the current operational flight program and navigation data base loaded into the FMC. This page is also used to select the correct effectivity date cycle of the navigation data base.

<u>PAGE ACCESS</u> page 1/2:

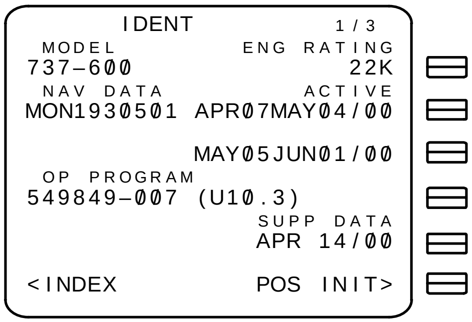
- Automatically from an on-ground power-up
- INIT/REF INDEX page IDENT prompt (LSK 1L)
- IDENT page 2/2 NEXT PAGE Key
- IDENT page 2/2 PREV PAGE Key

IDENT page 1 displays the following:

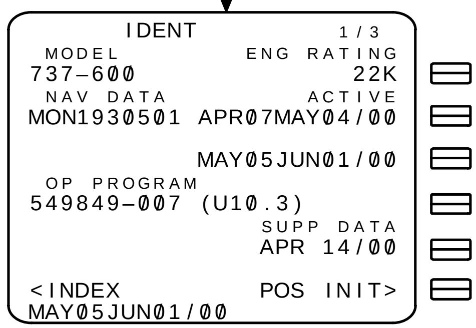
- Aircraft model
- Engine rating
- Nav data base number and effectivity dates
- Operational program number
- Supplemental data base effectivity date
- Access to INDEX and POS INIT pages

Selecting Alternate Nav Data Base

An effectivity date selection can only be made on the ground.

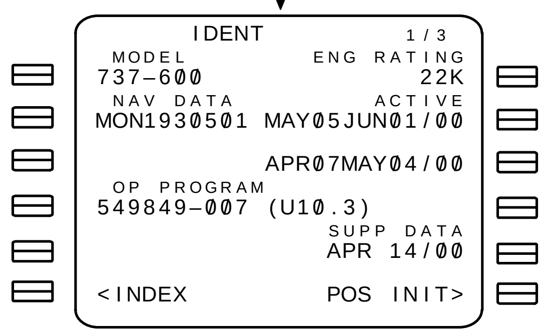


Press LSK 3R to transfer alternate data base effectivity dates to the scratch pad.



Press LSK 2R to transfer alternate data base effectivity dates from the scratch pad to the active line.

NOTE: U10.2A and earlier – 2 pages
U10.3 and later – – 3 pages when the Pilot Defined CO–Route is enabled.



The old data base effectivity dates are automatically moved down.

IDENT page 2 provides confirmation of the optional data bases that are loaded into the FMC. Unlike the navigation data base, these data bases are not subject to periodic revisions nor associated with effectivity dates.

Page IDENT 2 displays the following data bases when loaded:

- Performance Default
- Quick Reference Handbook
- Takeoff speeds
- Datalink (ACARS) Options
- Model/Engine data

PAGE ACCESS page 2:

U10.2A and earlier

– IDENT page 1 press NEXT PAGE or PREV PAGE

U10.3 and later

– IDENT page 1 NEXT PAGE Key

– IDENT page 3 PREV PAGE Key

```
        IDENT              2/2
   PERF DEFAULTS
 DEFAULT03P
   SW OPTIONS
 DEFAULT05O
   QRH T/O SPEEDS            ▷1
 DEFAULT01Q
   DATALINK CONFIG           ▷1
 DEFAULT02D
   MODEL/ENGINE DATA         ▷2
 BCG-005-0Z

 <INDEX           POS INIT>
```

U10.2A and earlier

```
        IDENT              2/3
   PERF DEFAULTS
 DEFAULT04P
   SW OPTIONS
 DEFAULT05O
   QRH T/O SPEEDS
 DEFAULT01Q
   DATALINK CONFIG
 DEFAULT02D
   MODEL/ENGINE DATA
 BCG-005-0Z

 <INDEX           POS INIT>
```

U10.3 and later

1 Airlines selectable option.

2 Displayed for 737-600, 737-700, 737-800 aircraft. Not used for 737-300, 737-400, 737-500 aircraft, however, will be displayed if loaded in FMC.

- Entries and selections are not allowed
- Data base names are updated automatically when the data bases are loaded

PERF DEFAULTS – Performance default data bases are as follows:

– U10.3 and earlier – DEFAULT03P
  U10.4 – DEFAULT04P

SW OPTIONS – Software default data bases are as follows:

– U10.0 – DEFAULT03O
– U10.1 – DEFAULT04O
– U10.2A – DEFAULT05O
– U10.3 – DEFAULT05O
– U10.4 – DEFAULT06O

DATALINK CONFIG – ACARS default data bases are as follows:

– U10.0 and U10.1 – DEFAULT01D
– U10.2A and U10.3 – DEFAULT02D
– U10.4 – DEFAULT04D

PAGE ACCESS page 3:

U10.3 and later

– IDENT page 2 NEXT PAGE Key

– IDENT page 1 PREV PAGE Key

```
        IDENT              3/3
  FLIGHT PLAN NAV DATA
 01FEB-13:00







 <INDEX           POS INIT>
```

U10.3 and later
(OPTION)

- Lists the date time stamp of the Flight Plan Nav Database if loaded

PAGE EXIT any page

– The INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.

– The POS INIT prompt (LSK 6R) provides access to the remainder of the preflight sequence to initialize the IRS.

Selection of either the INDEX or POS INIT prompts may be made at any time.

POSITION INITIALIZATION (POS INIT)

The FMCS can be used to initialize the IRS through various entries using the CDU. The IRS may be initialized using one of the following entries:

- LAST POS may be used if the aircraft has not been moved significantly since post-flight shutdown
- The REF AIRPORT (plus a GATE number if available) contained in the navigation data base
- Manual entry of latitude and longitude
- An entry carried over from the POS REF page 2/3

PAGE ACCESS page 1/3:

- INIT/REF INDEX page POS prompt (LSK 2L)
- IDENT page POS INIT prompt (LSK 6R)
- TAKEOFF REF page POS INIT prompt (LSK 4L)
  (when POS INIT has not been accomplished)
- POS SHIFT page 3/3 [NEXT PAGE] Key
- POS REF page 2/3 [PREV PAGE] Key
- [INIT REF] Key when on the ground and any IRS is in align mode

The SET IRS POS and corresponding data field (line 4R) will not be displayed when the IRS is in NAV, ATT, or OFF.

The REF AIRPORT data field (line 2L) and SET IRS POS data field (line 4R) will clear when the aircraft is airborne.

PAGE EXIT

- The INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.
- ROUTE prompt (LSK 6R) displays ROUTE page 1/1

INITIALIZE IRS FROM THE NDB

Set IRS to align mode.

Enter the origin airport into the scratch pad using the keyboard.

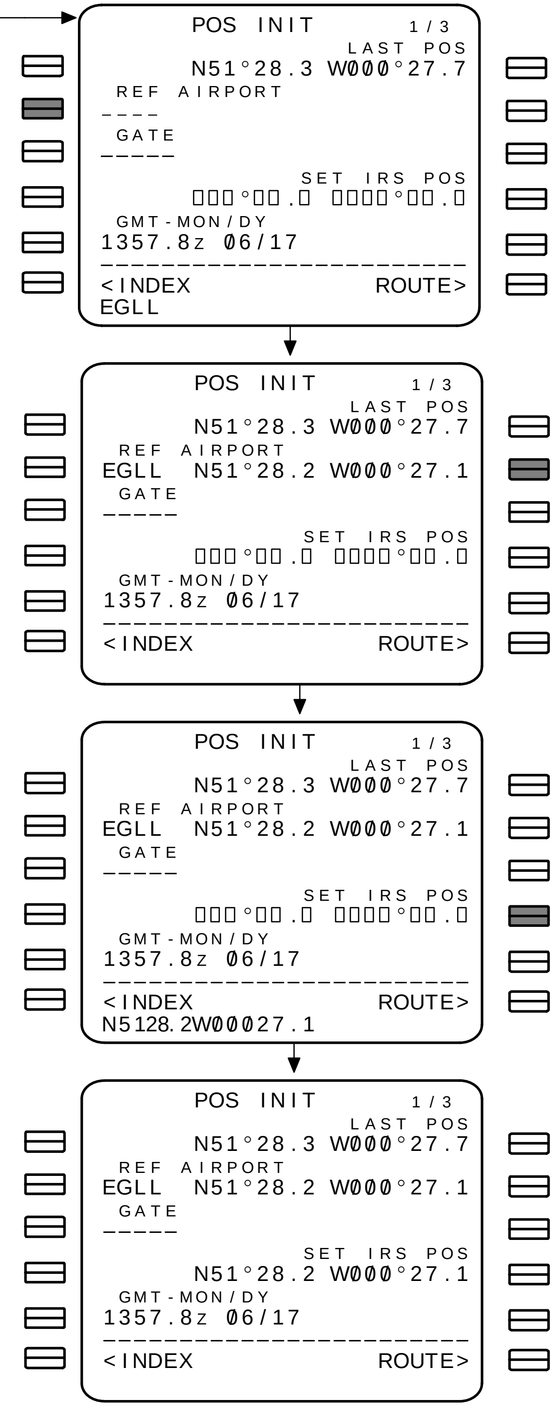
[E] [G] [L] [L]

Press LSK 2L to enter the REF AIRPORT and retrieve the the location from the NDB.

NOTE: See next page if GATE information is also stored in the NDB.

Press LSK 2R to copy the REF AIRPORT latitude and longitude to the scratch pad.

Press LSK 4R to transfer the REF AIRPORT latitude and longitude to the SET IRS POS line.



WHEN GATE DATA IS AVAILABLE IN THE NDB

Enter the REF AIRPORT into the scratch pad using the keyboard.

Press LSK 2L to transfer the scratch pad to the REF AIRPORT line.

Enter the GATE into the scratch pad using the keyboard.

Press LSK 3L to transfer the scratch pad to the GATE line.

Press LSK 3R to copy the GATE latitude and longitude to the scratch pad.

Press LSK 4R to transfer the scratch pad to the SET IRS POS line.

MANUAL ENTRY OF LATITUDE AND LONGITUDE

Enter the latitude and longitude into the scratch pad using the keyboard.

Press LSK 4R to transfer the scratch pad to the SET IRS POS line.

INITIALIZE IRS FROM LAST COMPUTED POSITION

POS INIT page 1/3 displays the last valid FMCS computed position under LAST POS (line 1R). This may be used to initialize the IRS if the airplane has not been moved significantly since the LAST POS was computed.

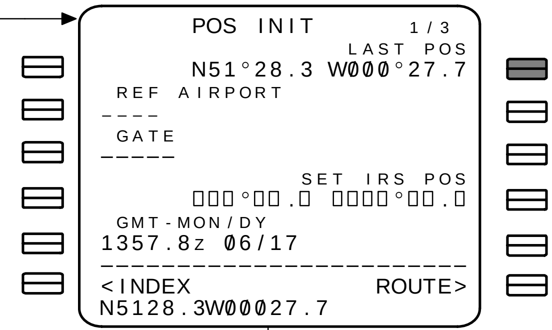
NOTE: If clock input is invalid, GMT must be entered.
If clock input is valid, only the hours may be entered to update the FMC time to local time.
The GMT legend and the Z is always displayed regardless of the time zone used for reference.
Date can not be edited.

PAGE EXIT

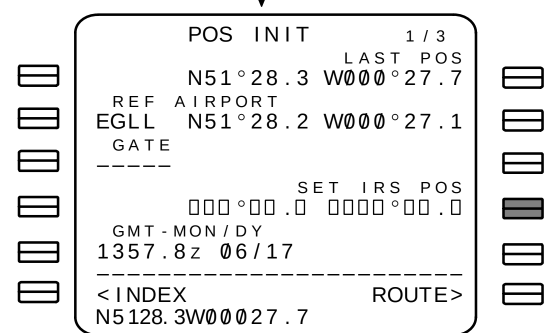
- The INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.
- The ROUTE prompt (LSK 6R) provides access to the route information.

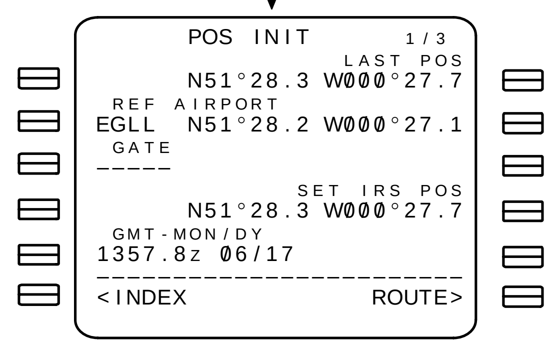
Selection of either the INDEX or ROUTE prompts may be made at any time.

Press LSK 1R to copy the FMCS last valid computed position into the scratch pad.



Press LSK 4R to transfer the LAST POS latitude and longitude to the SET IRS POS line.





ROUTE (RTE)
PRE U10.3

The ROUTE pages are used to enter and update flight plan data using ATC clearance language. A company route may be entered to construct the flight plan from predefined parameters stored in the NDB, or the route may be constructed manually. Modifications may also be made. As the route is entered, continuity is checked. If a discontinuity is detected, a ROUTE DISCONTINUITY legend appears on the appropriate RTE page at the point of the broken link.

<u>PAGE ACCESS</u> page 1/2:

- POS INIT page 1/3 ROUTE prompt (LSK 6R)
- TAKEOFF REF page ROUTE prompt (LSK 4R)
- DEPARTURES page ROUTE prompt (LSK 6R)
- ARRIVALS page ROUTE prompt (LSK 6R)
- Selection of waypoint from SELECT DESIRED WPT page
- RTE page 2/2 NEXT PAGE Key
- RTE page 2/2 PREV PAGE Key
- Press RTE Key

<u>PAGE EXIT</u>

- ALTN DEST prompt (LSK 6L) displays ALTERNATE DESTS page.
- Non–EFIS equipped aircraft – PERF INIT prompt (LSK 6R) displays PERF INIT page.
- EFIS equipped aircraft – OFFSET prompt (LSK 6R) displays LATERAL OFFSET page.

NOTE: For EFIS equipped aircraft – the PERF INIT prompt in field 6R is replaced with the OFFSET prompt.

- ORIGIN – airport identifier contained in the NDB. May be manually entered or called from the company route.

  NOTE: Entering or re–entering an ORIGIN at any time clears the existing route.

- CO ROUTE – company route identifier contained in the NDB. Entering a valid company route identifier calls up the stored company route and displays it on the route pages.

  NOTE: When a company route ID is entered and the route is not in the data base, the header changes to REF CO ROUTE.

- RUNWAY – destination RUNWAY or STAR may not be known when a route is first selected. These entries are made from the DEP/ARR page (See page 2–117).
- VIA – lateral path between waypoints. Valid entries are airways and direct great circle paths. DIRECT is displayed in the VIA field when a waypoint is entered in the TO field, and can be overwritten.
- DEST – displays the destination airport called from the NDB.
- FLT NO. – the flight number may be manually entered. It is displayed here and on the PROGRESS page. (airline selectable option)
- TO – displays valid identifiers of the selected route as follows:

• Waypoint identifiers
• Navaid identifiers
• Airport identifiers
• Course intersections
• Latitude and longitude data
• Waypoint bearing/distance
• Place/bearing–to–place/bearing data
• Waypoint/distance for along path waypoints.

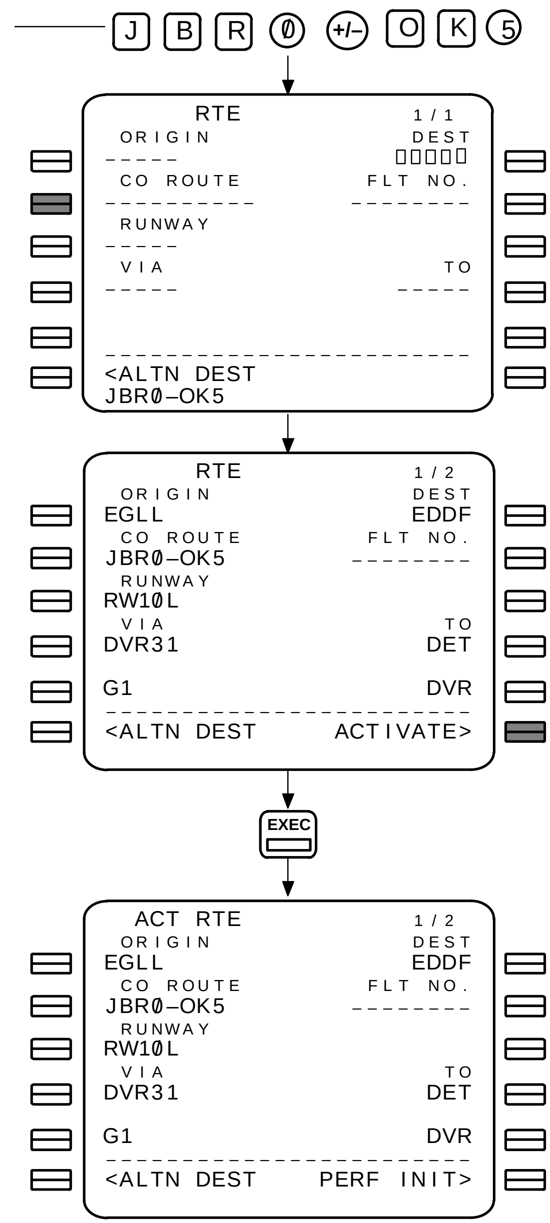
ACARS OPTION NOT SELECTED

Enter company route identifier into the scratch pad.

Press LSK 2L to transfer the scratch pad to CO ROUTE.

Press LSK 6R to enable activation of the entered route. The EXECUTE key lights.

The selected route becomes the active route after pressing the EXECUTE key.



ACARS OPTION SELECTED

(airline selectable option)

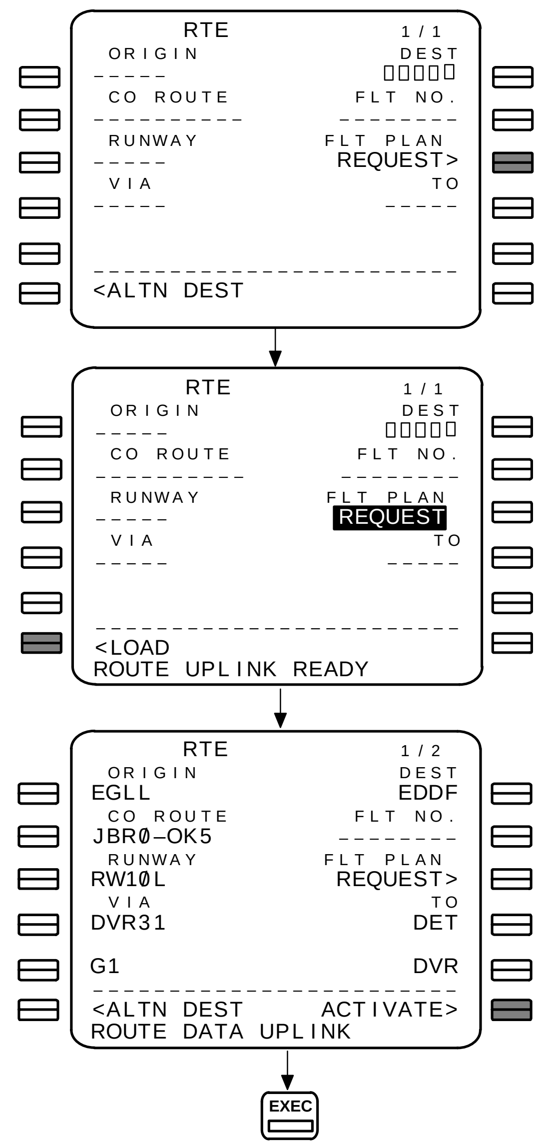
Press LSK 3R to initiate a request for route data.

The REQUEST prompt is highlighted in reverse video

When the ROUTE UPLINK READY message is displayed in the scratch pad, press LSK 6L to begin the upload.

Once loaded, the pilot may edit the route data as desired.

Press LSK 6R to enable activation of the entered route. The EXECUTE key lights.



ROUTE (RTE)
POST U10.3

The ROUTE pages are used to enter and update flight plan data using ATC clearance language. A company route may be entered to construct the flight plan from predefined parameters stored in the NDB, or the route may be constructed manually. Modifications may also be made. As the route is entered, continuity is checked. If a discontinuity is detected, a ROUTE DISCONTINUITY legend appears on the appropriate RTE page at the point of the broken link.

When non–unique route identifiers are entered, the SELECT DESIRED RTE page is displayed to allow selection of the source of the flight plan.

<u>PAGE ACCESS</u> page 1:

- POS INIT page 1/3 ROUTE prompt (LSK 6R)
- TAKEOFF REF page ROUTE prompt (LSK 4R)
- DEPARTURES page ROUTE prompt (LSK 6R)
- ARRIVALS page ROUTE prompt (LSK 6R)
- Selection of waypoint from SELECT DESIRED WPT page
- Selection of waypoint from SELECT DESIRED RTE page (pilot defined Company route option)
- RTE page 2 [NEXT PAGE] Key
- RTE last page [PREV PAGE] Key
- Press [RTE] Key

- ORIGIN – airport identifier contained in the NDB. May be manually entered or called from the company route.

  NOTE: Entering or re–entering an ORIGIN at any time clears the existing route.

- CO ROUTE – company route identifier contained in the NDB. Entering a valid company route identifier calls up the stored company route and displays it on the route pages.

  NOTE: When a company route identifier is entered and the route is not in the data base, the header changes to REF CO ROUTE.

- RUNWAY – destination RUNWAY or STAR may not be known when a route is first selected. These entries are made from the DEP/ARR page (See page 2–117).
- DEST – displays the destination airport called from the NDB.
- FLT NO. – the flight number may be manually entered. It is displayed here and on the PROGRESS page. (airline selectable option)

The following prompts are displayed only for the Pilot Defined Company Route option.

- SAVE/CONFIRM – this prompt is displayed when a minimum flight plan exists. Allows the pilot to save the current flight plan in the SUPP RTE Database. The save operation must be confirmed when the prompt changes.

  NOTE: SAVE prompt (LSK 5L) becomes non–operational if the SUPP RTE Database is full (10 routes).

- REVERSE – this prompt is displayed when a minimum flight plan exists. Allows the pilot to reverse the flight plan with the following items removed:
  - Terminal area procedures
  - Speed and altitude constraints
  - Holding patterns
  - Lateral offsets
  - RTAs
  - Company route identifier
  - Abeam points
  - Manually entered cruise winds

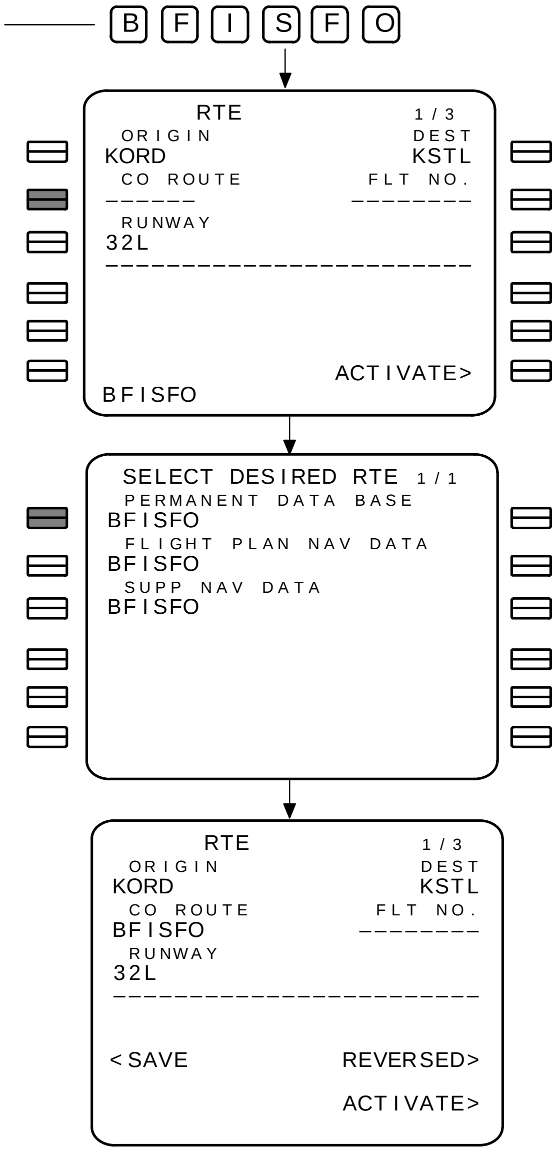
  If airborne – first fix of reversed flight plan is preceded by a DISCO.

  IF on ground – creates a DIRECT–TO the first fix of reversed flight plan.

Enter route identifier into the scratch pad.

Select the scratch-pad to to CO ROUTE line.

If the route identifier entered is non–unique, the SELECT DESIRED RTE page is displayed. Select the route from the appropriate data base.



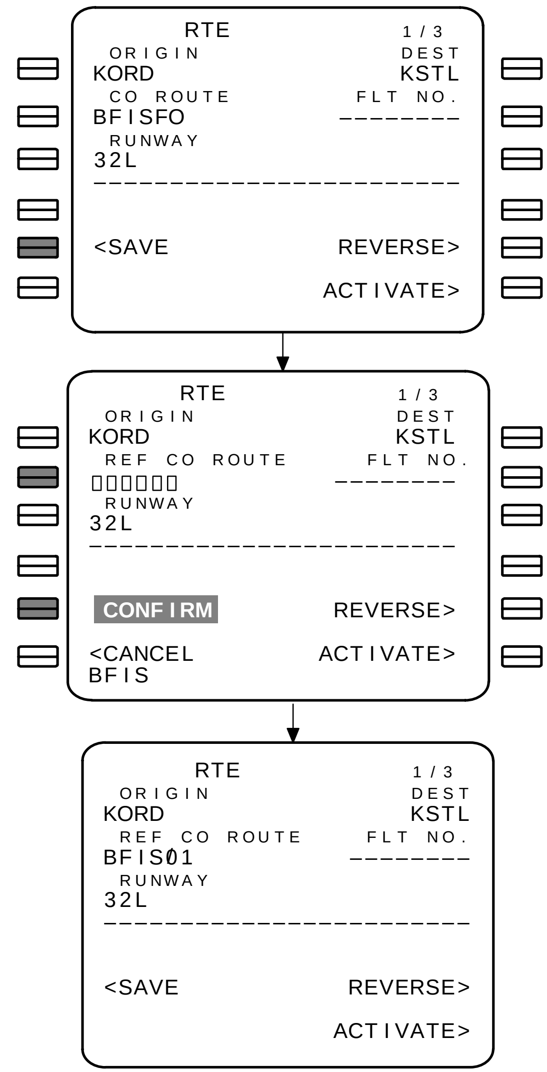
At this point the selected route may be modified or activated.

To save a modified route:

Select the SAVE PROMPT.

Enter the desired name into the scratchpad and select it to the CO ROUTE line.

Then select the CONFIRM PROMPT.



PERFORMANCE INITIALIZATION (PERF INIT)

The PERFORMANCE INITIALIZATION page provides the pilot with the means to enter aircraft and atmospheric parameters required to compute performance target values.

<u>PAGE ACCESS</u> page 1/2:

- Active ROUTE page PERF INIT prompt (LSK 6R) when on the ground (non–EFIS aircraft)
- INIT/REF INDEX page PERF prompt (LSK 3L)
- TAKEOFF REF page PERF INIT prompt (LSK 5L) prior to pre-flight complete
- PERF LIMITS page 2/2 [NEXT PAGE] Key
- PERF LIMITS page 2/2 [PREV PAGE] Key

NOTE: After a long-term power down, wait 15 seconds after applying power before entering performance initialization data.

When all required entries are made, the EXEC key will light. Press the EXEC key to activate the PERF INIT entries.

<u>PAGE EXIT</u>

- TAKEOFF prompt (LSK 6R) displays TAKEOFF REF page (U10.0)
- N1 LIMIT prompt (LSK 6R) displays N1 LIMIT page (U10.1 and later versions)
- INDEX prompt (LSK 6L) displays the INIT/REF INDEX page
- PERF LIMITS page 2/2

TRIP ALT is automatically calculated and displayed after GW is entered.

Box prompts: These are required fields and data must be provided manually or in some cases the data may be retrieved from the company route in the NDB.

- GW (gross weight)
- ZFW (zero fuel weight)

  NOTE: Entering a value for ether GW or ZFW will cause the other value to be calculated by the FMCS.

- PLAN/FUEL (planned fuel/fuel) – the fuel field displays the total fuel quantity from the fuel summation unit. If data from the fuel summation unit is not available, dashes are displayed and the header reads FUEL only.

  NOTE: Planned fuel (PLAN) is an airlines selectable option. This option allows entry of the anticipated fuel quantity. The planned fuel load may be manually entered into the PLAN field to provided accurate predictions. The actual fuel quantity will be used after engine start-up.

- RESERVES (required fuel reserves)
- COST INDEX
- CRZ ALT (cruise altitude)
  (after entry of CRZ ALT data, ISA DEV and T/C OAT fields are displayed)

  NOTE: The COST INDEX and CRZ ALT fields may be automatically entered from the company route data in the NDB. If data is not already provided, these fields must be completed.

Dash prompts: Fields containing dash prompts are not required. If correct data is available it may be entered to provide better predictions.

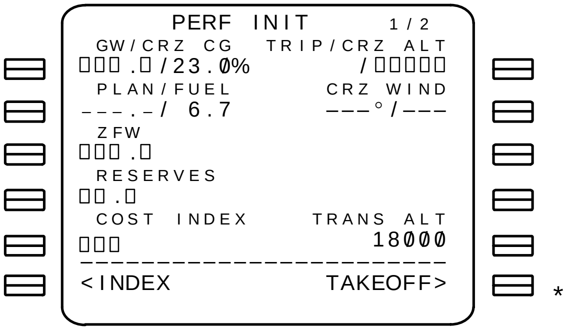
- CRZ WIND – manual entry of the anticipated winds aloft is propagated into the RTE LEGS pages, and will affect performance computations for all cruise waypoints listed.
- ISA DEV (forecast enroute ISA deviation) and T/C OAT (top of climb outside air temperature) may be entered in °C or °F. Entry of a value in one measurement base will cause the other to be calculated and displayed.

  NOTE: The aircraft temperature measurement base (°C or °F) is program pin controlled. To enter a value in the opposite measurement base, suffix the entry with the appropriate letter C or F. Negative values must be preceded by the minus sign.

- TRANS ALT (transition altitude) – defaults to the airport transition altitude from the NDB, however, this field may be overwritten.

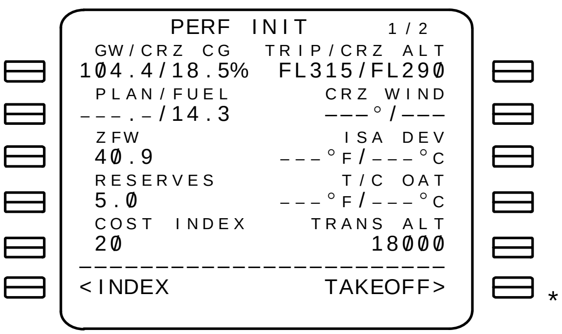
  NOTE: If a value is not entered into the TRANS ALT field, ISA DEV and CRZ WIND is assumed to be zero until actual PPOS WINDS data can be computed by the FMCS.

With Planned Fuel option selected



Enter data for required fields (shown in box prompts) into the scratch pad, then transfer the scratch pad contents to the desired field using the appropriate line select keys.

When all required fields have data entered into them the EXECUTE key will light.



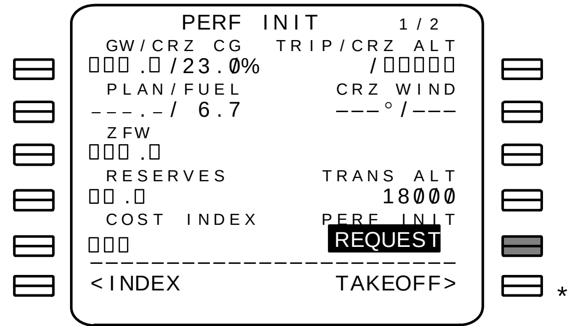
Enter data for dash prompt fields (if correct data is known) into the scratch pad, then transfer the scratch pad contents to the desired field using the appropriate line select keys.

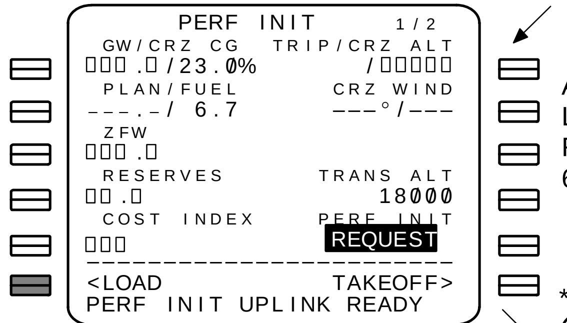
Pressing the EXECUTE key activates PERF INIT page entries.

* – U10.0 version shown. U10.1 and later versions display the N1 LIMIT prompt.

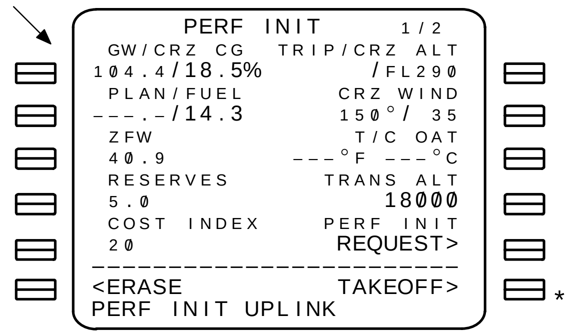
With ACARS option selected

Press LSK 5R to initiate a request for PERF INIT data from the ground station. The REQUEST prompt will be displayed in reverse video until the transfer is complete.



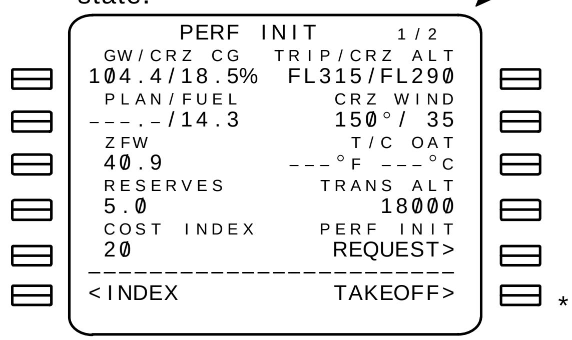


After the INDEX prompt changes to LOAD and the PERF INIT UPLINK READY message appears, press LSK 6L to begin the upload.



The upload data is displayed in small font for pilot review. Data may be edited as required. The EXECUTE key will light.

NOTE: The MCDU long delete function will allow the upload data to be backed out, and return the PERF INIT page to the LOAD state.



Pressing the EXECUTE key activates PERF INIT page entries. All loaded entries are then displayed in large font.

PERFORMANCE LIMITS (PERF LIMITS)

The PERFORMANCE LIMITS page provides the pilot with the means to enter restrictions of speeds in the FMCS flight profile optimizations for ECON and RTA modes. Speeds may be restricted on the low and/or high sides of the climb, cruise, and descent phases to meet special operational situations.

Default settings essentially do not provide restrictions on the cost-index driven flight profile optimizations (which are constrained by speed performance limitations associated with buffet margin restrictions).

Default settings are as follows:

- For 737-300, 737-400, and 737-500 aircraft
  Minimum speeds – 210 knots/.400 Mach
  Maximum speeds – 340 knots/.820 Mach
- For 737-600, 737-700, and 737-800 aircraft
  Defined in the MODEL/ENGINE database

NOTE: When entering the Mach value, trailing zeros may be omitted. When the entered value is transferred into the desired field, the required number of trailing zeros will be automatically included.

For RTA mode, the TIME ERROR TOLERANCE requirements are also established. on this page. The range is 6 to 30 seconds, and the FMC defaults to 30 seconds. This value may be adjusted for long time to go situations. When the TIME ERROR TOLERANCE entry is exceeded, the RTA speeds schedules are re–estimated.

<u>PAGE ACCESS</u>:

– PERF INIT page 1/2 NEXT PAGE Key

<u>PAGE EXIT</u>

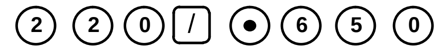
– RTA prompt (LSK 6R) displays RTA page

– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page

In the following example, the cruise MIN SPD limits are to be changed.

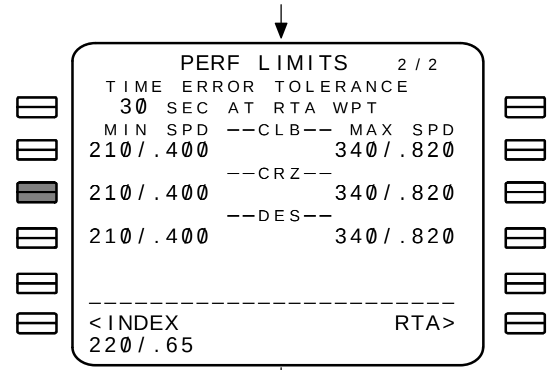
Without ACARS option selected

Enter the desired performance limit values into the scratch pad.



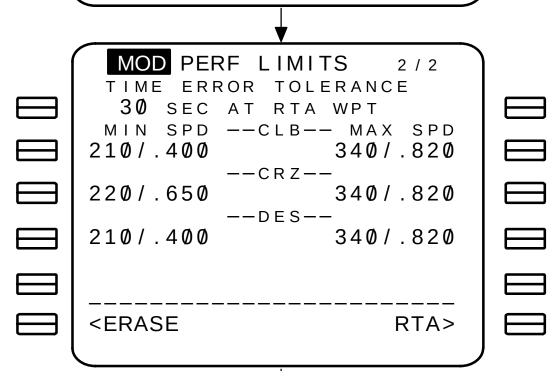
or

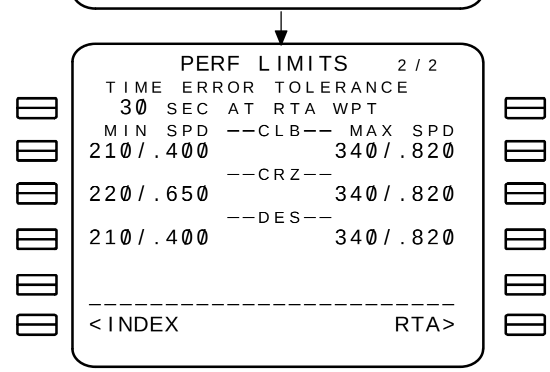
Press LSK 3L to transfer the contents of the scratch pad to the cruise MIN SPD field.



The PERF LIMITS page becomes a MOD page and the EXECUTE key lights.

The pilot may back out the change by selecting the ERASE prompt (LSK 6L) or accept the change by pressing the EXEC key.



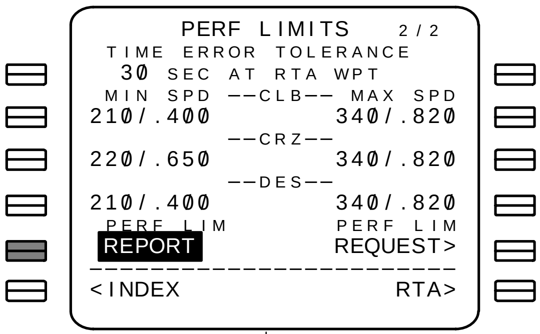


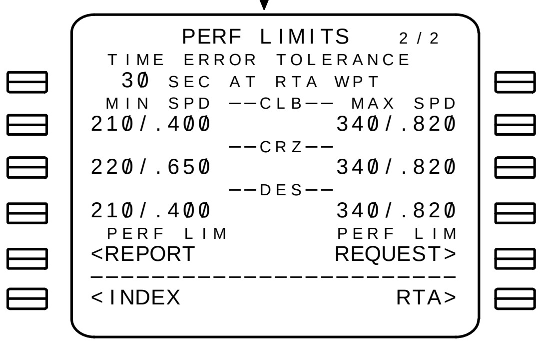
With the ACARS option selected, the pilot can communicate performance limits data with the ground station.

Selecting the REPORT prompt (LSK 5L) transmits the displayed performance limits data to the ground station.

Selecting the REQUEST prompt (LSK 5R) receives the performance limits data from the ground station and displays it in the PER LIMITS page.

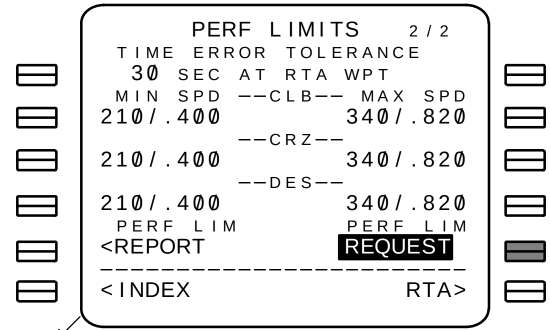
Press LSK 5L to report performance limits data to the ground station. The REPORT prompt is highlighted until the download is complete.

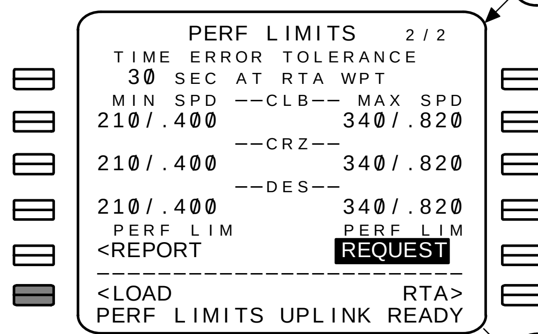




With ACARS option selected
(airlines selectable option)

Press LSK 5R to request performance limits data from the ground station. The REQUEST prompt is highlighted until the upload is complete.

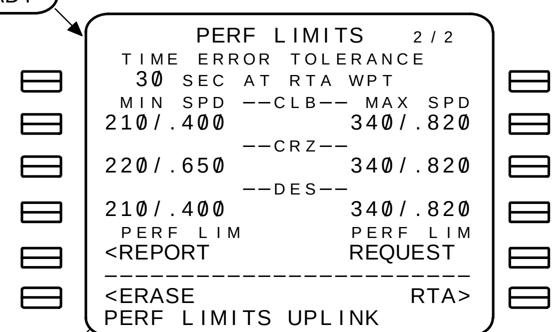


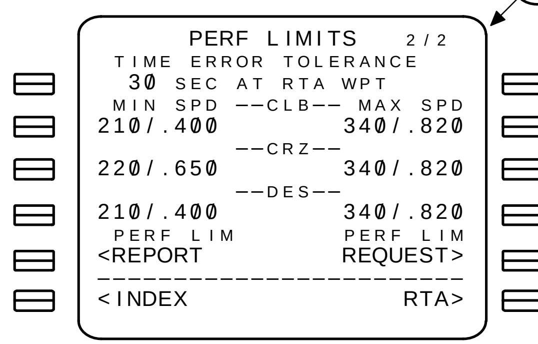


Press LSK 6L to initiate the load.

The EXECUTE key will light. The pilot may review and edit the changes if desired.

To back-out the upload performance limits data, press LSK 6L (MCDU long delete function may also be used).





Pressing the EXEC key completes the upload.

TAKEOFF REFERENCE (TAKEOFF REF) (U10.0 VERSION)

Without ACARS option selected

The TAKEOFF REFERENCE page 1/2 displays takeoff thrust targets for full rated or reduced thrust takeoff. When the VSPDS option is selected, climb thrust limits may also be controlled.

A checklist function with access to POS INIT, PERF INIT, ROUTE, and DEPARTURES pages which still require pre-flight initialization is also included. Each prompt is individually blanked when the required data entries for that page are complete.

PAGE ACCESS page 1/2:

- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)
- PERF INIT page TAKEOFF prompt (LSK 6R)
- TAKEOFF REF page 2/2 NEXT PAGE Key
- TAKEOFF REF page 2/2 PREV PAGE Key

PAGE EXIT

- INDEX prompt (LSK 6L) displays the INIT/REF INDEX page
- TAKEOFF REF page 1/2 NEXT PAGE Key

– OAT (outside air temperature) – required for calculating N_1 limits. OAT must be entered before attempting to arm the A/T on the ground. When a value is entered, values for xxK N_1 are computed and displayed.

NOTE: The aircraft temperature measurement base (°C or °F) is program pin controlled. To enter a value in the opposite measurement base, suffix the entry with the appropriate letter C or F. Negative values must be preceded by the minus sign.

NOTE: Aircraft with aspirated TAT probes will automatically display OAT values (FMC option).

– SEL TEMP[1] or SEL[2,3] (selected temperature) – enter the assumed temperature to enable a reduced thrust takeoff. When a value is entered, values for RED xxK N_1 are computed and displayed. SEL TEMP/SEL and xxK N1 values are also propagated to page 2/2.

– xxK N_1 or RED xxK N_1 (takeoff thrusts or reduced takeoff thrusts) – when an OAT value is entered, full thrust values are displayed in the xxK N_1 field. When the SEL TEMP[1] or SEL[2,3] value is entered, reduced thrust values are displayed and the field header changes to RED xxK N_1.

Thrust values and reduced thrust values are determined as follows:

- For 737-300, 737-400, and 737-500 aircraft – thrust limits are determined by the AIRFRAME/ENGINE program pins.
- For 737-600, 737-700, and 737-800 aircraft – thrust limits are determined by the AIRFRAME/ENGINE program pins and the rating tables in the database.

– FLAPS[2,3] (flaps position) – field is blank when takeoff reference speeds fields are blank. When displayed, the initial entry is the default value. Invalid entries result a message displayed in the scratch pad. A custom performance data base overrides the following

Valid factory FLAPS entries are determined as follows:

- For 737-300 aircraft – 1, 5, and 15 degrees
- For 737-400, and 737-500 aircraft – 5, and 15 degrees
- For 737-600, 737-700, and 737-800 aircraft – valid entries are defined by the Model/Engine data base and aircraft program pins

– QRH[2] or VSPDS[3] – Displays the FMCS computed values for takeoff speeds when the QRH or VSPDS select prompt (LSK 6R) is toggled to the ON state.

NOTES:

Unless otherwise indicated, a field/operational description applies to all airlines options.
1 – Standard Display
2 – QRH takeoff speeds option selected
3 – VSPDS option selected.
4 – TOGA RUNWAY POSITION UPDATE option selected
5 – RUNWAY REMAINING option selected
6 – Options 4 and 5 both selected
7 – RUNWAY OFFSET/RUNWAY REMAINING in FEET option selected
8 – QFE reference software option selected

– V_1, V_R, and V_2 (takeoff reference speeds) – are as follows:

- [1] Manual or selected values are displayed in large font under the V_1, V_R, and V_2 fields. FMCS computed values are displayed in small font. Manual or selected values of V_1 and V_R are sent to the EFIS speed tape for EFIS equipped aircraft. Values may be manually entered for display while on the ground.
- [2,3] FMCS computed values are displayed in the QRH or VSPDS fields when the QRH or VSPDS select prompt (LSK 6R) is toggled to the ON state. Computed values may be selected by pressing the appropriate line select key for the desired line. Selected values are displayed in large font in the V_1, V_R, and V_2 fields.

– [2,3] GW/TOW (gross weight/takeoff weight) – gross weight is the current, selected active, aircraft weight. This value is used by the FMCS to determine QRH takeoff speed. The takeoff weight is the value corresponding to the manually entered takeoff speeds V_1, V_R, and V_2 (displayed in large font).

– [1] PRE-FLT STATUS/PRE-FLT COMPLETE (pre-flight status) – when all required pre-flight data has been entered, this line will change to PRE-FLT COMPLETE.

– [1] Page access prompts are displayed (lines 4L, 5L, 4R, and 6L) for the pages that contain pre-flight required data fields and/or actions. These are described as follows:

- POS INIT prompt – blanked when a valid IRS position has been entered on the POS INIT page and that value agrees with all IRSs that are in ALIGN mode.
- PERF INIT prompt – blanked when valid fuel reserves, cost index, gross weight, and cruise altitude data has been entered on the PERF INIT page.
- ROUTE prompt – blanked when a route is activated on the RTE page.
- DEPARTURES prompt – blanked when the RUNWAY and VIA fields on the RTE page are completed.

NOTE: [2,3] The above prompts are sequentially displayed in line 6L when any of the pages require data or activation. When all requirements are met, line 6L displays the INDEX prompt.

– [1,2,3] When all required pre-flight data has been entered, and a runway was specified on an RTE page, the FMC POS UPDATE field (line 5R) is displayed. Pressing LSK 5R will cause the EXECUTE key to light and the CANCEL UPD prompt will appear in line 6R. Press the EXECUTE key to update the FMCS to the position of the indicated runway.

OR

– [4] The TO SHIFT prompt provides the means to enter an offset distance (in hundreds of meters/feet) from the runway position stored in the NDB. The FMCS position will be updated by the offset value entered each time the TOGA switch is pushed and the aircraft speed is less than 60 knots. Valid entries are:

- 100 to 900 meters
- [7] 100 to 3300 feet

OR

– [6] The RUNWAY REMAIN prompt provides the means to enter the remaining length (in hundreds of meters/feet) of the selected runway. The FMCS position will be updated by the RUNWAY REMAIN value entered each time the TOGA switch is pushed and the aircraft speed is less than 60 knots. Valid entries are:

- 1000 to 9900 meters
- [7] 3300 to 33000 feet

NOTE: When a position update occurs, the runway identifier and the offset value or runway distance remaining value is highlighted in reverse video.

Refer to page 2–111 for notes.

1

```
     TAKEOFF REF      1/2
 OAT                   V1
+15°C  +59°F        ---KT
 SEL TEMP              VR
+32°C  +90°F        ---KT
 RED 22K N1            V2
 92.0/ 92.0%        ---KT
-----PRE-FLT STATUS-----

             FMC POS UPD
                  RW32L>
------------------------
<INDEX       CANCEL UPD>
```

1, 4

```
     TAKEOFF REF      1/2
 OAT                   V1
+15°C  +59°F        ---KT
 SEL TEMP              VR
+32°C  +90°F        ---KT
 RED 22K N1            V2
 92.0/ 92.0%        ---KT
-----PRE-FLT STATUS-----

 RUNWAY          TO SHIFT
RW32L          RW32L  11M
------------------------
<INDEX       CANCEL UPD>
```

1, 5

```
     TAKEOFF REF      1/2
 OAT                   V1
+15°C  +59°F        ---KT
 SEL TEMP              VR
+32°C  +90°F        ---KT
 RED 22K N1            V2
 92.0/ 92.0%        ---KT
-----PRE-FLT STATUS-----

 RUNWAY        RWY REMAIN
RW32L                 76M
------------------------
<INDEX       CANCEL UPD>
```

2

```
     TAKEOFF REF      1/2
 SEL/OAT          QRH  V1
+32°C/ +59°F     133> ---
 RED 22K N1            VR
 92.0/ 92.0%     135> ---
 FLAPS                 V2
 5°              140> ---
                GW  / TOW
               110.0/
             FMC POS UPD
                  RW32L>
------------------SELECT
<INDEX       CANCEL UPD>
```

2, 4

```
     TAKEOFF REF      1/2
 SEL/OAT          QRH  V1
+32°C/ +59°F     133> ---
 RED 22K N1            VR
 92.0/ 92.0%     135> ---
 FLAPS                 V2
 5°              140> ---
                GW  / TOW
               110.0/
 RUNWAY          TO SHIFT
RW32L          RW32L  11M
------------------SELECT
<INDEX       CANCEL UPD>
```

2, 5

```
     TAKEOFF REF      1/2
 SEL/OAT          QRH  V1
+32°C/ +59°F     133> ---
 RED 22K N1            VR
 92.0/ 92.0%     135> ---
 FLAPS                 V2
 5°              140> ---
                GW  / TOW
               110.0/
 RUNWAY        RWY REMAIN
RW32L                 76M
------------------SELECT
<INDEX       CANCEL UPD>
```

3

```
     TAKEOFF REF      1/2
 SEL/OAT        VSPDS  V1
+32°C/ +59°F     133> ---
 RED 22K N1            VR
 92.0/ 92.0%     135> ---
 FLAPS                 V2
 5°              140> ---
                GW  / TOW
               110.0/
             FMC POS UPD
                  RW32L>
------------------SELECT
<INDEX       CANCEL UPD>
```

3, 4

```
     TAKEOFF REF      1/2
 SEL/OAT        VSPDS  V1
+32°C/ +59°F     133> ---
 RED 22K N1            VR
 92.0/ 92.0%     135> ---
 FLAPS                 V2
 5°              140> ---
                GW  / TOW
               110.0/
 RUNWAY          TO SHIFT
RW32L          RW32L  11M
------------------SELECT
<INDEX       CANCEL UPD>
```

3, 5

```
     TAKEOFF REF      1/2
 SEL/OAT        VSPDS  V1
+32°C/ +59°F     133> ---
 RED 22K N1            VR
 92.0/ 92.0%     135> ---
 FLAPS                 V2
 5°              140> ---
                GW  / TOW
               110.0/
 RUNWAY        RWY REMAIN
RW32L                 76M
------------------SELECT
<INDEX       CANCEL UPD>
```

Without ACARS option selected

The TAKEOFF REFERENCE page 2/2 provides a method of reducing takeoff thrust limits and displays the FMCS computed derate values.

<u>PAGE ACCESS</u> page 2/2:

– TAKEOFF REF page 1/2 NEXT PAGE Key

– TAKEOFF REF page 1/2 PREV PAGE Key

<u>PAGE EXIT</u>

– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page

– Press PREV PAGE Key

– QFE/QNH[8] prompt – toggles between QFE and QNH as the takeoff reference. QNH is the default selection.

NOTE: This prompt appears for 737-600, 737-700, and 737-800 aircraft only.

NOTE: The QFE/QNH selection on this page is reflected on the APPROACH REF page landing reference.

– SEL TEMP[1] or SEL[2,3] (selected temperature) – enter the assumed temperature to enable a reduced thrust takeoff. When a value is entered, values for RED xxK N_1 are computed and displayed along with derate levels..

NOTE: Any changes to SEL TEMP/SEL values are reflected in page 1/2.

– xxK N_1 or RED xxK N_1 (takeoff thrusts or reduced takeoff thrusts) – when an OAT value is entered, full thrust values are displayed in the xxK N_1 field. When the SEL TEMP[1] or SEL[2,3] value is entered, reduced thrust values are displayed and the field header changes to RED xxK N_1.

Thrust values and reduced thrust values are determined as follows:

- For 737-300, 737-400, and 737-500 aircraft – thrust limits are determined by the AIRFRAME/ENGINE program pins.
- For 737-600, 737-700, and 737-800 aircraft – thrust limits are determined by the Model/Engine database.

– TAKEOFF DERATE 1 (line 5L) and TAKEOFF DERATE 2 (line 5R) – provide selection of takeoff derate levels. To select a derate, press the appropriate line select key. The header will change from xxK DERATE to xxK <SEL> to indicate which derate is active. Only one derate may be selected when two are available. If a derate does not exist, the header and field are blank. The following table illustrates the possible derate levels according to aircraft/engine combinations:

AIRCRAFT	xxK DERATE ENGINE THRUST RATING		
	FULL	DERATE 1	DERATE 2
737-300	22K 20K	20K 18.5K	18.5 NONE
737-400	23.5K 22K	22K 20K	20K NONE
737-500	20K 18.5K	18.5K NONE	NONE NONE
737-600, 737-700. and 737-800	Derate levels are determined by the AIRFRAME/ENGINE program pins and the MODEL/ENGINE database.		

– RW WIND[2,3] (runway wind) – may be manually entered. The direction is entered corresponding to the MAG/TRUE switch position selected.

– RW SLOPE/HDG[2,3] (runway slope and heading) – may be manually entered. Entries are a percent gradient. Downhill gradients must be prefixed by the letter “D” or the – sign. The HDG is entered corresponding to the MAG/TRUE switch position selected. When the entry corresponds to true north, the entry must be suffixed with the letter “T”. Valid entries for RW SLOPE are:

- For 737-300, 737-400, and 737-500 aircraft – range is negative 2.0 to positive 2.0.
- For 737-600, 737-700, and 737-800 aircraft – thrust limits are determined by the Model/Engine Data Base.

NOTE: When RW WIND is non–zero, this entry is required.

TAKEOFF REFERENCE (TAKEOFF REF) CONT.
(U10.0 VERSION)

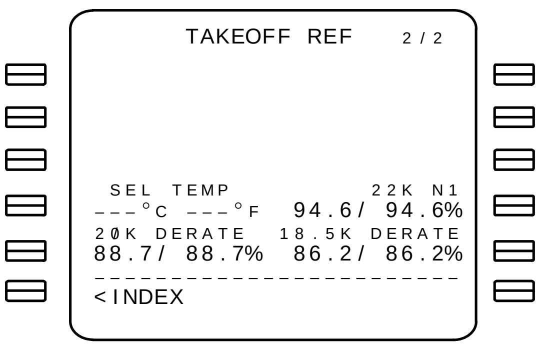
– TRIM[2,3] (stabilizer trim) – displayed when a gross weight has been calculated, and a manual CG has been entered.

– CG[2,3] – allows entry of a manual CG. Valid entries for CG are:

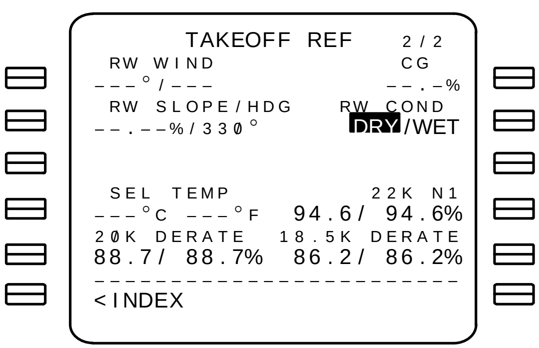
  - For 737-300, 737-400, and 737-500 aircraft – range is 5 to 32 percent MACH.
  - For 737-600, 737-700, and 737-800 aircraft – defined in Model/Engine data base.

– RW COND[2,3] (runway condition) – allows pilot to select runway conditions. Default is dry. Pressing LSK 2R toggles the selection. The active condition is highlighted in reverse video.

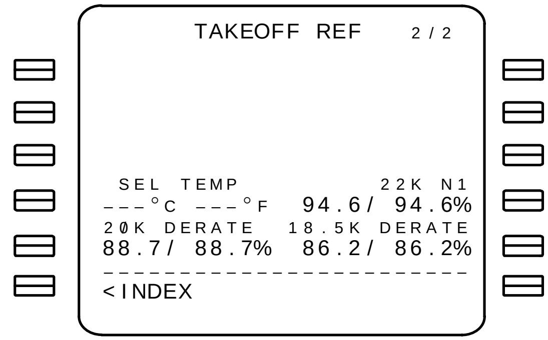
737-300, 737-400, and 737-500 aircraft
Standard Display



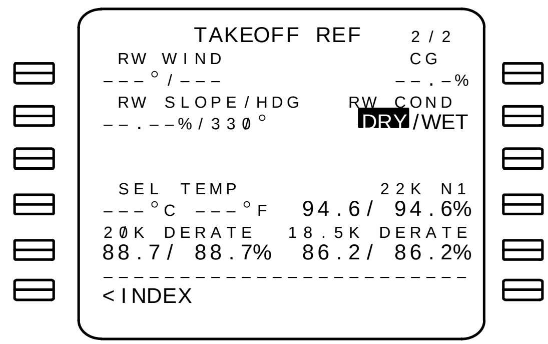
With VSPDS or QRH option selected



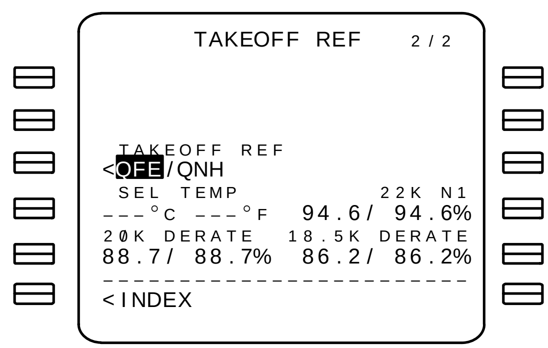
737-600, 737-700, and 737-800 aircraft
Standard Display



With QRH option selected



With QFE option selected



TAKEOFF REFERENCE (TAKEOFF REF) CONT.
(U10.0 VERSION)

With ACARS option selected

The TAKEOFF REFERENCE page 1/2 provides a method for requesting takeoff runway data for the selected origin airport from the ground station. Data for all runways will be uploaded, but only the selected runway data will be displayed on these pages. If the selected runway is changed, the data for the new runway is displayed.

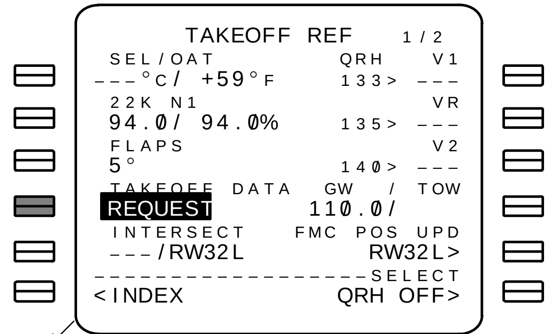
The following fields may have data uploaded:

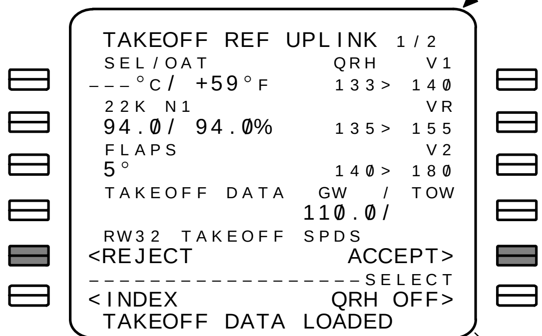
- OAT
- SEL
- FLAPS
- INTERSECT
- V_1, V_R, V_2
- RW WIND
- RW SLOPE/HDG
- DERATE 1/DERATE 2
- TRIM
- CG
- RW COND

Uploaded data or data that is computed and displayed as a result of the uploaded data will be displayed in small font until accepted or rejected.

If the uploaded data was rejected, it can be reloaded onto the page again by reselecting a takeoff runway.

Press LSK 4L to initiate an uplink request. The REQUEST prompt will be highlighted in reverse video until the upload is complete.

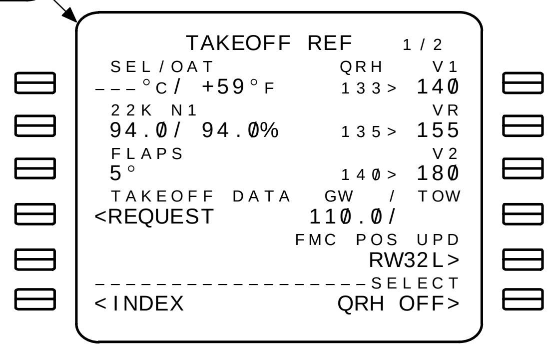




Review uploaded data for the currently selected runway.

Press LSK 5L to reject the uploaded data.

Press LSK 5R to accept the uploaded data.



TAKEOFF REFERENCE (TAKEOFF REF)
(U10.1 AND LATER VERSIONS)

Without ACARS option selected

The TAKEOFF REFERENCE page 1/2 displays takeoff thrust targets for full rated or reduced thrust takeoff. When the VSPDS option is selected, climb thrust limits may also be controlled.

A checklist function with access to POS INIT, PERF INIT, ROUTE, and DEPARTURES pages which still require pre-flight initialization is also included. Each prompt is individually blanked when the required data entries for that page are complete.

PAGE ACCESS page 1/2:

- INIT/REF INDEX page TAKEOFF prompt (LSK 4L)
- N1 LIMIT page TAKEOFF prompt (LSK 6R) (on the ground only)
- Active RTE page TAKEOFF prompt (LSK 6R) (PERF INIT complete and on the ground only)
- TAKEOFF REF page 2/2 NEXT PAGE Key
- TAKEOFF REF page 2/2 PREV PAGE Key

PAGE EXIT

- INDEX prompt (LSK 6L) displays the INIT/REF INDEX page
- TAKEOFF REF page 1/2 NEXT PAGE Key

FLAPS (flaps position) – field is blank when takeoff reference speeds fields are blank. When displayed, the initial entry is the default value. Invalid entries result a message displayed in the scratch pad. A custom performance data base overrides the default settings. When Box prompt is displayed, manual entry is required.

Factory default FLAPS settings are determined as follows:

- For 737-300, 400, and 737-500 aircraft – 5 degrees
  - Valid manual entries for 737–300 are 1, 5, and 15 degrees.
  - Valid manual entries for 737–400/500 are 5 and 15 degrees.
- For 737-600, 737-700, and 737-800 aircraft – defined in the loadable Perf Data Base.
  - Valid manual entries are defined in the loadable Perf Data Base.

When V1, VR, and V2 are blank:

- 737–300/400/500 – defaults to 5 degrees.
- 737–600/700/800 – data field blanks.

xxK N_1 or RED xxK N_1 or xxk BUMP N_1 (takeoff thrusts or reduced takeoff thrusts or takeoff bump thrust) – when an OAT value is entered, full thrust values are displayed in the header field. When an assumed temperature (SEL) (on TAKEOFF page 2) value is entered, reduced thrust values are displayed and the field header changes to RED xxK N_1.

Thrust values and reduced thrust values are determined as follows:

- For 737-300, 737-400, and 737-500 aircraft – thrust limits are determined by the AIRFRAME/ENGINE program pins.
- For 737-600, 737-700, and 737-800 aircraft – thrust limits are determined by the AIRFRAME/ENGINE program pins and the loadable Perf Data Base.

CG – initally displayed as dash prompt. Valid entries are as follows:

- For 737-300, 737-400, and 737-500 aircraft – 5.0 to 32.0 percent of MAC.
- For 737-600, 737-700, and 737-800 aircraft – determined by the AIRFRAME/ENGINE program pins and the loadable Perf Data Base.

TRIM – calculated trim position and header is displayed after CG and GW (on PERF INIT page 1) are entered.

NOTES:

Unless otherwise indicated, a field/operational description applies to all airlines options.
1 – Standard Display
2 – QRH takeoff speeds option selected
3 – VSPDS option selected.
4 – TOGA RUNWAY POSITION UPDATE option selected
5 – RUNWAY REMAINING option selected
6 – Options 4 and 5 both selected
7 – RUNWAY OFFSET/RUNWAY REMAINING in FEET option selected
8 – QFE reference software option selected
9 – Takeoff Speeds
10 – Takeoff Thrust Bump

Without ACARS option selected

V_1, V_R, and V_2 (takeoff reference speeds) – are as follows:

- [1] Manual or selected values are displayed in large font under the V_1, V_R, and V_2 fields. FMCS computed values are displayed in small font. Manual or selected values of V_1 and V_R are sent to the EFIS speed tape for EFIS equipped aircraft. Values may be manually entered for display while on the ground.
- [2,3] FMCS computed values are displayed in the QRH or VSPDS fields when the QRH or VSPDS select prompt (LSK 6R) is toggled to the ON state. Computed values may be selected by pressing the appropriate line select key for the desired line. Selected values are displayed in large font in the V_1, V_R, and V_2 fields.

QRH[2] or VSPDS[3] – Displays the FMCS computed values for takeoff speeds when the QRH or VSPDS select prompt (LSK 6R) is toggled to the ON state.

[1] PRE-FLT STATUS/PRE-FLT COMPLETE (pre-flight status) – when all required pre-flight data has been entered, this line will change to PRE-FLT COMPLETE.

– [1] Page access prompts are displayed (lines 4L, 5L, 4R, and 6L) for the pages that contain pre-flight required data fields and/or actions.

– [2,3] The access prompts are sequentially displayed in line 6L when any of the pages require data or activation. When all requirements are met, line 6L displays the INDEX prompt.

– The access prompts are described as follows:

  - POS INIT prompt – no longer displayed when a valid IRS position has been entered on the POS INIT page and that value agrees with all IRSs that are in ALIGN mode.
  - N1 LIMIT prompt (U10.2A) – displayed after POS INIT complete. Blanked when OAT entered on TAKEOFF REF page 2 or N1 LIMIT page (on the ground) or Aspirated TAT probe installed.
  - PERF INIT prompt – blanked when valid fuel reserves, cost index, gross weight, and cruise altitude data has been entered.
  - ROUTE prompt – blanked when a route is activated on the RTE page.
  - DEPARTURES prompt – blanked when the RUNWAY and VIA fields on the RTE page are completed.

TAKEOFF REFERENCE (TAKEOFF REF) CONT. (U10.1 AND LATER VERSIONS)

[1,2,3] When all required pre-flight data has been entered, and a runway was specified on an RTE page, the FMC POS UPDATE field (line 5R) is displayed. Pressing LSK 5R will cause the EXECUTE key to light and the CANCEL UPD prompt will appear in line 6R. Press the EXECUTE key to update the FMC to the position of the indicated runway.

OR

[4] The TO SHIFT prompt provides the means to enter an offset distance (in hundreds of meters/feet) from the runway position stored in the NDB. The FMCS position will be updated by the offset value entered each time the TOGA switch is pushed and the aircraft speed is less than 60 knots. Valid entries are:

- 100 to 900 meters
- [7] 100 to 3300 feet

OR

[6] The RUNWAY REMAIN prompt provides the means to enter the remaining length (in hundreds of meters/feet) of the selected runway. The FMC position will be updated by the RUNWAY REMAIN value entered each time the TOGA switch is pushed and the aircraft speed is less than 60 knots. Valid entries are:

- 1000 to 9900 meters
- [7] 3300 to 33000 feet

NOTE: When a position update occurs, the runway identifier and the offset value or runway distance remaining value is highlighted. Line 6R displays the CANCEL UPD prompt until the EXEC pushbutton is pressed.

```
        TAKEOFF REF     1/2
 FLAPS                    V1
 5°                    ---KT
23.5K N1                  VR
 98.0/98.0             ---KT
 CG                       V2
22.5%                  ---KT
-----PRE-FLT STATUS-----
<POS INIT         ROUTE>

<PERF INIT    DEPARTURE>
------------------------
<INDEX
```

U10.1 and 737–300/400/500

```
        TAKEOFF REF     1/2
 FLAPS                    V1
 1°                    ---KT
26K BUMP N1               VR
102.5/102.5            ---KT
 CG                       V2
22.5%                  ---KT
-----PRE-FLT STATUS-----
<N1 LIMIT         ROUTE>

<PERF INIT    DEPARTURE>
------------------------
<INDEX
```

U10.2A and 737–600/700/800

Standard Displayes

Refer to page 2–116.1 for notes.

1 (737–300/400/500)

```
    TAKEOFF REF       1/2
 FLAPS                  V1
 5°                  ---KT
23.5K N1                VR
 92.3/ 92.3          ---KT
 CG      TRIM           V2
22.0%    5.15        ---KT
----PRE-FLT COMPLETE----
------------------------
<INDEX
```

1, 4, 9 (737–300/400/500)

```
    TAKEOFF REF       1/2
 FLAPS                  V1
 5°                  ---KT
RED 22K N1              VR
 89.3/ 89.3          ---KT
 CG      TRIM           V2
22.0%    5.15        ---KT
-----PRE-FLT STATUS-----
 RUNWAY           TO SHIFT
RW32L          RW32L   11M
------------------------
<INDEX        CANCEL UPD>
```

1, 5, 9 (737–300/400/500)

```
    TAKEOFF REF       1/2
 FLAPS                  V1
 5°                  ---KT
23.5K N1                VR
 98.3/ 98.3          ---KT
 CG      TRIM           V2
22.0%    5.15        ---KT
-----PRE-FLT STATUS-----
 RUNWAY         RWY REMAIN
RW32L                  76M
------------------------
<INDEX        CANCEL UPD>
```

2, 4 (737–300/400/500)

```
    TAKEOFF REF       1/2
 FLAPS          QRH     V1
 5°            133>    ---
RED 22K N1              VR
 92.0/ 92.0    135>    ---
 CG      TRIM           V2
21.5%    4.65  140>    ---
              GW   /   TOW
             110.0/
           FMC POS UPD
                   RW32L>
------------------SELECT
<INDEX        CANCEL UPD>
```

2, 4, 9 (737–300/400/500)

```
    TAKEOFF REF       1/2
 FLAPS          QRH     V1
 5°            133>    ---
RED 22K N1              VR
 92.0/ 92.0    135>    ---
 CG      TRIM           V2
21.5%    4.65  140>    ---
              GW   /   TOW
             110.0/
 RUNWAY           TO SHIFT
RW32L          RW32L   11M
------------------SELECT
<INDEX        CANCEL UPD>
```

2, 5, 9 (737–600/700/800)

```
    TAKEOFF REF       1/2
 FLAPS          QRH     V1
 1°            133>    ---
26K N1                  VR
 98.3/ 98.3    135>    ---
 CG      TRIM           V2
22.5%    5.25  140>    ---
              GW   /   TOW
             110.0/
 RUNWAY         RWY REMAIN
RW32L                  76M
------------------SELECT
<INDEX        CANCEL UPD>
```

3, 4, 10 (737–800)

```
    TAKEOFF REF       1/2
 FLAPS          VSPDS   V1
 1°            133>    133
26K BUMP N1             VR
102.5/102.5    135>    135
 CG      TRIM           V2
22.5%    5.25  140>    140
              GW   /   TOW
             172.0/
           FMC POS UPD
                   RW32L>
------------------SELECT
<INDEX        CANCEL UPD>
```

3, 4, 9 (737–700)

```
    TAKEOFF REF       1/2
 FLAPS          VSPDS   V1
 1°            133>    ---
RED 26K N1              VR
 92.0/ 92.0    135>    ---
 CG      TRIM           V2
22.5     5.25  140>    ---
              GW   /   TOW
             110.0/
 RUNWAY           TO SHIFT
RW32L          RW32L   11M
------------------SELECT
<INDEX        CANCEL UPD>
```

3, 5, 9, 10 (737–800)

```
    TAKEOFF REF       1/2
 FLAPS          VSPDS   V1
 1°            133>    ---
26K BUMP N1             VR
102.5/102.5    135>    ---
 CG      TRIM           V2
22.5     5.25  140>    ---
              GW   /   TOW
             110.0/
 RUNWAY         RWY REMAIN
RW32L                  76M
------------------SELECT
<INDEX        CANCEL UPD>
```

Without ACARS option selected

The TAKEOFF REFERENCE page 2/2 provides a method of reducing takeoff thrust limits and displays the FMC computed takeoff thrusts.

PAGE ACCESS page 2/2:

– TAKEOFF REF page 1/2 NEXT PAGE Key

– TAKEOFF REF page 1/2 PREV PAGE Key

PAGE EXIT

– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page

– Press PREV PAGE Key

RW WIND[2,3] (runway wind) – may be manually entered. The direction is entered corresponding to the MAG/TRUE switch position selected.

RW SLOPE/HDG[2,3] (runway slope and heading) – may be manually entered. Entries are a percent gradient. Downhill gradients must be prefixed by the letter "D" or the – sign. The HDG is entered corresponding to the MAG/TRUE switch position selected.

Valid entries for RW SLOPE are:

- For 737-300, 737-400, and 737-500 aircraft – range is negative 2.0 to positive 2.0.
- For 737-600, 737-700, and 737-800 aircraft – thrust limits are determined by the Model/Engine Data Base.

NOTE: When RW WIND is non–zero, RW SLOPE/HDG is required.

NOTE: When the entry for RW WIND and RW SLOPE/HDG corresponds to true north, the entry must be suffixed with the letter "T".

QFE/QNH[8] prompt – toggles between QFE and QNH as the takeoff reference. QNH is the default selection. The selection made on this page is reflected on the APPROACH REF landing page.

NOTE: This prompt appears for 737-600/700/800 aircraft only.

SEL/OAT (assumed/actual outside air temperature) – enter the assumed temperature to enable a reduced thrust takeoff. When a value is entered, values for RED xxK N_1 are computed and displayed along with derate levels. The actual temperature is automatically displayed when available if aspirated TAT probe is installed.

RW COND (runway conditions) – allows selecting runway condition by using LSK 1R as a toggle. The display defaults to the DRY condition.

- For 737-300, 737-400, and 737-500 aircraft – DRY or WET are the allowed selections.
- For 737-600, 737-700, and 737-800 aircraft – DRY, WET, or WET SK–R are the allowed selections.

xxK N_1 or RED xxK N_1 or xxK BUMP N_1 (takeoff thrusts or reduced takeoff thrusts or takeoff bump thrust) – when an OAT value is entered, full thrust values are displayed in the xxK N_1 field. When the SEL value is entered, reduced thrust values are displayed and the field header changes to RED xxK N_1.

AIRCRAFT	xxK ENGINE THRUST RATING		
	FULL	DERATE 1	DERATE 2
737-300	22K	20K	18.5
	20K	18.5K	NONE
737-400	23.5K	22K	20K
	22K	20K	NONE
737-500	20K	18.5K	NONE
	18.5K	NONE	NONE
737-600, 737-700. and 737-800	Derate levels are determined by the AIRFRAME/ENGINE program pins and the MODEL/ENGINE database.		

Thrust values and reduced thrust values are determined as follows:

- For 737-300, 737-400, and 737-500 aircraft – thrust limits are determined by the AIRFRAME/ENGINE program pins.
- For 737-600, 737-700, and 737-800 aircraft – thrust limits are determined by the Model/Engine Data Base.

737-300, 737-400, and 737-500 aircraft

Standard Display and THR REDUCTION not entered.

```
       TAKEOFF REF     2/2





 SEL/OAT             22K N1
----/ +15°C     94.6/ 94.6
            THR REDUCTION
                   ----AGL
------------------------
<INDEX
```

With VSPDS or QRH option selected and THR REDUCTION entered.

```
       TAKEOFF REF     2/2
 RW WIND            RW COND
---°/---            DRY/WET
 RW SLOPE/HDG
--.--%/330°

 SEL/OAT             22K N1
----/ +15°C     94.6/ 94.6
            THR REDUCTION
          CLB      800AGL
------------------------
<INDEX
```

U10.1

```
       TAKEOFF REF     2/2
 RW WIND            RW COND
---°/---            DRY/WET
 RW SLOPE/HDG
--.--%/330°

 SEL/OAT             22K N1
----/ +15°C     94.6/ 94.6
            THR REDUCTION
          CLB      800AGL
------------------------
<INDEX
```

U10.2A and LCD CDU

737-600, 737-700, and 737-800 aircraft

Standard Display without thrust bump and THR REDUCTION not entered.

```
       TAKEOFF REF     2/2





 SEL/OAT             26K N1
----/ +15°C     98.6/ 98.6
            THR REDUCTION
                   ----AGL
------------------------
<INDEX
```

With QRH option selected, thrust bump, and THR REDUCTION entered.

```
       TAKEOFF REF     2/2
 RW WIND            RW COND
---°/---      DRY/WET/SK-R
 RW SLOPE/HDG
--.--%/330°

 SEL/OAT        26K BUMP N1
    / +15°C     98.6/ 98.6
            THR REDUCTION
          CLB     1000AGL
------------------------
<INDEX
```

U10.1

```
       TAKEOFF REF     2/2
 RW WIND            RW COND
---°/---      DRY/WET/SK-R
 RW SLOPE/HDG
--.--%/330°

 SEL/OAT        26K BUMP N1
    / +15°C     98.6/ 98.6
            THR REDUCTION
          CLB     1000AGL
------------------------
<INDEX
```

U10.2A and LCD CDU

With QFE option selected and THR REDUCTION not entered.

```
       TAKEOFF REF     2/2



 TAKEOFF REF
<QFE/QNH
 SEL/OAT             26K N1
----/ +15°C     98.6/ 98.6
            THR REDUCTION
                   ----AGL
------------------------
<INDEX
```

U10.1

```
       TAKEOFF REF     2/2



 TAKEOFF REF
<QFE/QNH
 SEL/OAT             26K N1
----/ +15°C     98.6/ 98.6
            THR REDUCTION
                   ----AGL
------------------------
<INDEX
```

U10.2A and LCD CDU

With ACARS option selected

The TAKEOFF REFERENCE page 1/2 provides a method for requesting takeoff runway data for the selected origin airport from the ground station. Data for all runways will be uploaded, but only the selected runway data will be displayed on these pages. If the selected runway is changed, the data for the new runway is displayed.

The following fields may have data uploaded:

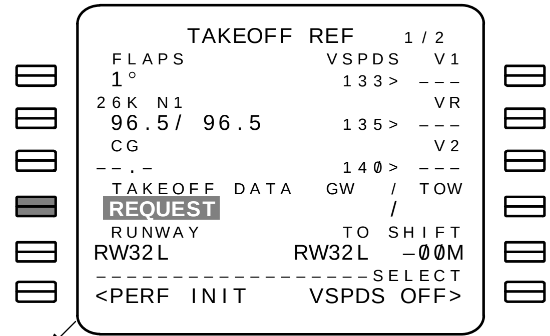
- FLAPS
- TAKEOFF N1
- CG
- TRIM
- V_1, V_R, V_2
- INTERSECT
- RUNWAY
- GW/TOW
- SEL/OAT
- RW WIND
- RW SLOPE/HDG
- RW COND

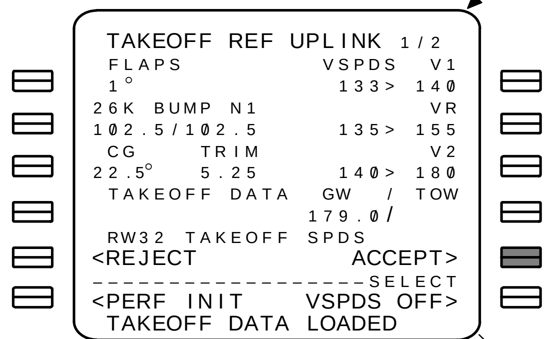
Uploaded data or data that is computed and displayed as a result of the uploaded data will be displayed in small font until accepted or rejected.

If the uploaded data was rejected, it can be reloaded onto the page again by reselecting a takeoff runway.

737–800

Press LSK 4L to initiate an uplink request. The REQUEST prompt will be highlighted until the upload is complete.

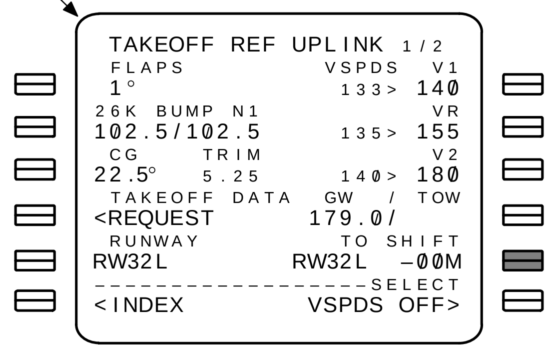




Review uploaded data for the currently selected runway.

Press LSK 5L to reject the uploaded data.

Press LSK 5R to accept the uploaded data.



TAKEOFF REFERENCE (TAKEOFF REF). (U10.3 VERSION) WITH THRUST BUMP AND QUIET CLIMB SYSTEM

The TAKEOFF REFERENCE page 2 provides a method of reducing takeoff limits and activating the Quiet Climb System (option). Once the temperature data is available (manually loaded, uploaded, or from TAT probe) and CUTBACK (LSK 6R) is toggled ON, CUTBACK N1, REDUCTION, and RESTORE values are displayed.

```
             TAKEOFF REF      2/2


                                CUTBACK N1
                               80.5/ 80.5
 SEL/OAT                        27K BUMP N1
     °/ +15°C                 102.5/102.5
REDUCTION       THR             RESTORE
 800AGL         CLB             3000AGL
------------------------------CUTBACK
<INDEX                           ON/OFF
```

REDUCTION – blanked until temperature data is available. Clears to dashes at flight completion. Value always displayed in feet whether or not the value is at or above the transistion altitude. Default value from MEDB is displayed in small font. Manual entries must be within the limits specified in the MEDB.

NOTE: When CUTBACK is toggled ON – displays the cutback reduction altitude. When CUTBACK is toggled OFF – displays the takeoff profile reduction altitude.

RESTORE – displayed when CUTBACK is toggled ON. Default value from MEDB is displayed in small font. Manual entries must be within the limits specified in the MEDB.

CUTBACK – default state for CUTBACK toggle is OFF. Currently selected mode is displayed in in large font.

- The CUTBACK prompt is blanked for any of the following conditions:
  - Not in Takeoff mode and on the ground
  - FMC requires data to compute the CUTBACK N1
  - Aircraft current altitude is above the RESTORE altitude
  - CUTBACK (LSK 6R) is toggled OFF above the REDUCTION altitude
- The CUTBACK prompt is not blanked for any of the following conditions:
  - Data required to compute CUTBACK N1 (LSK 3R) are available but ADC inputs are invalid
  - Aircraft current altitude is below the RESTORE altitude
  - If Cutback becomes unavailable, the CUTBACK toggle switches to OFF

DEPARTURE/ARRIVAL INDEX (DEP/ARR INDEX)

The DEP/ARR INDEX page provides access to the departure and arrival procedures for the origin and destination airports in the selected route.

PAGE ACCESS:

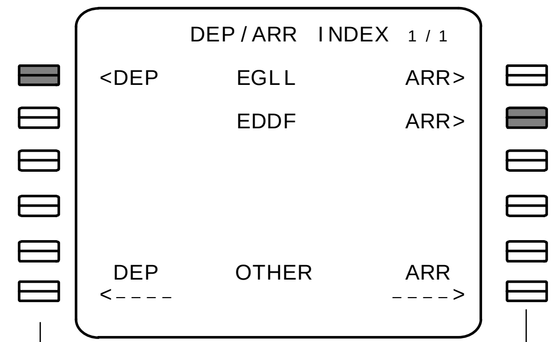
- INDEX prompt (LSK 6L) on DEPARTURES page
- INDEX prompt (LSK 6L) on ARRIVALS page
- Press DEP ARR Key

PAGE EXIT

- Active DEP prompt (LSK 1L)
- Any active ARR prompt (LSK 1R through 6R)

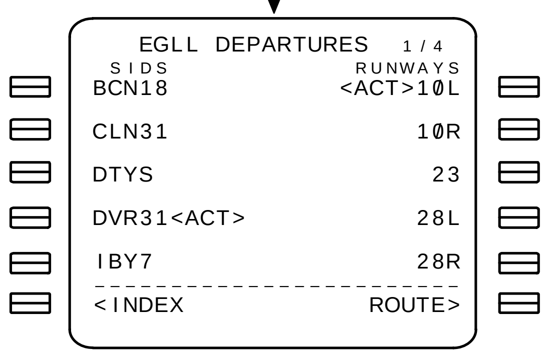
Arrival and departure data for other airports in the NDB are made available for display by entering the airport identifier into the scratch pad, and selecting the DEP prompt (LSK 6L) or ARR prompt (LSK 6R).

If the ACARS option is selected, the departure and arrival data is uplinked with the route.

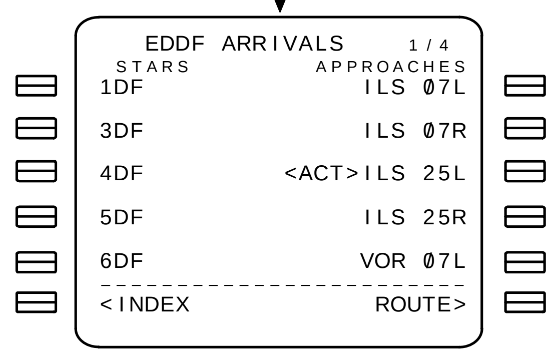


Press LSK 1L to display the EGLL departure procedures.

Press LSK 2R to display the EDDF arrival procedures.



The active route items are identified by the <ACT> prompt.



DEPARTURES

The DEPARTURES page provides access to an alphabetical listing of the SIDS contained in the NDB for the indicated origin airport in the selected route.

If a runway has been selected prior to entering this page, only the procedures associated with that runway are displayed.

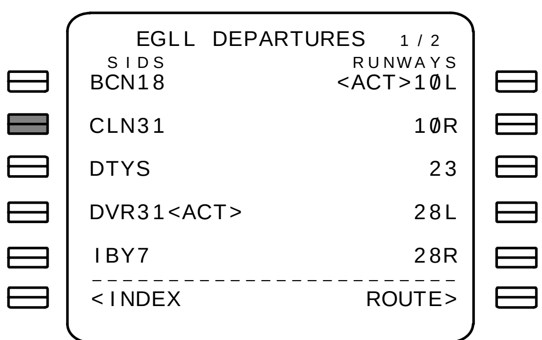
PAGE ACCESS: page 1/x

- DEP prompt on DEP/ARR INDEX page
- DEPARTURE prompt on TAKEOFF REF page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

PAGE EXIT

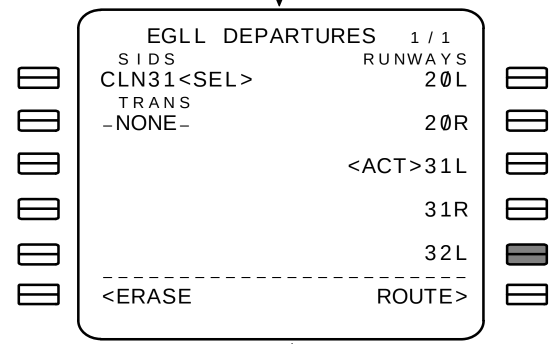
- INDEX prompt (LSK 6L) displays the DEP/ARR INDEX page
- ROUTE prompt (LSK 6R) displays the RTE 1/2 page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

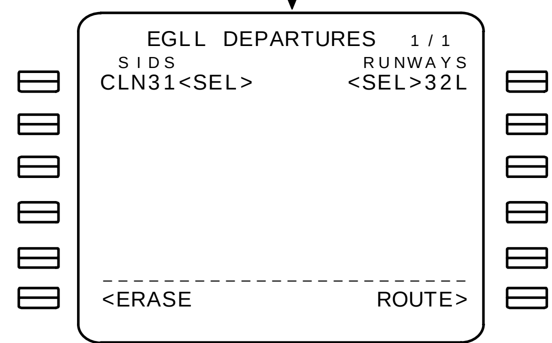
To change a departure point:



Press LSK 2L to select SID CLN31. The EXEC key will light.

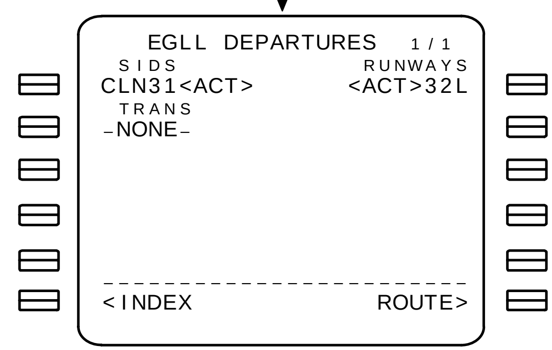
Press LSK 5R to select the 32L runway.





NOTE: Press LSK 6L to return to the original DEPARTURE page. with the original SIDS and RUNWAYS data.

Press the EXEC key to enter the current selections into the flight plan.



NOTE: The original SID/RUNWAY entry in the active route are replaced with the new selection. The change is also reflected on the RTE page.

The DEPARTURES page provides access to an alphabetical listing of the SIDS and Engine Out SIDS (airlines selectable option) contained in the NDB for the indicated origin airport in the selected route.

If a runway has been selected prior to entering this page, only the procedures associated with that runway are displayed.

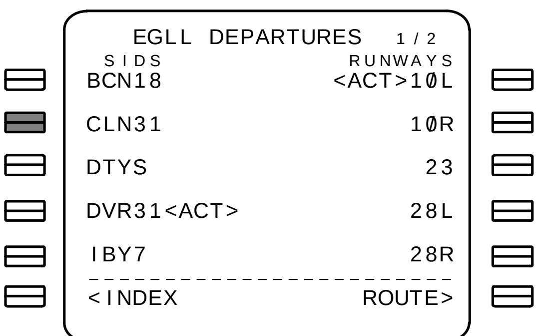
PAGE ACCESS: page 1/x

- DEP prompt on DEP/ARR INDEX page
- DEPARTURE prompt on TAKEOFF REF page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

PAGE EXIT

- INDEX prompt (LSK 6L) displays the DEP/ARR INDEX page
- ROUTE prompt (LSK 6R) displays the RTE 1/2 page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

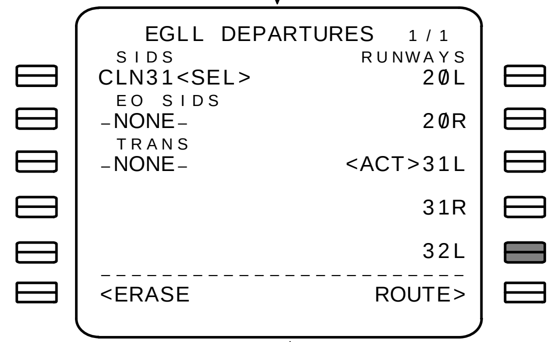
To change a departure point:



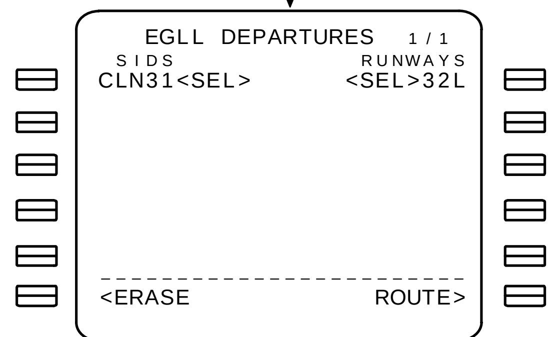
Press LSK 2L to select SID CLN31. The EXEC key will light.

DEPARTURES
ENGINE OUT SIDS (OPTION) (U10.3)

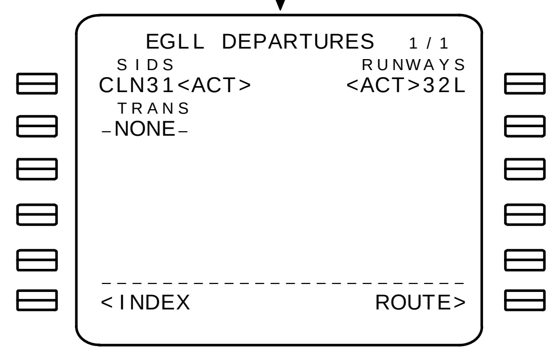
Press LSK 5R to select the 32L runway.



NOTE: Press LSK 6L to return to the original DEPARTURE page. with the original SIDS and RUNWAYS data.



Press the EXEC key to enter the current selections into the flight plan.



NOTE: The original SID/RUNWAY entry in the active route are replaced with the new selection. The change is also reflected on the RTE page.

ARRIVALS

The ARRIVALS page provides access to an alphabetical listing of the STARS contained in the NDB for the indicated arrival airport in the selected route.

If an approach or runway has been selected prior to entering this page, only the arrival procedures associated with that approach or runway are displayed.

<u>PAGE ACCESS</u> page 1/x:

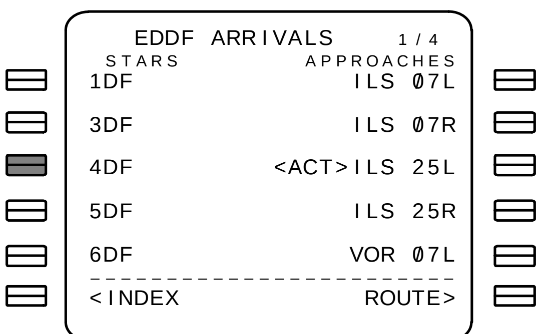
- ARR prompt (LSK 1R through 5R) on DEP/ARR INDEX page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

<u>PAGE EXIT</u>

- INDEX prompt (LSK 6L) displays the DEP/ARR INDEX page
- ROUTE prompt (LSK 6R) displays the RTE 1/2 page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

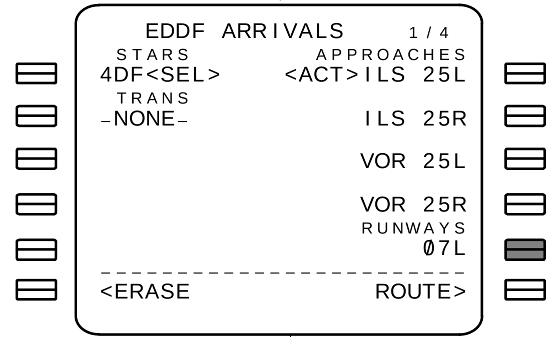
To change a procedure:

The active route items are identified by the <ACT> prompt.



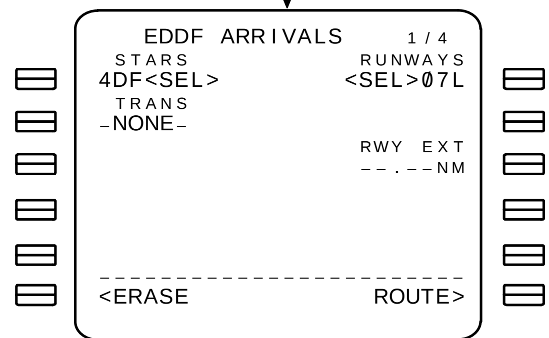
Press LSK 3L to select STAR 4DF. The EXEC key will light.

Press LSK 5R to select the runway 07L.

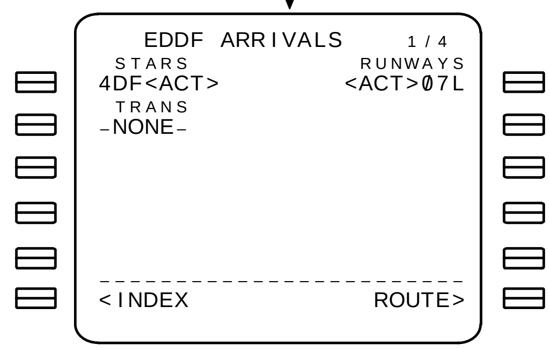


NOTE: RWY EXT permits adding a waypoint at a selected distance (1 to 25 nm). This waypoint is identified as the runway prefixed by “RX–”.

NOTE: Press LSK 6L to return to the original ARRIVAL page. with the original STARS and APPROACH data.



Press the EXEC key to enter the current selections into the flight plan.



NOTE: The original STAR/APPROACH/RUNWAY entry in the active route are replaced with the new selection. The change is also reflected on the RTE page.

ROUTE LEGS (RTE LEGS)

The ROUTE LEGS page provides a list of all waypoints in the route, and detailed information for each leg.

PAGE ACCESS

- Press LEGS key
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available
- Selecting a waypoint from the SELECT DESIRED WPT page

PAGE EXIT

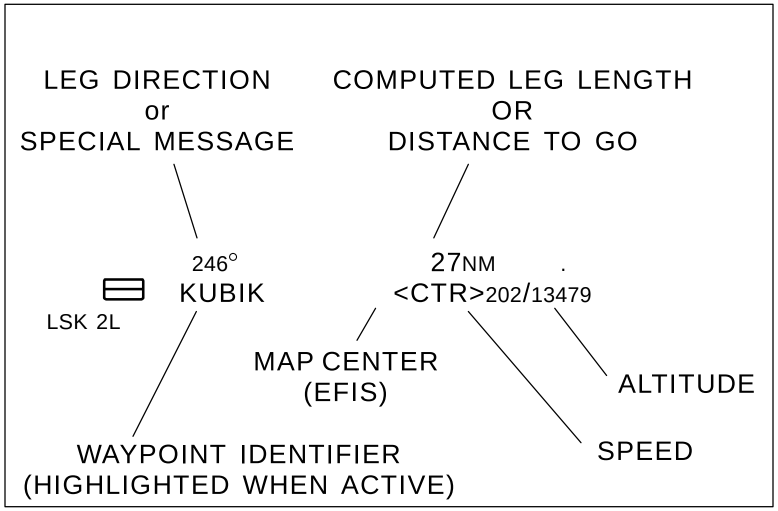
- RTE DATA prompt (LSK 6R) displays the RTE DATA 1/x page

WAYPOINT IDENTIFIERS – are displayed in fields 1L through 5L on all available pages, with the active waypoint highlighted in reverse video. Valid entries are:

- Waypoint identifier
- Navaid identifier
- Airport identifier
- Course intersection
- Latitude/longitude
- Bearing/distance from a waypoint
- Place/bearing to place/bearing
- Place/distance from a flight plan waypoint

LEG DIRECTION/SPECIAL MESSAGE – field displays directional data or special procedural instructions.

- Directional Data:
    - Computed Course to waypoint
    - Specified procedural course from NDB
    - Specified procedural heading (suffixed with HDG) from NDB
- Special Procedural Instructions:
    - HOLD AT
    - PROC TURN
    - XX.X ARC Y
    - THEN
    - PROC HLD



Course and heading values are relative to magnetic north unless suffixed by “T” (true).

COMPUTED LEG LENGTH/DISTANCE TO GO – This field indicates the computed distance of the leg between the previous and next waypoints. If the distance cannot be computed the field is blank. For the active leg, this is the distance from the present position to the next waypoint.

SPEED – Entries for this field must be suffixed with a slash (/). Mach entries are not allowed. Valid entries are:

- For 737-300, 737-400, and 737-500 – 100 to 340 knots
- For 737-600, 737-700, and 737-800 – determined by Model/Engine data base.

ALTITUDE – entries may be made as 078, 780, or FL078 for the entered flight level 7800. A displayed altitude may be suffixed with and “A” or “B”, to indicate at or above/below respectively.

NOTE: Flight level would normally not be used at this altitude, however the FMS will accept this entry.

NOTE: Flight plan specified and manually entered values for speed and altitude are displayed in large font.

MAP CENTER – displayed on EFIS equipped aircraft when in plan mode. Indicates the waypoint to be centered on the EFIS display.

ADDITIONAL INFO – supplied to further define the waypoint.

- GP X.XX – gradients are displayed if a vertical component is defined in the NDB.
- BYPASS – displayed if the waypoint cannot be flown over.
- OFFSET – displayed when the leg is an offset.

```
  ACT RTE    LEGS      1/6
  203°       7.2NM
VLA                262/FL234
  246°        27NM
KUBIK              262/13479
  245°       8.0NM
RESOW              262/10406
  187°       8.9NM
TOY                250/ 7116
  109°        12NM
FONTI              250/ 4500A
 RNP/ACTUAL-------------
1.70/0.15NM      RTE DATA>
```

```
  ACT RTE    LEGS      1/6
  203°       7.2NM
VLA                262/FL234
  246°        27NM
KUBIK       <CTR>262/13479
  245°       8.0NM
RESOW              262/10406
  187°       8.9NM
TOY                250/ 7116
  109°        12NM
FONTI              250/ 4500A
 RNP/ACTUAL------MAP CTR
1.70/0.15NM          STEP>
```

EFIS equipped aircraft
in plan mode

RNP/ACTUAL – required/actual navigation performance values are displayed for the currently active leg. RNP defaults to the current navigation environment default values unless the NDB contains a defined value for that leg. Only manually entered values of RNP (if airlines option selected) are displayed in large font.

RTE DATA (LSK 6R) – selecting this prompt displays the Route legs extended data (RTE DATA) page for the waypoints currently displayed.

STEP (map center step) – pressing LSK 6R sequences the EFIS center pointer through the flight plan.

As each waypoint is passed, the next waypoint in the plan automatically moves to line 1 and is identified as the active waypoint.

Use the NEXT PAGE/PREVIOUS PAGE keys to view additional waypoints in the active flight plan.

Selecting a new waypoint into line 1 gives DIRECT TO guidance (refer to DIR, page 2–131). Following this selection, an option to fly to an intercept point is available (refer to INTC, page 2–133). The intercept course is initially set from the original flight plan inbound course to the newly selected destination, and may be edited as necessary.

When valid changes are made to the RTE LEGS page, the EXEC key lights. The EXECUTE key must be pressed to activate the changes.

ROUTE LEGS EXTENDED DATA (RTE DATA)

Without ACARS option selected.

The RTE DATA page provides ETA and cruise winds data for each waypoint on the corresponding RTE LEGS page.

PAGE ACCESS

- RTE DATA prompt (LSK 6R) on the RTE LEGS page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

PAGE EXIT

- LEGS prompt (LSK 6R) displays the RTE LEGS page corresponding to the waypoints on the currently displayed RTE DATA page.

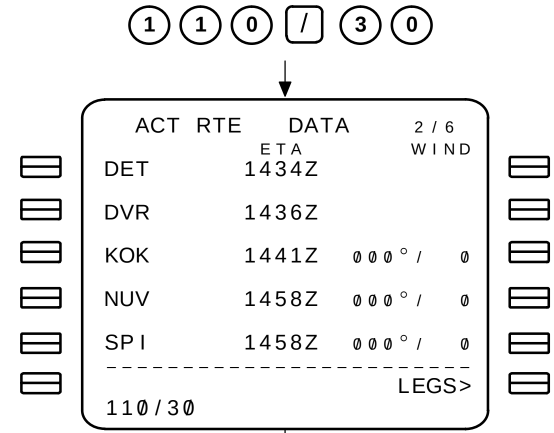
Waypoints – correspond one-to-one with the waypoints listed on the RTE LEGS pages.

ETA (estimated time of arrival) – computed for each waypoint. ETA values are continuously updated as the flight progresses.

WINDS – cruise winds data is displayed beginning with the waypoint following top of climb, and ending with the waypoint preceding the top of descent. If the PERF INIT page has a winds value entered, that value will be propagated onto these pages. Manual entries may be made for any cruise waypoint, and is propageted from the entry waypoint to the last cruise waypoint or the next manually entered value. Manually entered values are displayed in large font.

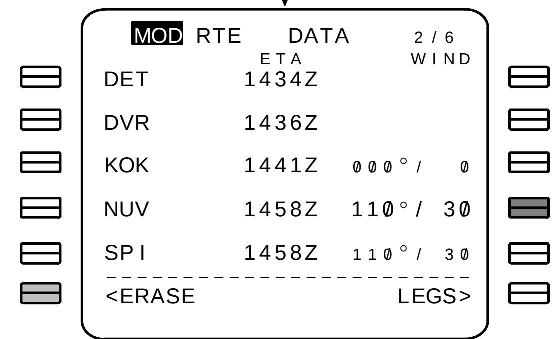
To manually enter forecast winds data at waypoint NUV:

Enter data into the scratch pad.

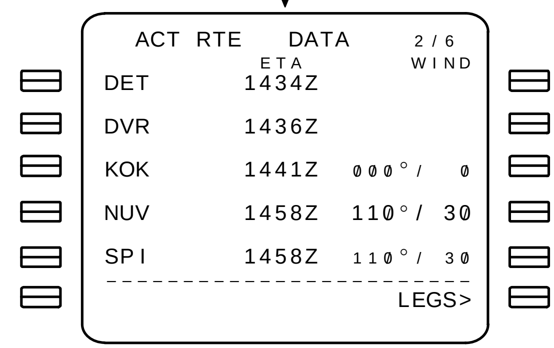


Press LSK 4R to transfer the scratch pad to line 4R.

NOTE: Press LSK 6L to return to the unmodified page.



Press EXEC key to activate the modified RTE DATA page.



With ACARS option selected.

The RTE DATA page displays computed ETA and provides uplink cruise winds data for each waypoint of the flight plan or a modified flight plan.

PAGE ACCESS

- RTE DATA prompt (LSK 6R) on the RTE LEGS page
- NEXT PAGE/PREVIOUS PAGE key when multiple pages are available

PAGE EXIT

- LEGS prompt (LSK 6L) displays the RTE LEGS page corresponding to the waypoints on the currently displayed RTE DATA page.

Waypoints – correspond one-to-one with the waypoints listed on the RTE LEGS pages.

ETA (estimated time of arrival) – computed for each waypoint. ETA values are continuously updated as the flight progresses.

WINDS – cruise winds data is displayed beginning with the waypoint following top of climb, and ending with the waypoint preceding the top of descent. If the PERF INIT page has a winds value entered, that value will be used on these pages. Uploaded values are displayed in small font until activated.

Cruise winds data may be edited prior to activating the upload.

```
   ACT RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    000°/   0
NUV         1458Z    000°/   0
SPI         1458Z    000°/   0
--------------------------WINDS
<LEGS                  REQUEST>
```

```
   MOD RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    000°/   0
NUV         1458Z    000°/   0
SPI         1458Z    000°/   0
--------------------MOD WINDS
<ERASE                 REQUEST>
```

Press LSK 6R to initiate the uplink request.

```
   ACT RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    000°/   0
NUV         1458Z    000°/   0
SPI         1458Z    000°/   0
--------------------------WINDS
<LEGS                   REQUEST
```

```
   MOD RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    000°/   0
NUV         1458Z    000°/   0
SPI         1458Z    000°/   0
--------------------MOD WINDS
<ERASE                  REQUEST
```

Press LSK 6L to load the uplink data onto the page.

```
   ACT RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    000°/   0
NUV         1458Z    000°/   0
SPI         1458Z    000°/   0
--------------------------WINDS
<LOAD                   REQUEST
CRZ WIND UPLINK READY
```

```
   ACT RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    110°/  30
NUV         1458Z    110°/  30
SPI         1458Z    110°/  30
--------------------------WINDS
<ERASE                 REQUEST>
CRZ WIND FL270 UPLINK
```

```
   MOD RTE    DATA         2/6
              ETA          WIND
DET         1434Z
DVR         1436Z
KOK         1441Z    110°/  30
NUV         1458Z    110°/  30
SPI         1458Z    110°/  30
--------------------------WINDS
<ERASE                 REQUEST>
CRZ WIND FL270 UPLINK
```

Press LSK 6L to return to the unloaded page.

or

Press EXEC key to activate the uploaded/manually entered values.

CLIMB (CLB)

The CLIMB pages display performance information specific to the climb phase of the flight.

- Eight climb modes are available:
  - ECON – economy mode
  - Manual – manual target speed mode
  - MAX RATE – maximum rate mode
  - MAX ANGLE – maximum angle mode
  - RTA – required time of arrival mode
  - ENG OUT – engine out mode (advisory only)
  - RTA CRZ – required time of arrival to cruise mode (refer to CRZ pages)
  - CRZ – cruise climb mode (refer to CRZ pages)

<u>PAGE ACCESS</u>

- Press CLB key
- Press VNAV key when climb is active performance mode (FANS MCDU ONLY)
- Select desired CLB page prompt on any CLB page and press the EXEC key.
- NEXT PAGE key from DES page (FANS MCDU ONLY)
- PREV PAGE key from CRZ page (FANS MCDU ONLY)
- Automatically displayed from TAKEOFF REF page after takeoff (U10.3)

<u>PAGE EXIT</u>

- Select desired CLB page prompt on any CLB page and press the EXEC key
- Press any function mode key
- RTA prompt LSK 6R), when displayed, displayes the RTA PROGRESS page

* – U10.2A and earlier created a MOD CLB page that was not executable.
– U10.3 is completely advisory only.

```
 ACT ECON CLB                 1/1
 CRZ ALT                 AT BROMY
FL290                       4000A
 TGT SPD                 TO BROMY
280/.720          1431.5z/ 21NM
 SPD REST               ERR BROMY
250/10000                   130LO
------------          CLB-1 N1
                       97.3/ 97.3%
                      ------------
<MAX RATE                ENG OUT>

<MAX ANGLE                   RTA>
```

```
 ACT 280KT CLB                1/1
 CRZ ALT                 AT BROMY
FL290                       4000A
 TGT SPD                 TO BROMY
280/.720          1431.5z/ 21NM
 SPD REST               ERR BROMY
250/10000                   130LO
------------          CLB-1 N1
<ECON                  97.3/ 97.3%
                      ------------
<MAX RATE                ENG OUT>

<MAX ANGLE                   RTA>
```

```
 ACT MAX ANGLE CLB            1/1
 CRZ ALT                 AT BROMY
FL290                       4000A
 TGT SPD                 TO BROMY
280/.720          1431.5z/ 21NM
 SPD REST               ERR BROMY
250/10000                   130LO
------------          CLB-1 N1
<ECON                  97.3/ 97.3%
                      ------------
<MAX RATE                ENG OUT>

                             RTA>
```

```
 ACT MAX RATE CLB             1/1
 CRZ ALT                 AT BROMY
FL290                       4000A
 TGT SPD                 TO BROMY
280/.720          1431.5z/ 21NM
 SPD REST               ERR BROMY
250/10000                   130LO
------------          CLB-1 N1
<ECON                  97.3/ 97.3%
                      ------------
                         ENG OUT>

<MAX ANGLE                   RTA>
```

```
 ACT RTA CLB                  1/1
 CRZ ALT                 AT BROMY
FL290                       4000A
 TGT SPD               TIME ERROR
280/.720                  ON TIME
 SPD REST
250/10000
------------          CLB-1 N1
<ECON                  97.3/ 97.3%
                      ------------
<MAX RATE                ENG OUT>

<MAX ANGLE                   RTA>
```

```
* MOD ENG OUT CLB             1/1
 CRZ ALT                  MAX ALT
FL290                       FL180
 TGT SPD                       N1
220KT                       93.4%


--------------------------------
<LT ENG OUT          RT ENG OUT>

<MAX RATE                   ECON>

<MAX ANGLE                   RTA>
```

```
 ENG OUT CLB                  1/1
 CRZ ALT                  MAX ALT
FL290                       FL180
 TGT SPD                       N1
210KT                       93.4%


--------------------------------
<LT ENG OUT          RT ENG OUT>
```

CRZ ALT (cruise altitude) – top of climb altitude value. If manually changed, the new value will propagate to all pages displaying CRZ ALT.

TGT SPD (target speed) – active computed target speed except:

- Engine out mode – displays minimum drag speed
- Manual target speed mode – requires manual entry:
  - For 737-300, 737-400, and 737-500 100 to 340 knots CAS/0.04 to 0.82 MACH
  - For 737-600, 737-700, and 737-800 determined by Model/Engine database
- Altitude/Speed intervention (airlines selectable option) (displays CAS/MCP, i.e 280/MCP)

SPD REST (speed restriction) – Displays active speed restrictions. Dashes are displayed when restrictions do not apply.

NOTE: The controlling parameter (TGT SPD or SPD REST) is highlighted in reverse video.

- Displays XXX/FLAPS if active speed restriction is lower than minimum speed at current flaps setting.
- If CUTBACK is toggled ON (TAKEOFF REF page 2), then the displayed speed rest is the Restore Altitude plus the origin runway altitude (U10.3).

Mode prompts – not displayed for currently selected mode page. Displayed prompts display the associated CLB page when selected by the corresponding LSK. The mode prompts are:

- ECON
- MAX RATE
- MAX ANGLE
- ENG OUT (ADVISORY ONLY)
- RTA

AT xxxxx – identifies the next waypoint in the flight plan with an altitude constraint.

MAX ALT – provides maximum altitude for ENG OUT mode.

TO xxxxx – displays the predicted ETA and distance to the waypoint indicated by the AT xxxxx field.

N1 – provides the maximum continuous N1 value for ENG OUT mode.

TIME ERROR – displays the computed time error to the waypoint indicated by the AT xxxxx field for the RTA mode.

Computed Reduced N_1 – displays computed reduced values of N_1.

- U10.2A and earlier.
  - Header indicates CLB-1 N_1 or CLB-2 N_1
  - If computed value is equal to full rate or is not specified, field is blank.
- U10.3.
  - Header indicates CUTBACK N_1, CLB N_1, CLB-1 N_1, or CLB-2 N_1

MOD pages – Anytime data is changed, the EXECUTE key will light and the displayed page becomes a MOD page. The RTA prompt is replaced with the ERASE prompt. Slelecting the ERASE prompt (LSK 6R) returns the page to the previous values. Pressing the EXECUTE key activates the changes.

NOTE: For U10.2A and earlier, selecting the ENG OUT Mode prompt generates computed values propagated through the climb and cruise phases. These MOD pages are not executable.

NOTE: For U10.3, selecting the ENG OUT Mode prompt will provide predictions for the engine out condition, but will not propagate the data.

A CLB page may be selected and activated by pressing the EXECUTE key before the flight starts.

CRUISE (CRZ)

The CRUISE pages provide performance target information for the cruise phase of the flight. Allows initiation of a climb or a decent to a selected altitude during the cruise phase.

– Pages:
  - CRZ – cruise
  - CRZ CLB – initiate cruise climb
  - CRZ DES – initiate cruise descent

– Modes:
  - ECON – economy mode
  - ENG OUT – engine out mode (advisory only)
  - LRC – long range mode
  - MANUAL – manually selected speed mode
  - RTA – required time of arrival mode

PAGE ACCESS (with cruise portion of flight plan active)

– Press CRZ key for cruise pages.

– Press DES key for cruise descent pages.

– Press CLB key for cruise climb pages.

NOTE: When selecting one of the three mode keys, the corresponding page will be displayed in the mode currently active.

– Select desired CRZ mode prompt on CRZ or CRZ CLB page and press EXECUTE.

– Press VNAV key when climb is active performance mode (FANS MCDU ONLY)

– NEXT PAGE key from DES page (FANS MCDU ONLY)

– PREV PAGE key from CRZ page (FANS MCDU ONLY)

PAGE EXIT

– Press any function mode key

CRZ ALT (cruise altitude) – top of climb altitude value. If manually changed, the display changes to the CRZ CLB or CRZ DES page as appropriate, and the new value will propagate to all pages displaying CRZ ALT.

OPT/MAX (optimum/maximum altitude) – displays the optimum unconstrained altitude and the maximum altitude for the active flight plan.

TGT SPD (target speed) – active computed target speed except:

- Engine out mode – displays minimum drag speed
- Manual target speed mode – requires manuall entry:

For 737-300, 737-400, and 737-500
100 to 340 knots CAS/0.04 to 0.82 MACH

For 737-600, 737-700, and 737-800
determined by Model/Engine database

```
  ACT ECON CRZ          1/1
CRZ ALT   OPT/MAX      STEP
FL290  FL327/340      FL330
 TGT SPD         STEP POINT
.731       1448.8z/    27NM
 TURB N1        ACTUAL WIND
 87.3/ 87.3%      114°/ 27
 FUEL AT EDDF       SAVINGS
 W/STEP 14.9           1.7%
---------------------------
                   ENG OUT>

<LRC                   RTA>
```

```
  ACT LRC CRZ           1/1
CRZ ALT   OPT/MAX      STEP
FL290  FL327/340      FL330
 TGT SPD         STEP POINT
.731       1448.8z/    27NM
 TURB N1        ACTUAL WIND
 87.3/ 87.3%      114°/ 27
 FUEL AT EDDF       SAVINGS
 W/STEP 14.9           1.7%
---------------------------
<ECON              ENG OUT>

                       RTA>
```

```
  ACT 280KT CRZ         1/1
CRZ ALT   OPT/MAX      STEP
FL290  FL327/340      FL330
 TGT SPD         STEP POINT
.731       1448.8z/    27NM
 TURB N1        ACTUAL WIND
 87.3/ 87.3%      114°/ 27
 FUEL AT EDDF       SAVINGS
 W/STEP 14.9           1.7%
---------------------------
<ECON              ENG OUT>

<LRC                   RTA>
```

```
  ACT RTA CRZ           1/1
CRZ ALT   OPT/MAX
FL290  FL327/340
 TGT SPD
.731
 TIME ERROR     ACTUAL WIND
EARLY 05:31       114°/ 27
 FUEL AT EDDF
         14.9
---------------------------
<ECON              ENG OUT>

<LRC                   RTA>
```

```
 MOD ENG OUT CRZ        1/1
CRZ ALT             MAX ALT
FL290                 FL243
 TGT SPD             TO T/D
.731          1521.3z/ 27NM
 N1
 87.9%
---------------------------
<LT ENG OUT     RT ENG OUT>

<ECON

<LRC                   RTA>
```

```
       ENG OUT CRZ      1/1
CRZ ALT             MAX ALT
FL290                 FL243
 TGT SPD             TO T/D
.731          1521.3z/ 27NM
 N1
 87.9%
---------------------------
<LT ENG OUT     RT ENG OUT>
```

TURB N1 (turbulence penetration N1) – provides turbulence penetration N1 for reference.

N1 – provides the maximum continuous N1 value for ENG OUT mode.

TIME ERROR – displays the computed time error for the RTA mode.

SPD REST (speed restriction) – Displays active speed restrictions. Dashes are displayed when restrictions do not apply.

NOTE: The controlling parameter (TGT SPD or SPD REST) is highlighted in reverse video.

FUEL AT xxxxx – Displays predicted fuel weight using currently selected active flight plan and mode. If a flight level is entered into the STEP field, “W/STEP” is also displayed.

STEP – displayed when PPOS is greater than 100 nm from the to of descent. Initially contains dashes. When a flight level is entered, the STEP POINT and FUEL AT xxxxx fields are updated to include the step, and the SAVINGS/PENALTY field is displayed.

MAX ALT – provides maximum altitude for ENG OUT mode.

STEP POINT – displays computed ETA and distance to the top of descent, or:

- Display computed ETA and distance to STEP when PPOS is greater than 100 nm from top of descent
- Display “NOW” after STEP is passed
- Display “UNABLE” when STEP is less than 100 nm from top of descent

TO T/D – displays computed ETA and distance to the top of descent in ENG OUT mode.

WIND – Displays wind direction and magnatude. When current wind data is used, the header displays as ACTUAL WIND. When a flight level is entered in the STEP field, manual entry of wind data is allowed (except RTA CRZ mode), and the header displays EST WIND. The display will revert to ACTUAL WIND if the STEP field is deleted or a new CRZ ALT is entered.

SAVINGS/PENALTY – displays computed percentage of savings or penalty associated with flying the displayed profile with the step, verses without the step.

Mode prompts – not displayed for currently selected mode page. Displayed prompts display the associated CLB page when selected by the corresponding LSK. The mode prompts are:

- ECON
- MAX RATE
- MAX ANGLE
- ENG OUT (ADVISORY ONLY)
- RTA
- LRC

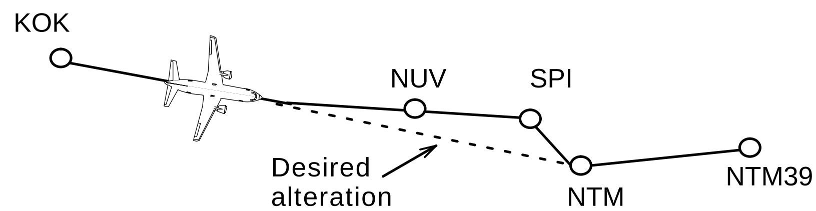
MOD pages – Anytime data is changed, the EXECUTE key will light and the displayed page becomes a MOD page. The RTA prompt is replaced with the ERASE prompt. Slelecting the ERASE prompt (LSK 6R) returns the page to the previous values. Pressing the EXECUTE key activates the changes.

```
  ACT CRZ CLB              1/1
 CRZ ALT
FL330
 TGT SPD                TO FL330
.731              1449.2z/ 15NM
 SPD REST            ACTUAL WIND
250/10000             114°/ 27
------------            SAVINGS
<ECON                      1.7%
                   ------------
<MAX RATE              ENG OUT>

<MAX ANGLE                 RTA>
```

```
  ACT CRZ DES              1/1
 CRZ ALT
FL250
 TGT SPD                TO FL250
.731              1451.4z/ 28NM
 SPD REST            ACTUAL WIND
240/10000             114°/ 27
                        PENALTY
                             1%
-------------------------------
                   PLANNED DES>

<FORECAST                  RTA>
```

DIRECT TO (DIR)

DIRECT TO provides a means to enter a waypoint to be flown to directly from present position. If the entered waypoint is in the flight plan, it becomes the active waypoint and the intervening legs are deleted. If the entered waypoint is not on the flight plan, a route discontinuity is created.



PAGE ACCESS (with cruise portion of flight plan active)

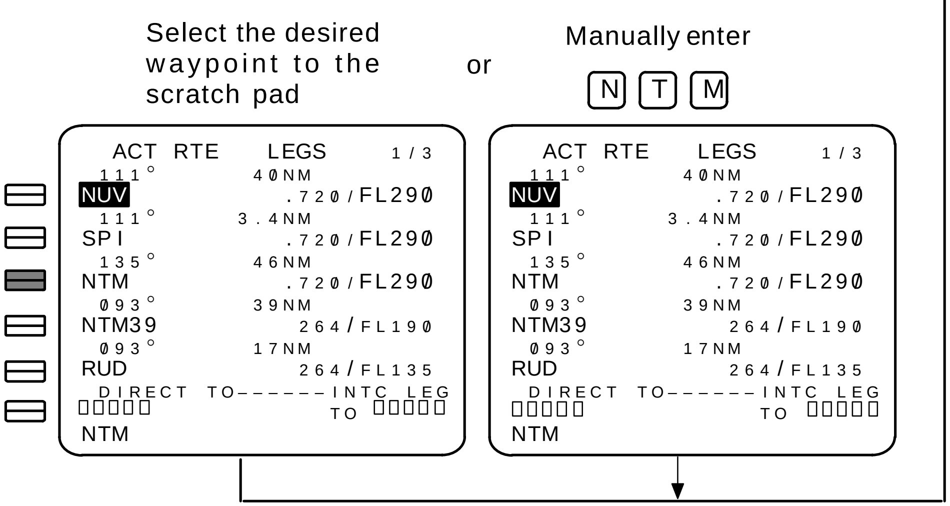
- Press DIR INTC key for DIR pages
- On the active RTE LEGS pages, select any waypoint in the list and line select it to the first position (active waypoint)
- Select a waypoint from the SELECT DESIRED WAYPOINT page

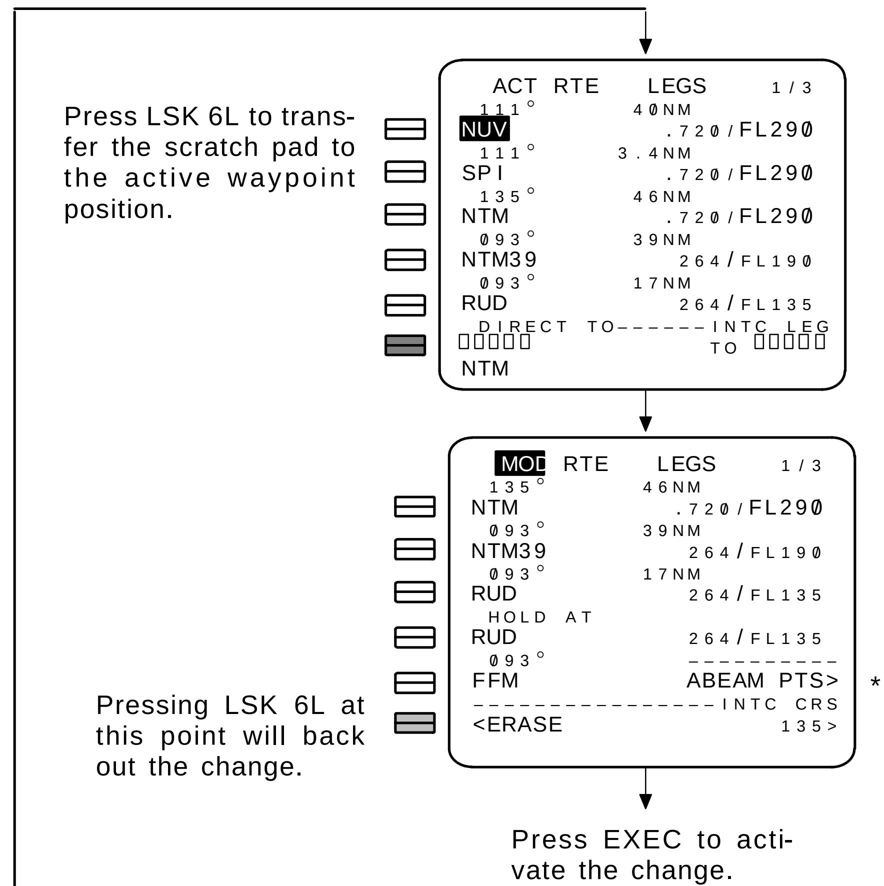
PAGE EXIT

- Press any mode key

Data fields are the same as the RTE LEGS pages.

Selecting the ABEAM PTS prompt (LSK 5R) will add waypoints on the new course representing the abeam position to the old waypoint (within 700 nm of the new course). Wind data specified at the old waypoints will be applied to the new abeam waypoints (within 100 nm of old waypoint). The standard naming convention applies. If the ABEAM WAYPOINTS software option is not available, this field is blank.

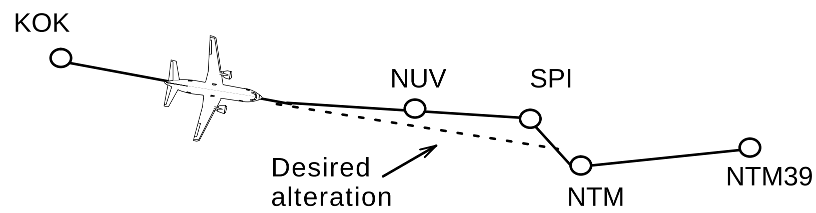




* With Abeam Waypoints option selected

INTERCEPT LEG (INTC)

INTERCEPT provides a means to enter a waypoint to be flown to that intercepts a leg. If the entered waypoint is in the flight plan, it becomes the active waypoint and the intervening legs are deleted. If the entered waypoint is not on the flight plan, a route discontinuity is created.



PAGE ACCESS (with cruise portion of flight plan active)

- Press DIR INTC key for INTC pages
- On the active RTE LEGS pages, select any waypoint in the list and line select it to the first position (active waypoint)
- Select a waypoint from the SELECT DESIRED WAYPOINT page

PAGE EXIT

- Press any mode key

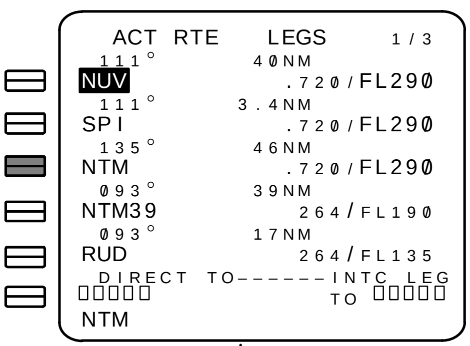
Data fields are the same as the RTE LEGS pages.

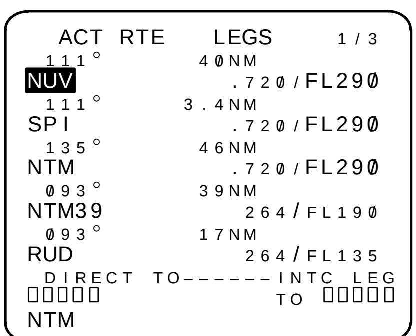
Selecting the ABEAM PTS prompt (LSK 5R) will add waypoints on the new course representing the abeam position to the old waypoint (within 700 nm of the new course). Wind data specified at the old waypoints will be applied to the new abeam waypoints (within 100 nm of old waypoint). The standard naming convention applies. If the ABEAM WAYPOINTS software option is not available, this field is blank.

Select the desired waypoint to the scratch pad

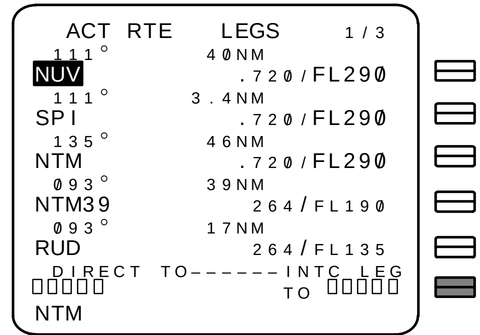
or

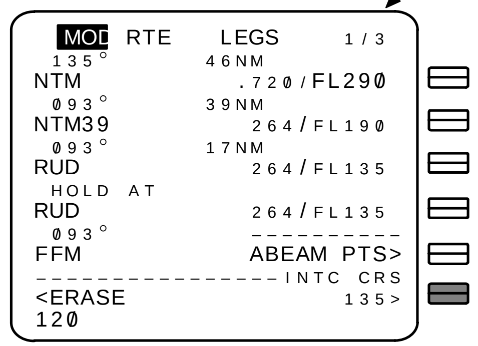
Manually enter N T M





Press LSK 6R to transfer the scratch pad to the active waypoint position.

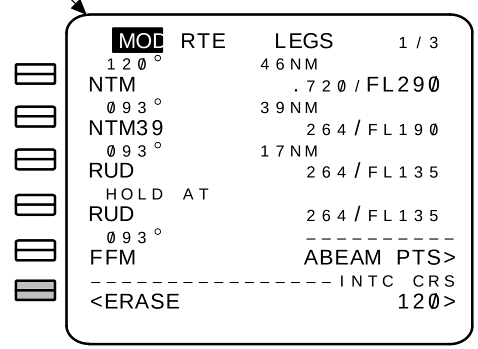




Enter desired intercept course.

1 2 0

Then press LSK 6R.



Pressing LSK 6L at this point will back out the change.

Press EXEC to activate the change.

* With Abeam Waypoints option selected

PROGRESS

(without ACARS)

Progrss pages display current in-flight status for the active route.

PAGE ACCESS page 1

– Press PROG key

– NEXT PAGE key from PROGRESS page 3

– PREVIOUS PAGE key from PROGRESS page 2

PAGE EXIT

– Press any mode key

– NAV STATUS prompt (LSK 6R) on PROGRESS page 1 displays the NAV STATUS page

– NEXT PAGE key displays PROGRESS page 2

– PREVIOUS PAGE key displays PROGRESS page 3

```
              UAL12149 PROGRESS 1/3
             FROM       ALT   ATA   FUEL
LINE 1 –    KOK        FL290 1441z  5.3
             099°       DTG   ETA   FUEL
LINE 2 –    NUV           84 1457z  5.2
             246°
LINE 3 –    SPI           88 1458z  5.1

LINE 4 –    EDDF         257 1528z  3.9
             TO T/D           FUEL QTY
LINE 5 –    1501z/  98NM            4.9
             WIND
            104°/27KT     NAV STATUS>
```

With Flight Number option selected
(airlines selectable option)

LINE 1 – displays the following information about the last waypoint passed:

- FROM – waypoint identifier
- ALT – altitude at the waypoint
- ATA – actual time of arrival
- FUEL – fuel quantity at the specified waypoint

LINE 2 – displays the following information about the active waypoint:

- Leg direction or procedural header from the RTE LEGS page and the active waypoint (highlighted in reverse video)
- DTG – distance to go computed from PPOS
- ETA – estimated time of arrival computed from PPOS
- FUEL – fuel quantity remaining at the specified waypoint

LINE 3 – displays the following information relative to the next waypoint in the active flight plan:

- Leg direction or procedural header from the RTE LEGS page and the next waypoint
- DTG – distance to go computed from PPOS
- ETA – estimated time of arrival computed from PPOS
- FUEL – fuel quantity remaining at the specified waypoint

LINE 4 – displays the following information relative to the destination:

- Destination waypoint
- DTG – distance to go computed from PPOS
- ETA – estimated time of arrival computed from PPOS
- FUEL – fuel quantity remaining at the specified waypoint

NOTE: If a modified flight plan is in progress, this line will reflect the modification and the waypoint will have the header display “MOD”.

LINE 5 – displays the following:

- ETA and distance to the next vertical point computed from PPOS. The next vertical point may be one of the following:
  - T/C – top of climb
  - STEP POINT
  - T/D – top of descent
  - E/D – end of descent
- FUEL QTY – displays current fuel quantity from the summation unit.

WIND – displays current wind direction and speed.

(without ACARS)

A performance speed schedule to achive a required time of arrival to a specified waypoint may be activated through PROGRESS page 2 (RTA PROGRESS). The target speed schedule to meet the RTA is computed using the ECON mode cost index that results in the desired ETA performance prediction. EXECuting a mod to this page will activate the RTA performance mode for the specified waypoint.

<u>PAGE ACCESS</u> page 2

- NEXT PAGE key from PROGRESS page 1.
- PREVIOUS PAGE key from PROGRESS page 3.
- RTA prompt (LSK 6R) from CLB, CRZ, DES, and PERF LIMITS pages.

<u>PAGE EXIT</u>

- Press any mode key.
- LIMITS prompt (LSK 6L) on PROGRESS page 2 displays the PERF LIMITS page.
- NEXT PAGE key displays PROGRESS page 3.
- PREVIOUS PAGE key displays PROGRESS page 1.

```
      RTA  PROGRESS       2/3
 RTA WPT










------------------------
<LIMITS         PRIOR RTA>
```

RTA mode not enabled

```
MOD RTA  PROGRESS       2/3
 RTA WPT                RTA
EDOF                1015:00z
 RTA SPD         TIME ERROR
250/.633     EARLY    05:00
 RECMD T/O              GMT
0911:30z            0855:20z
DIST--TO EPH      --ALT/ETA
 340NM              0958:20z
FIRST--T/O WINDOW---LAST
0900:20z            0917:30z
------------------------
<ERASE
```

MOD RTA page

PRIOR RTA prompt – displayed only if an active RTA mode was changed to another performance mode. Selecting the PRIOR RTA prompt will recall the RTA waypoint and time entered before the performance mode change.

ERASE – allows entries to be backed out.

LINE 1

- RTA WPT – enter the desired waypoint to be defined by the RTA mode. Removing an RTA designated waypoint from this prompt removes the RTA requirement for that waypoint but does not delete the waypoint from the flight plan.
- RTA – displayed after RTA WPT is entered. Enter the required time of arrival. If the entry is suffixed by “A”, the FMC assumes “AT or AFTER”. If the entry is suffixed by “B”, the FMC assumes “AT or BEFORE”. No entry is assumed to be “AT”.

LINE 2

- RTA SPD – displays target speeds of climb CAS and cruise MACH. Target speed schedule is based on the cost index value entered on the PERF INIT page.
- TIME ERROR – displays the on-time status and amount of time difference between ETA and the desired RTA as follows:
  - If ETA is within the WINDOW (line 5), display “ON TIME”.
  - If ETA is after LAST (line 5), display LATE and time difference.
  - If ETA is before FIRST (line 5), display EARLY and time difference.

LINE 3

- RECMD T/O – displays the computed time for takeoff. This value represents the “brake release” time and is only displayed on the ground.
- GMT – displays current GMT.

LINE 4

- DIST––TOxxxxx – displays the distance from PPOS to the designated RTA wayppoint. When less than 10 nm, display changes to read tenths of a nm.
- ALT/ETA displays predicted altitude at, and estimated time of arrival to, the designated RTA waypoint.

LINE 5

- T/O WINDOW (takeoff window) (pre takeoff) – displays the earliest and latest times to meet the RTA schedule. When the entered RTA time is “AT or BEFORE” FIRST, field is blank. If entered RTA time is “AT or AFTER”, LAST, field is blank.
- RTA WINDOW (in flight) – always displays earliest and latest times to meet RTA schedule.

PROGRESS (CONT.)

(without ACARS)

Progress page 3 displays current dynamic flight information.

PAGE ACCESS page 3

- NEXT PAGE key from PROGRESS page 2
- PREVIOUS PAGE key from PROGRESS page 3

PAGE EXIT

- Press any mode key
- NEXT PAGE key displays PROGRESS page 1
- PREVIOUS PAGE key displays PROGRESS page 2

HEADWIND/TAILWIND – displays present headwind or tailwind speed.

WIND – displays current wind direction and speed.

XTK ERROR – displays present crosstrack error. Indicates direction; left (L) or right (R) of track and distance in nautical miles.

- For U10.2A and earlier the distance is N.N NM from the lateral guidance path for all transitions, and is consistent with the HSI indication.
- For U10.3 the the distance is NN.NN NM from the actual desired VNAV track.

GPS–X TRK – displays the GPS heading when the GPS with Integrity option is selected and the data received is valid. The header indicates which GPS (left –L, right –R, center –C) receiver is providing the position data.

CROSSWIND – displays current crosswind component.

SAT/ISA DEV – displays current static air temperature and equivalent ISA deviation. For aircraft with non-aspirated TAT probes, SAT is blank when on the ground.

VERT DEV – displays current vertical deviation from the computed path when descent is active.

TAS – displays current true airspeed.

U10.2A and earlier

```
        PROGRESS        3/3
 HEADWIND           CROSSWIND
27KT                  R   3KT
 WIND             SAT/ISA DEV
104°/ 27          -40°C/   0°C
 XTK ERROR           VERT DEV
L 0.1NM                  12HI
                          TAS
                        470KT
```

```
 UAL12149 PROGRESS      3/3
 HEADWIND           CROSSWIND
27KT                  R   3KT
 WIND             SAT/ISA DEV
104°/ 27          -40°C/   0°C
 XTK ERROR           VERT DEV
L 0.1NM                  12HI
                          TAS
                        470KT
```

With Flight Number option selected
(airlines selectable option)

U10.3

```
        PROGRESS        3/3
 HEADWIND           CROSSWIND
27KT                  R   3KT
 WIND             SAT/ISA DEV
104°/ 27          -40°C/   0°C
 XTK ERROR           VERT DEV
L 0.01NM                 12HI
                          TAS
                        470KT
```

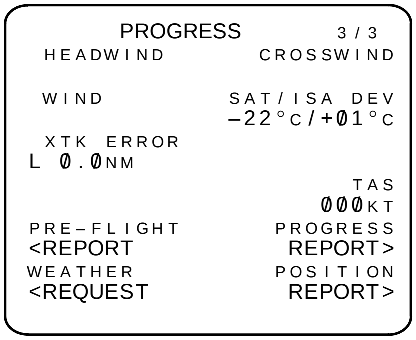
```
        PROGRESS        3/3
 HEADWIND           CROSSWIND
27KT                  R   3KT
 WIND             SAT/ISA DEV
104°/ 27          -40°C/   0°C
 XTK ERROR           VERT DEV
L 0.01NM                 12HI
 GPS-L TRK                TAS
246°T                   470KT
```

With GPS with Integrity option selected
(airlines selectable option)

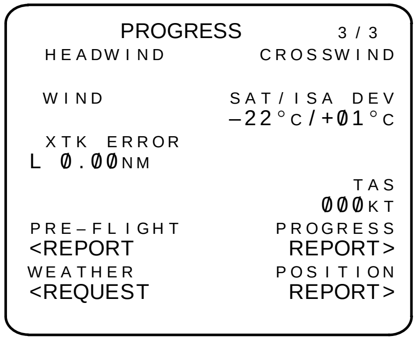
(with ACARS)

Progress page 3 provides the capability to communicate information with the ground station. When selecting any of the ACARS prompts on this page, the selected prompt is highlighted for 3 seconds.

U10.2A and earlier



U10.3



PRE-FLIGHT REPORT – displayed while on the ground and TAKEOFF REF page 1 displays PRE-FLIGHT COPMPLETE. Selecting this REPORT prompt (LSK 5L) reports the following data to the ground station:

- Date
- Aircraft Type
- Thrust Rating
- Nav Data Base Identifier
- Flight Number
- Company Route Identifier
- Departure Airport Identifier
- Arrival Airport Identifier
- Zero Fuel Weight
- Alternate Destination Data
- ETA to Destination
- Distance to Destination
- Predicted Fuel at Destination
- Takeoff Weight
- Landing Weight
- Fuel Information
- Flight Plan Predictions
- Cost Index

WEATHER REQUEST – selecting this REQUEST prompt (LSK 6L) upoads wind data for the active destination and alternate destination(s) in the active route. The uploaded data will also include a modified flight plan destination if required.

PROGRESS REPORT – selecting this REPORT prompt (LSK 5R) downloads current progress data as follows:

- Active Destination Airport Identifier
- Destination Runway Identifier
- Predicted Fuel at Destination
- ETA to Destination
- Flight Number

POSITION REPORT – selecting this REPORT prompt (LSK 6R) downloads the following information:

- Current FMC Position
- Current Time (UTC)
- Current Altitude
- Next Waypoint after GOTO Waypoint
- Actual Wind
- Last Sequenced Waypoint Identifier
- GOTO Waypoint Identifier
- Static Air Temperature
- Total Fuel

DOWN TRACK FIX INFORMATION (FIX INFO)

The FIX INFO page provides bearing and distance from an entered waypoint or navaid, and displays ETA, distance to go, and predicted altitude at radial or distance intersections. These intersections are the intersections of the current active flight plan and the manually entered radial/distances from the FIX. The FIX entry must be a valid waypoint or navaid contained in the nav data base. Radial/distance (RAD/DIS) entries can be radials or distances from the entered FIX. Radial or distance intersection data may be entered as waypoints in the route by line selecting into the scratch pad and transferring to the LEGS or RTE pages. The new waypoint is entered in fix/bearing/distance format.

Entering a fix displays fix information on the EFIS in map mode.

PAGE ACCESS

– Press FIX key

– NEXT PAGE key from FIX INFO page 2

– PREVIOUS PAGE key from FIX INFO page 2

PAGE EXIT

– Press any mode key

NOTE: When a lateral offset exists in the active flight plan, the page title is OFFSET FIX INFO and the page is for reference only (cannot select a fix into the scratch pad for transfer to the LEGS or RTE pages). All fix data is relative to the offset plan.

A maximum of two fix points may be entered, with three RAD/DIS (lines 2 through 4) entries for each fix point. The second fix point is entered on FIX INFO page 2.

FIX – enter or select the desired airport, navaid, or waypoint identifier.

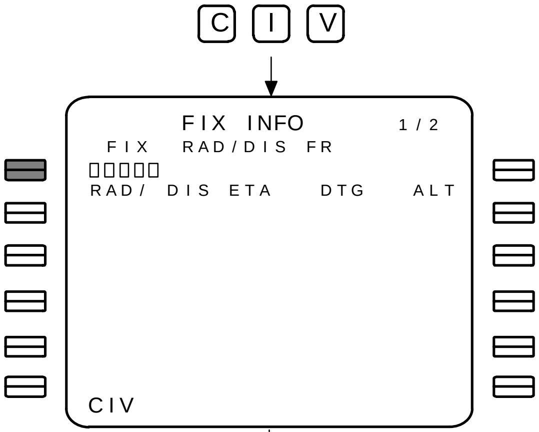
RAD/DIS FR (line 1) – displays the bearing and distance from PPOS to the identifier entered in the FIX field.

RAD/DIS (lines 2 through 4) – entry of a radial or distance results in the other being displayed.

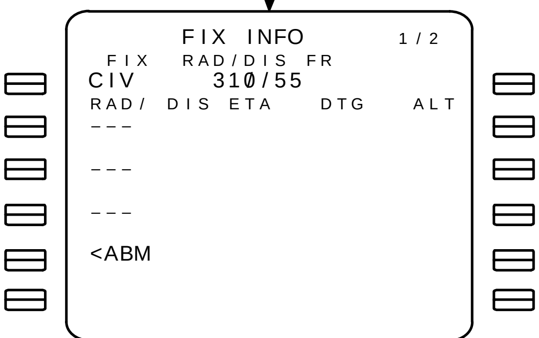
ETA, DTG, and ALT are calculated and displayed based on the RAD/DIS entry.

ABM (abeam) – When a valid fix is entered into line 1, the ABM prompt is displayed. Selecting this prompt (LSK 5L) displays RAD/DIS, ETA, DTG, and ALT for the point along the flight path where the aircraft will be directly abeam the entered fix point.

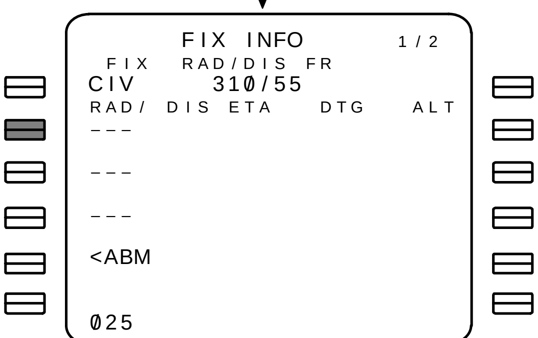
Enter the desired fix point into the scratch pad.



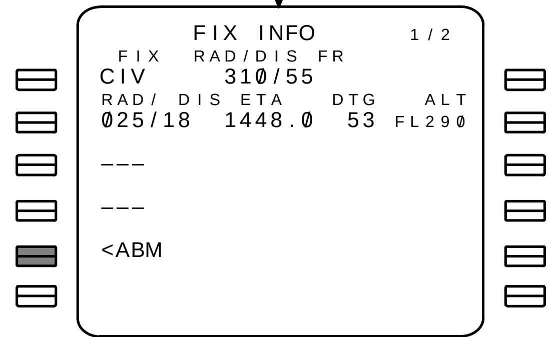
Press LSK 1L to transfer the scratch pad to FIX.



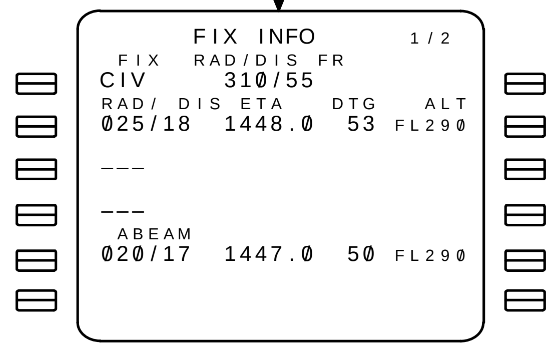
Enter a radial into the scratch pad.



Press LSK 2L to transfer the scratch pad to RAD.



Press LSK 5L to display the abeam point data.



NOTE: When entering a value for RAD, the slash is optional (025/). When entering a value for DIS, the entry must be prefixed by the slash (/18).

DESCENT (DES)

Flight plan modifications entered and executed during the active descent result in the FMC flying the old flight plan until it completes path predictions for the new plan. The FMC will fly the old flight plan for no more than 60 seconds while waiting for the new path predictions. If after 60 seconds predictions for the new plan have not been completed, VNAV disengages. This operation protects against possible violations of new plan constraints. Failure to complete path predictions within allotted time can be a result of multiple bypasses in descent or insufficient time between crew-entered modifications.

Path descent data such as VERT DEV, V/B, and V/S are not available unless there is a waypoint in descent prior to any discontinuities with an associated AT altitude constraint.

When a FANS MCDU is used, the descent page is displayed when the Descent phase is active and the VNAV key is pressed. The DES page may also be selected by using the NEXT PAGE and PREV PAGE keys when other vertical guidance performance pages are displayed.

There are two types of descent: path descent (PATH DES) and airmass descent (SPD DES). This page describes only path descent. In a path descent, the FMC controls pitch to fly the airplane along an altitude profile (path) based upon flight plan and altitude restrictions. Using the speed brake or the throttle, the pilot controls speed to the FMC-generated target airspeed displayed on the airspeed indicator. The path predictions are based on either an FMC-generated economy speed (ECON) or a crew-entered speed, either of which can be preplanned. The descent page is automatically displayed when the current display is a CRZ page, top of descent is reached, and MCP altitude has been set below current altitude. A path descent is automatically started when top of descent is reached and MCP altitude is set below current altitude. Five miles prior to top of descent, a RESET MCP ALTITUDE message is displayed in scratch pad.

PAGE ACCESS

- Press DES key when ECON PATH DES is active.
- MANUAL PATH DES page ECON prompt (LSK 5L).
- CRZ DES or RTA CRZ DES page PLANNED DES prompt (LSK 5R) when ECON PATH DES is planned. Select DES NOW and press EXECute.

PAGE EXIT

- FORECAST prompt (LSK 6L) displays the DESCENT FORECAST page.
- RTA prompt (LSK 6R) displays the RTA PROGRESS page.
- SPEED prompt (LSK 5R) displays the SPD DES page.

E/D ALT – displays end of descent altitude.

TGT SPD – displays computed target speed.

SPD REST – displays most restrictive speed. If the speed restriction is the controlling factor, it is highlighted in reverse video. Restrictions are determined as follows:

- Destination airport speed restrictions minus 10 knots.
- Waypoint speed restriction with a value greater than 210 knots.
- Minimum FLAPS UP operating speed.

VERT DEV – (after top of descent) displays current deviation from the computed path in feet.

AT xxxxx – displays next waypoint at which an altitude constraint occurs. Will also display an existing speed restriction or predicted speed (small font) and altitude.

TO T/D, TO xxxxx – displays time and distance references as follows:

- Prior to descent phase, displays computed ETA and distance to go to top of descent.
- Early descent in progress, displays computed ETA and distance to go to original top of descent.
- In descent phase, displays computed ETA and distance to go to the first waypoint with an altitude constrain or an intermediate top of descent, which ever occurs first.

WPT/ALT – displays waypoint and altitude constraint for vertical bearing. FPA, V/B, and V/S are determined by this entry. If AT is blank dashes are displayed.

FPA – displays aircraft's instantaneous flight path angle.

V/B – displays ground reference vertical bearing between aircraft and waypoint/altitude constraint measured along great circle from aircraft to waypoint (not along flight plan path).

V/S – displays vertical speed required to maintain vertical bearing V/B.

DES NOW prompt (LSK 6R) causes the EXECute key to light. Pressing the EXECute key activates the page displayed.

```
      ECON PATH DES     1/1
 E/D ALT            AT FFM
4000                  4000
 TGT SPD            TO T/D
.720/264   1516.2z/  3.5NM
 SPD REST          WPT/ALT
240/10000         FFM/4500
               FPA  V/B  V/S
               0.0  2.7 2630
------------------------
                    SPEED>

<FORECAST         DES NOW>
```

Before top of descent

```
  ACT ECON PATH DES     1/1
 E/D ALT            AT FFM
4000                  4000
 TGT SPD            TO T/D
.720/264   1516.2z/  3.5NM
 SPD REST          WPT/ALT
240/10000         FFM/4500
 VERT DEV      FPA  V/B  V/S
     8LO       0.0  2.7 2630
------------------------
                    SPEED>

<FORECAST             RTA>
```

After top of descent

SPEED DESCENT (SPD DES)

In an airmass descent, the FMC controls the speed, using pitch, to an FMC-generated economy speed (ECON) or a crew-entered speed. The FMC protects altitude constraints from missing on the “LOW” side and warns the pilot if constraints will be missed on the “HIGH” side. A path prediction is computed by the FMC and the airplane’s vertical deviation from this path is provided to the crew on the ADI and CDU DES page. An airmass (speed) or path descent is automatically started when top of descent is reached and MCP altitude is set below current altitude. Five miles prior to top of descent, a RESET MCP ALTITUDE message is displayed in scratch pad.

<u>PAGE ACCESS</u>

- Press DES key when ECON SPEED DES is active.
- MANUAL SPD DES page ECON prompt (LSK 5L).
- CRZ DES or RTA CRZ DES page PLANNED DES prompt (LSK 5R) when ECON SPEED DES is planned. Select DES NOW and press EXECute.

<u>PAGE EXIT</u>

- FORECAST prompt (LSK 6L) displays the DESCENT FORECAST page.
- RTA prompt (LSK 6R) displays the RTA PROGRESS page.
- PATH prompt (LSK 5R) displays PATH DES

The page title can read as follows:

- ECON SPD DES
- xxxKT SPD DES (manually entered speed descent)

E/D ALT – displays end of descent altitude.

TGT SPD – displays computed target speed.

SPD REST – displays most restrictive speed. If the speed restriction is the controlling factor, it is highlighted in reverse video. Restrictions are determined as follows:

- Destination airport speed restrictions minus 10 knots.
- Waypoint speed restriction with a value greater than 210 knots.
- Minimum FLAPS UP operating speed.

VERT DEV – (after top of descent) displays current deviation from the computed path in feet.

AT xxxxx – displays next waypoint at which an altitude constraint occurs. Will also display an existing speed restriction or predicted speed (small font) and altitude.

TO T/D, TO xxxxx – displays time and distance references as follows:

- Prior to descent phase, displays computed ETA and distance to go to top of descent.
- Early descent in progress, displays computed ETA and distance to go to original top of descent.
- In descent phase, displays computed ETA and distance to go to the first waypoint with an altitude constrain or an intermediate top of descent, which ever occurs first.

WPT/ALT – displays waypoint and altitude constraint for vertical bearing. FPA, V/B, and V/S are determined by this entry. If AT is blank dashes are displayed.

FPA – displays aircraft’s instantaneous flight path angle.

V/B – displays ground reference vertical bearing between aircraft and waypoint/altitude constraint measured along great circle from aircraft to waypoint (not along flight plan path).

V/S – displays vertical speed required to maintain vertical bearing V/B.

DES NOW prompt (LSK 6R) causes the EXECute key to light. Pressing the EXECute key activates the page displayed.

```
      ECON SPD DES        1/1
 E/D ALT
1865
 TGT SPD              TO T/D
.720/264   1516.2z/ 3.5NM
 SPD REST            WPT/ALT
240/10000       ------/-----
                FPA  V/B  V/S
                0.0
------------------------
                       PATH>
<FORECAST          DES NOW>
```

Before top of descent

```
 ACT ECON SPD DES         1/1
 E/D ALT
1865
 TGT SPD              TO FFM
.720/264   1518.3z/   76NM
 SPD REST            WPT/ALT
240/10000       ------/-----
 VERT DEV       FPA  V/B  V/S
   120HI        3.4
------------------------
                       PATH>
<FORECAST              RTA>
```

After top of descent

DESCENT FORECASTS (DES FORECASTS)

Without ACARS

The DES FORCASTS page enables the pilot to enter descent wind data to more accurately define the descent path and allow for non-standard conditions.

PAGE ACCESS

– Any DES or CRZ DES page FORECASTS prompt (LSK 6L).

PAGE EXIT

– Press DES key to return to the descent page.

TRANS LVL – displays the transition level for decent planning level.

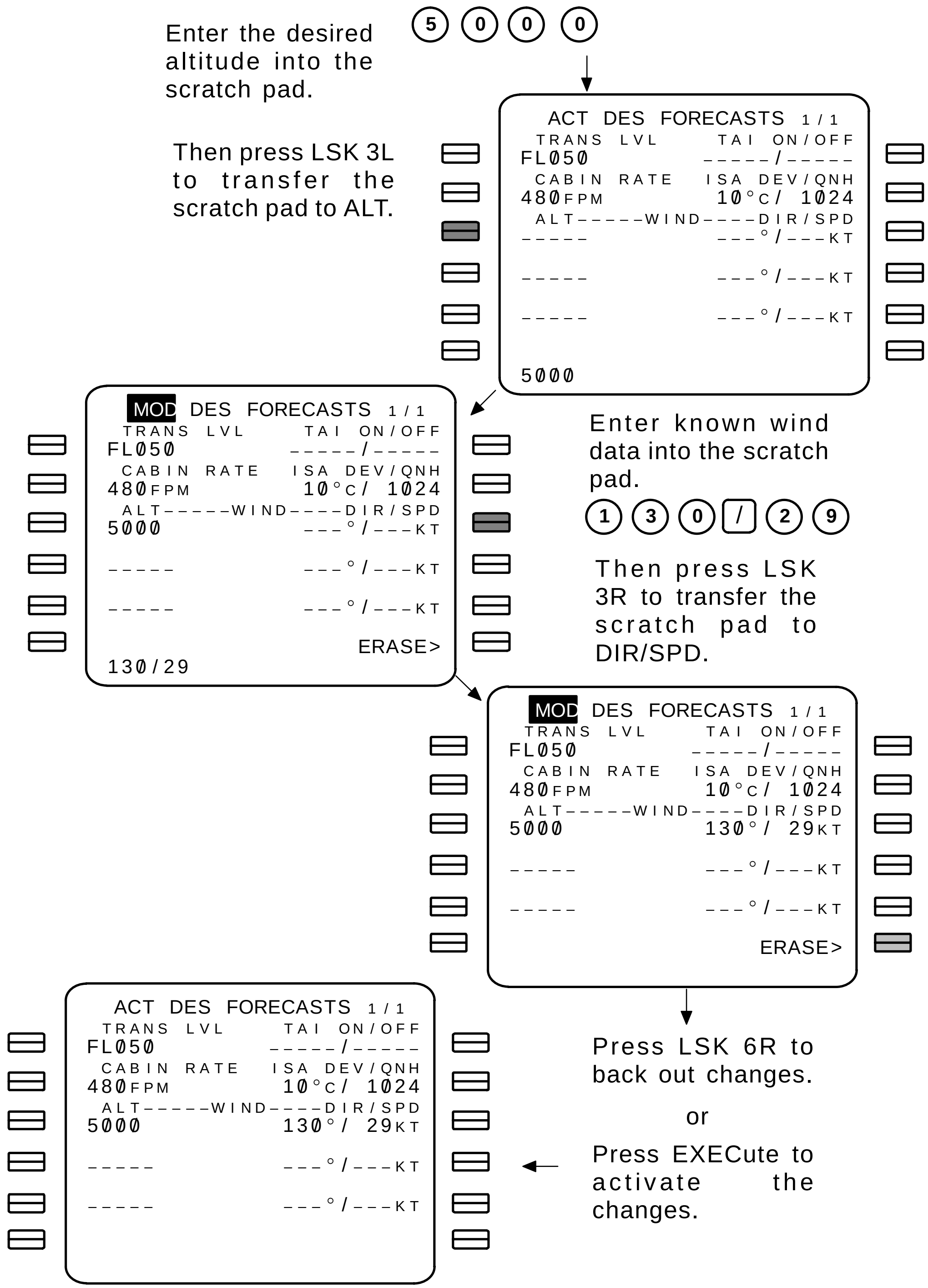
CABIN RATE – displays the computed rate of descent.

TAI ON/OFF – displays the start/stop altitude levels that anti-ice is expected to be used. This helps the FMCS account for additional high idle thrust required over the normal decent idle throttle setting.

ISA DEV – displays the manually entered value to be used for descent path construction.

QNH – displays value of QNH entered above the transition level to provide compensation for the differences between pressure and true altitudes. QNH may be entered in inches of mercury or in millibars.

LINES 3 through 5 – Allows entries of altitude, wind direction, and wind speed. Valid entries are sequenced from highest (line 3) to lowest (line 5) altitude and must be more than 100 feet apart. Incomplete entries are ignored or deleted. Manually deleting an altitude will delete the corresponding wind data. Entries may be made in fields displaying dashes.



With ACARS

The DES FORCASTS page enables the pilot to upload descent wind data to more accurately define the descent path and allow for non-standard conditions.

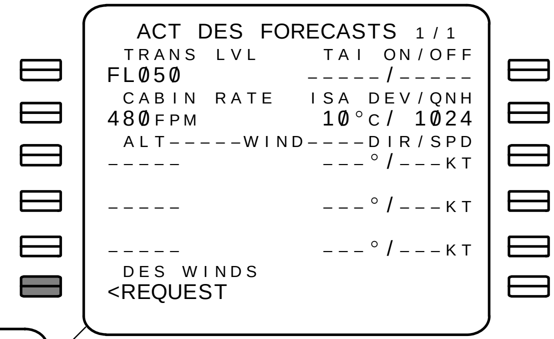
PAGE ACCESS

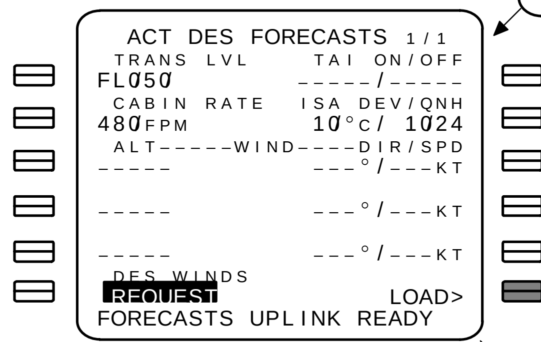
- Any DES or CRZ DES page FORECASTS prompt (LSK 6L).

PAGE EXIT

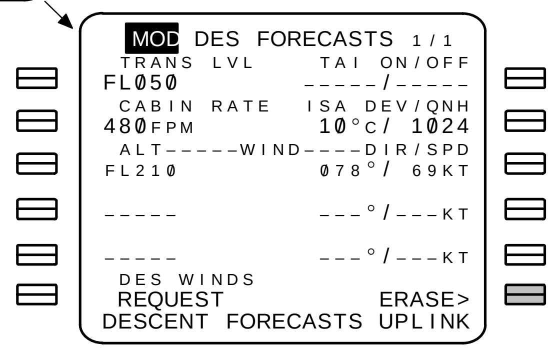
- Press DES key to return to the descent page.

Press LSK 6L to initiate the request.





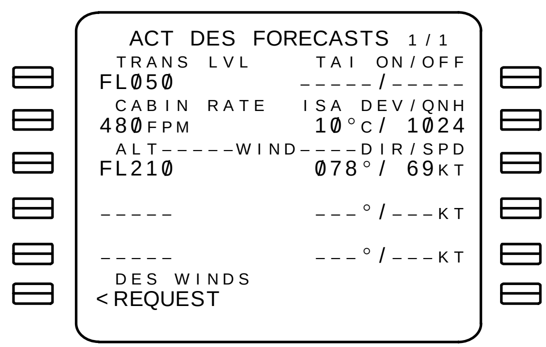
Press LSK 6R to upload winds data.



Press LSK 6R to back out changes.

or

Press EXECute to activate the changes.



TRANS LVL – displays the transition level for decent planning level.

CABIN RATE – displays the computed rate of descent.

TAI ON/OFF – displays the start/stop altitude levels that anti-ice is expected to be used. This helps the FMCS account for additional high idle thrust required over the normal decent idle throttle setting.

ISA DEV – displays the manually entered value to be used for descent path construction.

QNH – displays value of QNH entered above the transition level to provide compensation for the differences between pressure and true altitudes. QNH may be entered in inches of mercury or in millibars.

LINES 3 through 5 – Allows entries of altitude, wind direction, and wind speed. Valid entries are sequenced from highest (line 3) to lowest (line 5) altitude and must be more than 100 feet apart. Incomplete entries are ignored or deleted. Manually deleting an altitude will delete the corresponding wind data. Entries may be made in fields displaying dashes.

REQUEST – initiates an upload when the prompt is available.

HOLD (RTE HOLD)
(U10.0 AND U10.1 VERSIONS)

The RTE HOLD page provides a means of selecting a holding pattern fix point from the aircraft's present position (PPOS) or from any other fixed geographical points in the flight plan or Nav Data Base. When a holding fix in the flight plan is entered, the MOD RTE HOLD page is displayed. The MOD RTE HOLD page provides complete specification of the holding pattern parameters. When a preplanned hold is stored in the Nav Data Base for the entered hold fix, the preplanned hold parameters are displayed automatically. The hold must be made active in the route with the EXEC key. The hold can be exited using the prompt on the ACT RTE HOLD page or by executing the direct-to function to a downsteam waypoint while flying the hold pattern. An RTE HOLD page is not generated for procedure holds.

<u>PAGE ACCESS – RTE LEGS PAGE</u>

– Press HOLD key to display the RTE LEGS page 1 with no previously entered holding patterns in the flight plan.

– RTE HOLD page NEXT HOLD prompt (LSK 6L).

<u>PAGE EXIT</u>

– Entering a waypoint into the box prompt (LSK 6L) displays RTE HOLD page.

– PPOS prompt (LSK 6R) displays RTE HOLD page.

For a description of the fields in lines 1 through 5 of the RTE LEGS page, refer to the RTE LEGS discription on page 2–123.

Box prompts: Allows manual entry or line selection of a waypoint.

PPOS – initiates a holding pattern from present position.

```
  ACT RTE    LEGS     1/6
  111°         40NM
NUV             .720/FL290
  111°        3.4NM
SPI             .720/FL290
  135°         46NM
NTM             .720/FL290
  093°         39NM
NTM39            264/FL190
  093°         17NM
RUD              264/13000
--------HOLD AT---------
□□□□□                PPOS>
```

```
  ACT RTE    HOLD      1/1
  FIX              TGT SPD
PPOS                 264KT
  TURN DIR         FIX ETA
R                  1448.3Z
  INBD CRS        EFC TIME
111°                 ----Z
  LEG TIME      HOLD AVAIL
1.5MIN                0+47
  LEG DIST      BEST SPEED
--.-NM               264KT
------------------------
<NEXT HOLD      EXIT HOLD>
```

<u>PAGE ACCESS – RTE HOLD PAGE</u>

– Entering a valid holding fix or HOLD AT xxxxx into the box prompt (LSK 6L) on the RTE LEGS page.

– PPOS prompt (LSK 6R) on the RTE LEGS page.

– NEXT PAGE/PREVIOUS PAGE keys on other RTE HOLD pages.

<u>PAGE EXIT</u>

– NEXT HOLD prompt (LSK 6L).

– Exiting the current hold.

FIX – holding fix inserted in the route.

TURN DIR – turn direction defaults to right "R". May be manually changed to left "L".

INBD CRS – inbound course for holding pattern. May be manually entered or contained in the data base.

LEG TIME – defaults to 1.5 minutes above 14,000 feet, and 1 minute at or below 14,000 feet unless a custom performance data base contains different defaults. May be manually changed. If a value is entered, LEG DIST will be dashes.

LEG DIST – defaults to dashes unless data is contained in a custom performance data base. May be manually changed. If a value is entered, LEG TIME will be dashes.

TGT SPD – defaults to value in BEST SPEED. May be manually changed. Field is highlighted in reverse video when the hold is active.

FIX ETA – displays computed time that the fix waypoint will be passed again.

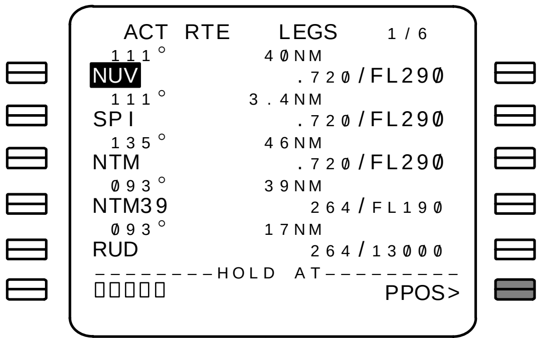
EFC TIME – entered time estimate that the hold will be exited. Field is blanked when GMT is later than the displayed EFC TIME.

HOLD AVAIL – displays the time available for the hold that allows reaching the destination with the required reserve fuel quantity.

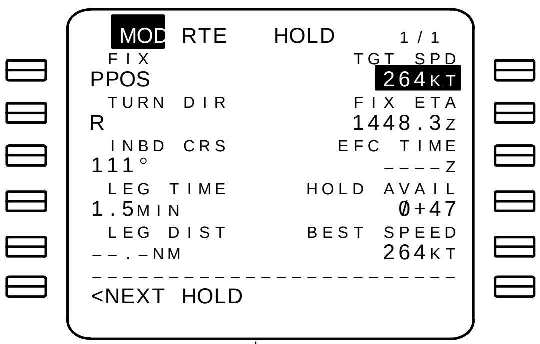
BEST SPEED – displays the best speed for the current holding pattern altitude and conditions. This value may exceed regulatory maximum speed.

HOLD (RTE HOLD) CONT
(U10.0 AND U10.1 VERSIONS)

To initiate a hold at present position
(no holding patterns entered into the route)

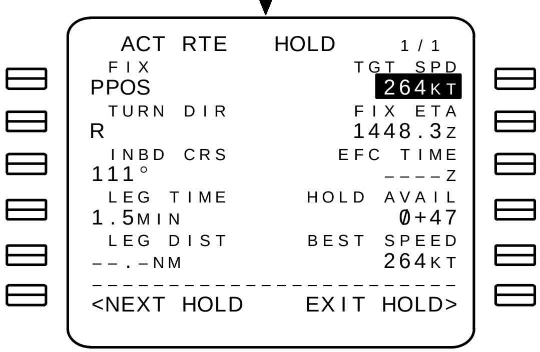


Press LSK 6R to initiate a hold at present position.



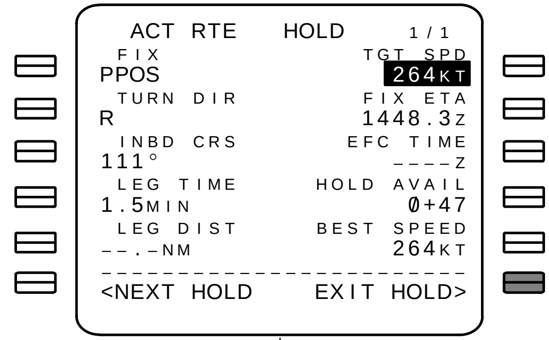
Make any valid changes at this point.

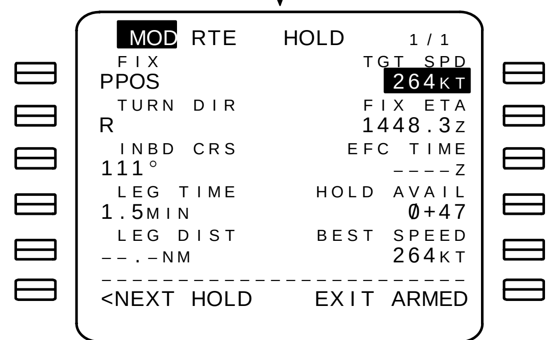
Press EXECute to activate the hold.



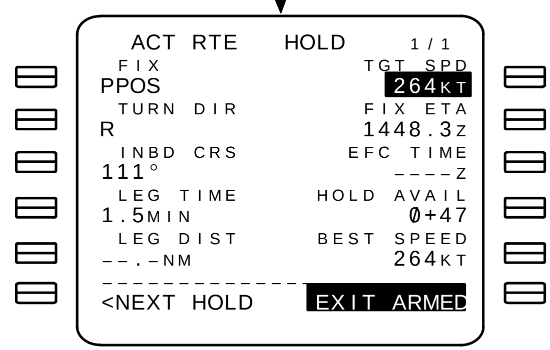
To exit the hold press LSK 6R.

To exit an active hold
Press LSK 6R.





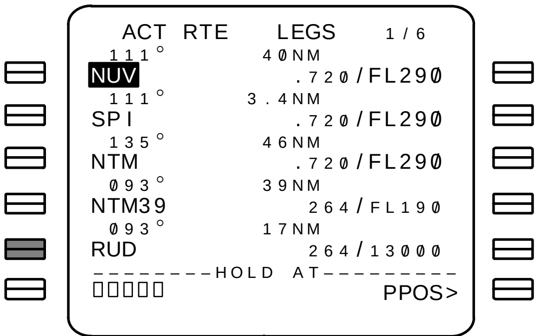
Press EXECute to exit the hold and continue with the activate the route.



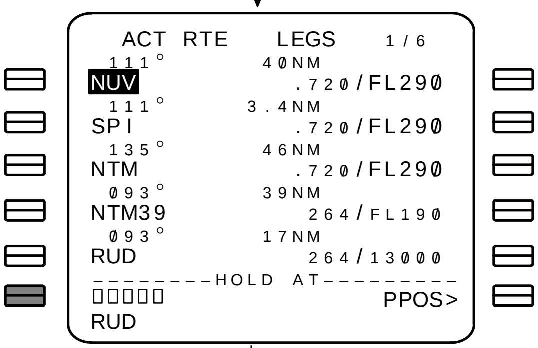
EXIT ARMED will remain highlighted until the aircraft passes the the hold FIX point and continues with the active route.

HOLD (RTE HOLD) CONT
(U10.0 AND U10.1 VERSIONS)

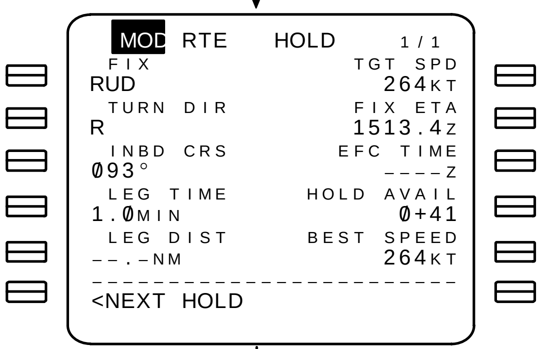
To initiate a hold at a waypoint in flight plan
(no hold points entered into the route)



Press LSK 5L to select the RUD waypoint to the scratch pad.

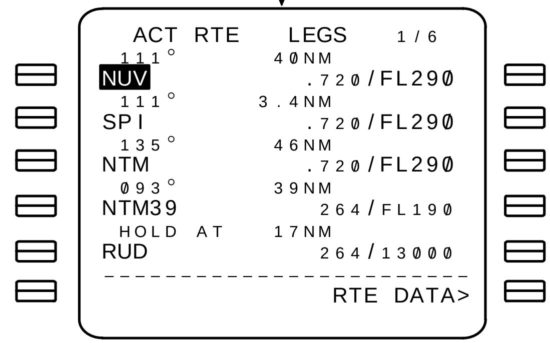


Press LSK 6L to transfer the scratch pad to the box prompts.



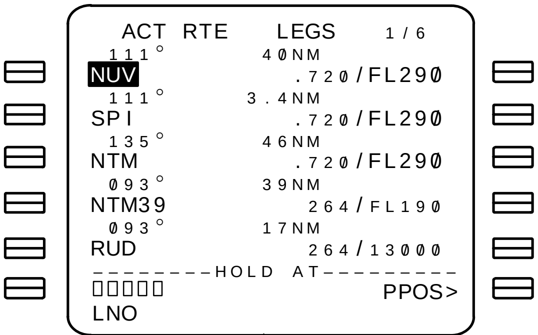
Make any valid changes at this point.

Press EXECute to incorporate the hold into the flight plan.

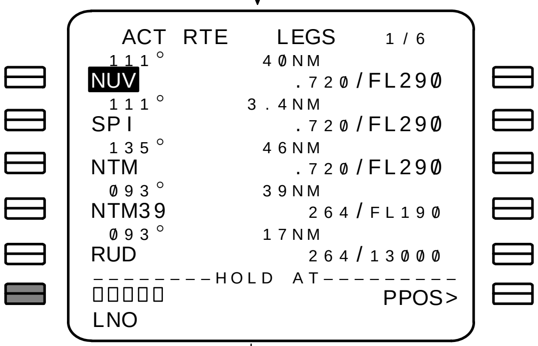


To add more hold points (maximum of five at any one time) into the flight plan, select the NEXT HOLD prompt (LSK 5L) and enter additional hold points using any of the described methods.

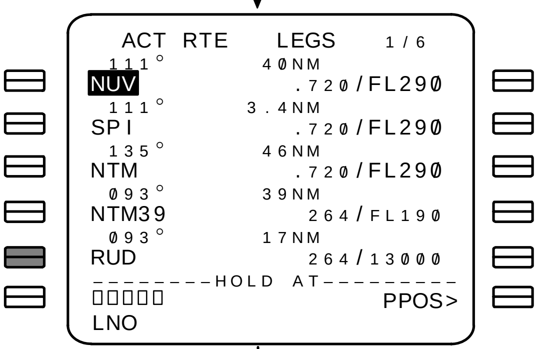
To initiate a hold at a waypoint not in the flight plan
(no hold points entered into the route)



Enter a waypoint into the scratch pad.

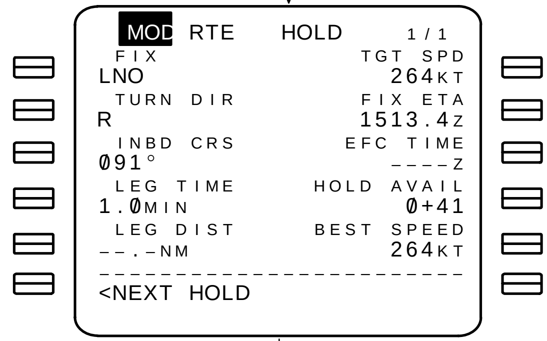


Press LSK 6L to transfer the scratch pad to the box prompts.

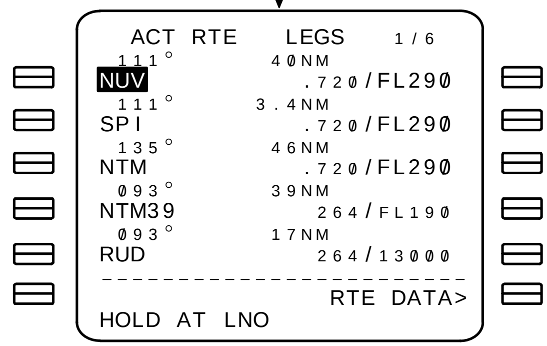


Select the point in the flight plan to insert the hold location.

Make any valid changes at this point.



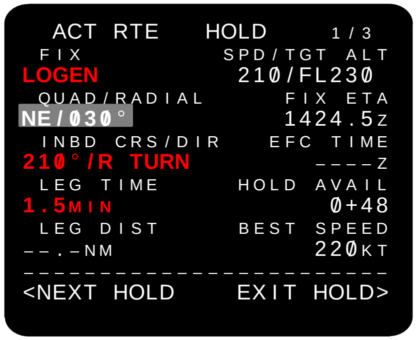
Press EXECute to incorporate the hold into the flight plan.



To add more hold points (maximum of five at any one time) into the flight plan, select the NEXT HOLD prompt (LSK 5L) and enter additional hold points using any of the described methods.

HOLD (RTE HOLD) CONT.
(U10.2A THRU U10.4 VERSIONS)

With Quadrant/Radial



QUAD/RADIAL – the QUAD is a compass direction defined in the chart to the right, and the RADIAL is the reciprocal of the inbound course (except when the hold is placed on a PBD waypoint from a VHF navaid). Manual entry of a quadrant and radial causes the INBD CRS/DIR to be computed and displayed.

When the hold is placed on a PBD waypoint from a VHF navaid, the RADIAL is the bearing of the waypoint and is not changable. The INBD CRS is computed and displayed, however, it may not be the reciprocal. Manual entries of QUAD in this case must correspond to the displayed INBD CRS.

The RADIAL and the INBD CRS are referenced to the MAG/TRUE cockpit switch. An entry made with the MAG/TRUE switch in the true north position is displayed with the “T“ suffix.

SPD/TGT ALT – Manual entry of a speed/target altitude constraint is also displayed on the RTE LEGS page and will cause the hold page to be updated as required.

Allowable entries of SPD are as follows:

- For 737–300/400/500 aircraft – 100 to 340 knots.
- For 737–600/700/800 aircraft – defined in the loadable Perf Data Base.

For U10.2A and U10.3, all values of QUAD/RADIAL, INBD CRS/DIR, and LEG TIME are displayed in large font.

For U10.4, manual entries and database entries are displayed in large font. FMC predicted values are in small font.

DIR – A right-turn on the inbound course is the default direction when not specified.

For U10.2A and U10.3, the default LEG TIME is 1.5 min above 14,000 ft and 1 min at or below 14,000 ft.

For U10.4, the default LEG TIME is 1.5 min above 14,200 ft and 1 min at or below 14,200 ft.

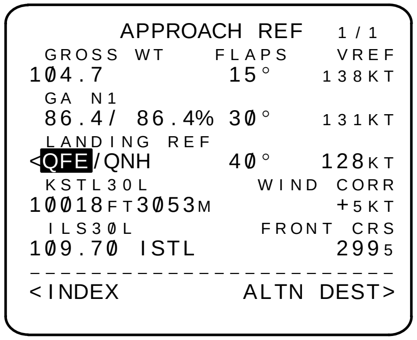
TGT ALT must be less than or equal to the CRZ ALT.

NOTE: If an altitude constraint has not been specified for the holding pattern, and the predicted altitude at the hold waypoint is the CRZ ALT, then the hold will be at the CRZ ALT. If CRZ ALT is changed, the cruise holding altitude will also change.

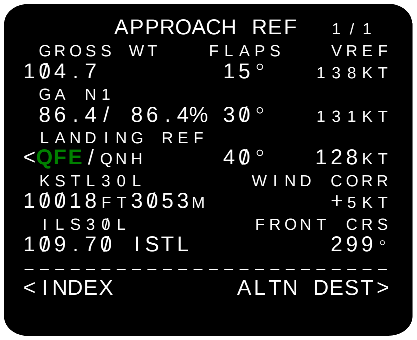
Holding INBD CRS	Holding Qudrant
180 thru 202	N
203 thru 247	NE
248 thru 292	E
293 thru 337	SE
338 thru 022	S
023 thru 067	SW
068 thru 112	W
113 thru 157	NW
158 thru 180	N

APPROACH REFERENCE (APPROACH REF)

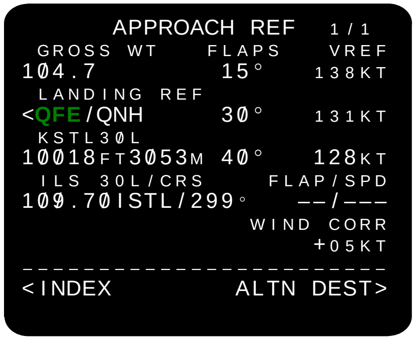
The APPROACH REFERENCE page provides information related to the state of the aircraft and the runway/approach procedure in the active flight plan.



U10.0 and U10.1



U10.2A and U10.3



U10.4

PAGE ACCESS

- Press INIT REF key while in flight.
- INIT/REF INDEX page APPROACH prompt (LSK 5L).

PAGE EXIT

- INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.
- ALTN DEST prompt (LSK 6R) displays the ALTN DEST page (airlines selectable option).

GROSS WT – displays the instantaneous gross weight. To estimate landing speeds, estimated gross weight may be manually entered. Reverts to computed value when exiting page. Box prompts are displayed if the computed value is not valid.

GA N1 – displays GA N_1 limits.

LANDING REF – the selected landing reference is highlighted in reverse video (airline selectable option on 737-600, 737-700, and 737-800 aircraft).

RUNWAY LENGTH (line 4) – displays the runway length whenever the runway is specified in the active flight plan. The header displays the runway identifier.

APPROACH (line 5) – displays the radio tuning frequency and facility identifier from the NDB. The header displays the approach identifier.

FLAPS – displays flaps detent values (maximum of three) used to compute the corresponding values of VREF. Flaps values are as follows:

- For 737-300, 737-400, and 737-500, the displayed values are 15, 30, and 40 degrees.
- For 737-600, 737-700, and 737-800, the displayed values are determined by the Model/Engine data base.

VREF – computed values of vertical speeds are displayed for each flaps setting displayed in FLAPS field. Manually entered values are displayed in large font, and for EFIS equipped aircraft, these values are sent to the EFIS speed tape.

- For 737-300, 737-400, and 737-500, valid speed entries are 90 to 200 knots.
- For 737-600, 737-700, and 737-800, the displayed values are determined by the Model/Engine data base.

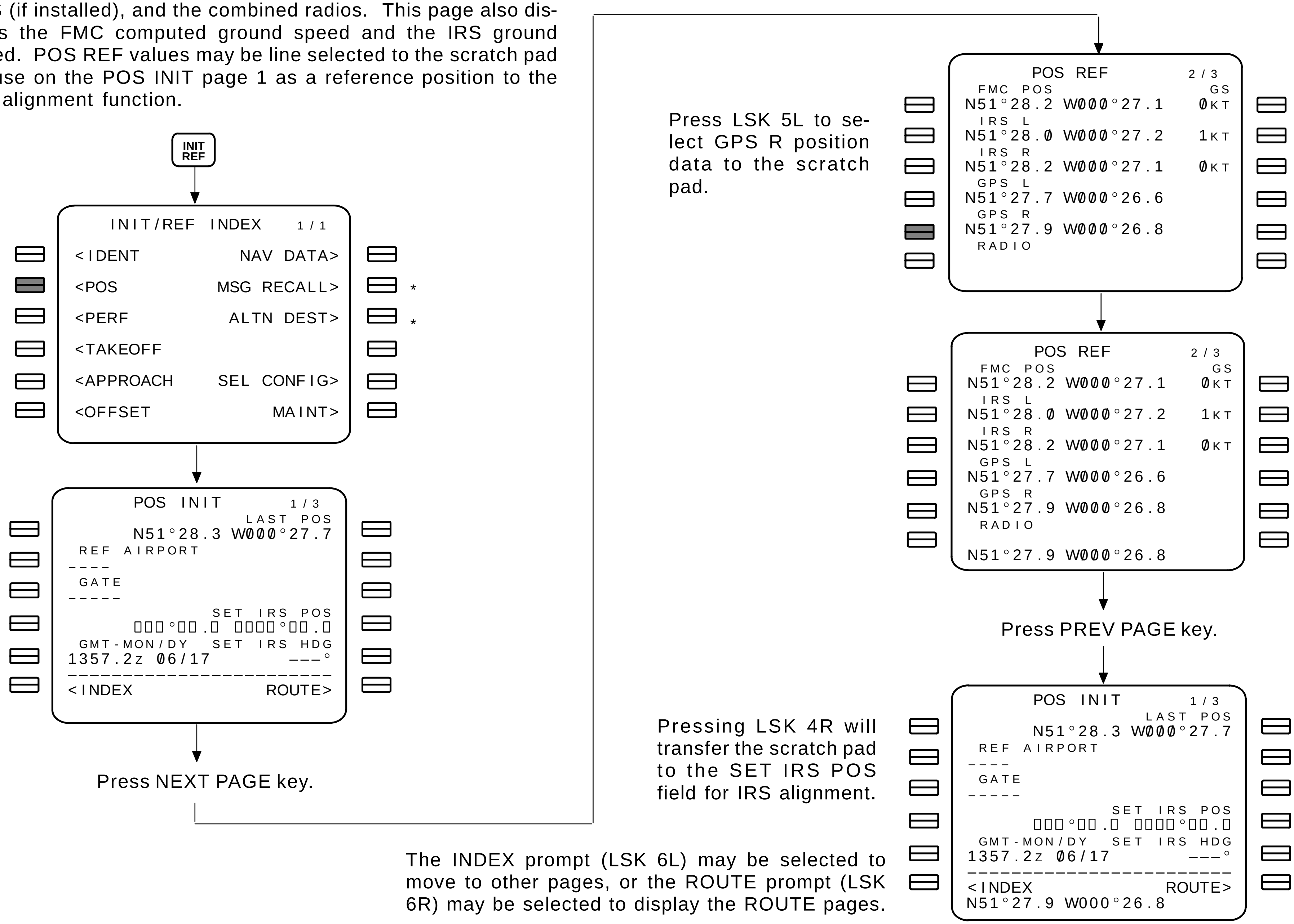
WIND CORR – wind correction defaults to +5 knots. The displayed value is added to the values of VREF for the overall speed at the displayed FLAPS setting. Manual entry of values from 0 to 20 knots may be made.

FRONT CRS – displays the front course when APPROACH displays an ILS, localizer, or localizer backcourse. The displayed course is suffixed with a “T” when referenced to true north.

POSITION REFERENCE (POS REF)

The POS REF page displays the longitude and latitude reported by the FMC, each IRS (when in the NAV mode), the reference GPS (if installed), and the combined radios. This page also displays the FMC computed ground speed and the IRS ground speed. POS REF values may be line selected to the scratch pad for use on the POS INIT page 1 as a reference position to the IRS alignment function.

Any line may be selected to the scratch pad for transfer to other data pages.



* – Airlines Selectable Options.

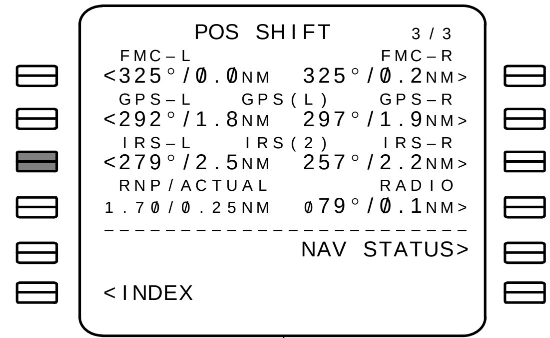
The POS SHIFT page displays the position difference between the FMC(s) and available sensors with respect to the computed FMC position displayed on line 1 of the POS REF page.

The POS SHIFT key allows the FMC position to be updated to any of the sensor positions displayed. Such updating is not normally required. A navaid radio performing poorly enough to corrupt the FMC position would be identified with a message, and the data ignored.

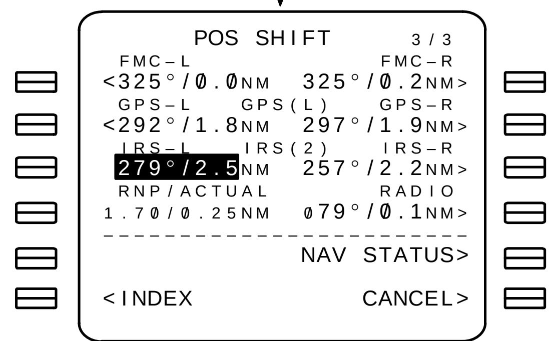
The required and actual navigation performance values are also displayed. This value may be the default value for the current phase of flight, the RNP for the active leg (as defined in the NDB, or a manual entry.

When the update is performed, the primary FMC position is updated, then the secondary FMC and sensor positions are updated relative to the primary FMC position.

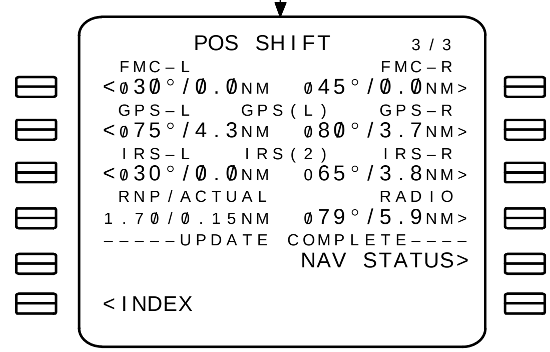
Press the line select key adjacent to the desired sensor.



The position data for the selected sensor is highlighted and the EXECute key lights.



Press the EXECute key.



PAGE ACCESS

- PREV PAGE key while on the POS INIT page.
- NEXT PAGE key while on the POS REF page.

PAGE EXIT

- INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.
- NAV STATUS prompt (LSK 5R) displays the NAV STATUS page.

Once a sensor is selected, the associated position data is highlighted, and the data is not updated until the EXECute key is pressed.

To deselect a choice, use the CANCEL prompt (LSK 6R).

To change a selection, select a new sensor prior to pressing the EXECute key.

REFERENCE NAVIGATION DATA (REF NAV DATA)

The REF NAV DATA page displays runway data from the permanent data base, or waypoints, navaids, and airports in any data base. This page also provides the capability to enter waypoints, navaids, and airports to a temporary data base.

The temporary nav data base may contain the following maximum number of entries:

- 20 waypoints (40 waypoints U10.3)
- 40 navaids
- 6 airports

The temporary data base is shared between the REF NAV DATA and SUPP NAV DATA pages. Entries are maintained until completion of the current flight or FMC power has been off for more than 10 seconds.

<u>PAGE ACCESS</u>

– NAV DATA prompt (LSK 1R) on the INIT/REF INDEX page.

<u>PAGE EXIT</u>

– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.

– SUMMARY prompt (LSK 2R) displays the NAV SUMMARY page.

– NAV OPTIONS prompt (LSK 6R) displays the NAV OPTIONS page.

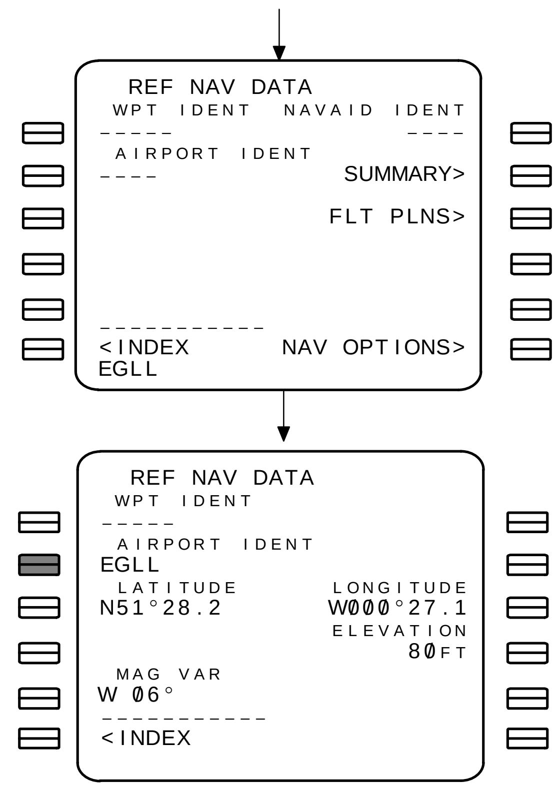
WPT/AIRPORT/NAVAID IDENT – Identifiers are entered into the scratch pad and line selected to the appropriate field. To display a runway, the airport must be entered. Entries that are not contained in the permanent data base result in a page displayed with box prompt in the appropriate fields. Runway data cannot be entered or altered in any data base.

Waypoints may be entered as latitude/longitude, reference navaids, or radial and distance. Radials referenced to true north are suffixed by the letter T.

If an addition is attempted when the temporary data base is full, the message DATA BASE FULL is displayed. Space may be made by deleting unwanted temporary waypoints. Waypoints in the flight plan or used on the FIX INFO page, and history waypoints on the PROGRESS page cannot be deleted

<u>To Display Airport Data</u>

Enter the airport identifier. E G L L

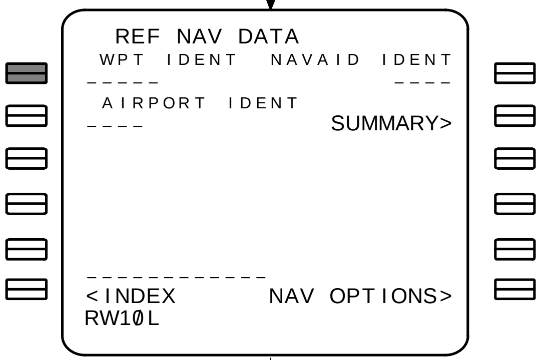


Press LSK 2L to transfer the scratch pad to the AIRPORT IDENT field and display the airport identifier REF NAV DATA page.

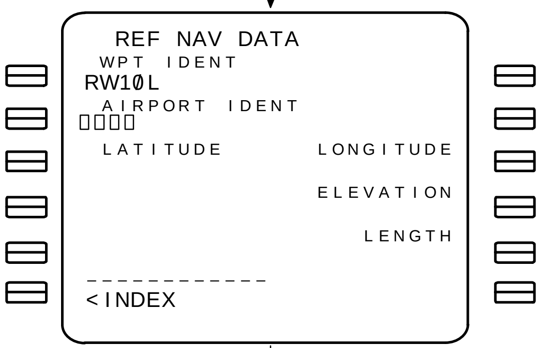
FLT PLNS* – the flight plans prompt displays the FLIGHT PLAN SUMMARY page (U10.3 and Pilot Defined Company Route option).

Enter the runway identifier.

R W 1 0 L

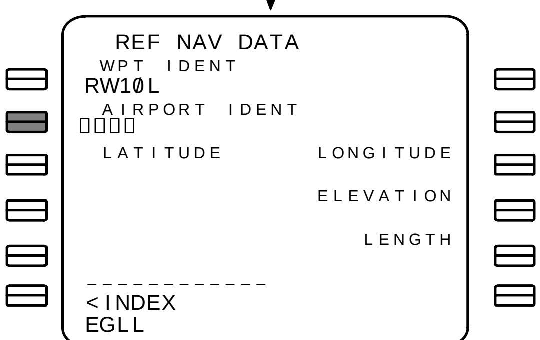


Press LSK 1L to transfer the scratch pad to WPT IDENT.



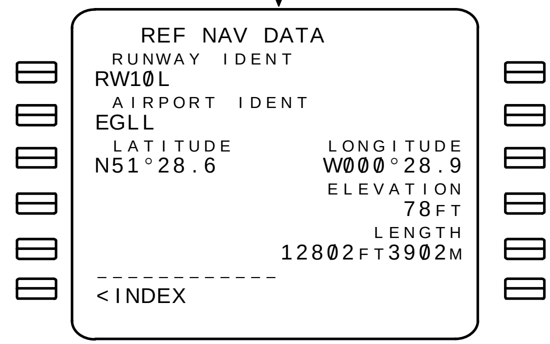
E G L L

Enter the airport identifier.



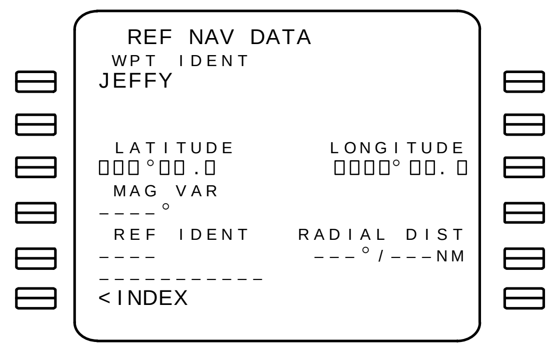
Press LSK 2L to transfer the scratch pad to AIRPORT IDENT.

<u>To Display Runway Data</u>



<u>To Display Waypoint Data</u>

When entering a waypoint and selecting it to field 1L, the REF NAV DATA waypoint page is displayed.



After all required data is entered (box prompts), the EXECute key lights. Pressing EXECute adds the waypoint to the temporary data base.

REF NAV DATA (CONT.)

To Display Navaid Data

Enter the navaid identifier, then press LSK 1R to transfer the scratch pad to NAVAID IDENT.

A navaid can be entered into the temporary data base by completing all of the fields and pressing the EXECute key.

```
    REF NAV DATA
                   NAVAID IDENT
                            DET
                          CLASS
                           VDHW
 LATITUDE             LONGITUDE
N51°18.2             E000°35.9
 FREQ                 ELEVATION
117.30                    700FT
 MAG VAR
W 05°
------------
<INDEX
```

Navaid classifications can be found in the Jeppesen Airway Manual. Navaid classification possibilities are:

V T H B

VOR (optional)

Voice Weather Capability (optional)

A – Automatic Weather Broadcast
B – Scheduled Broadcast

Co-Located Equipment

D – DME
I – ILS/DME
M – Military TACAN
T – TACAN

Altitude Class

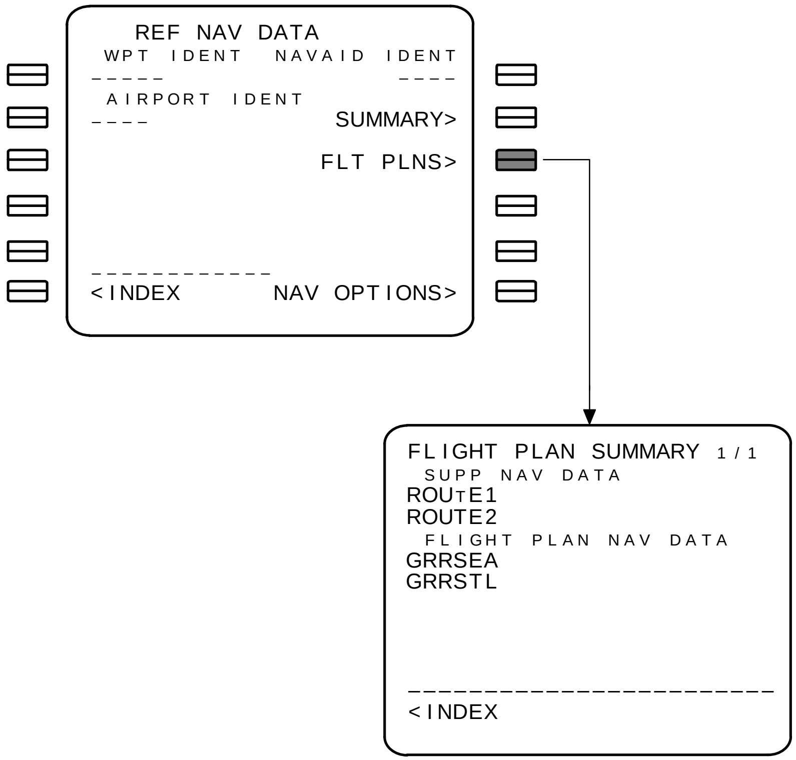
H – High Altitude
L – Low Altitude
T – Terminal
U – Undefined

NOTE: If V is the first character, it must be followed by a D or a T.

To Display Flight Plan Database
(U10.3)

The Flight Plan Database (airlines selectable option) may contain up to 20 pilot defined company routes (1000 waypoints). These routes are loadable on the aircraft using the standard ARINC 615 loader.

Flight plans are listed in sequence according to the data base they are stored in. Multiple pages may be required to list all entries.



SUPPLEMENTAL NAVIGATION DATA (SUPP NAV DATA)

The SUPP NAV DATA page displays runway data from the permanent data base, or waypoints, navaids, and airports in any data base. This page also provides the capability to enter waypoints, navaids, and airports to a temporary data base.

The temporary nav data base may contain the following maximum number of entries:

- 20 waypoints (40 waypoints U10.3)
- 40 navaids
- 6 airports

The temporary data base is shared between the REF NAV DATA and SUPP NAV DATA pages. Entries are maintained until completion of the current flight or FMC power has been off for more than 10 seconds.

<u>PAGE ACCESS</u>

– NAV DATA prompt (LSK 1R) on the INIT/REF INDEX page when "SUPP" is entered into the scratch pad prior to selection, and the airplane is on the ground.

<u>PAGE EXIT</u>

– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.

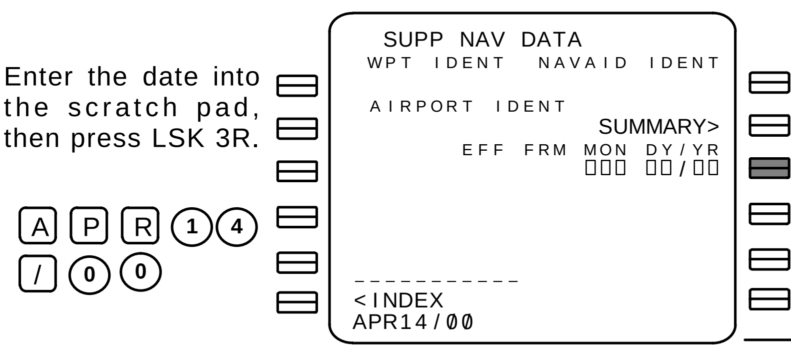
– SUMMARY prompt (LSK 2R) displays the NAV SUMMARY page.

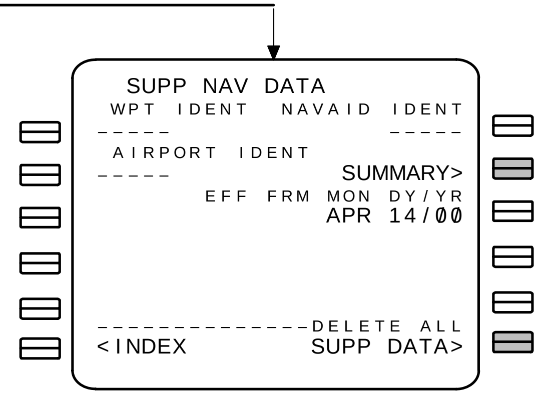
– NAV OPTIONS prompt (LSK 6R) displays the NAV OPTIONS page.

Refer to the REF NAV DATA page for data entry procedures.

Prior to making entries into temporary data base, the effectivity date for when the FMCS can use the data must be entered.

Enter the date into the scratch pad, then press LSK 3R.





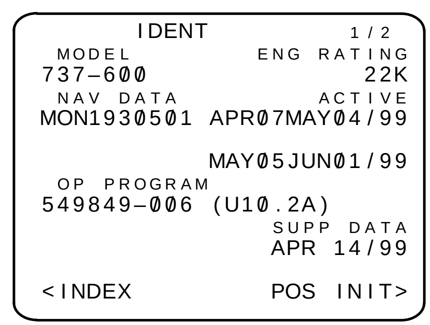
Selecting the SUMMARY prompt (LSK 2R) displays all SUPP and TEMP nav data base entries.

To delete all entries on the SUPP NAV DATA page, select the DELETE ALL SUPP DATA prompt (LSK 6R) and then press the EXECute key.

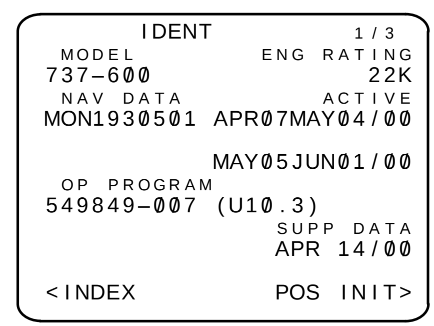
NOTE: This feature is not available once a route has been entered.

Individual entries may be deleted using the DEL key.

The supplemental data base effectivity date entered also appears on the IDENT page.



PRE U10.3



POST U10.3

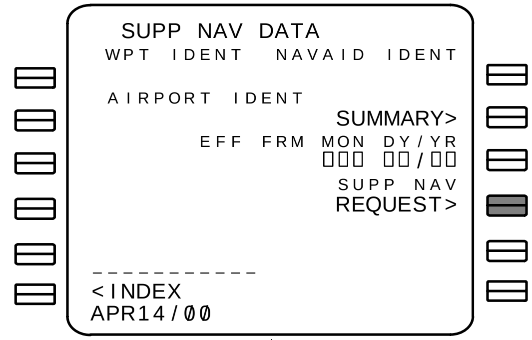
With ACARS Option Selected
(Airlines selectable option)

The REQUEST and REPORT prompts allow supplemental data base information to be communicated between the aircraft and the ground station.

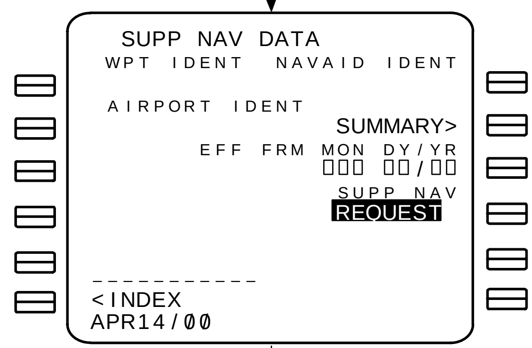
Select the REPORT prompt (LSK 4L) to send a copy of the SUPP NAV DATA base to the ground station.

NOTE: The REPORT prompt is available only when the SUPP NAV DATA base contains data.

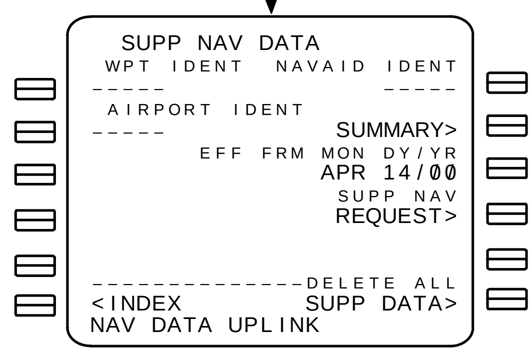
Select the REQUEST prompt (LSK 4R) to request a copy of the SUPP NAV DATA base from the ground station.



The REQUEST prompt remains highlighted until completion.



The completion of the upload is indicated by the REQUEST prompt changing and a message in the scratch pad.



SELECT DESIRED WAYPOINT (SELECT DESIRED WPT)

The SELECT DESIRED WPT pages provide a means to distinguish between waypoints that have the same identifier. The system may contain up to 12 waypoints with the same identifier. Line selecting the desired waypoint automatically returns the CDU display to the page where the waypoint was entered, and the selected waypoint is inserted where the previous attempt was made.

PAGE ACCESS

- Automatically displayed when a non-unique waypoint is entered on a page.

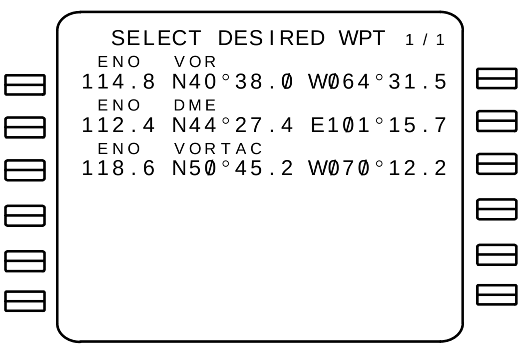
PAGE EXIT

- NEXT PAGE/PREVIOUS PAGE keys when multiple pages exist.
- Selection of the desired waypoint (LSK 1L through LSK 6L).

Waypoints are displayed in order from closest to farthest from the reference point.

The reference position is defined as follows:

- If a mod is being made to an RTE or RTE LEGS page which does not affect the GOTO waypoint, then the reference position is defined as the latitude/longitude of the waypoint preceding the entered waypoint.
- All other operations including DIR-TO and INTC use PPOS.



SELECT DESIRED ROUTE (SELECT DESIRED RTE)
(U10.3) PILOT DEFINED COMPANY ROUTE OPTION

The SELECT DESIRED RTE page provides a means to distinguish between non–unique route identifiers stored in different data bases. Line selecting the desired route source automatically returns the CDU display to the RTE page, and the selected route is inserted in the CO ROUTE line.

PAGE ACCESS

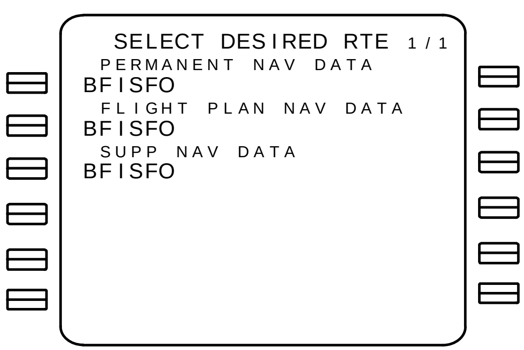
– Automatically displayed when a non-unique route identifier is entered on the RTE page.

PAGE EXIT

– Selection of the desired route (LSK 1L through LSK 3L).

Non–unique route identifiers are displayed for each data base they are contained in.

If an identifier is not stored in a particular data base, that data base header will not appear on the display.



N_1 LIMIT SELECTION (N_1 LIMIT)
(U10.0 VERSION)

The N_1 LIMIT page provides manual selection of the N_1 limit data that is displayed on the N_1 indicator bug and sent to the autothrottle. Values of N_1 limits are displayed for the current conditions.

<u>PAGE ACCESS</u>

– Press [N1 LIMIT] key

<u>PAGE EXIT</u>

– Press any mode key

AUTO/GA/CON/CLB/CRZ – the <ACT> prompt indicates which set of N_1 values are currently being used by the system. When AUTO is active, the FMC automatically selects the N_1 values.

CLB-1 and CLB-2 (LSK 6L or LSK 6R) – the <SEL> prompt indicates which climb thrust restrictions are used. Climb thrust reductions may be removed by pressing the delete key, then pressing the appropriate LSK (6L or 6R) to remove the <SEL> prompt.

- CLB-1 approximates a 3% reduction to 10,000 ft, then gradual thrust increase to normal climb N_1 at 15,000 ft.
- CLB-2 approximates a 6% reduction to 5,000 ft, then gradual thrust increase to normal climb N_1 at 15,000 ft.

T/R ALT – thrust reduction altitude may be overwritten.
(Takeoff Profile option) (airlines selectable option)

```
        N1 LIMIT          1/1
                        T/R ALT
 AUTO  <ACT>            1642FT

 GA              91.7/ 91.7%

 CON             89.5/ 89.5%

 CLB             89.5/ 89.5%

 CRZ             87.5/ 87.5%
------REDUCED CLB-------
CLB-1  <SEL>          CLB-2
```

NOTE: If the N_1 LIMIT page is used to manually select an N1 setting (e.g. GA, CONCLB, or CRZ), automatic selection resumes when the autopilot changes autothrottle or pitch modes.

N_1 LIMIT SELECTION (N_1 LIMIT) CONT.
(U10.1 AND LATER VERSIONS)

The N_1 Limit page provides manual selection of the N_1 limit data that is displayed on the N_1 indicator bug and sent to the autothrottle. Values of N_1 limits are displayed for the current conditions. Takeoff thrusts, thrust bump (when available), and climb thrusts may be selected while on the ground as part of pre–flight inititalization.

PAGE ACCESS

- Press N1 LIMIT key
- PERF INIT page N1 LIMIT prompt (LSK 6R) (U10.1/U10.2)
- TAKEOFF REF page N1 prompt (LSK 6R) (U10.2)

PAGE EXIT

- TAKEOFF prompt (LSK 6R) (on the ground)
- PERF INIT prompt (LSK 6L) (on the ground)
- Press any mode key (in the air)

ON THE GROUND

SEL/OAT (assumed/actual outside air temperature) – enter the assumed temperature to enable a reduced thrust takeoff. When a value is entered, values for RED xxK N_1 are computed and displayed along with derate levels. The actual temperature is automatically displayed when available if aspirated TAT probe is installed. If an assumed OAT is entered (SEL) and thrust bump (TO–B) (if available) is selected, the assumed OAT is blanked and further entries are not permitted.

TO and CLB selections – selecting a takeoff thrust level results in the <ACT> prompt being displayed next to the selection, and a corresponding climb thrust is automatically selected (<SEL>). The climb selection is the highest available climb thrust level that will not cause a throttle push at transition from takeoff mode.

NOTE: The aircrew may override the automatic selection.

IN THE AIR

AUTO/GA/CON/CLB/CRZ – the <ACT> prompt indicates which set of N_1 values are currently being used by the system. When AUTO is active, the FMC automatically selects the N_1 values.

N_1 LIMIT SELECTION (N_1 LIMIT) CONT.
(U10.1 AND LATER VERSIONS)

CLB-1 and CLB-2 (LSK 6L or LSK 6R) – the <SEL> prompt indicates which climb thrust restrictions are used. Climb thrust reductions may be removed by pressing the delete key, then pressing the appropriate LSK (6L or 6R) to remove the <SEL> prompt.

- CLB-1 approximates a 3% reduction to 10,000 ft, then gradual thrust increase to normal climb N_1 at 15,000 ft.
- CLB-2 approximates a 6% reduction to 5,000 ft, then gradual thrust increase to normal climb N_1 at 15,000 ft.

NOTE: If the N_1 LIMIT page is used to manually select an N1 setting (e.g. GA, CONCLB, or CRZ), automatic selection resumes when the autopilot changes autothrottle or pitch modes.

```
        N1 LIMIT        1/1
 SEL/OAT        26K BUMP N1
    / +15°C    102.5/102.5
 26K
<TO            <SEL>   CLB>
 24K DERATE
<TO-1                CLB-1>
 22K DERATE
<TO-2                CLB-2>
 26K BUMP
<TO-B <ACT>
------------------------
<PERF INIT         TAKEOFF>
```

```
        N1 LIMIT        1/1

<AUTO <ACT>

<GA               101.6/101.6

<CON               99.8/ 99.8

<CLB               92.8/ 92.8

<CRZ               83.8/ 83.8
------REDUCED CLB-------
<CLB-1                CLB-2>
```

(U10.2A) (737–600/700/800 with thrust bump)

ON THE GROUND — IN THE AIR

```
        N1 LIMIT        1/1
 SEL/OAT            18.5K N1
----/ +15°C      89.8/ 89.8
 26K
<TO                    CLB>
 24K DERATE
<TO-1 <ACT>   <SEL> CLB-1>
 22K DERATE
<TO-2                CLB-2>


------------------------
<PERF INIT         TAKEOFF>
```

```
        N1 LIMIT        1/1

<AUTO <ACT>

<GA               101.6/101.6

<CON               99.8/ 99.8

<CLB               89.8/ 89.8

<CRZ               83.8/ 83.8
------REDUCED CLB-------
<CLB-1 <SEL>          CLB-2>
```

(U10.2A) (737–300/400/500)

ON THE GROUND — IN THE AIR

ALTERNATE DESTINATIONS (ALTERNATE DESTS)

Without ACARS

Up to five alternate destinations may be entered on the ALTERNATE DESTS summary page, to allow the FMC to continuously predict fuel remaining and time of arrival at each of these locations. An alternate is added to the list by line selecting any waypoint or airport defined in any of the Nav Data Bases into the desired position on this page. Predictions of time and fuel burn are based on FMC generated or crew entered values of distance, altitude, and wind. The crew is also provided a selection of predictions based on a direct course from present position to the alternate, or via missed approach from the destination airport.

<u>PAGE ACCESS</u>

- APPROACH REF page ALTN DEST prompt (LSK 6R).
- INIT/REF INDEX page ALTN DEST prompt (LSK 3R).
- RTE page ALTN DEST prompt (LSK 6L).
  (in the air only)

<u>PAGE EXIT</u>

- Any mode key.

ALTN – entered alternate waypoints, navaids or airport identifiers, 5 characters or less.

VIA – indicates the method that the alternate destinations predictions are based on (D = Direct-To, M = Missed Approach).

DTG/EST DTG – computed distance to go is displayed in small font. When the direct method is used manual entries are allowed (large font) and the header displays EST DTG.

ETA – displays estimated time of arrival to the alternate destination.

FUEL – displays the predicted fuel remaining at the alternate destination.

TRIP ALT – displays FMC best cruise altitude. May be overwritten to enhance the accuracy of the alternate's predictions.

ACTUAL WIND/EST WIND – displays wind direction and magnitude. May be manually overwritten to enhance the accuracy of the alternate's predictions. The header changes to EST WIND for manual entries.

```
   ALTERNATE DESTS     1/6
ALTN VIA DTG   ETA    FUEL
KRNO  D   30  1007z   9.8>

KFAT  D  194  1033z   7.9>

-----

-----

CF03  D  352  1055z   6.2>

          NEAREST APRTS>
```

```
  ALTERNATE DESTS     2/6
 ALTN     VIA      TRIP ALT
KRNO    DIRECT       FL200
 DTG           ACTUAL WIND
 30                 0°/  0
 ETA
1007z
 FUEL
 9.8

<MISSED APP

<INDEX       NEAREST APRTS>
```

```
    NEAREST ARPTS      1/6
ALTN VIA DTG   ETA    FUEL
KRNO  D   30  1007z   9.8>

KLJS  D   60  1018z   9.6>

KATH  D   88  1022z   9.2>

KMSF  D  116  1028z   8.7>

KSCK  D  144  1033z   8.5>

                 PREVIOUS>
```

```
  ALTERNATE DESTS     2/6
 ALTN     VIA      TRIP ALT
KRNO    MISAPP       FL200
 DTG              EST WIND
 363               ---°/---
 ETA           KSFO - KRNO
1111z                  166
 FUEL
 8.8

<DIRECT-TO

<INDEX       NEAREST APRTS>
```

MISSED APP/DIRECT–TO prompt (line 5L) is a toggle to allow changing the method of predicting the route.

Destination – Alternate (field 3R) – displayed in missed approach method only. Displays the computed distance to fly from the original destination to the alternate. Manual entries are displayed in large font, will be used in predictions, and will be reflected in the DTG field.

INDEX prompt – returns the display to page 1/x.

NEAREST APRTS prompt – selection results in the FMC searching the NDB for five airports nearest to PPOS. NEAREST ARPTS age 1/x is displayed listing the airports from closest to most distant. Selecting an airport (LSK 1R through 5R) displays detailed information.

PREVIOUS prompt – selection returns the display to ALTERNATE DESTS page 1/x.

With ACARS

Field 6L provides the capability to request wind data for the active and alternate destination airports as well as any MOD flight plan destination if different that the active flight plan.

PAGE ACCESS

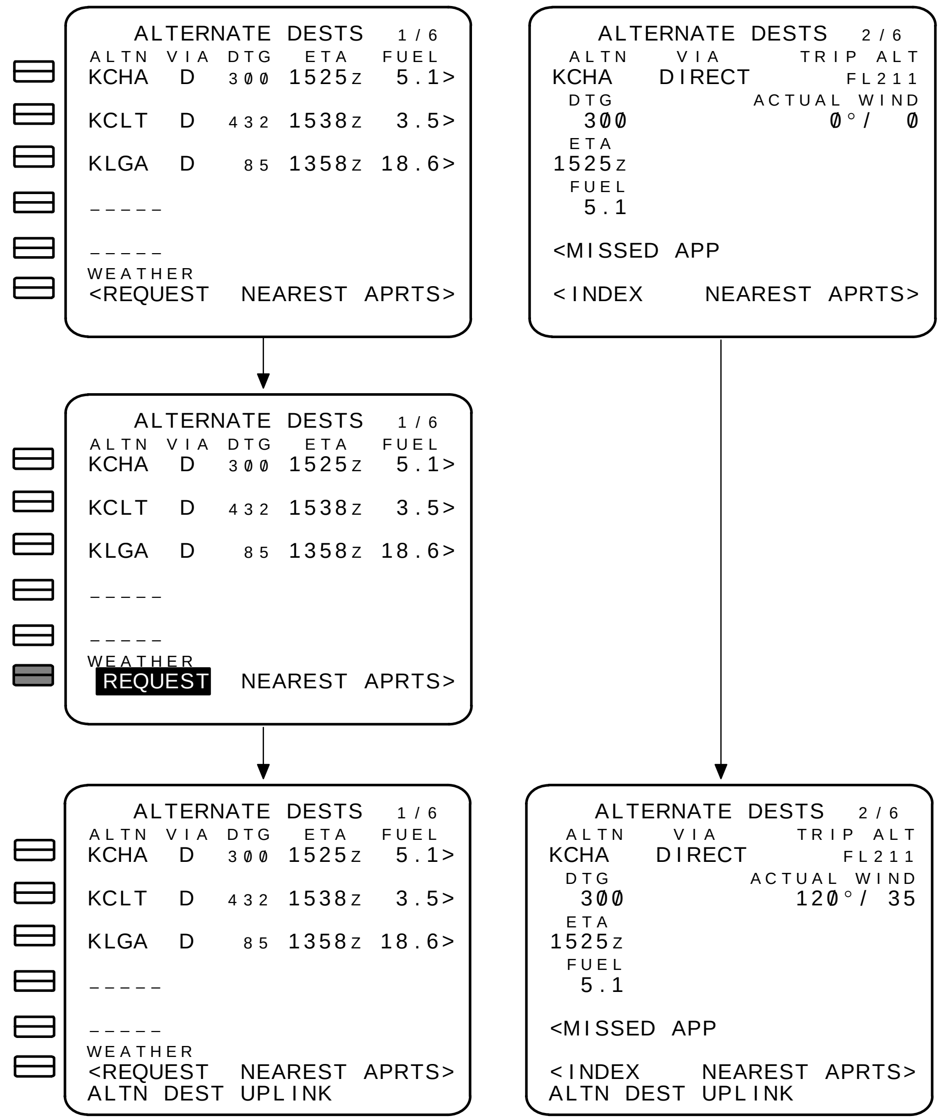
– APPROACH REF page ALTN DEST prompt (LSK 6R).
– RTE page ALTN DEST prompt (LSK 6L). (in the air only)

PAGE EXIT

– Any mode key.

To request wind data, select the REQUEST prompt (LSK 6L).

Once loaded, ALTN DEST UPLINK message is displayed in the scratch pad, and wind data is loaded into the appropriate ALTNERNATE DESTS pages 2/x through x/x.



MESSAGE RECALL
(AIRLINES SELECTABLE OPTION)

The Message Recall function provides a complete list of all alerting and advising messages whose display criteria are still true. Messages which have been acknowledged with the CLR key may be checked on this page to see if they are still active. Messages which are no longer active (because the causing conditions are no longer true) are removed from the list. The list has no limit to its size. The NEXT PAGE and PREV PAGE keys are used to review additional Message Recall pages when they exist.

PAGE ACCESS page 1/x

– INIT/REF INDEX page MSG RECALL prompt (LSK 2R).

PAGE EXIT

– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.

```
    MESSAGE RECALL   1/1
NAV DATA OUT OF DATE
UNABLE CRZ ALTITUDE
SCANNING DME FAIL



<INDEX
```

No required entries

PAGE ACCESS page x/x

– Press NEXT PAGE key to display subsequent pages when they are available.

– Press PREV PAGE key to display previous pages.

SUMMARY
(U10.2A AND PREVIOUS VERSIONS)

Summary pages are provided to display the contents of the temporary and supplemental navigation data bases. These pages provide a convenient means of reviewing waypoints, navaids, and airports that have been previously defined through crew entries. The summary pages include the position for each entry as a latitude and longitude, or as bearing/range from a reference, corresponding to how the entry was defined. They are organized such that the temporary and supplemental entries appear on separate sets of pages, and each set of pages lists waypoints, navaids, and airports separately.

<u>PAGE ACCESS</u> page 1

– REF NAV DATA page SUMMARY prompt (LSK 2R)

– SUPP NAV SUMMARY page 2 – press PREV PAGE key

```
   TEMP NAV SUMMARY    1/2
 WAYPOINTS
ELN01 ELN 270/32
 NAVAIDS
KGRT  N15°53.2/W075°17.3
 AIRPORTS
KWIN  N03°42.7 W116°08.7




<INDEX
```

No required entries

<u>PAGE EXIT</u>

– INDEX prompt returns the display to the page that the SUMMARY page was accessed from.

SUMMARY (CONT.)
(U10.2A AND PREVIOUS VERSIONS)

PAGE ACCESS page 2

- SUPP NAV DATA page SUMMARY prompt (LSK 2R)
- TEMP NAV SUMMARY page 1 – press NEXT PAGE key

```
   SUPP NAV SUMMARY   2/2
 WAYPOINTS
HIL01 N32°23.1 W117°32.1
SAMME N19°18.0 W117°10.7
GRR01 GRR 230/5
 NAVAIDS
KGVR  N45°46.1 W098°53.2
 AIRPORTS
KMNX  N45°26.2 W042°16.3



<INDEX
```

No required entries

PAGE EXIT

- INDEX prompt returns the display to the page that the SUMMARY page was accessed from.

SUMMARY (CONT.)
(U10.3 PILOT DEFINED COMPANY ROUTE OPTION)

FLIGHT PLAN SUMMARY

<u>PAGE ACCESS</u> page 1

- REF NAV DATA page FLT PLNS prompt (LSK 3R)
- NEXT and PREV keys when multiple pages exist

```
FLIGHT PLAN SUMMARY 1/1
 SUPP NAV DATA
ROUTE1

ROUTE2
 FLIGHT PLAN NAV DATA
GRRSEA

GRRSTL


------------------------
<INDEX
```

No required entries

Displays the identifiers for Pilot Defined Company Routes stored in the Supplimental and Flight Plan Nav Data bases. Identifiers are selectable to the scratchpad for entry into the RTE page.

Entries in the Supplimental Navigation Database are deletable.

NAVIGATION STATUS (NAV STATUS)

The NAV STATUS page provides the status of the navigation aids being tuned by the FMCS, including the VHF receiver tuning and the currently selected GPS and IRS.

PAGE ACCESS page

- POS SHIFT (POS REF 3/3) page NAV STATUS prompt (LSK 5R).
- PROGRESS page NAV STATUS prompt (LSK 6R).
- INIT/REF INDEX page NAV STATUS prompt (LSK 6R). (in the air only)

PAGE EXIT

- Index prompt displays the INIT/REF INDEX page.
- POS SHIFT prompt (LSK 6R) displays POS SHIFT (POS REF 3/3) page.

```
        NAV STATUS        1/2
      VOR-L            ILS-R
SEA  A116.80     IBFIM110.90
      DME-L            DME-R
SEA   116.80     BDF   114.70
NIK   117.40     CIV   113.20

ALW   116.40
HQM   117.70

      GPS(L)     IRS(2)

<INDEX            POS SHIFT>
```

GPS – Displays currently selected GPS. GPS is blank when GPS is inhibited for use in navigation.

IRS – Displays currently selected IRS.

For VOR and ILS (lines 2 and 3)

```
     VOR-L       ILS-R
SEA  A116.80   IBFIM110.90
```

NAVAID type and position.

Frequency selected on the VHF/NAV Control Panel:

- Large font – Navaid tuned, receiving valid data.
- Small font – Navaid tuned, not receiving valid data.
- Blank – Navaid failed.

Navaid identifier:

- Large font – Navaid tuned, receiving valid data.
- Highlighted – Navaid used in navigation solution.
- FAIL – Navaid failed.
- Blank – Navaid not available for frequency set in VHF/NAV Control Panel.

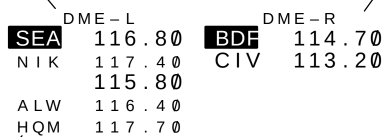
Tuning Method:

- A – Auto tuned by FMCS.
- M – Manually tuned.
- P – Auto tuned by data base procedures.

NOTE: The FMC will auto tune to 108.0 (or blank if scanning DME) if it cannot find a usable navaid within the frequency range.

For DME (lines 4 thru 9)

NAVAID type and position.



Non-Scanning DME (737-300/400/500):

– Not in agility tuning mode:
  - Frequency displayed corresponds to frequency set in VHF/NAV Control Panel.
– In agility tuning mode:
  - First frequency displayed (line 5) is from receiver performing the agility tuning.
  - Second frequency displayed (line 6) is the second station.
  - Frequency set is listed under the corresponding navaid position of the receiver performing the agility tuning.

Scanning DME:

- Frequencies are listed in sequence corresponding to directed frequency 1 through 5.
- Frequency set is listed under the corresponding navaid position of the receiver performing the tuning.

Navaid identifier:

- Large font – Navaid tuned, receiving valid data.
- Highlighted – Navaid used in navigation solution.
- FAIL – Navaid failed.
- Blank – Navaid not available for tuned frequency set.

Frequency:

- Large font – Navaid tuned, receiving valid data.
- Small font – Navaid tuned, not receiving valid data.
- Blank – Navaid failed.

NAVIGATION OPTIONS (NAV OPTIONS)

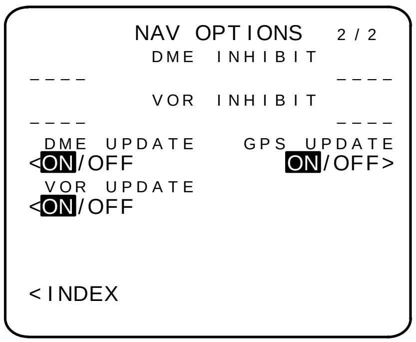
The NAV OPTIONS (NAV STATUS 2/2) page provides the ability to inhibit individual DME and VOR navaids from being used in the navigation solution. Updating may be turned on or off for each type of navaid.

PAGE ACCESS

– REF NAV DATA page NAV OPTIONS prompt (LSK 6R).
– NEXT PAGE/PREVIOUS PAGE key from the NAV STATUS page.

PAGE EXIT

– NEXT PAGE/PREVIOUS PAGE key displays the NAV STATUS page 1/2.
– INDEX prompt (LSK 6L) displays the INIT/REF INDEX page.



DME INHIBIT – two (MAX) DME navaids may be inhibited from being used in the navigation solution by entering the navaid identifier in the scratch pad and line selecting it to the field (LSK 1L or LSK 1R). Entries may be overwritten or deleted to make changes in the list. DME navaid types include:

- DME
- VOR/DME
- TACAN
- VORTAC

VOR INHIBIT – two (MAX) VOR navaids may be inhibited from being used in the navigation solution by entering the navaid identifier in the scratch pad and line selecting it to the field (LSK 2L or LSK 2R). Entries may be overwritten or deleted to make changes in the list.

DME/VOR/GPS UPDATE – toggles used to determine types of navaid data used in the navigation solution. Receivers remain tuned but the data is not used when turned off. LSK 3L, 4L, and 3R are toggles for the on off selection with the selected setting highlighted in reverse video.

LATERAL OFFSET (OFFSET)

The LATERAL OFFSET page provides a means to initiate a lateral offset.

NOTE: This function is available in 737-300/400/500 aircraft with EFIS installed, and all 737-600/700/800 aircraft.

PAGE ACCESS

- INIT/REF INDEX page OFFSET prompt (LSK 6L).
- RTE page OFFSET prompt (LSK 6L).

PAGE EXIT

- Any mode key.

The following guidelines apply to entries:

Box prompts: Appear when current or ending waypoint is in a non-offsettable leg.

Dash prompts: Require an entry.

Entering a zero offset distance cancels the offset.

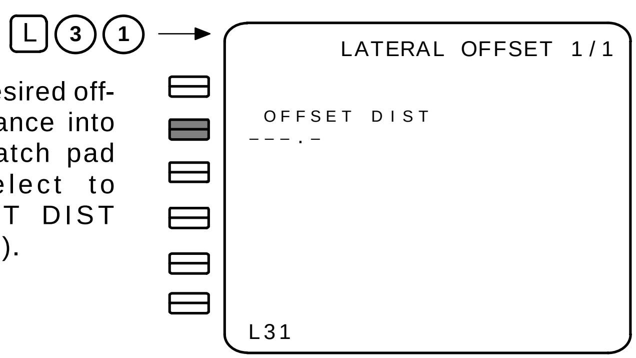
If a starting waypoint is not entered, the offset will begin at PPOS.

If an ending waypoint is not entered, the offset will continue through the end of the active flight plan unless cancelled or a non-offsettable leg is encountered.

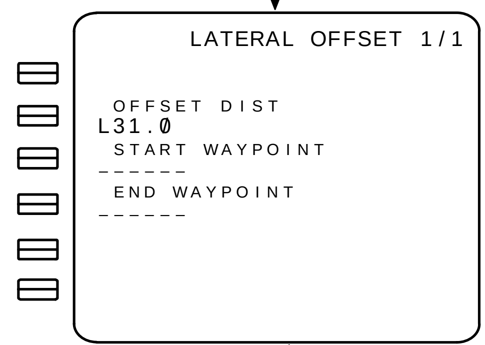
Executing a Direct-To or Intercept will cancel an active offset.

Page title changes as follows:

- ACT – indicates flight plan and offset are active.
- MOD – indicates MOD in flight plan.

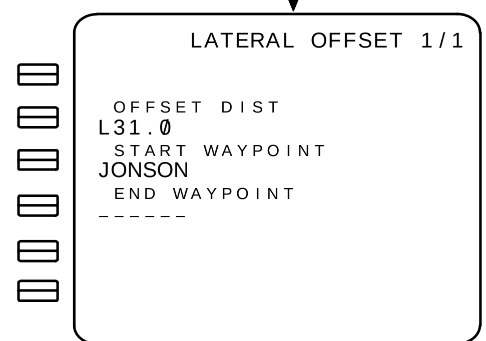


Enter desired offset distance into the scratch pad and select to OFFSET DIST (LSK 2L).



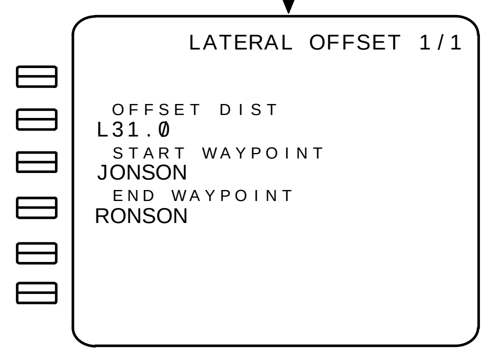
If EXECute key pressed now, offset will commence from PPOS to first non-offsettable leg, or end of flight plan, which ever occurs first.

Enter START WAYPOINT



If EXECute key pressed now, offset will commence from JONSON to first non-offsettable leg, or end of flight plan, which ever occurs first.

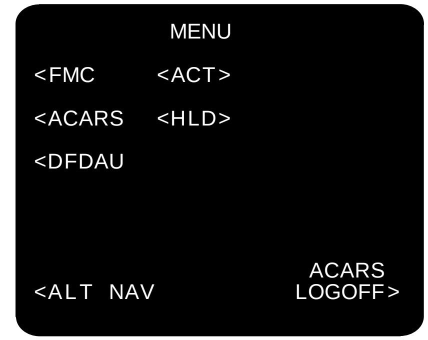
Enter END WAYPOINT



If EXECute key pressed now, offset will commence from JONSON to first non-offsettable leg, or RONSON, which ever occurs first.

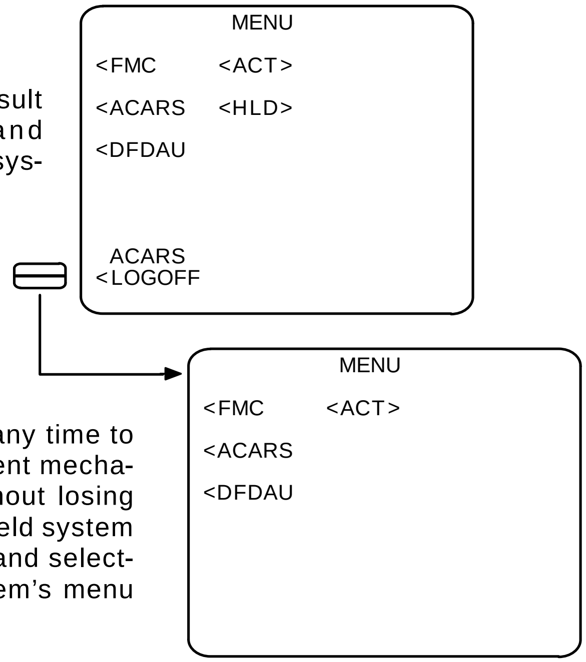
MENU
(MCDU ONLY)

The MENU page is available only on MCDUs. This page is used to select the system to be “connected” (made the “active” system) to the MCDU. The ability to “activate”, “logoff” (deactivate), or put a system on “hold” is described here.



ALT NAV MCDU ONLY.

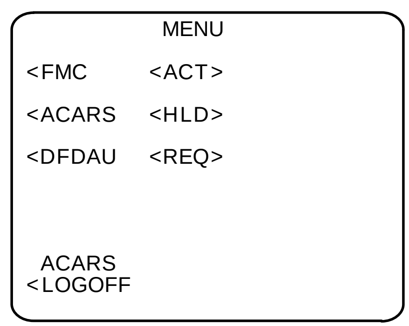
A system requesting service will result in the CALL light coming on and <REQ> appearing adjacent to the system’s name on the MENU page.



The active system may be put on “hold” at any time to return to the FMC. This provides a convenient mechanism to temporarily return to the FMC without losing your place in the subsystem’s pages. The held system is reactivated by selecting the MENU page and selecting the line select key adjacent to the system’s menu text.

A system is made the active (<ACT>) system by pressing the line select key adjacent to its menu text.

This page illustrates the MENU page when the FMC is the active (<ACT>) system (the system currently being serviced by the MCDU), the ACARS system is on hold (<HLD>), and DFDAU is requesting (<REQ>) service. The LOGOFF prompt is generated to allow the “held” system to be disconnected from the MCDU.



The system on “hold” must be logged off to allow any other system (other than the FMC) to be the active system.

NOTE: While a system is on “hold”, the CALL annunciator will remain lit.

ALT NAV LEGS
(LCD MCDU/FANS MCDU U2 ONLY)

The ALT NAV LEGS page provides a means of accessing the Alternate Navigation Flight Plan. The waypoints are listed in flight plan order and may be edited in the same manner as the RTE LEGS pages.

A primary differences between this page and the normal RTE LEGS page is that the estimated time of arrival (ETA) to the waypoint is displayed istead of the estimated time enroute (ETE) to the waypoint, and the altitudes are not displayed.

NOTE: The on–side receiver must be operational for ALT NAV functionality.

<u>PAGE ACCESS</u> page 1

- MENU page ALT NAV prompt (LSK 6L)
- ALT NAV WPT DATA page LEGS prompt (LSK 6L)
- ALT NAV PROGRESS page LEGS prompt (LSK 6L)
- Displayed when FMC fails and ALT NAV Flight Plan is not activated

A Direct–To flight plan change may be impimented on the ALT NAV LEGS page by selecting or entering the desired waypoint identifier to line 1 and exicuting the MOD. If the designated waypoint is located down–path in the flight plan, all intermediate waypoints are delected.

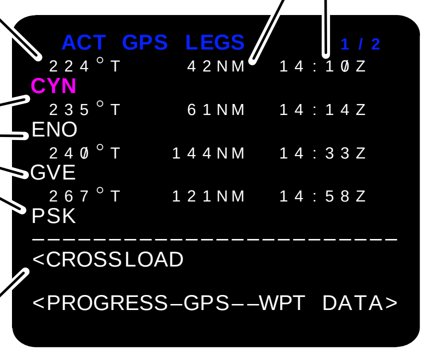
Course between waypoints. Applies to the leg going to the waypoint identified on the next line. Course shown is the start course of each leg. As indicated, the course is referenced to true north.

Leg distance and estimated time of arrival to the waypoint are displayed for each leg.

Waypoint identifiers are listed in flight plan sequence, active waypoint listed in line 1.

Waypoints may be manually entered:

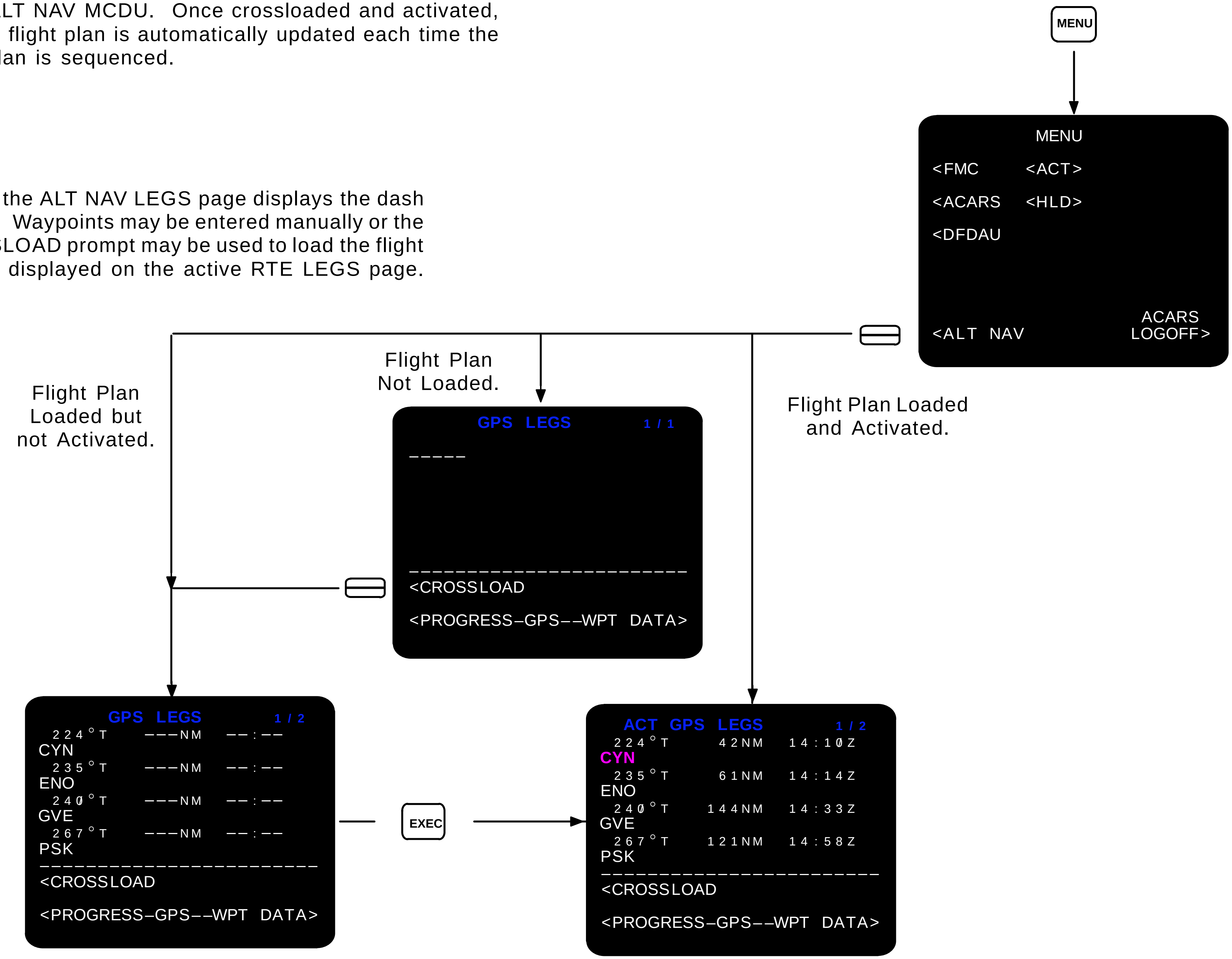
- Identifier/Latitude/Longitude
- Identifer
- Latitude/Longitude



The CROSSLOAD prompt is displayed when an active flight plan is entered into the FMC.

If an active flgiht plan exists in the FMC, the CROSSLOAD prompt is displayed. Selecting LSK 5L crossloads the FMC flight plan to the ALT NAV MCDU. Once crossloaded and activated, the ALT NAV flight plan is automatically updated each time the FMC flight plan is sequenced.

Initially the ALT NAV LEGS page displays the dash prompt. Waypoints may be entered manually or the CROSSLOAD prompt may be used to load the flight plan as displayed on the active RTE LEGS page.



ALT NAV WPT DATA
(LCD MCDU/FANS MCDU U2 ONLY)

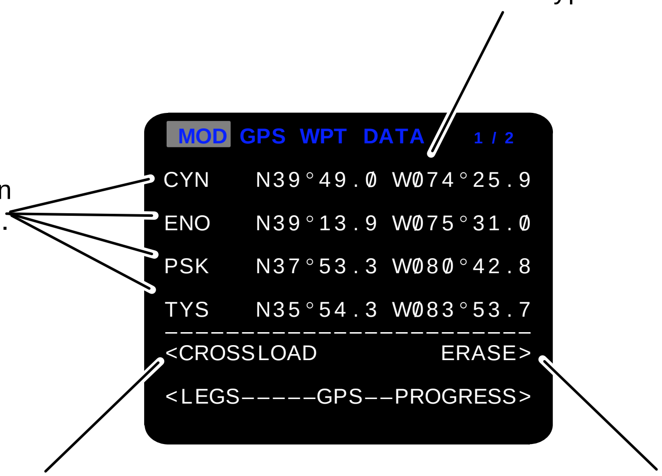
The ALT NAV WPT DATA page provides a means of accessing the Alternate Navigation Flight Plan. The waypoints are listed in flight plan order and may be edited in the same manner as the RTE DATA pages.

<u>PAGE ACCESS</u> page 1

– GPS LEGS page WPT DATA prompt (LSK 6R)

– GPS PROGRESS page WPT DATA prompt (LSK 6R)

Waypoint Latitude and Longitude.



Waypoint identifiers are listed in flight plan sequence, current waypoint listed in line 1.

Waypoints may be manually entered:

- Identifier/Latitude/Longitude
- Identifer
- Latitude/Longitude

The CROSSLOAD prompt is displayed when an active flight plan is entered into the FMC.

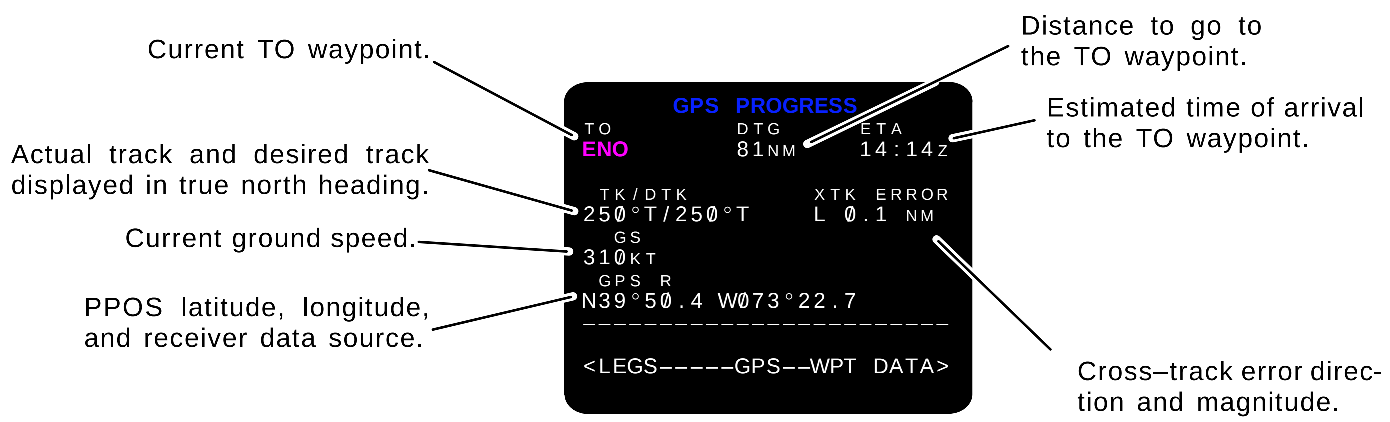
When a MOD is performed, the ERASE prompt is displayed to allow the change to be removed. This prompt is displayed until the MOD is executed.

ALT NAV PROGRESS
(LCD MCDU/FANS MCDU U2 ONLY)

The ALT NAV PROGRESS page provides in–flight status of the aircraft's progress along the active lateral route. This page does not allow editing.

PAGE ACCESS

- MENU page ALT NAV prompt (LSK 6L)
  (ALT NAV Flight Plan is already available)
- GPS LEGS page PROGRESS prompt (LSK 6L)
- GPS WPT DATA page PROGRESS prompt (LSK 6R)



BASIC AUTOPILOT AUTOTHROTTLE INTERFACE WITH FMCS

The guidance outputs furnished by the FMCS can be used to fly the aircraft manually via instruments and CDU displays, or they can be coupled directly to the autopilot and autothrottle systems to provide fully automatic control and steering of the aircraft.

DUAL FMC INTERFACES

See Table 2–2 for a detailed summary of the dual FMC interfaces to the autopilot, autothrottle, and other LRU's.

LNAV/VNAV MODE ENGAGEMENT

The autopilot/flight director LNAV-coupled mode will be engaged whenever the FMCS is operational, an IRS is valid, the aircraft's present position is within lateral engage limits of the FMCS's active flight plan, and the LNAV switch on the MCP has been pressed and is lit. VNAV will be engaged whenever the FMCS is operational, PERF INIT has been made active, and the LNAV switch has been pressed and is lit. For path descents, LNAV must be valid and engaged in order to engage VNAV.

LNAV- and VNAV-coupled control of the aircraft by the FMCS does not become active until after liftoff. VNAV-coupled mode control by the FMCS does not become active until the aircraft is above 400 feet radio altitude and more than 7 seconds past liftoff.

If the autopilot supports the "LNAV TAKEOFF" option, then LNAV can be engaged on the ground if the heading, track, and course of the first leg in the active flight plan is within 5 degrees of the origin runway heading.

ALTITUDE SELECTION

The altitude set on the ALTITUDE SEL control of the AFDS MCP provides altitude alerting for all autopilot operations. This MCP altitude (MCP ALT) also serves as a limiter for FMCS-coupled operations. The displayed altitude will be captured by the autopilot or flight director when they are engaged and the aircraft's flight path intersects the displayed altitude. During VNAV operation, the FMCS will not cause the airplane to fly through or away from the selected MCP ALT.

AUTOTHROTTLE ARMING

The A/T ARM switch is located on the MCP. If the autothrottle is armed, the autothrottle switch will remain in the armed position when the AFDS is engaged in the VNAV mode. The autothrottle will be directed to control to-target airspeed, limit N_1, retard to idle, or arm as determined by the AFDS.

ALTITUDE INTERVENTION

This feature provides the pilot with the ability to perform the following operations using the Altitude Select knob on the MCP and the Altitude Intervention pushbutton on the MCP:

Delete the next altitude constraint while in climb or descent.

To delete the next altitude constraint, the MCP altitude is set above/below (for climb/descent respectively) the next altitude constraint and the Altitude Intervention pushbutton is pressed. This operation can be performed with or without VNAV engaged. An altitude constraint on a waypoint which represents a leg terminated at an altitude, cannot be deleted using Altitude Intervention.

Increase the cruise altitude while in climb or cruise phase.

This is done by setting the MCP altitude above the cruise altitude and pressing the Altitude Intervention pushbutton. To do this in climb, there must be no altitude constraints remaining in the climb phase. Attempting to raise the cruise altitude above the maximum allowable cruise altitude using Altitude Intervention will not change the cruise altitude and will result in MAX ALT FLXXX message (same for both FAA and CAA flight rules). This operation can be performed with or without VNAV engaged. Cruise altitude cannot be lowered using Altitude Intervention.

Resume a climb/descent after holding an MCP altitude while in climb/descent phase (only if the VNAV ALT option is enabled; see description below).

To resume a climb/descent (while in climb (or cruise)/descent respectively) from the altitude hold of the MCP altitude, the MCP altitude is set above/below, respectively, the hold altitude and the Altitude Intervention pushbutton is pressed. This operation can only be performed with VNAV engaged.

Initiate, while in cruise phase, either a step climb or a transition to descent phase.

To initiate a step climb, the MCP altitude is raised up to but not above the maximum allowable cruise altitude and the Altitude Intervention pushbutton is pressed. As described for increasing the cruise altitude while in climb or cruise phase above, the cruise altitude is set to the MCP altitude selected. To initiate a transition to descent phase, the MCP altitude is set below the cruise altitude and the Altitude Intervention pushbutton is pressed.

For the airplane to automatically climb or descend in response to resume climb/descent or initiate step climb/transition to descent phase as described above, the autopilot must be engaged (CMD) and VNAV must be selected. With F/D only (and VNAV selected), the F/D bars will command climb or descent as appropriate.

An Altitude Intervention option (VNAV ALT) that is controlled by an FMC software option code, provides two different modes of operation of the Altitude Intervention function. This option affects the annunciation which is displayed on the EFIS EADI when the airplane has leveled off at the MCP altitude (i.e., ALT HOLD and VNAV engaged). VNAV ALT is displayed with the option enabled and ALT HOLD is displayed with the option disabled. The option also affects the action which is required to initiate/resume a climb or descent from a hold at the MCP altitude. With the VNAV ALT option enabled, the action required is to set the MCP Altitude to a new altitude, and then press the Altitude Intervention pushbutton. With the VNAV ALT option disabled, the required action is to set the MCP Altitude to a new altitude, and then re-engage VNAV (selecting the new MCP altitude causes VNAV to disengage).

The VNAV ALT option may only be enabled when a -420 EFIS Symbol Generator or a CDS is installed. This symbol generator has the capability of displaying the VNAV ALT annunciation.

SPEED INTERVENTION

A Speed Intervention function, selectable by pressing the MCP SPEED INTERVENTION pushbutton, is provided to allow a means of overriding the FMC's commanded speed. Selection of Speed Intervention mode will unblank the MCP's speed window, automatically setting it to the commanded FMCS speed. Changes to the commanded speed can then be made via the MCP SPEED INTERVENTION pushbutton.

OVERVIEW

After a flight plan has been entered into the FMC and a departure runway has been selected, LNAV can be engaged on the ground if the heading, track and course of the first leg in the active flight plan are within 5 degrees of the runway heading (assuming the autopilot supports this feature).

Once in position on the active runway, initiate the takeoff by pressing the takeoff/go-around (TOGA) switch on the thrust lever. If LNAV was not previously engaged, it may be activated any time after "unsquat" to provide roll command of the aircraft from the FMCS. When the aircraft is at a safe altitude and acceleration to the FMC target speed is desired, press the VNAV switch on the MCP to begin control of the aircraft to the FMCS-computed profiles.

The CLB phase automatically becomes active at liftoff. In climb with VNAV engaged, the airplane's speed and thrust are controlled by the FMCS. Increase the value shown in the ALTITUDE window of the MCP as ATC clearances permit. The AFDS will level off the airplane at the lower of MCP or CDU displayed altitude restriction. If the selected altitude is above present altitude and VNAV is engaged, the FMCS will request the AFDS to control to FMC airspeed with the elevators. At the same time, the AFDS will request the autothrottle to switch to N_1 mode, controlling thrust to FMCS Climb N_1 Limit.

As either MCP or FMCS CDU altitude is approached, the AFDS transitions to its altitude acquire, and then to its altitude hold configuration. At the point where the altitude acquisition sequence comes on, the AFDS will request the autothrottle to go into a speed mode, with control to the FMC speed.

Step climbs in cruise, or from an intermediate level off in climb, are performed much as the normal climb. If the aircraft is level at MCP ALTITUDE (but not at an FMC restriction altitude), increase the value in the ALTITUDE window; this action disengages VNAV and puts the autopilot in ALT HOLD. Press VNAV and the aircraft will begin the climb as described above. If the aircraft is level at FMCS CDU altitude (assuming MCP ALTITUDE was set above that CDU value), the AFDS continues with VNAV remaining engaged.

There are two types of FMCS descents: an airmass or SPEED descent and a PATH descent. Both LNAV AND VNAV must be engaged to fly an automatic PATH descent, while only VNAV is necessary to fly a SPEED descent.

PATH descents are normally initiated and flown automatically by the FMCS. An early PATH descent may be initiated, causing the aircraft to descend 1,000 feet per minute until it intercepts the planned idle path and then picks up the normal descent.

To enable automatic capture of a descent path, MCP ALTITUDE is decreased to a value less than the current cruise altitude. Upon reaching the top-of-descent point, the FMCS requests the AFDS to control to FMCS vertical speed, requests the autothrottle to retard the throttles to idle, and then enters its ARM mode. In PATH descent, the FMCS will control to the earth-fixed referenced path, but <u>it is the pilot's responsibility to control speed, as required,</u> by use of the speed brake or throttle. Upon reaching the next level segment, the AFDS will transition through an altitude acquisition to an altitude hold configuration and the autothrottle will begin controlling to FMCS speed. If the aircraft levels at an MCP ALTITUDE not corresponding to a level path segment, decrease the MCP ALTITUDE further (causing VNAV to disengage) and press the VNAV switch on the MCP. As in the climb, leveling off at some FMCS-commanded altitude prior to reaching E/D ALT will not disengage VNAV.

SPEED descents are normally initiated and flown automatically by the FMCS at the top of descent when no PATH descent is defined; i.e., when no further waypoint has an altitude constraint assigned. SPEED descents are also automatically flown if the FMC is not engaged in LNAV. For example, if a PATH descent is selected while flying a flight plan leg without a coded vertical angle, and the crosstrack deviation to the LNAV path exceeds the Required Navigation Performance (RNP) for the particular Navigation environment, the FMC will automatically revert to SPEED descent. SPEED descents can also be manually selected with the SPEED prompt on the ECON PATH DES page (followed by EXEC). Early SPEED descents can be executed by dialing down the MCP altitude, selecting the CAPTURE prompt on the ECON SPD DES page, and executing. The particular descent path can be achieved by the use of other aircraft flight control systems at the discretion of the crew. During a SPEED mode descent, the AFDS autopilot will follow FMCS speed with the control on the elevators, and the autothrottle will retard the throttles to idle and enter its ARM mode. Level-off occurs at MCP ALT, at intermediate FMC altitude constraints, or at the end-of-descent (E/D) altitude for SPEED descents. Upon lateral sequencing of the glide scope intercept waypoint, the FMC will cause VNAV to disengage.

When flying a STAR, approach, or approach transition that contain legs with defined vertical angles (gradients) other than zero, VNAV will be valid only for PATH DES mode. The AFDS autopilot will follow FMCS vertical speed and the autothrottle will enter speed mode on these gradient legs. If crosstrack deviation to the LNAV path exceeds the Required Navigation Performance (RNP) for the particular Navigation environment, while on these legs, the FMC will automatically disconnect VNAV. During these approaches the speed target for missed approach can be set via SPD INTV on the APPROACH REF page.

A cruise-descent is a 1000 FPM descent, with the autopilot controlling V/S by means of the elevators and the autothrottle controlling the target speed.

Upon landing and taxi, the FMCS clears the route information and any Temporary Navigation Data Base entries from the past flight. Upon shutdown, last reported IRS and FMCS positions and any flight fault data are stored for access when the system is again powered up.

ALERTING AND ADVISORY MESSAGES

FMCS MESSAGES

If an error or system failure results in reduced capability, the FMC will generate a crew message for display in the CDU scratch pad. These messages, as well as certain FMC internal responses, provide for an orderly transition from fully FMCS-guided flight to a less automated mode, if required.

The FMCS is designed to automatically preserve the most capable mode of navigation and guidance than can be maintained with the equipment and navigation aids available. To accomplish this, it establishes a fixed order of precedence of sensor capabilities and sensor selection. Failure of an FMCS component (FMC or CDUs) will cause that component to be shut down completely. The FMCS provides advisory information to the crew via the CDUs and other cockpit displays for use if external failures prevent coupled operation.

There are two categories of CDU messages, both of which cause the CDU "MSG" light to come on. They are:

- Alerting Messages – These have the highest priority and identify a condition which must be corrected before further FMCS-guided flight is advisable or possible. Alerting messages appear in the scratch pad as they occur and displace any lower priority messages. Alerting messages cause the amber "FMC" light on both FMA panels to come on.
- Advisory Messages – These are of a lower priority and inform you of CDU entry errors or system status.

When multiple messages are generated, they are "stacked" for display in a prioritized sequence, or in the order of their occurrence if of the same priority. Most messages are cleared with the CLR key or by correcting the causing condition.

Entry error Advisory Messages have priority over other Advisory Messages, which are not displayed until the scratch pad has been cleared of all entries. The CDU "MSG" light remains on until all awaiting messages have been displayed.

The following tables provide a complete list of FMCS alerting advisory messages, their causes, and the recommended corrective actions.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
ABOVE MAX CERT ALT	Aircraft has exceeded its maximum certified altitude.	Descend to an altitude below maximum certified altitude.
ACARS ALERT [1]	Flight crew action required for ACARS.	Select ACARS management unit on an MCDU and perform necessary action. Clear message.
ACARS CALL [1]	The ACARS MU is requesting service from the crew.	Select the ACARS MU on the MCDU Menu page.
ACARS UPLINK [1]	ACARS message waiting.	Select ACARS management unit on an MCDU and perform necessary actions. Clear message.
ACARS MU FAIL [1]	The ACARS management unit has suffered a hardware failure	Verify ACARS MU is powered.
ACARS NO COMM [1]	No ACARS link available.	Verify operation of SAT, VHF, and/or Mode 5 transceivers. Clear message.
ACARS VOICE [1]	VHF Transceiver set to voice.	Clear message.

1. Message only generated when FMS includes at least one MCDU.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
ACARS VOICE BUSY [1]	All VHF voice circuits are busy.	Message will clear when a circuit becomes available or message may be cleared with CLR key.
ALT CONSTRAINT XXXXX (ALTITUDE VALUE) (U10.0 THRU U10.3)	Added or modified constraint or CRZ ALT conflicts with existing constraints altitudes at other waypoints in the route (may be displayed during missed approach).	Clear message and amend entry.
ALT CONSTRAINT XXXXX (ALTITUDE VALUE) (U10.4)	Except when in missed approach, added or modified constraint or CRZ ALT conflicts with existing constraints altitudes at other waypoints in the route.	Clear message and amend entry.
ALTN DEST UPLINK	ACARS uplink of alternate airport data has been loaded.	Review alternates. Clear message.
APPRCH VREF NOT SELECTED	FMC is in approach environment and VREF has not been selected.	Select VREF on APPROACH REF page.

1. Message only generated when FMS includes at least one MCDU.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
ARR N/A FOR RUNWAY	Runway or approach does not match up with the selected arrival procedures.	Modify selection or manually clear message.
ATC ROUTE DATA UPLINK	ACARS uplink of route data has been loaded.	Review and accept or reject the mod plan created by the uplink.
ATC ROUTE UPLINK LOADING	ATC ACARS route data from ACARS is being loaded into the FMC.	Suspend manual alphanumeric entry until loading is complete.
ATC ROUTE UPLINK READY	ATC uplink of route data ready to be loaded into the FMC.	Review and accept or reject data.
ATC RTA DATA UPLINK	ACARS uplink of ATC required time of arrival data has been received.	Review and accept or reject data.
ATC RTA UPLINK READY	Non ATC uplink of RTA data is ready to be loaded into the FMC.	Select the RTA progress page and load the uplink. Accept or reject.
ATC UPLINK WAITING	An ACARS uplink from ATC of route data cannot be loaded into the FMS at this time.	Eliminate the mod plan by executing or erasing it.
BUFFET ALERT	Current conditions result in maneuver margin less than specified.	Bring aircraft back to within operating envelope.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
CHECK FLIGHT PLAN	The FMC has found and corrected a NAV DATA BASE ERROR.	Check flight plan for correctness. Correct as necessary.
CHECK FMC FUEL QUANTITY	FMC has detected a decrease in fuel quantity: decrease >1500 lbs for 120 sec.	Check fuel quantity indicators. Verify FMC fuel from flight plan or fuel used data.
CRZ ALT CHANGED TO XXXXX (U10.4)	Altitude constraint added by selecting a STAR or approach procedure during missaed approach conflict with the current CRZ ALT.	Review and correct CRZ ALT.
CRZ WIND FLXXX UPLINK (FLIGHT LEVEL VALUE)	Enroute cruise wind data from ACARS has been loaded.	Review and accept or reject cruise wind data. Clear message.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
CRZ WIND XXXXX UPLINK (ALTITUDE VALUE)	Enroute cruise wind data from ACARS has been loaded.	Review and accept or reject cruise wind data. Clear message.
CRZ WIND UPLINK LOADING	Uplink of cruise wind data is being loaded into the flight plan.	Loading complete or terminate loading via long delete.
CRZ WIND UPLINK READY	ACARS uplink with cruise wind data has been received and cruise wind data LOAD prompt is displayed on RTE DATA page.	Load data via LOAD prompt on RTE DATA page.
CUTBACK UNAVAILABLE (U10.3)	All data required to calculate the CUTBACK N1 is available and the FMC is unable to select a correct value.	Clear Message.
CYCLE IRS OFF-NAV	IRS logic requires manually restarting alignment.	On IRS Mode Panel move IRS mode control knob to OFF, then to NAV.
DATA BASE FULL (U10.2A AND EARLIER)	Entry attempted has exceeded capability of the Temporary Navigation Data Base.	Go to REF NAV DATA or SUPP NAV DATA pages and delete unneeded temporary waypoints, navaids, or airports.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
DATA BASE FULL (U10.3)	Entry attempted has exceeded capability of the Temporary or Supplimental Navigation Data Base. or Attempting to confirm a save route which exceeds the capacity of the Temporary or Supplimental Navigation Data Base.	Go to REF NAV DATA or SUPP NAV DATA pages and delete unneeded temporary waypoints, navaids, or airports.
DATA BASE INVALID	The automatic validity test of the Navigation Data Base has failed.	Advise Maintenance Personnel to reload data base or repair equipment.
DATALINK CONFIG INVALID	Loaded Datalink config table is failing CRC check.	Reload table.
DES PATH UNACHIEVABLE	After the descent is active, the FMCS predictions show the profile constraints at the next waypoint cannot be made and the path maintained.	Modify the active RTE LEGS or DES page plan, and re-engage LNAV and VNAV.
DESCENT FORECASTS UPLINK	ACARS uplink data of descent forecast data has been loaded.	Review and execute or erase data.

DISCO INSRTD AFTER XXXXX (WAYPOINT IDENTIFIER)	Geometry of the next waypoints will not allow the FMC to fly the plane without bypassing more than one waypoint.	Amend the active flight plan.
DISCONTINUITY	Passing last waypoint in the plan prior to a ROUTE DISCONTINUITY.	Select RTE or RTE LEGS to specify the waypoints for a continuous plan.
DRAG REQUIRED	Due to unforecast conditions, the aircraft is 10 kts or more above FMC target speed, or within 5 kts or .01 mach of VMO/MMO.	Use speed brakes or change drag as required to bring aircraft to FMC target speed.
DUAL FMC OP RESTORED	Movement of the source select switch position has caused a resynchronization and dual operation is restored, or the source select switch position has not changed, and is in either BOTH-ON-LEFT or BOTH-ON-RIGHT and the FMC has automatically restored DUAL after 5 minutes.	None required.
DUPLICATE FLIGHT PLAN ID (U10.3)	The Flight Plan ID entered is already contained in the Flight Plan Nav Database.	Clear message.

END OF OFFSET	2 minutes prior to passing the offset leg termination	Clear message.
END OF ROUTE	Passing last route leg termination.	Go to RTE or RTE LEGS and EXECute a route modification.
ENG OUT SID MOD (U10.3)	An engine out SID has been automatically inserted into the flight plan (MOD).	Clear message.
ENTER IRS POSITION	IRS has returned value different from that entered, or IRS logic still requires entry.	On POS INIT page re-enter IRS POS.
FORECASTS UPLINK READY	Uplink of descent forecasts data has been received.	Select the DES FORECASTS page and load the data. Accept or reject.
INSUFFICIENT FUEL	A change in conditions or flight plan route causes predictions to show not enough fuel aboard to reach destination with 2000 lbs of fuel remaining.	Modify route plan or cruising altitude, or divert for additional fuel.
INVALID ALTN DEST UPLINK	ACARS uplink of alternate destination data unusable due to errors.	Re-request uplink. Clear message.
INVALID ATC ROUTE UPLINK	ACARS uplink of ATC route data unusable due to errors.	Re-request uplink. Clear message.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
INVALID ATC RTA UPLINK	ACARS uplink of ATC required time of arrival unusable due to errors.	Re-request uplink. Clear message.
INVALID CRZ WIND UPLINK	ACARS uplink of wind data unusable due to errors.	Re-request uplink. Clear message.
INVALID DELETE	DEL key operation attempted for a data field not allowed.	Clear message and select proper field after DEL key is pressed.
INVALID ENTRY	Attempted data entry has incorrect format or range for the selected data field.	Clear message and scratch pad entry, and repeat entry with correct data for desired field.
INVALID FORECASTS UPLINK	ACARS uplink of descent forecast data unusable due to errors.	Re-request uplink. Clear message.
INVALID LIMITS UPLINK	ACARS uplink of performance limits data unusable due to errors.	Re-request uplink. Clear message.
INVALID NAV DATA UPLINK	ACARS uplink of supplemental navigation data unusable due to errors.	Re-request uplink. Clear message.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
INVALID OFFSET	Any flight plan mod that causes the start of offset to become non–offsettable (i.e. start waypoint is followed by a disco or end of flight plan dashes). This entry may be from an ACARS uplink. An ACARS uplink may also cause the message if a start waypoint was uplinked, and followed by a disco or end of flight plan dashes.	Close disco or enter a valid waypoint in end of flight plan dashes.
INVALID PERF INIT UPLINK	ACARS uplink of performance initialization data unusable due to errors.	Re-request uplink. Clear message.
INVALID QUAD	The QUAD/RANGE entry is incorrectly formated or out of range for a PBD waypoint from a navaid.	Clear message.
INVALID ROUTE UPLINK	ACARS uplink of route data unusable due to errors.	Re-request uplink. Clear message.
INVALID RTA UPLINK	ACARS uplink of required time of arrival data unusable due to errors.	Re-request uplink. Clear message.
INVALID TAKEOFF UPLINK	ACARS uplink data received indicates the aircraft is performance limited for the runway.	Limit takeoff weight of aircraft or select a new runway.

<table>
<tr><th>MESSAGE</th><th>CAUSING CONDITION</th><th>CORRECTIVE ACTION</th></tr>
<tr><td>IRS MOTION</td><td>IRS has detected motion during alignment resulting in need for realignment.</td><td>Where available, automatic realignment started; else, on IRS Mode Panel move Mode Control to OFF then NAV.</td></tr>
<tr><td>IRS NAV ONLY
(U10.2A AND EARLIER)</td><td>
<table>
<tr><th>ENVIRONMENT</th><th>RNP</th><th>TIME TO ALARM</th></tr>
<tr><td>OCEANIC</td><td>12.0 NM</td><td>80 SEC</td></tr>
<tr><td>ENROUTE</td><td>2.0 NM</td><td>80 SEC</td></tr>
<tr><td>TERMINAL</td><td>1.0 NM</td><td>60 SEC</td></tr>
<tr><td>APPROACH</td><td>0.5 NM</td><td>10 SEC</td></tr>
</table>
Messages inhibited in approach environment when:
• VOR/LOC mode is active from DFCS
• Both VOR receivers are manually tuned to the Procedure navaid
• VALID VOR data is being received
• VOR/ILS mode is displayed on at least one EHSI
</td><td>Clear Message.</td></tr>
</table>

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
LNAV BANK ANGLE LIMITED	The aircraft is within five minutes of the turn roll–up point. or The aircraft is in a turn and will exceed airspace containment area due to perf limited bank angle.	Clear message. or Sequence the waypoint. or Will clear when ANP no longer exceeds RNP.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
LOC CAP ACTIVE	Aircraft is approaching its turn onto the localizer course and will maintain an intercept heading.	Clear message manually or wait for AFDS to signal reset to the FMCS.
LOC CAP CANCELLED	Flight plan modifications or the aircraft condition did not facilitate localizer capture.	Clear message manually.
MAX ALT FLXXX (FLIGHT LEVEL VALUE)	Altitude entry is above max altitude — (current capability in ECON mode).	Clear message and amend data entry in scratch pad.
MAX CAS XXX MAX MACH .XXX MIN CAS XXX (MACH/CAS VALUE) MIN MACH .XXX	In Manually Selected Speed CRZ mode, cruise altitude or target speed entered will result in limit on selected speed.	Clear message; accept limited speed for new altitude, or modify selected altitude or speed.
MISSED CAPTURE	Proper localizer capture maneuver performed, but AFDS did not capture.	Clear message manually.
MODEL/ENG DATA INVALID [4]	MODEL/ENGINE database is either not loaded or contains an error.	Reload table.

4. Displayed for 737–600/700/800 aircraft only.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
NAV DATA LOADING	Supplemental nav data from ACARS is loading into FMC.	Suspend manual alphanumeric entry until loading is complete.
NAV DATA OUT OF DATE	Navigation data base effectivity date does not match clock date upon selection or upon power-on.	Select effective navigation data base or have Maintenance Personnel reload new navigation data base.
NAV DATA UPLINK	ACARS uplink of supplemental navigation data has been loaded.	Review data. Clear message.
NAV INVALID-TUNE XXXXX (NAVAID IDENTIFIER)	FMCS is unable to autotune or receive approach procedure navaid.	Cross-check radios and manually tune specified navaid.
NO DES PATH AFTER XXXXX (WAYPOINT IDENTIFIER)	The profile constraints cannot be achieved and the path maintained as planned after the named waypoint.	Select RTE LEGS or DES pages to delete or modify the constraints at the descent waypoints.
NO OFFSET AT LEG XXXXX	Entry of lateral offset start or end waypoint for a leg that is non-offsettable.	Review offset plan. Enter a valid start or end waypoint.
NOT IN DATA BASE	FMCS could not find required data for entered identifier.	Clear message and check data entry, or enter required information into temporary or supplemental navigation data base via REF NAV DATA or SUPP NAV DATA page.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
NOT IN FLIGHT PLAN	Entered RTA waypoint or LATERAL OFFSET START or END waypoint that was not found in flight plan.	Clear message and enter a valid waypoint which is in the flight plan.
NOT ON INTERCEPT HEADING	INTC function used when aircraft is not within leg capture criteria and LNAV is engaged.	Manually steer aircraft onto a heading which will intercept the active leg of the planned route and engage LNAV.
OFFSET DELETED	An entered start waypoint has been deleted from the flight plan through an edit on any page other than the OFFSET page.	Review flight plan.
OFST ENDS ABEAM XXXXXX	Planned lateral offset path cannot “be back by” the selected end waypoint.	Review offset plan. Enter a valid end waypoint.
	Also displayed when the aircraft is the offset distance plus two minutes from the active plan end of offset and no end waypoint exists.	Clear message.
OFST ENDS ABEAM YYYYYY	A nonoffsettable leg exists prior to the end of the offset plan.	Review and change offset plan to avoid nonoffsettable legs.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
OVERSPEED DISCONNECT	Aircraft exceeds airport speed restriction by 15 kts or more while below speed restriction altitude.	Slow aircraft to within 10 kts of speed target and re-engage VNAV or clear message manually.
PARTIAL ALTN DEST UPLINK	Due to errors or insufficient alternate destination slots, only a partial alternate destination uplink was received.	Review, edit, delete slots, and/or request a new uplink of the data as necessary.
PARTIAL ATC ROUTE UPLINK	Due to errors, only a partial ATC route uplink was received.	Accept, reject, or request new route data.
PARTIAL FORECASTS UPLINK	Due to errors, only a partial descent forecast uplink was received.	Accept, reject, or request new descent forecast data.
PARTIAL LIMITS UPLINK	Due to errors, only a partial performance limits uplink was received.	Accept, reject, or request new performance limit data.
PARTIAL NAV DATA UPLINK	Due to errors or insufficient slots, only a partial supplemental navigation data base uplink was received.	Review, edit, delete slots, and/or request a new uplink of the data as necessary.
PARTIAL PERF INIT UPLINK	Due to errors, only a partial performance initialization data uplink was received.	Accept, reject, or request a new uplink of the performance initialization data.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
PARTIAL ROUTE LOADED (U10.3)	The route loaded references data not contained in any of the data bases.	Clear Message.
PARTIAL ROUTE UPLINK	Due to errors, only a partial non-ATC route uplink was received.	Accept, reject, or request a new uplink of the route data.
PERF DEFAULTS INVALID	Loaded Perf Defaults table is failing CRC check.	Reload table.
PERF INIT UPLINK	Performance initialization data from ACARS has been loaded.	Review and accept or reject data.
PERF INIT UPLINK READY	Uplink of performance data has been received.	Select the PERF INIT page and load the data. Accept or reject.
PERF LIMITS UPLINK	ACARS uplink performance limits data has been received.	Review and execute or erase data.
PERF LIMITS UPLINK READY	Uplink of performance limits data has been received	Select the PERF LIMITS page and load the data. Accept or reject.
PRINTER FAIL [1]	Cockpit printer has failed.	Check printer. Clear message.

1. Message only generated when FMS includes at least one MCDU.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
PRINTER UPLINK [1]	ACARS uplink has a message for the printer.	Select ACARS management unit on an MCDU and perform necessary actions. Clear message.
PROGRAM PIN ERROR [2]	FMCS connector wiring incorrect.	FMCS not operational. Inform maintenance personnel.
PROGRAM PIN NOT IN DB [4]	FMCS connector wiring does not correspond to valid interconnects defined in the MODEL/ENGINE database.	FMCS not operational. Inform maintenance personnel.
QRH DATA INCOMPATIBLE	Configuration of loaded QRH T/O Speeds data (CAA/FAA) not compatible with configuration of FMC QRH calculations (CAA/FAA).	Clear message. Reload QRH T/O Speeds data.
QRH T/O SPEEDS INVALID [3]	Loaded QRH T/O Speeds table is failing CRC check.	Reload table.

1. Message only generated when FMS includes at least one MCDU.
2. CLR key will not clear message. FMC connector wiring error. FMC not operational.
3. Displayed for 737–300/400/500 aircraft only.
4. Displayed for 737–600/700/800 aircraft only.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
RESEND MESSAGE	A CDU downlink message is initiated and the FMC is unable to deliver the message to the ACARS MU.	Clear message and re-initiate the downlink.
RESET MCP ALT (amber “FMC” light on)	Normal FMCS operation would take aircraft away from MCP ALTITUDE.	Dial MCP ALTITUDE to a value in the proper direction (higher for climb, lower for descent).
RESET MCP ALT (amber “FMC” light off)	Passing 5 nm prior to top of descent point without dialing down MCP ALTITUDE.	Decrease MCP ALTITUDE value as clearances permit.
ROUTE DATA UPLINK	Non-ATC route data from ACARS has been loaded.	Review and accept or reject the non-ATC route data uplink.
ROUTE FULL	Entry of more than 99 waypoints or a sixth hold attempted.	Clear message and review existing and desired route segments for possible deletion.
ROUTE UPLINK LOADING	Non-ATC ACARS Route data from ACARS is being loaded into the FMC.	Suspend manual alphanumeric entry until loading is complete.
ROUTE UPLINK READY	Non-ATC ACARS uplink of Route data ready to be loaded into the FMC.	Select route page and load the uplink. Accept or reject.
RTA DATA UPLINK	Required time of arrival for a waypoint from ACARS has been loaded.	Review and accept or reject data.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
RTA UNACHIEVABLE	RTA does not fall within the computed RTA window.	Enter an achievable RTA or another perf mode selection.
RTA UPLINK READY	Non-ATC ACARS uplink of RTA data is ready to be loaded into the FMC.	Select the RTA progress and load the uplink. Accept or reject.
RUNWAY N/A FOR SID	Runway selection not compatible with departure procedure selection.	Clear message and check selections.
RW/APP CRS ERROR	While in approach, the MCP selected course does not match the front course of the selected approach in the active flight plan.	Clear message. Correct the MCP selected course to within 1 degree of the front course for the selected approach.
RW/APP TUNE DISAGREE	While in approach, the tuned approach frequency or channel is inconsistent with the selected approach in the active flight plan.	Clear message. Tune to correct frequency or channel for the selected approach.
SCANNING DME FAIL	Both DME inputs are failing (displayed only on aircraft with “scanning DME” and “VOR inhibit” options selected).	Clear message and report failure to maintenance group.
SELECT ACTIVE WPT/LEG	Power-up restart or insertion of a different flight plan while airborne.	Execute a direct-to or leg-intercept to tell FMCS which leg of route is active.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
SELECT MODE AFTER RTA	Exiting RTA into manual speed mode.	Select a normal performance mode such as ECON.
SINGLE FMC OPERATION	In a dual FMC installation, the primary FMC determined that the secondary FMC is not available	Clear message and report failure to maintenance group. Change position of FMC source select switch to restore dual operation.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
STEEP DES AFTER XXXXXX	FMC altitude constraint at waypoint XXXXXX results in a steep descent path to the next waypoint.	Monitor descent. Remove altitude constraint at XXXXXX if allowed.
SUPP RTE DATA BASE FULL	Attempted to save a route when the Supplimental Route Database is full.	Clear message. Delete unused or unwanted routes from the Supplimental Route Database to make room for new ones.
TAI ON ABOVE 10° C	Aircraft is operating with anti-icing with TAT above 10°C.	Clear message and check use of anti-icing for engine cowl or wing surfaces.
TAKEOFF DATA LOADED	The selected departure runway and/or the runway intersection match one of the uplinked takeoff data sets.	Review and accept or reject the entered takeoff data.
TAKEOFF DATA UPLINK	Takeoff data from ACARS has been loaded.	Review and accept or reject data.
TAKEOFF SPEEDS DELETED	A change is detected in the parameters required for QRH speed computation. The large font takeoff speeds are invalidated and QRH speeds are recomputed and displayed.	Reselect desired takeoff speeds. Clear message.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
UNABLE CRZ ALTITUDE	FMCS predicts aircraft cannot reach the new CRZ ALT due to no cruise time possible at entered CRZ ALT.	Clear message and review CRZ ALT selection.
UNABLE HOLD AIRSPACE	FMS generated hold pattern (using perf limit bank angle) exceeds allowable hold airspace.	Clear message. or Execute hold exit arm. or Perform a flight plan modification which results in the hold leg no longer being the active go to waypoint. or Enter a waypoint which is more than three minutes away from the active hold.
UNABLE MACH .XXX	In Manually Selected Speed CRZ mode, entered Mach not attainable at any altitude.	Clear message select new speed command.
UNABLE NEXT ALTITUDE	Due to undershoot, the next climb constraint cannot be achieved, or due to overshoot, the next descent constraint cannot be achieved.	Clear message and review FMCS ERROR AT prediction (CLB page), or clear message and review vertical bearing information on DES page.

UNABLE REQD NAV PERF-RNP	FMC ANP is not sufficient for current specified RNP values (pilot-entered). Messages inhibited in approach environment when: • VOR/LOC mode is active from DFCS • VOR/LOC mode is armed and LNAV is not engaged • VOR/ILS mode is displayed on at least one EHSI Message also displayed on the EHSI when in approach environment.	Clear message. When entering data on ground, check accuracy. In flight, check the position differences on POS SHIFT page; if FMCS position is clearly corrupted, update FMCS to best sensor position source.
UNABLE TO OFFSET	A valid offset cannot be constructed from the entered offset parameters.	Review offset and re-enter valid data.
USING RSV FUEL	A change in route causes fuel burn to exceed total fuel minus reserves.	Clear message and amend the active flight plan.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
V SPEEDS UNAVAILABLE [4]	Unable to compute because of conditions which are not supported by the flight manual.	Check inputs or manually enter.
VERIFY GW AND FUEL	Fuel input has failed, or it has been 30 minutes since a manual entry of fuel was made.	Enter fuel weight on PERF INIT page.
VERIFY POSITION (U10.2A AND EARLIER)	Position Differences: ORIGIN-IRS, >4 nm on ground; FMC-Rnwy Update, >10 nm on ground; IRS-IRS, for 40 sec, >10 nm; IRS-Radio, for 80 sec, >4 nm; FMC-IRS, for 40 sec, >10 nm;	When entering data on ground, check data accuracy. In flight, check the position differences on POS SHIFT page; if FMC position is clearly corrupted, update FMC to best sensor position source.

4. Displayed for 737–600/700/800 aircraft only.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
VERIFY POSITION (CONT) (U10.2A AND EARLIER)	FMCS-Radio, for 80 sec, > 2.0 nm, enroute; for 60 sec, > 1.0 nm, terminal; for 10 sec, > 0.5 nm, approach & LNAV engaged; FMC-GPS, same as FMC-Radio; FMC-FMC, same as FMC-Radio Messages inhibited in approach environment when: • VOR/LOC mode is active from DFCS • Both VOR receivers are manually tuned to the Procedure navaid • VALID VOR data is being received • VOR/ILS mode is displayed on at least one EHSI	When entering data on ground, check data accuracy. In flight, check the position differences on POS SHIFT page; if FMC position is clearly corrupted, update FMC to best sensor position source.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
VERIFY POSITION (U10.3)	Position Differences: ORIGIN-IRS, >4 nm on ground; FMCS-Rnwy Update, >10 nm on ground; IRS-IRS, for 40 sec, >10 nm; IRS-Radio, for 80 sec, >4 nm; IRS–FMC, for 40 sec, >10 nm; FMC-Radio, Displayed RNP, >0.5 nm FMC-GPS, Displayed RNP, >0.5 nm FMC-FMC, Displayed RNP, >0.5 nm (DUAL FMS ONLY)	When entering data on ground, check data accuracy. In flight, check the position differences on POS SHIFT page; if FMC position is clearly corrupted, update FMC to best sensor position source.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
VERIFY POSITION (CONT) (U10.3)	Messages inhibited in approach environment when: • VOR/LOC mode is active from DFCS • Both VOR receivers are manually tuned to the Procedure navaid • VALID VOR data is being received • VOR/ILS mode is displayed on at least one EHSI	

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
VERIFY RNP	Default value of RNP becomes less than pilot-entered value of RNP, or a GPS approach has been selected and the FMC is in the Approach Navigation Environment and the default RNP is active (no NDB or manual RNP has been entered).	Clear message. Check pilot-entered RNP.
VERIFY RNP VALUE	Manually entered RNP is larger than default RNP, or manually entered RNP is less than ANP.	Clear message. Check entered value of RNP.
VERIFY TAKEOFF SPEEDS	System gross weight has changed since the T/O REF speeds were selected.	Check selected (small font) takeoff speeds and ACCEPT or REJECT on TAKEOFF page.
VNAV DISCONNECT	The criteria for VNAV engagement are no longer satisfied (VNAV disengages).	Manually control the vertical path.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
XXXXX [5] (MCP ALTITUDE VALUE)	Resetting MCP ALTITUDE to a value not equal to the CRZ ALT caused the value to appear in scratch pad (CRZ page only).	Select MCP ALTITUDE value into the appropriate target altitude data field or clear message.
XXXX [6] (AIRPORT IDENTIFIER)	A REF AIRPORT is entered on POS INIT and no entry of ORIGIN yet appears on RTE page 1.	Select the airport identifier into the origin data field.

5. MCP altitude setting appears in scratch pad for possible line selection into a data field when MCP ALT is changed.
6. Airport identifier appears on RTE page for possible line selection into the ORIGIN field.

ALTERNATE NAVIGATION MESSAGES

NOTE: This section only applies to an Update 2 LCD MCDU.

When the ALT NAV MCDU is being operated as a normal MCDU (displaying the normal FMC pages), the previous list of messages beginning on page 3–2 will apply.

When the ALT NAV MCDU is displaying the ALT NAV pages, a unique set of messages are diplayed when conditions warrent. These messages cause the MSG annunciator to illuminate just as FMC operations would and are in addition to the previous list of messages.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
INVALID ENTRY	An attempt was made to enter data having an invalid format or range for the data field selected.	Clear message. Correct entry error.
GPS FAIL	GPS data is not being received.	Clear message. ALT NAV processing halts.
GPS INTEGRITY LOST	GPS data received is invalid or the GPS HIL value is greater than two times RNP for the current navigation environment.	None.
LO POS ACCURACY	The GPS horizontal figure of merit is greater than RNP for the current navigation environment.	None.
ROUTE FULL	An attempt was made to enter more than 60 waypoints.	Clear message. If more waypoints are required, reveiw the ALT NAV flight plan for possible deletions.

MESSAGE	CAUSING CONDITION	CORRECTIVE ACTION
WAYPOINT NOT DEFINED	An attempt was made to enter a waypoint that does not have a known LAT/LON.	Clear message. Correct entry error.
WPT PREVIOUSLY DEFINED	An attempt to enter an existing identifier using a LAT/LON that is different from the currently stored LAT/LON.	Clear message, then: Correct possible error in desired LAT/LON data. or Delete stored waypoint and re–enter desired data. or Select another name for the desired waypoint.

FMCS POWER LOSS AND SENSOR FAILURE RECOVERY

The FMCS is designed to survive power transients and interruptions without suffering permanent loss of its navigation and guidance capabilities. Three modes of power loss recovery are possible:

- If the system's primary operating power has been interrupted for less than 10 seconds, the system recovers automatically and continues to operate normally.
- If the power has been interrupted for 10 seconds or more while the aircraft is on the ground, the system goes through a complete power-up procedure. All preflight data and flight plan entries must be re-entered.
- If the power has been interrupted for 10 seconds or more while the aircraft is in the air, the system retains all loaded data, disengages, and reverts to display of a MOD RTE LEGS 1/1 page on the CDU with a SELECT ACTIVE WPT/LEG message in the scratch pad. The system will not turn on the EXEC key light until or unless a TO waypoint has been defined.

System recovery to full operation is dependent upon the status of other aircraft sensor and flight control system.

Failures of the FMCS itself will completely stop the FMCS from supplying flight management information.

FMCS failures are indicated by the CDU display and lighted alert indicators.

The following are FMCS failure indicators:

LIGHTS: Amber FMC Alert on FMA and amber FAIL light on CDU indicate FMC failure.

CDU DISPLAY: Blank – CDU failure (if dual CDUs are installed, use other CDU; FMCS is still operational); pull faulty CDU circuit breaker.

"FMC" – FMC failure; pull FMC circuit breaker.

Failures of FMC memory are indicated by the CDU display: OP PROGRAM INVALID. Pull FMC circuit breaker for 20 seconds and reset. If still in failed condition reload operational flight program via portable or airborne disk loader.

Reductions of FMCS capabilities are attributable to failures of other aircraft systems. It is important to note this characteristic in post-flight reports to Maintenance Personnel.

FMC FAILURE WITH AN ALT NAV MCDU INSTALLED

One function of the ALT NAV MCDU is to provide basic backup navigation capability should the FMC fail. The ALT NAV flight plan is maintained current as long as the FMC is operational. After a failure of the FMC, the ALT NAV MCDU will perform basic computations and sequence the active flight plan.

NOTE: The ALT NAV computations do not use wind data.

When the ALT NAV MCDU has the FMC flight plan loaded and activated prior to an FMC failure, the ALT NAV MCDU will display the active ALT NAV LEGS page when the ALT NAV prompt (LSK 6L) on the MENU PAGE is selected.

If the flight plan was not loaded and activated prior to the FMC failure, the ALT NAV MCDU will display the inactive ALT NAV LEGS page when the ALT NAV prompt (LSK 6L) on the MENU PAGE is selected. Selecting the LAST FMC PLAN prompt (LSK 5L) will display the inactive ALT NAV flight plan as it was crossloaded. Verify and correct (if required) the TO waypoint, then execute the plan to make it active.

Once the ALT NAV flight plan is active, the ALT NAV MCDU will continue to provide advisory lateral path guidance information to the ESAI.

NOTE: For an accurate and up–to–date ALT NAV flight plan, it is important to crossload and activate the FMC flight plan as soon as it is activated in the FMC.

ALT NAV MCDU POWER LOSS

The ALT NAV MCDU is designed to survive power transients and interruptions without suffering permanent loss of its navigation and guidance capabilities. Three modes of recovery after a complete power loss are implemented.

- If the power to the ALT NAV MCDU is interrupted for less than 10 seconds, the unit recovers automatically and continues to operate normally.
- If the power is interrupted for 10 seconds or more while the aircraft is on the ground, the ALT NAV MCDU performs a full power–up cycle, including a complete self check. All pre–flight entries must be repeated.
- If the power is interrupted for 10 seconds or more while the aircraft is in the air, the ALT NAV MCDU requests the FMC to crossload the flight plan. The ALT NAV pages may then be accessed via the ALT NAV prompt on the MENU page, reviewed, updated or corrected if necessary, and re–activated.

SOURCE RECEIVER FAILURE

If the on–side receiver fails, the ALT NAV MCDU will no longer be able to provide an alternate navigation solution. The ALT NAV prompt on the MENU page is blanked as well as all data fields in the ALT NAV pages that require the receivers input data.

The basic Flight Management Computer System (FMCS) consists of a Flight Management Computer (FMC) and a Control Display Unit (CDU). A second FMC and second CDU are available as an option. Either or both of the CDUs may be any type of Multi-Purpose Control Display Units (MCDUs), which are available as an option. The FMCS is integrated with other flight control systems to form the Flight Management System (FMS), capable of providing continuous automatic navigation, guidance, and performance management. These other systems are:

- In 737–300, 737–400, and 737–500
  - A dual-channel Autopilot/Flight Director System (AFDS).
  - A full regime autothrottle system (A/T).
  - Two Ring-Laser Gyro Inertial Reference Systems (IRS).
  - An optional Electronic Flight Instrument System (EFIS).
  - An optional satellite Global Positioning System (GPS).
- In 737–600, 737–700, and 737–800
  - A dual-channel Autopilot/Flight Director System (AFDS).
  - A full regime autothrottle system (A/T).
  - The Air Data Inertial Reference Systems (ADIRS).
  - The Control Display System (CDS).
  - An optional satellite Global Positioning System (GPS).

The FMCS also communicates with a complement of other avionic systems. These systems include:

- In 737–300, 737–400, and 737–500
  - Two digital Air Data Computers (DADC).
  - Two VHF NAV receivers.
  - Two DME interrogators.
  - Two HSIs (or Electronic HSIs (EHSIs) if EFIS is installed).
  - Two ADIs (or Electronic ADIs (EADIs) if EFIS is installed).
  - Two Mach Airspeed Indicators (MASI).
  - Two N_1 indicators.
  - The Flight Mode Annunciator (FMA) panels (or one Thrust Mode Annunciator (TMA) panel and two Autoflight Annunciator (AA) panels if EFIS is installed).
  - A GMT clock.
  - A Fuel Summation Unit.

– In 737–600, 737–700, and 737–800
  - The Air Data Inertial Reference Unit (ADIRU).
  - Instrumentation displayed on the CDS.
  - A GMT clock.
  - The Fuel Quantity Indicator System

In addition, control/display function is available to any other ARINC 739 compatible system when an MCDU is included in the FMCS.

The functional arrangement of the FMCS is shown in Figure 4–1. When interfaced with autopilot and autothrottle, the FMCS provides a fully integrated flight management capability. Optimal performance computations, navigation, and guidance are provided from the beginning of the climbout phase to glide slope intercept or flaps greater than 15 degrees, with lateral and longitudinal autopilot coupling and automatic thrust control. Also a second FMC in a dual configuration provides redundant and independent navigation.

In a dual FMC configuration, both FMCs (OFPs and data bases) can be separately loaded via a data loader. A cockpit switch determines which FMC is loaded. The other FMC may also be loaded using the crossload CDU pages.

FMCS SENSOR INPUTS

Navigation and performance data are computed using inputs of:

From the IRS:

- Present position (latitude, longitude, and inertial altitude)
- Vertical speed (inertial)
- Ground speed components (north/south, east/west)
- Heading (magnetic and true)
- Roll and pitch angle
- Optional — GPS position (latitude, longitude)

From the Air Data System:

- Pressure altitude (uncorrected and baro-corrected)
- True Airspeed (TAS), Mach Airspeed (MAS), and Calibrated Airspeed (CAS)
- Total Air Temperature (TAT)
- DME slant range (from the DME interrogators)
- VOR bearing (from the VHF NAV receivers)
- Total fuel quantity (from the fuel summation unit)
- Pneumatic bleed status (from the Bleed Control Panels)

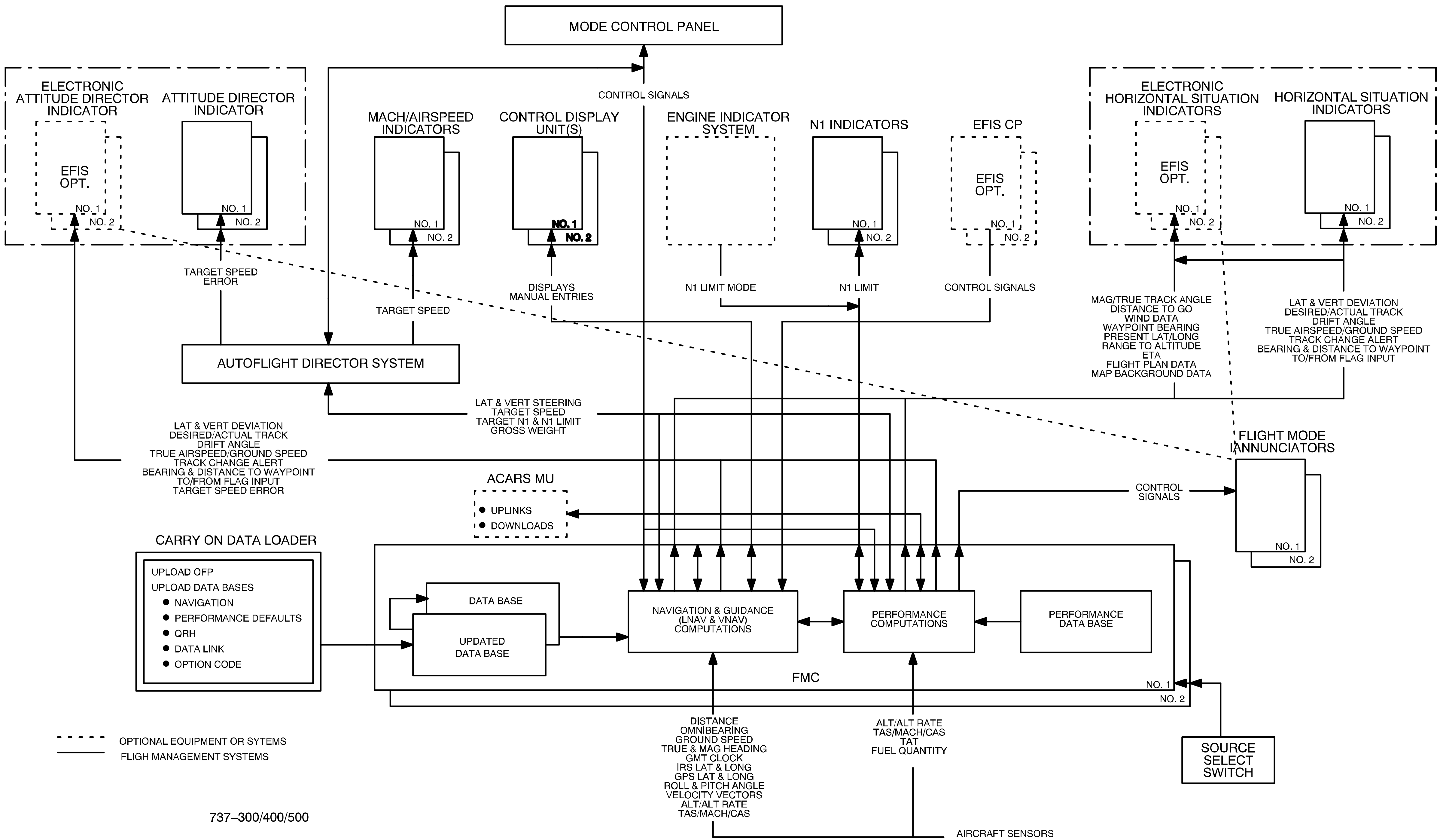


Figure 4–1 FMCS Functional Arraingement (Sheet 1)

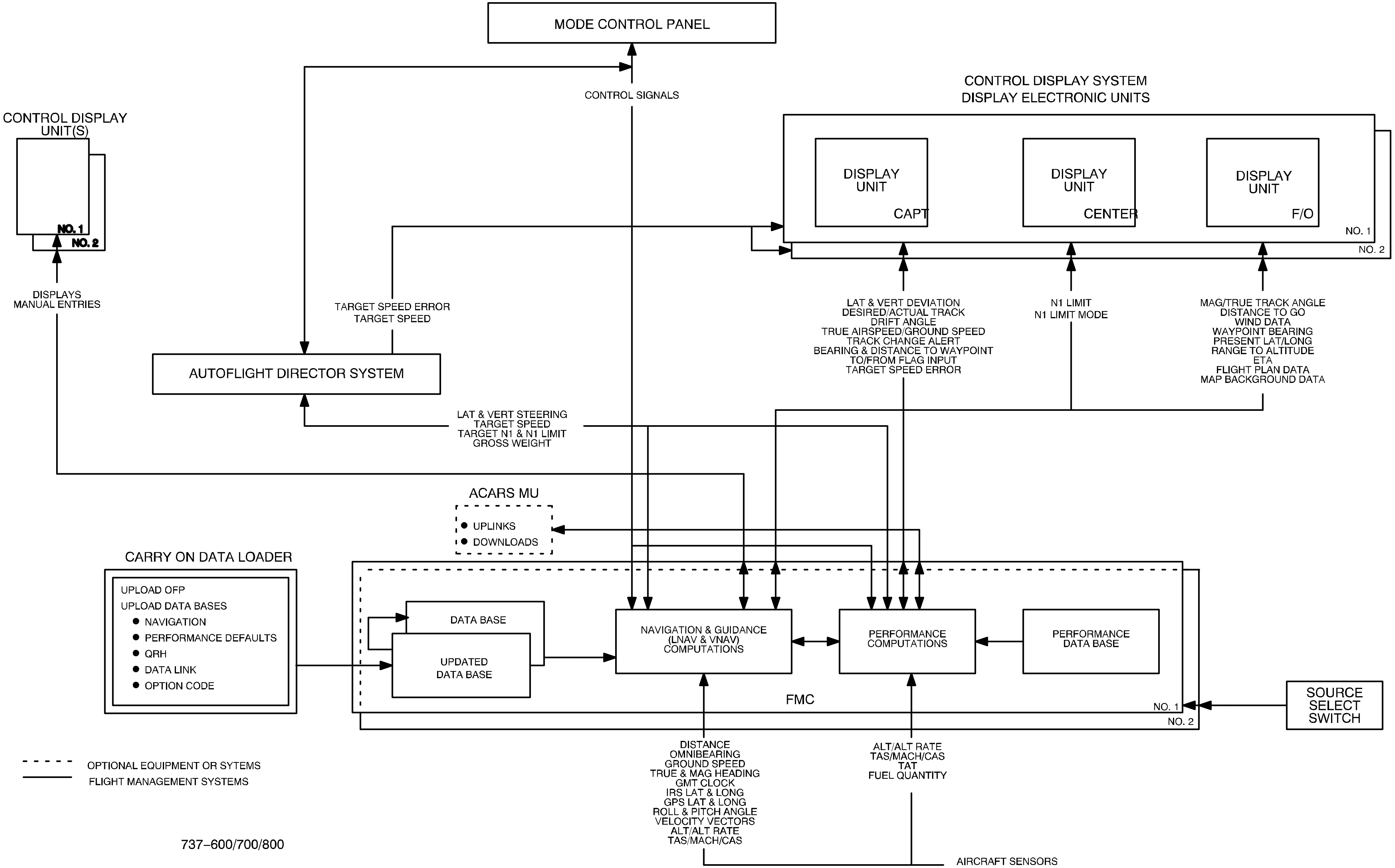


Figure 4–1 FMCS Functional Arraingement (Sheet 2)

ALT NAV SENSOR INPUTS

The ALT NAV MCDU provides an alternate navigation solution in the lateral plan and a backup navigation source that will continue to send guidance data to the ESAI should the FMC fail. The functional arraingment is shown in Figure 4–1A.

The ALT NAV MCDU's source of velocity and position data is from the on–side receiver. Without this input, the ALT NAV pages will not be available. The receiver provides the following data:

- Present position (LAT/LON)
- Ground speed
- Track angle (true)
- Universal Time
- Horizontal Integrety Limit (HIL)
- Horizontal Figure of Merit (HFOM)
- GNR Sensor status
- GNSS Fault Summary data

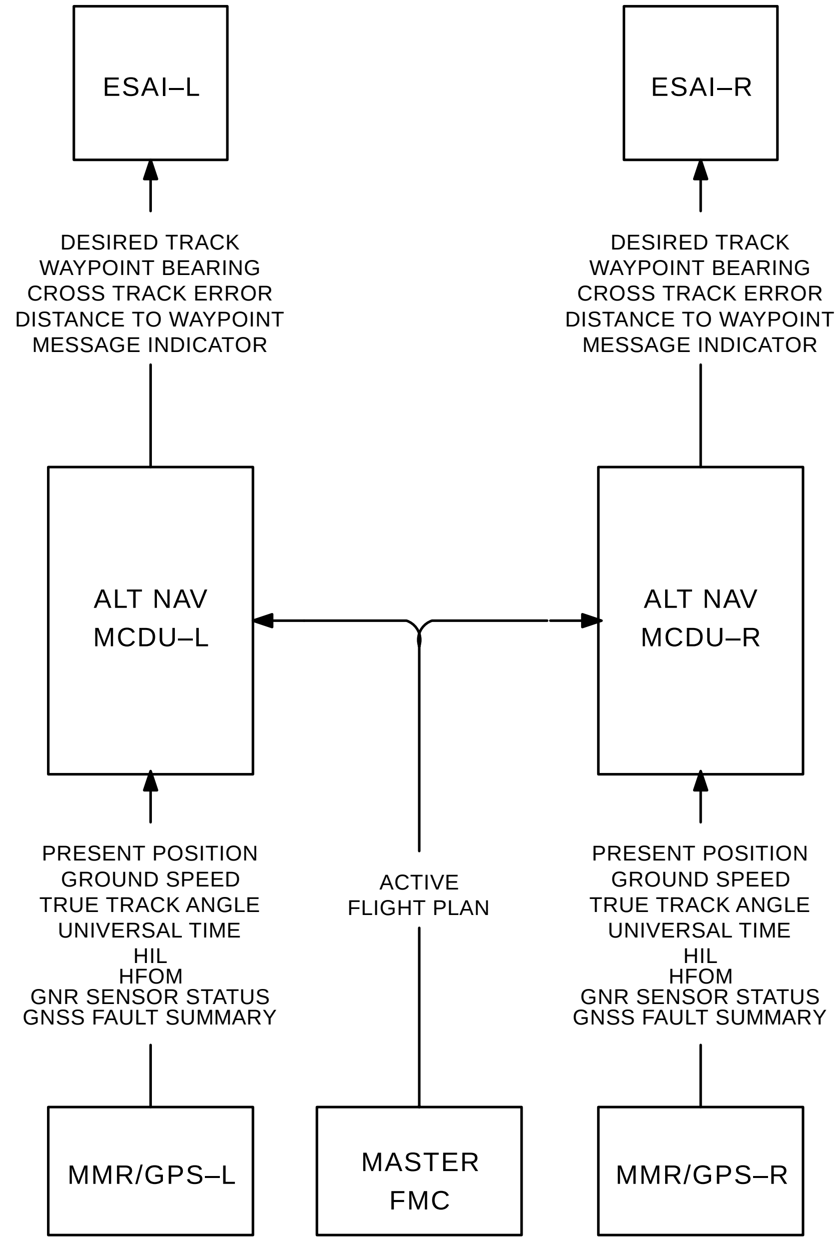


Figure 4–1A ALT NAV MCDU Functional Arraingement

FMCS SYSTEM CONTROLS AND DISPLAYS

The primary controls and displays associated with the operation of the FMCS are described below. Their locations on the flight deck are shown in Figure 4–1.

CONTROL/DISPLAY UNIT (CDU)

The CDUs provide the operator interface with the Flight Management Computer (FMC) and are the only components of the FMCS visible to you. The general arrangement of the CDU is illustrated in Figure 2–1.

AFDS MODE CONTROL PANEL (MCP)

The arrangement of the MCP is illustrated in Figure 4–2. The FMCS interacts directly with only six of its controls:

- The LNAV selector switch
- The VNAV selector switch
- The altitude select control (ALTITUDE SEL)
- The course select control (COURSE)
- The altitude intervention switch (ALT INTV)
- The speed intervention switch (SPD INTV)

The LNAV and VNAV selectors are push switches which engage or disengage FMCS LNAV and VNAV guidance to the autopilot and autothrottle. The switches are lit in the engaged state. The ALTITUDE SEL control provides altitude data directly to the FMCS for VNAV mode control. The FMCS receives selected course data from the MCP to generate a selected course radial and its reciprocal for display on the EFIS EHSI when a VOR is being manually tuned. FMC operations in the altitude and speed intervention modes are discussed on pages 2–179 through 2–181.

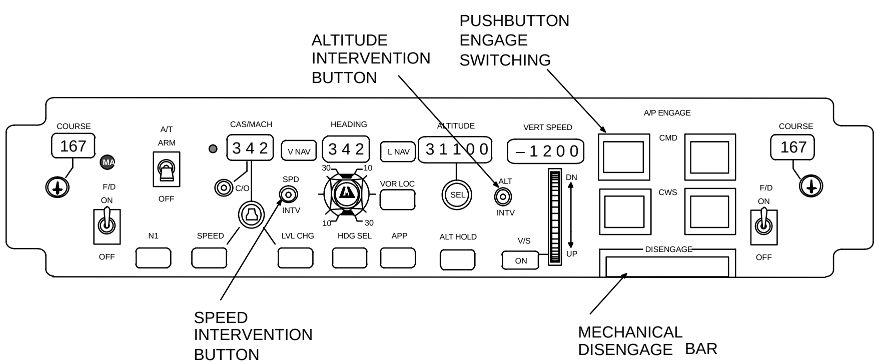


Figure 4–2 Mode Control Panel

AUTOTHROTTLE (A/T)

Autothrottle-coupled operations with the FMCS are automatic and controlled by command mode selection from the AFDS. Autothrottle coupling is enabled by the A/T ARM switch located on the AFDS MCP.

FLIGHT MODE ANNUNCIATOR (FMA)

The panel of the FMA is shown in Figure 4–3. The Captain's and First Officer's FMAs are identical. The principal information furnished by the FMCS for display on the FMA is an indication of the active N_1 limit operating mode and whether a reduced N_1 limit is active. In addition, FMC failures and Alerting Messages light the amber FMC annunciator located on the FMA.

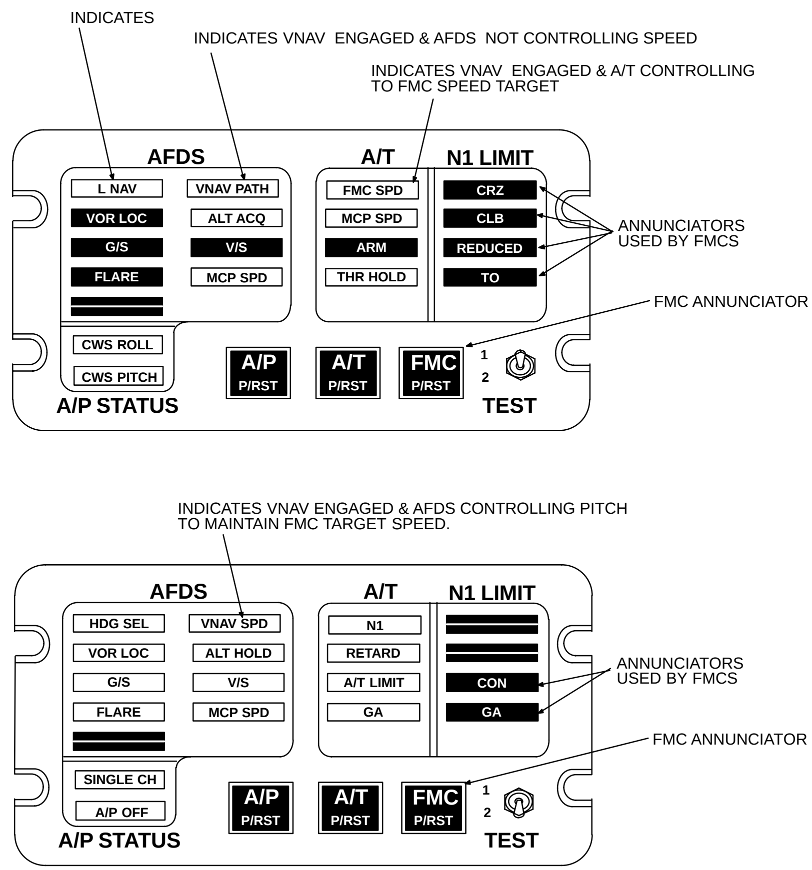


Figure 4–3 Flight Mode Annunciator

SOURCE SELECT SWITCH

The source select switch is only used in a dual FMC configuration. It provides a means to designate which FMC is the primary computer.

THRUST MODE ANNUNCIATOR (TMA)

The TMA is part of the EFIS option. The panel of the TMA is shown in Figure 4–4. The information furnished by the FMCS for display on the TMA is the active N_1 limit operating mode and whether a reduced N_1 limit is active.

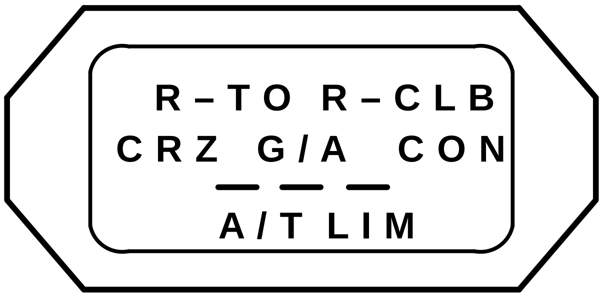


Figure 4–4 Thrust Mode Annunciator

AUTOFLIGHT ANNUNCIATOR (AA)

The AA is part of the EFIS option. The panel of the AA is shown in Figure 4–5. The Captain’s and First Officer’s AAs are identical. FMC failures and alerting messages light the amber FMC annunciator.

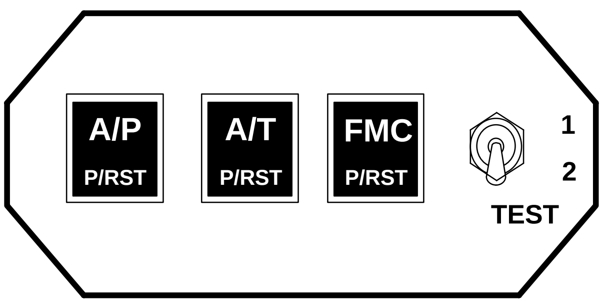


Figure 4–5 Autoflight Annunciator

INSTRUMENTS

Four types of instrumentation on the flight deck are interfaced with the FMCS. They are:

- The Horizontal Situation Indicators.
- The Mach/Airspeed Indicators.
- The N_1 Indicators.
- The Attitude Director Indicators.

Horizontal Situation Indicator (HSI)

The standard HSI installed in the Boeing 737-300 through 737-800 aircraft is shown in Figure 4–6. When the FMCS is active in LNAV and VNAV modes, it provides display outputs to both the Captain's and the First Officer's HSIs for:

- The course pointer.
- The drift angle cursor.
- The lateral deviation bar.
- The vertical deviation pointer.
- The TO/FROM indicator flag.
- The ALERT annunciator, which provides a visible advisory prior to the FMCS's automatic execution of a programmed lateral path change.
  - Lateral track changes are annunciated 10 seconds prior to initiation of the turn maneuver.
  - The ALERT annunciator will go out when the commanded lateral track change should begin.
- The distance to go in nautical miles to the next geographically fixed waypoint.
- The ground speed.
- Bearing to the next geographically fixed waypoint.
- True airspeed (optional).

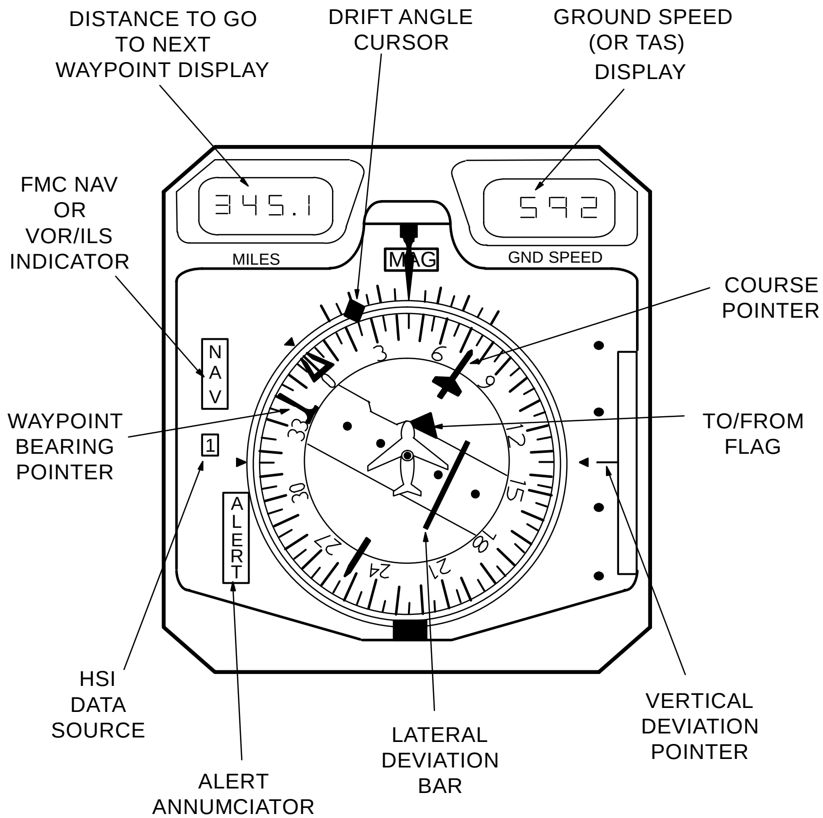


Figure 4–6 Horizontal Situation Indicator (HSI)

Mach/Airspeed Indicator (MASI)

The MASI display is shown in Figure 4–7. The FMCS provides an output of target airspeed to the AFDS to position speed cursors in both MASIs whenever the VNAV mode is engaged. You may override and disable the automatic cursor by pulling out the PULL TO SET knob.

N_1 Indicator

The N_1 Indicator is illustrated in Figure 4–8. The FMCS provides computed percent of N_1 Limit, which is used to position the N_1 cursors. The system also generates target N_1 for reduced thrust modes, which is transmitted to the autothrottle. You may disable the automatic cursor by pulling out the PULL TO SET knob.

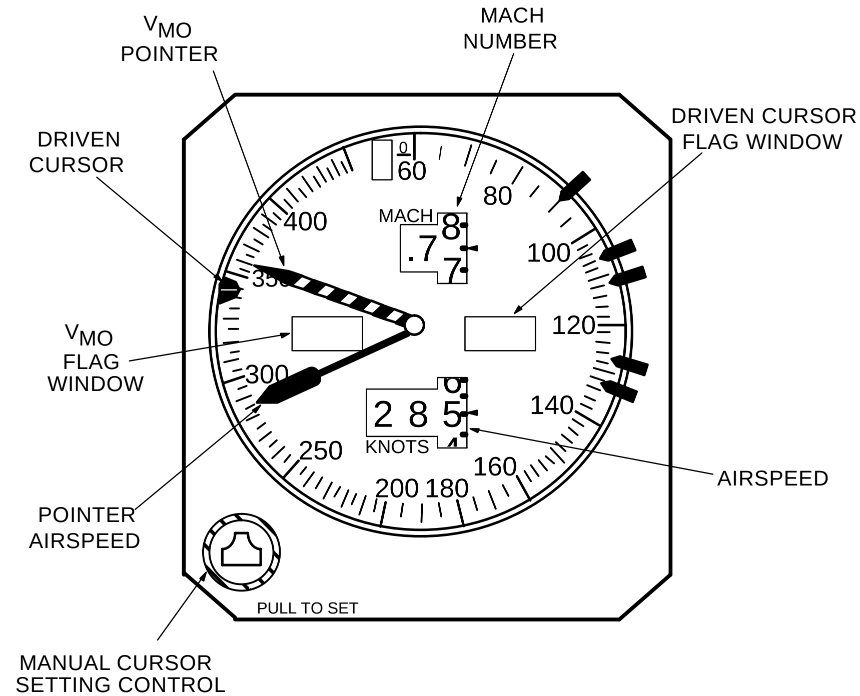


Figure 4–7 MACH/Airspeed Indicator

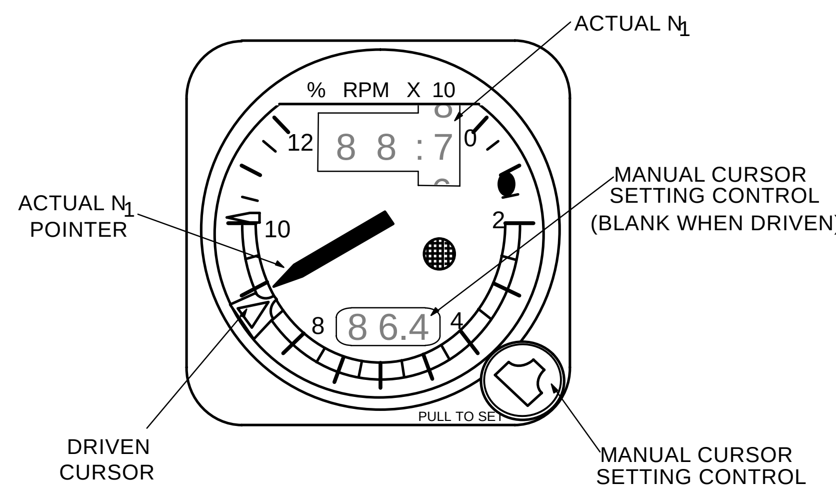


Figure 4–8 N_1 Indicator

Attitude Director Indicator (ADI)

The standard ADI installed in Boeing 737 aircraft is shown in Figure 4–9. When the FMCS is active in the VNAV mode and the A/T is engaged in FMC SPD mode, the autothrottle provides a speed error signal to the fast/slow pointer which shows the difference between current speed and FMCS target speed.

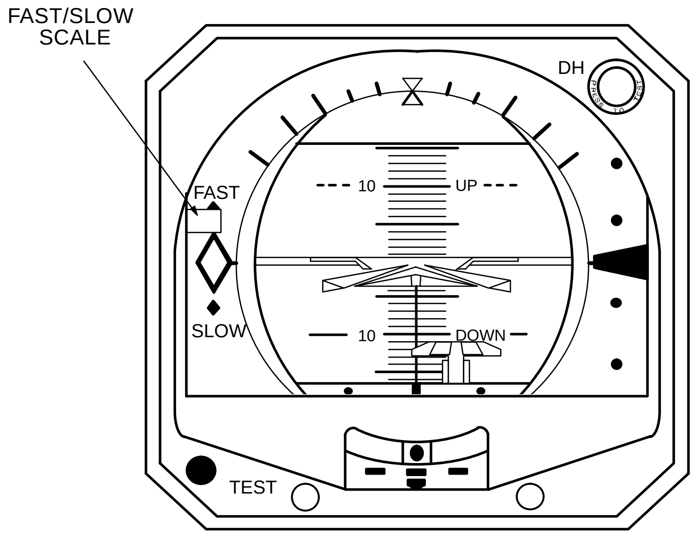


Figure 4–9 Attitude Director Indicator

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The EFIS option functionally replaces the HSI and ADI on the flight deck in 737-300/400/500 aircraft, and provides additional advisory data such as map display, weather radar information, radio altitude information, and automatic flight control mode annunciation.

The EFIS consists of the following components:

- Electronic Flight Instrument Control Panels (EFCPs)
- Electronic Attitude Director Indicators (EADIs)
- Electronic Horizontal Situation Indicators (EHSIs)
- Electronic Flight Instrument Symbol Generators (EFSGs)
- Remote Light Sensor

The EFCP (shown in Figure 4–10) is located on the flight deck and provides selected EFIS modes, selected display options, and selected range information to the FMCS. The FMCS provides flight-plan-related information to the EFIS when the MAP or PLAN mode is selected on the EFCP.

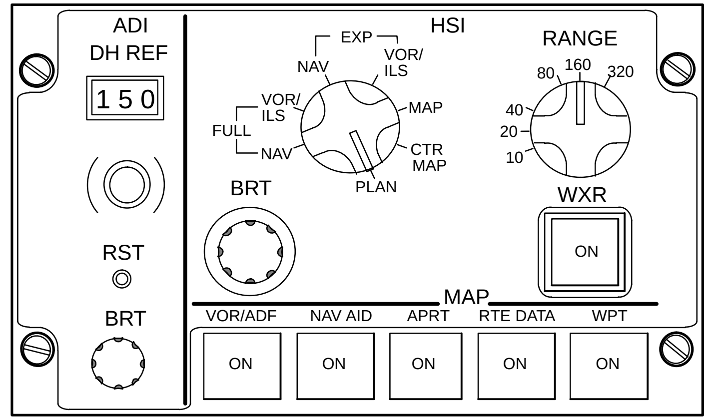


Figure 4–10 Electronic Flight Instrument Control Panel

COMMON DISPLAY SYSTEM (CDS)

The CDS option functionally replaces the HSI and ADI on the flight deck in 737-600/700/800 aircraft, and provides additional advisory data such as map display, weather radar information, radio altitude information, and automatic flight control mode annunciation.

The CDS consists of the following components:

- Common Display Control Panels (CDSCPs)
- Electronic Attitude Director Indicators (EADIs)
- Electronic Horizontal Situation Indicators (EHSIs)

The CDSCP (shown in Figure 4–11) is located on the flight deck and provides selected display modes, selected display options, and selected range information to the FMCS. The FMCS provides flight-plan-related information to the CDS when the MAP or PLAN mode is selected on the CDSCP.

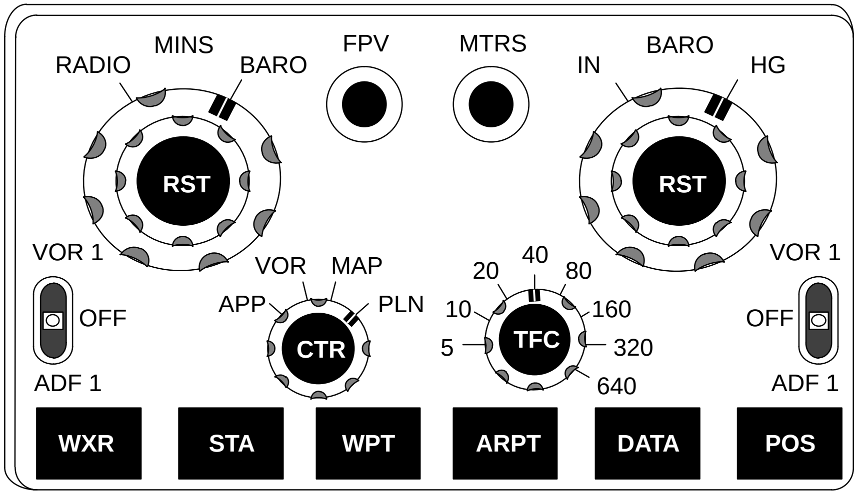


Figure 4–11 Common Display System Contol Panel

The information provided to the EFIS or CDS from the FMCS consists of background and dynamic data. The FMCS specifies the data type to be displayed, its position, and symbology orientation viewed on the display (see Figures 4–12 and 4–13). Background data information is extracted from the Navigation Data Base and the flight plan. This flight plan information is identical to the FMC lateral flight plan.

The background symbol information sent to the EFIS or CDS is made up of the following:

- Flight Plan Route Data (ACT and MOD)
  - Waypoints
  - Route data
  - Runways
  - Holding Patterns
  - Altitude Profile Points (T/C, S/C, T/D, E/D, and airport speed restriction deceleration points)
- Alphanumeric Messages
  - Primary FMC in a dual FMC configuration
- Tuned Navaids
- Origin and Destination Airports
- Other Airports
- Selected Reference Points

- Navaids (VORTAC, VOR, DME/TACAN)
- Waypoints (not in flight plan, but in NDB)
- Procedure Turns
- Procedure Holds

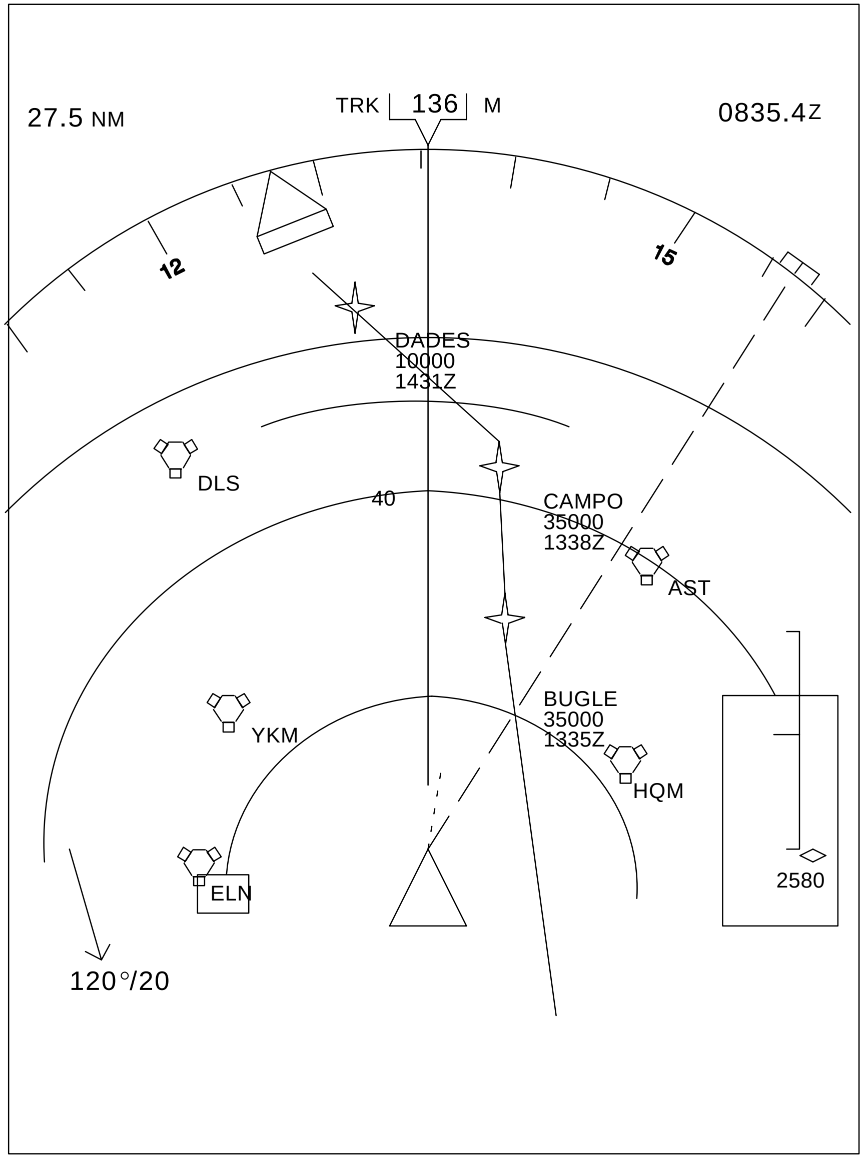


Figure 4–12 Typical Display in Map Mode

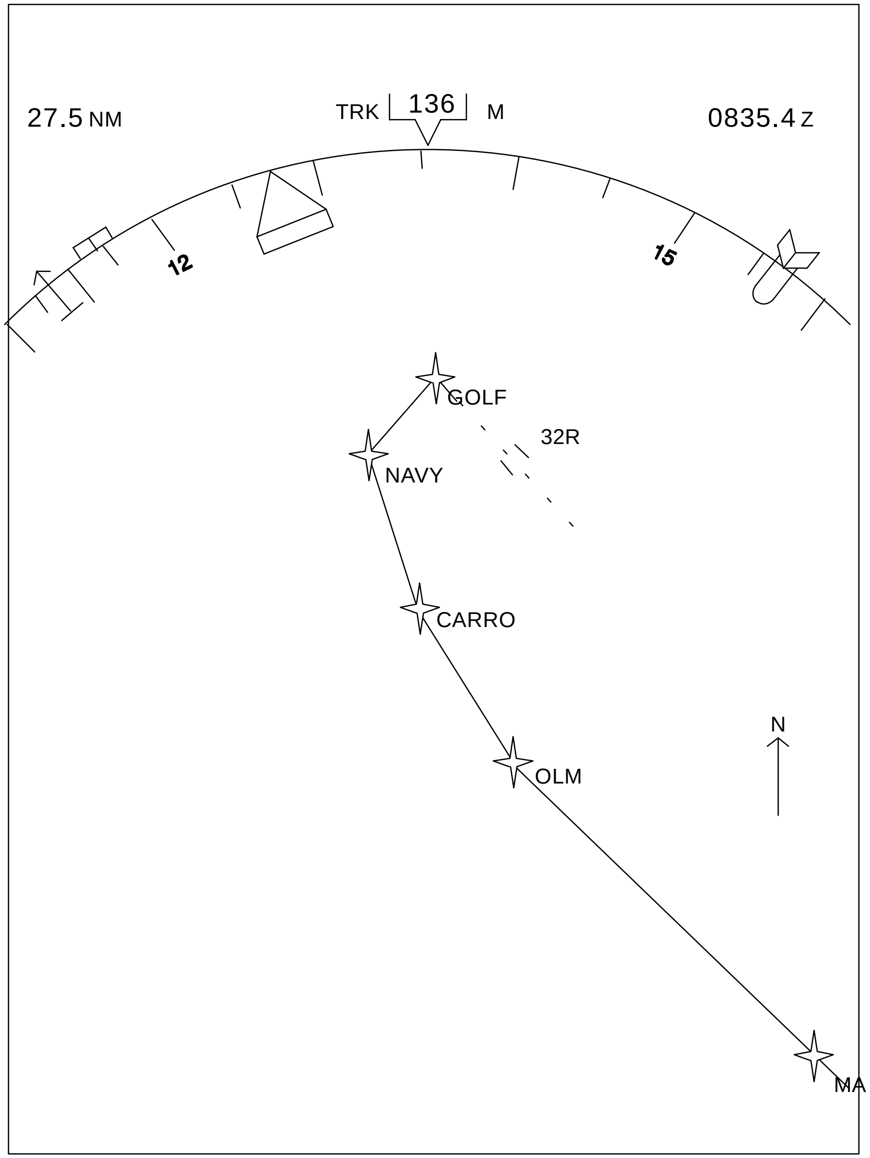


Figure 4–13 Typical Display in Plan Mode

MAP mode symbol categories to be displayed by the FMCS must be selected on the control panel. Modifications made to the active flight plan using the FMCS are displayed along with the active flight plan until executed. Once executed, only the active flight plan is displayed.

Dynamic symbol information consists of general navigation and guidance parameters and special data parameters. The dynamic symbol information that is sent to the EFIS or CDS from the FMCS consists of the following:

EHSI Information

- Dist to Go (to a waypoint)
- Estimated Time of Arrival
- Desired Track
- Cross-Track Deviation
- Vertical Deviation
- Range to MCP Altitude
- Present Lat & Long FMC, FMC Radio Position, GPS, and IRS
- Lateral Offset Track
- Waypoint Bearing
- Track Angle (True & Mag)
- Wind Speed & Direction
- Drift Angle
- Active Waypoint Name
- IRS Position Difference
- Display Bit

EADI Information

- Ground Speed
- Flight Path Angle
- V_{REF} Speed (Speed Tape Option Only)
- V_1 Speed (Speed Tape Option Only)
- V_R Speed (Speed Tape Option Only)

ALTERNATE NAVIGATION SYSTEM CONTROLS AND DISPLAYS

The primary controls and displays assosiated with the operation of Alternate Navigation function are described in the following paragraphs.

ALTERNATE NAVIGATION CONTROL/DISPLAY UNIT

The primary unit that provides the Alternate Navigation (ALT NAV) function is the LCD MCDU with Update 2 (ALT NAV MCDU) operational program loaded. The ALT NAV MCDU is identical in appearance and operation to the other versions of MCDUs when displaying the normal FMC pages, performing the alternate navigation function in the background.

RECEIVER INPUTS

In order to ferform the ALT NAV function, the ALT NAV MCDU must have inputs from the on–side MMR/GPS/IRS receiver to obtain velocity and position data required for guidance output data. Without this input, the ALT NAV function will not operate.

ELECTRONIC STANDBY ATTITUDE INDICATOR

When the ALT NAV MCDU is displaying the ALT NAV pages, display outputs to the Electronic Standby Attitude Indicator (ESAI) are used to provide lateral path guidance. The ALT NAV MCDU drives the on–side display to present the aircrew with basic up–to–date flight plan information.

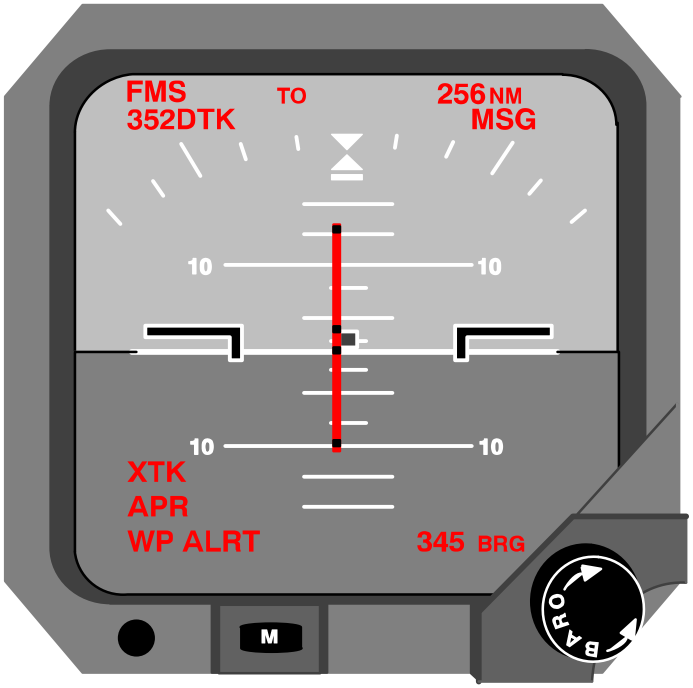


Figure 4–13A Electronic Standby Attitude Indicator

The ALT NAV MCDU controls the following:

- The lateral deviation bar.
- The ALERT annunciator (provides visable advisoryapproximately 10 seconds prior to a lateral path change, and goes away when change should occur).
- Distance to go in nautical miles to the next geographically fixed waypoint.
- Ground speed.
- Bearing to next geographically fixed waypoint.

FMCS PERFORMANCE COMPUTATIONS

The essential difference between the Flight Management Computer System and conventional area navigation systems lies in the FMCS's ability to provide optimal speed, thrust, and flight path guidance. This optimization is based upon sensor measurements of flight conditions and the operator's definition of flight cost factors, as done through the Cost Index (CI) which specifies the relative weightings of fuel saving and time-of-flight saving. Thus, climb, cruise, and descent optimization which assure the best possible return on trip cost can be employed without increasing flight crew workload.

The FMCS provides speed and thrust targets for the selected flight phase and mode of operation, and thrust limits to protect the engines. The speed and thrust target and thrust limit data are transmitted to the autopilot and autothrottle systems to provide direct automatic control of the aircraft's flight path.

As a default the system selects the ECON mode which uses the pilot selected Cost Index (CI) to construct the most cost efficient altitude-speed flight profile. The CI extremes of 0 and 200 represent, respectively, the most fuel efficient profile and the fastest profile (short of the buffet boundaries).

Other performance modes may be selected on the individual flight phase pages of CLB, CRZ, and DES. In CRZ the Long Range

Cruise (LRC) selection commands a speed providing 99% maximum fuel efficiency (corresponding to a Cost Index of 20 to 25 in the ECON mode, depending on altitude). For engine out (ENG OUT) conditions, the FMCS displays the maximum continuous thrust N_1, maximum altitude capability and optimum airspeed based on maximum continuous thrust, minimum drag speed, and current gross weight. Vertical navigation (VNAV) mode cannot be engaged when an ENG OUT mode is active.

PERFORMANCE DATA BASE

The system's performance data base is contained in the permanent program memory of the Flight Management Computer. It consists of:

- A detailed aerodynamic model of the aircraft, which includes basic high-speed drag polars, target airspeeds for all operating modes and conditions, a buffet limit envelope, and stored values of the aircraft's certified operating limits. The aerodynamic model also includes speed and altitude capability data required for engine-out operating conditions.
- A fuel flow and thrust model for the type of engine installed on the aircraft. The model is used during computations of fuel flow, thrust, engine limits and target values, and for corrections for the effects of air conditioning and anti-icing bleeds. Thrust targets for turbulence penetration are also provided as advisory information for the crew.

PERFORMANCE OPTIMIZATION

It is convenient to think of the performance advisory capability of flight management systems as an electronic Operations Manual. In at least one sense, that description applies to the FMCS: it provides flight planning and performance information that the flight crew would normally obtain from the Operations Manual. But the FMCS furnishes a great deal more information that cannot be obtained from the Operations Manual, nor, for that matter, from the Performance Engineer's Manual.

Climb speed schedules and Descent speed schedules for optimal operation of the aircraft are determined largely as a function of the Cost Index number, which relates the operator's direct hourly flying costs to the cost of fuel, to allow trade-off between the two. Cruise speed schedule is a function of cost index, gross weight, cruise altitude, and headwind.

PERFORMANCE SELECTION FOR REQUIRED TIME OF ARRIVAL (RTA)

The Required Time of Arrival (RTA) advisory and control capabilities provide a performance speed schedule to achieve an ETA equal to the entered RTA. Selection of the RTA performance mode is made through an RTA time entry specified at some waypoint in the flight plan on the RTA PROGRESS page. This selection will override any prior performance mode selections for climb, cruise, and/or descent up to the RTA waypoint. The target speed schedule to meet the RTA is derived by estimating the ECON mode Cost Index (CI) that results in the ETA performance prediction equal to the RTA. Using the CI to adjust the speed schedule for the flight phases involved insures that all performance envelope limitations will be observed. If the entered RTA is unachievable through an allowable CI, a CDU message will be displayed.

While still on the ground, normal performance predictions compute time of flight to each waypoint based on the pilot entered Cost Index, where CI ranges from 0 for most fuel efficient to 200 for the fastest. If an RTA is now entered for some waypoint, the time of flight to that waypoint is backed off from the RTA time to compute the recommended take-off time. As supplementary information, RTA computations also estimate the flight times for a CI of -40 and 200 to provide a T/O WINDOW display, which shows the earliest and latest take-off times to meet the entered RTA. When airborne, the earliest and latest ETAs achievable at the selected waypoint are estimated and displayed as the RTA WINDOW. Both window time computations use the extended CI range of -40 that results in speed targets slower than the most fuel efficient speed, but bounded by the slow speed buffet boundaries.

During flight the full performance predictions running in the background constantly update the ETA for the RTA waypoint and hence compute an RTA error. Whenever this RTA time error exceeds a computed error tolerance, RTA computations will estimate a new CI, which in turn changes the target speed schedule. The computed error tolerance is based on a value entered on the PERF LIMITS page and on the time remaining to the RTA waypoint. The PERF LIMITS page also allows the pilot to specify narrower minimum and maximum performance speed limits by flight phase than the normal default limits.

FLIGHT ENVELOPE PROTECTION

Cost-optimal flight profiles may require flying the aircraft at or near the limits of airplane or engine performance. Reliance upon a system such as the FMCS, therefore, requires assurance that the speed and thrust targets provided by the system will not exceed those limits, and that the flight planning computations will offer performance options that are within the airplane’s capabilities. The FMCS operational program has been specifically designed to assess the effects of actual flight conditions, computed performance targets, and crew data entries or requests, and continuously evalu–

ates these variables with respect to the computed or programmed capabilities of the aircraft and its engines.

Any condition that exceeds these limits is annunciated. The actual outputs of the system are restricted by the computed limit boundaries. Monitoring of invalid or abnormal conditions in the aircraft itself is included in this feature.

The aircraft's environmental (temperature/altitude), airspeed (V_{MO} and M_{MO}) limits and maneuver margin envelopes are continuously checked. N_1 limit data is used to check the target speeds and thrust commands. The maneuver margin to initial buffet can be either chosen by the airline (for FAA operators) or limited to 1.3 g's (for CAA operators) as selected by a program logic pin.

FMCS NAVIGATION

The FMCS incorporates provisions for both self-contained and radio-augmented navigation in the lateral and vertical planes. The system furnishes, as its basic navigational outputs, continuous real-time solutions for:

- Aircraft Position (latitude, longitude, altitude)
- Ground Speed
- Flight Path Angle
- Drift Angle
- Track Angle
- Wind Velocity and Direction

ALT NAV MCDU NAVIGATION

The ALT NAV MCDU is capable of performing self–contained naviagtion in the lateral plan only. The unit displays basic navigation outputs which are continually updated with data from the supplying receiver. These outputs include:

- Aircraft Position (latitude, longitude, altitude)
- Ground Speed
- Track Angle

NOTE: The ALT NAV function does not account for or incorporate wind data.

NAVIGATION DATA BASE

The FMCS's navigation data base is stored in the memory of the FMC in two parts: a body of active permanent data which is effec–

tive until a specified expiration date, and a set of data revisions for the next period of effectivity. The effectivity dates for both sets of data are displayed for reference on the system's configuration identification page (IDENT). One of the two sets of data is selected as the active navigation data base when the system is powered up to enable the navigation and guidance functions. Data base updates must be accomplished at intervals of 28 days. Navigation data bases are usually tailored to each airline's requirements.

The navigation data base contains all current information required for operation in a specified geographic area. It can include data for:

- VOR, DME, VORTAC, and TACAN Navigation Aids
- Waypoints
- Airports and Runways
- Standard Instrument Departures (SIDs)
- Standard Terminal Arrival Routes (STARs)
- Enroute Airways
- Charted Holding Patterns
- Approach Procedures
- Approach and Departure Transitions
- Procedure Specified Navaids
- Company Route Structures
- Instrument Landing Systems (ILSs)
- Terminal Gates
- Missed Approaches
- Procedure Turns
- Procedure Holds (automatically terminated holding patterns)

The data base is capable of supplying on request all of the information required for the assembly of a complete flight plan for the selected route.

In addition to the content of the permanent data base, the system will accept crew-entered data for up to 40 additional navigation aids, 40 temporary waypoints, and 6 temporary airports in a temporary navigation data base. These crew entries will be retained in the FMC's temporary data base until flight completion.

A supplemental navigation data base consisting of 20 waypoints, 40 NAVAIDS, and 6 airports can also be entered by the crew. These entries are shared with the allotted entries in the temporary navigation data base with the exception that 20 of the 40 waypoints are for exclusive use by the temporary navigation data base. To gain access to the supplemental navigation data base, a four-character code (SUPP) is entered into the scratch pad prior to selection of the NAV DATA> prompt on the INIT/REF INDEX page. Before the FMCS can make use of the supplemental navigation data base, an effectivity date when it becomes valid must be entered. This effectivity data is also displayed on the IDENT page. The supplemental data base is retained until individual identifiers are deleted or until it is deleted in its entirety using prompts. Navigation data base updating does not delete supplemental entries.

Navigation data stored in the navigation data base is rounded off as shown in Table 4–1.

DATA ITEM	NEAREST INCREMENT
Airport lat/long	1/10 minute
ILS lat/long	second*
Navaid lat/long	second*
Runway lat/long	second*
Waypoint lat/long	second*
Airport Speed Limit Alt	100 feet
STAR/APP Transition Level	100 feet
SID/STAR/APP Alt Restrictions	100 feet
SID/STAR/APP Heading/Course/Radius	1 degree
SID/STAR/APP Waypoint Distance	1/10 nautical mile
Company Route Cruise Alt	100 feet
Hold Pattern Inbound Course	1 degree
Localizer Bearing	1 degree
Navaid Elevation	20 feet
Runway Bearing	1 degree
Runway Length	50 feet
SID Transition Alt	100 feet

* ILS, Navaid, Runway, and Waypoint lat/long are displayed on the CDU to the nearest 1/10 minute even though they are stored to the nearest second in the Nav Data Base

Table 4–1 NDB Data Baseline Measurements

DETERMINING OPTIMAL NAVIGATION CONFIGURATION

The FMCS selects the navigation sensors that provides the best solution for aircraft present position. This selection depends upon the availability and validity of outputs from the aircraft's primary navigation sensors. The selection process is completely automatic and controlled solely by the FMC. The basic sensor inputs required for the optimal data-mixing process are:

- Slant range measurements from DME interrogators (standard, frequency agile, or frequency scanning).
- Bearing data from either of the two VOR receivers.
- Baro-corrected and uncorrected pressure altitude and true air-speed from either one of the ADCs.
- Latitude, longitude, inertial altitude, inertial vertical speed, true heading, magnetic heading, and groundspeed components from either of the IRSs.

- Latitude, longitude from an optional GPS interface, from a stand-alone GPS or from a GPIRU.
- Hybrid latitude, longitude from a GPIRU (pre-mixed GPS and IRS).

DME or VOR validity is determined by station geometry in relation to the computed present position and the reasonableness of the actual data received from the tuned navaids.

The FMC selects and uses all valid available sensors for aircraft state calculations, correcting the IRS data based on the following:

- GPS
- Multi-DME
- DME/VOR (co-located)
- LOC/DME (aligned with runway)
- LOC

POSITION DETERMINATION

The navigation processing consists of computations for both horizontal and vertical positions of the aircraft. The vertical navigation process computes values of altitude and flight path angle (FPA) using data from the IRS and the air data computers. While on the ground, FPA is assumed to be zero. The more involved process of horizontal navigation primarily consists of a filtering process using GPS, DME and VOR navigation data to correct the IRS position computations. The pilot can manually update the FMC to one of the FMC, GPS, or radio positions through selections on the POS SHIFT page as appropriate.

GPS data will be used first to update the aircraft state estimates based on certification level, flight phase, and pilot selection.

For a dual FMC installation, the guidance position and velocity calculations are also based on the setting of the source select switch. In the NORMAL position the guidance position and velocity are a combination of each FMC's navigation position and velocity weighted by the corresponding navigation uncertainties. When the source select switch is set on BOTH ON L the left FMC's aircraft state estimate is used for guidance. Conversely, when the switch is set on BOTH ON R the right FMC's state is used for guidance.

RADIO MANAGEMENT

When the AUTO mode of VOR/DME tuning is selected, the FMCS is responsible for the selection and tuning of navigation aids that can be successfully used to provide navigation solutions when combined with data from the IRS.

The best navigation aids are broadly defined to be the 10 navigation aids closest to the aircraft's computed present position. In order to qualify as candidates for the best navigation aid list, these facilities must be within a range which is suitable for its class of operation and the present altitude of the airplane. This is done in each FMC in a dual configuration.

From the best navigation aid list, the FMCS determines the best navigation aid pair as a function of the line-of-position (LOP) crossing angle and the distance to the station and the horizon. The crossing angle of the LOPs must lie between 30 degrees and 150 degrees. The best navaid pair is defined as the combination which produces a crossing angle closest to the ideal value of 90 degrees. Re-selection of the best navaid pair will be performed every five seconds. This operation and tuning are also done in each FMC but only the primary FMC's selected navaids are used for tuning.

If one of the two DME interrogators has been switched to MAN mode, the FMCS will attempt to use the manually tuned DME station and to find a complementary DME station that provides an acceptable LOP crossing angle. When this is not possible, the DME interrogator in the AUTO mode may be operated by the FMCS in a frequency-agile submode (if agility DME is installed) in order to preserve the primary dual-DME navigation solution. When this occurs, the single AUTO mode DME interrogator will be tuned alternately to each of two DME stations, selected by the FMCS as the best pair, at intervals of 5 seconds; otherwise, the FMCS may operate in a VOR/DME mode.

GPS NAVIGATION

The use of GPS data for navigation depends on the certification level, flight phase, and pilot inhibits. The certification determines the following GPS ratings: primary, supplemental, and advisory.

As primary, the GPS data may be used in all flight modes and on the ground unless inhibited by the pilot. If inhibited, the use of GPS data may be re-enabled and is also reset at the end of the flight.

With the supplemental rating, GPS data may be used if it is checked against other sole means certified navigation data sources. VHF is the sole means method while enroute domestic and in terminal areas; IRS is the sole means for oceanic. If VHF radio data is unavailable in terminal, approach, or enroute flight, GPS updating is allowed without affecting actual navigation performance. Otherwise the VHF data is used as a check of the GPS data. In an oceanic navigation flight environment IRS data is used for the check. This GPS use is also dependent on pilot inhibit selections.

When GPS is set for advisory only, GPS data is only displayed for pilot information.

FMCS FLIGHT PLANNING

An entire flight can be preplanned well before pushback from the gate, and, excepting the takeoff and final approach to landing phases, can be automatically flown by the FMCS as it sends its commands to the AFDS and autothrottle. A complete lateral flight plan may be selected out of the FMC's navigation data base. The lateral routing may also be modified manually with assistance from the FMCS's data base search capability. The FMCS accepts route entry and revisions via CDU keyboard entry in a format compatible with air traffic control clearance language.

The vertical portion of the route can be automatically preplanned by the FMCS using speed and altitude targets optimized for flight economy. As with the lateral plan, the crew can easily modify the FMCS's default values to tailor the vertical segment schedules to the requirements of each day's flight.

NAVIGATION DATA BASE SELECTION

Upon its initial power-up, the FMCS displays the system configuration display: the IDENT page. This page is used to confirm that the particular FMC installed in the aircraft has the correct aircraft and engine configuration performance data in its memory. The crew can also confirm the applicability of the navigation data base loaded into the FMC and its effectivity date. Upon power-up, the FMC compares the navigation

data base effectivity date with the date from the GMT clock system. If the navigation data base is not effective for the date received, the message NAV DATA OUT OF DATE is displayed in the scratch pad. If the data base indicated as being ACTIVE is not suitable for the upcoming flight, the current updated navigation data base must be selected.

IRS INITIALIZATION

The aircraft's Inertial Reference System's latitude and longitude may be initialized from the FMCS CDU. If an IRS is in the ATT mode, the primary FMC can be used to initialize the IRS heading. A SET IRS POS is entered in any of four ways:

- Selecting the stored LAST POS retained in the FMCS from the previous power on/off cycle.
- Entering the ICAO identifier for an airport whose position is contained in the navigation data base.
- Entering the gate identifier for the airport entered above, provided that gate position is contained in the navigation data base.

- Directly entering the desired latitude and longitude.

GMT OR LOCAL TIME SELECTION

The FMCS receives and displays Greenwich Mean Time (GMT) data and date information from the aircraft clock system. The FMCS also estimates times at each of the planned route horizontal and vertical waypoints and at the destination. The aircraft clock input to the FMCS may be GMT or local time, depending on which you use to set the aircraft clock. To ensure that the FMCS has GMT time, the GMT hours can be entered when the clock input in use is set to a local non-GMT time zone.

FLIGHT PLAN DEFINITION

The intended route can be selected well in advance of the actual takeoff. For those carriers who have fixed flight plans, these routes can be stored in the FMC navigation data base and selected by entering a Company Route number into the CDU. This calls a complete set of route parameters from the data base. In an ideal situation, the crew makes no further entries. However, changes might be necessary. Consequently, the FMCS will also accept manual entries, which modify any number of route parameters. Similarly, the crew may construct entirely new routes from data stored in the navigation data base. This data is generally the same navigation data available on aeronautical charts.

Lateral Plan Construction

The crew can create a string of horizontal navigation waypoints that will make up the planned route in either of two ways:

- Entering a Company Route identifier.
- Manually entering each individual waypoint or airway segment.

Airlines can define specific company routings to be included in the navigation data base compiled for their areas of operation. Selection of a specific route is accomplished by entering a Company Route (CO ROUTE) identifier on page 1 of the Route (RTE) displays. Provided gross weight has already been entered on the PERF INIT page, the FMCS will call the company's route data from the navigation data base and construct a complete horizontal and vertical flight plan. The vertical plan information defaults to Economy mode if other modes are not defined among the CO ROUTE data. It is then possible to modify this CO ROUTE plan, if required, by manual entries on either the RTE or Route Legs (RTE LEGS) page displays. Sometimes a CO ROUTE will not provide enough information for a complete flight; an example of this is when the specifics of the destination arrival are not included so that you may tailor the plan to that day's conditions. FMCS functions, such as those available through the Departures/Arrivals (DEP/ARR) key, assist you in making these finishing touches to the flight plan.

If an unnamed intersection of two airways is desired as a waypoint, it can be entered into the flight plan using a place bearing/place bearing entry to define the intersection; for example, ATL011/CHA087.

The minimum plan to which the automatic flight controls can be engaged consists of an origin, a destination, and a waypoint which defines the route.

As each route waypoint is entered, the FMCS searches its navigation data base to extract the necessary data. If a waypoint or airway is in the data base, the system checks to see that the route being strung together is made up of compatible entries. If a discontinuous set of route waypoints and interconnecting segments is entered, you should refer to aeronautical charts for an alternative and clear the discontinuity. For an explanation of data entry into the FMCS, refer to PART 2, NORMAL OPERATION.

A lateral offset path may be constructed by entering a right or left offset distance (up to 99.9 nm), with optional starting waypoint, and end waypoint on the LATERAL OFFSET page.

Vertical Plan Construction

Vertical plan information can be preplanned within the stored Company Routes in the navigation data base. It is then called from storage, along with the lateral plan, when a CO ROUTE is selected. The FMCS will also provide a set of vertical plan defaults whenever a lateral plan is generated. This default is to the Economy mode for each of the flight phases, with consideration of airport speed/alt restrictions (such as the 250-kt limit below 10,000 feet in the U.S.). The RTE LEGS displays indicated the speed and altitude planned or predicted at each waypoint of the route. Restrictions or crew entries of speed and/or altitude constraints are shown in boldface characters on the displays, while FMCS default predictions are shown in the smaller block characters. Altitudes or Flight Levels followed by an “A” are “at or above” targets, a “B” indicates an “at or below” target, and no letter suffix means the altitude is an “at” target to be met. Two altitude values indicate an altitude “window” or block crossing restriction for that waypoint.

FLIGHT PLAN MODIFICATION

Until the planned route is activated and executed, it is simply that: a planned route. When the system has an active route, the displays associated with that route have an ACT prompt in the title line of the page. No two performance phases can be active at any one time.

Modifications to any route plan can be made at any time with the FMCS. If the changes made are to an active route, the ACT will be changed to MOD. The MOD prompt goes away if the modifications are erased or activated, and ACT reappears on the display title line. Lateral or vertical modifications can be inserted from the scratch pad into the RTE LEGS pages. Crews can also initiate step climbs or descents, or speed schedule changes directly on the performance displays (CLB, CRZ, DES); these will create a MOD condition until executed.

ALT NAV MCDU FLIGHT PLANNING

ALT NAV FLIGHT PLAN DEFINITION

The ALT NAV flight plan is an abbreviated version of the FMC flight plan. It may only contain those contiguous waypoints defined by great circle legs (maximum of 60 waypoints) from the lateral path. The crew must also keep in mind that the ALT NAV function does not account for wind data.

Waypoint identifier names, latitude data, and longitude data formats use the same convention as for the FMC flight plan.

ALT NAV LATERAL PLAN CONSTRUCTION

The crew may construct the ALT NAV flight plan using ether of two methods; manual entry or crossloading.

An entire lateral flight plan may be loaded manually into the ALT NAV MCDU using the ALT NAV WPT DATA and ALT NAV LEGS pages. Standard waypoint identifiers and corresponding latitude and longitude data is entered in the ALT NAV WPT DATA pages. The route is entered on the ALT NAV LEGS page. As each entry is made, the ALT NAV MCDU verifies that the entry is valid.

The FMC flight plan must be active before it can be crossloaded to the ALT NAV MCDU. Once active, the crew may crossload by selecting the ALT NAV prompt on the MENU page. When the ALT NAV LEGS page is displayed, select the CROSSLOAD prompt. After the crossload is complete, the execute light will illuminate. Executing the ALT NAV flight plan will then cause all projected values to be displayed and the ALT NAV flight plan to be activated.

The waypoints must be defined by a fixed geographical position. Examples are:

- Locations of enroute navaids along established airways.

- Defined intersection points of enroute airways.
- Manditory reporting points at the transition boundaries between flight information regions.
- Locations of named fixed points such as:
  - Airports
  - Runway threshold points
  - Airport navaid stations
  - Fixed named waypoints.
- Procedure–generated waypoints defined by a course from a fix to a distance from the fix, or a DME distance.
- Crew–entered waypoints defined by latitude and longitude.

ALT NAV PLAN MODIFICATION

Modifcations to the ALT NAV flight plan may also be made if necessary. Modifications are performed in the same fashion as for the FMC flight plan. Once the complete route is entered and activated, the FMC will update the ALT NAV flight plan as each waypoint in the FMC flight plan is sequenced.

NOTE: Modifications may only be entered on the ALT NAV LEGS and ALT NAV WPT DATA pages. The ALT NAV PROGRESS page is for information display only (just as is the FMC RTE PROGRESS page).

The ALT NAV MCDU is now ready to provide lateral guidance to the ESAI if an unexpected FMC failure occurs.

FMCS GUIDANCE

The FMCS incorporates flight path guidance and steering functions which work in unison to provide output commands to the aircraft's autopilot, flight director, and autothrottle systems. These commands enable automatic flight path control and performance optimization.

WAYPOINT DEFINITION

The primary structure of a flight-planned route consists of a sequence of waypoints joined by a series of navigation legs or route segments. A waypoint is completely defined in terms of its latitude, longitude, and altitude, but in some cases these parameters may be affected by other operational variables. The FMCS implementation recognizes two distinct types of waypoints:

- Fixed Waypoints, which are the most common and are defined by a fixed geographic position. Examples of fixed waypoints are:
  - Locations of navigation aids, which define established airways.
  - Defined intersections of enroute airways.
  - Locations of airports, runway thresholds, navaids, and other named waypoints.
  - Pilot-entered waypoints are defined by one of the following:
    - Latitude and longitude.
    - Bearings from two named waypoints.
    - Bearing and distance from a named waypoint.
    - Along track offsets.

- Floating Waypoints, whose positions are dependent upon the aircraft's operating state and external variables such as wind. Examples of floating waypoints are:
  - The point at which a constant-heading leg intercepts a VOR radial.
  - The point at which a constant-heading leg intercepts a DME arc.
  - The point at which a climb profile flown on a constant heading or course passes through a specified altitude.
  - The point at which a constant-heading leg intercepts a course to the next fixed waypoint.
  - The point at which a constant-heading or course leg is manually terminated by the crew (usually part of a procedure representing ATC vectoring).

For information on how waypoint identifiers are named for storage in the Navigation Data Base, see Appendix A — WAYPOINT NAMING.

Waypoints not in the Nav Data Base can be created on the REF NAV DATA, SUPP NAV DATA, RTE, and RTE LEGS pages.

The lateral flight plan is determined by fixed and floating waypoints and is computed by lateral guidance processes. The active TO waypoint which is highlighted on the RTE LEGS and PROGRESS pages may be a fixed or floating waypoint. Floating waypoint identifiers are enclosed in parentheses.

In addition to the two types of waypoints previously discussed, the system takes into account in its profile predictions the existence of points of importance to the vertical performance calculations. These points are like the floating waypoints since they occupy positions dependent upon aircraft operating state and external variables such as wind. These points do not appear on any of the RTE or RTE LEGS displays. They only influence the system by their “presence” being accounted for in time and distance predictions. Examples of these points are:

- Speed change — the point at which acceleration or deceleration to a new speed command or restriction begins.
- Transition altitude — The point at which QNE is used for altitude reference, rather than origin QNH. The term transition altitude level is used during the climb phase.
- Transition level — the point at which destination QNH is used for altitude reference, rather than QNE. The term transition level is used during the descent phase.
- Crossover altitude — the point at which the controlling target speed switches from CAS to Mach in climb and from Mach to CAS in descent.
- Intercept descent path — the point at which the projected early descent path intercepts the normal descent path.
- Top of climb (T/C) — the projected point where climb operation transitions to cruise.
- End of descent (E/D) — either the last waypoint with an “at ” altitude restriction in the flight plan route, or a point 1,000 feet

above the destination airport runway if no waypoint is specified for termination of the descent.

- Top of descent (T/D) — the projected point where cruise operation transitions to descent. This applies to intermediate level-offs due to flight plan constraints.

INITIAL PATH CAPTURE

An initial path capture maneuver may be required when the FMCS becomes coupled to the AFDS (MCP LNAV is engaged) or when the FMCS is already coupled and the FMCS executed flight plan is changed.

When the FMCS is not presently coupled to the AFDS (LNAV is off), and a valid flight plan exists, path capture criteria are continually tested.

When the FMCS is already coupled to the AFDS (LNAV is on) and the FMCS flight plan is changed, path capture criteria are tested with respect to the new flight plan. If LNAV is out of limits, the FMCS will disengage itself from the AFDS and periodic testing will begin as described above.

The path capture criteria are as follows:

- If the present aircraft track crosses the leg to be captured at an intercept angle of greater than 8 degrees or less than 90 degrees, the track will be maintained until the leg is captured by the lateral steering function. If, however, the predicted intercept point is so close to the leg's termination waypoint that a path cannot be calculated, a new path will be calculated direct to the waypoint (instead of maintaining present track). If the direct path does not allow calculation of an acceptable path, then path capture will be turned over to the normal steering function to steer to the flight plan path.

- If the present aircraft track does not cross the leg to be captured or its backward extension, or crosses at an intercept greater than 30 degrees, but the aircraft is within 3 nautical miles of the desired leg, then the path capture will be turned over to the normal steering function to steer to the flight plan path.

- If the intercept is less than or equal to 8 degrees outside 3 nm, or less than or equal to 30 degrees inside 3 nm crosstrack, then lower initial steering gains will be used.

If none of the above criteria is satisfied and an attempt to use the INTC function is made, the advisory message "NOT ON INTERCEPT HEADING" will be displayed on the CDU and no MCP engagement of the FMCS flight plan will be permitted until a corrective change has been introduced.

During climb, cruise, and speed mode descent operation, VNAV may be engaged, provided the airplane is not in violation of a flight plan altitude constraint and MCP altitude is set in the appropriate direction. VNAV will not control the airplane in a direction away from MCP altitude.

For path descent operation, the maximum descent flight path angle for predicting interception of the vertical reference path is 7 degrees for aircraft operation above the airport speed restriction altitude plus 1,000 feet and 6 degrees below this altitude. If the predicted late descent path with these limitations does not intercept the vertical reference path without violating an altitude constraint, a DES PATH UNACHIEVABLE message is displayed on the CDU. Longitudinal steering also is constrained by these limits when vertical speed command to the AFDS is being generated.

The vertical speed steering commands at path capture or at the vertical flight path transitions are acceleration-limited so as to produce a normal acceleration of not more than 0.1g.

For U10.3 and later, the FMS will remain in PATH DES Mode as long as the cross–track error is less than twice the RNP value with LNAV disengaged, or the active leg has a vertical angle. In this case, the FMS will switch to VNAV SPEED Mode.

HEADING GUIDANCE

Most navigational legs are defined in terms of great circle tracks, either between the aircraft's computed present position and a waypoint. There are, however, some flight plan procedures which require constant-heading legs to be flown. Such procedures are most often found in terminal-area operations. When such legs exist in a flight plan, the constant heading to be flown is distinguished by a suffix appended to the displayed value; for example, 203° HDG.

WAYPOINT TRANSITIONS, LEG SWITCHING, AND PATH CAPTURE CRITERIA

In defining the guidance maneuver requirements for leg-to-leg transitions at waypoints, the lateral guidance recognizes two basic types of transitions:

- Fly-over (FO) transitions, which require the aircraft to pass directly over the waypoint's geographic position (Ref Figure 4–14).
- Non-fly-over (NFO) transitions, in which the aircraft is not required to pass over the waypoint position (Ref Figure 4–15).

Maneuvering requirements are also dictated by the magnitude of the course change involved in the transition. The geometry of the transition turn is illustrated in the following figures showing the maneuvers required for both fly-over and non-fly-over transitions. Fly-over transitions occur only in terminal area procedures (SIDS/ STARS), not during the enroute phase of flight. Note that the turning maneuver required for a transition involving a course change of 135 degrees or less differs considerably from that required for a course change greater than 135 degrees.

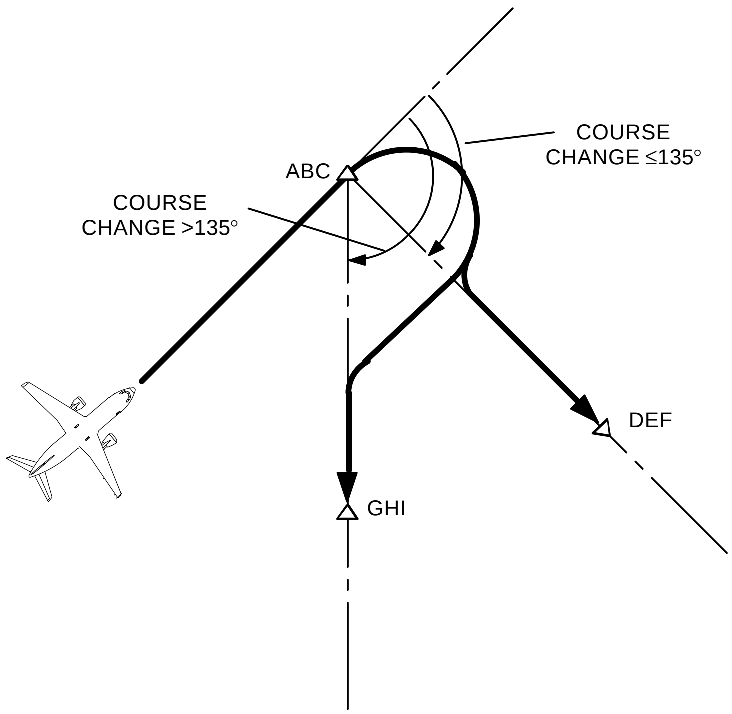


Figure 4–14 Waypoint Transition Turn Geometry Fly-Over (FO)

Transition switching point criteria are determined by the FMCS for NFO transitions to provide a roll lead-in point on the inbound leg to the waypoint. This produces a smooth, coordinated turn that intercepts the outbound leg without overshoot. In those cases that involve large course changes (greater than 135 degrees), the subsequent path capture maneuver required to complete this path or any of the FO transition paths is subject to a 45-degree path-intercept limitation.

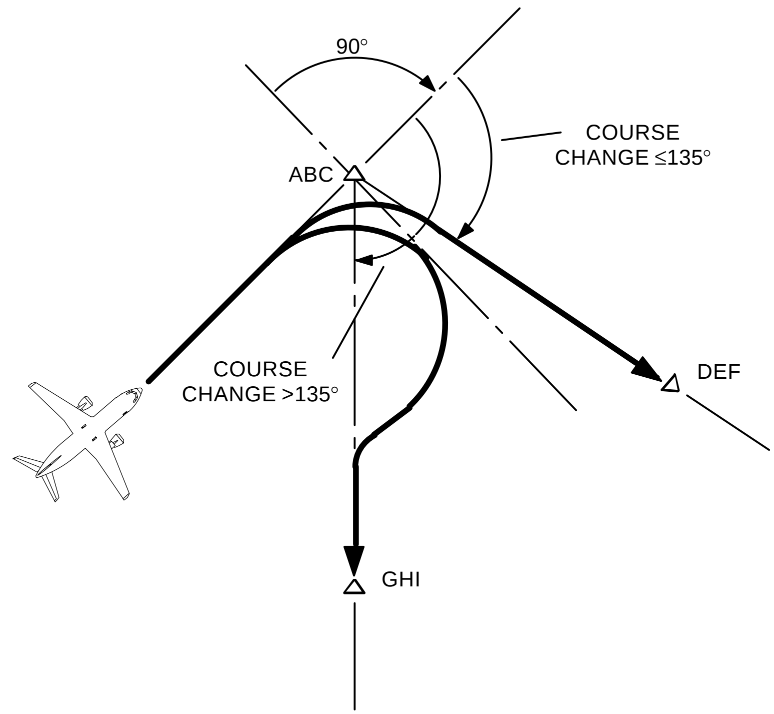


Figure 4–15 Waypoint Transition Turn Geometry Non-Fly-Over (NFO)

VERTICAL PROFILE DISENGAGEMENT (U10.3)

If a PATH Descent is being flown, VNAV will not be available in the following circumstances:

- When the Glide Slope Intercept waypoint is reached, ILS Glide Slope is armed, and the intercept waypoint is not a hold entry fix.
- When the active leg has a vertical slope, the Cross–Track Error is twice RNP, and LNAV is not engaged.

If a SPEED Descent is being flown, VNAV guidance will continue until the End–of–Descent altitude.

HOLDING PATTERNS

As an airline option, the FMCS navigation data base may contain definition data for all of the published enroute holding patterns in the geographic area covered by the data base. Published holding procedures may be selected and incorporated directly into the active flight plan for automatic holding entry when the aircraft reaches the designated holding fix. In addition, the system includes provisions which allow you to construct impromptu holding patterns at any selected waypoint in the flight plan, or at the aircraft's present geographic position (PPOS).

The parameters that determine the FMCS's definition of a holding pattern are illustrated in Figure 4–16. The fundamental variables are:

- Holding fix position
- Inbound holding course
- Holding turn direction
- Pattern leg length

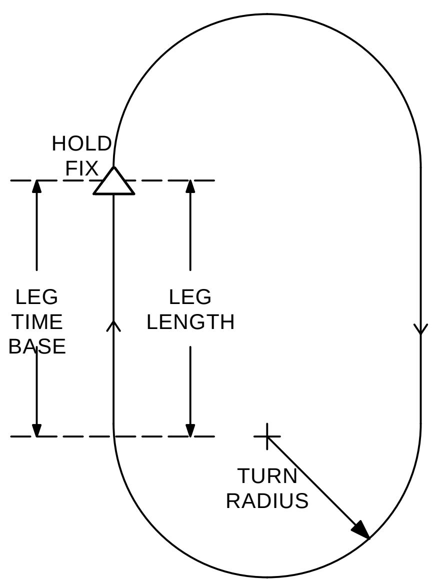


Figure 4–16 Holding Pattern Definition

The holding fix position may be any fixed waypoint or the aircraft's present position at the time of engagement of the holding mode. The inbound course turn direction and leg length in the holding pattern will be obtained from the navigation data base if there is a published pattern for the designated holding fix. If the pattern is not found in the data base, the FMCS will assume that right-hand turns are to be used and will establish a default value for leg length.

Normally the leg time is expressed in terms of the time in minutes required to fly the inbound leg. The altitude of the aircraft determines the leg length time that will be set.

Alternatively, leg length may be expressed as a distance in nautical miles; this form is defined as the distance between the point at which the aircraft rolls out on the inbound leg and the holding fix, as shown in Figure 4–17 . These variables can also be entered manually to alter the preplanned default pattern.

For U10.0 through U10.3 – the leg time is set at 1.5 minutes above 14,000 feet, and 1 minute at or below 14,000 feet. Once the hold is planned or activated, altitude changes and leg times must be manually entered.

For U10.4 and later the leg time threshold is 14,200 feet. Climbing or decending through this altitude will automatically result in an updated leg time until the hold waypoint is the go–to waypoint.

NOTE: The leg length will not be automatically updated if the leg time or leg length was manually entered on the HOLD page.

Constant radius turns and a best holding or pilot-entered speed schedule determined by the FMCS are used in flying the holding pattern. The offset distance (turn radius) on the holding side of the pattern is determined by the maximum speed in the turns at each end of the pattern, taking wind into account, and by the maximum bank angle used to construct the path (25 degrees). Additionally, the offset distance is further limited to internally stored values of ATC holding pattern limits.

Entry into the holding pattern is automatically controlled by the FMCS, and the entry procedure is dependent upon the aircraft's initial inbound course to the holding fix. The system's preprogrammed guidance routines for the entry are based upon the FAA's 70-degree sector decision criteria, as shown in Figure 4–17.

Exiting the hold may be accomplished by one of several methods. The normal method is to select the EXIT HOLD prompt on the active RTE HOLD page and pressing EXECute. Another method is to select a down track waypoint and perform a Direct–To function. In ether case, the aircraft will fly the remainder of the hold pattern to the hold fix waypoint, then continue flying the active route.

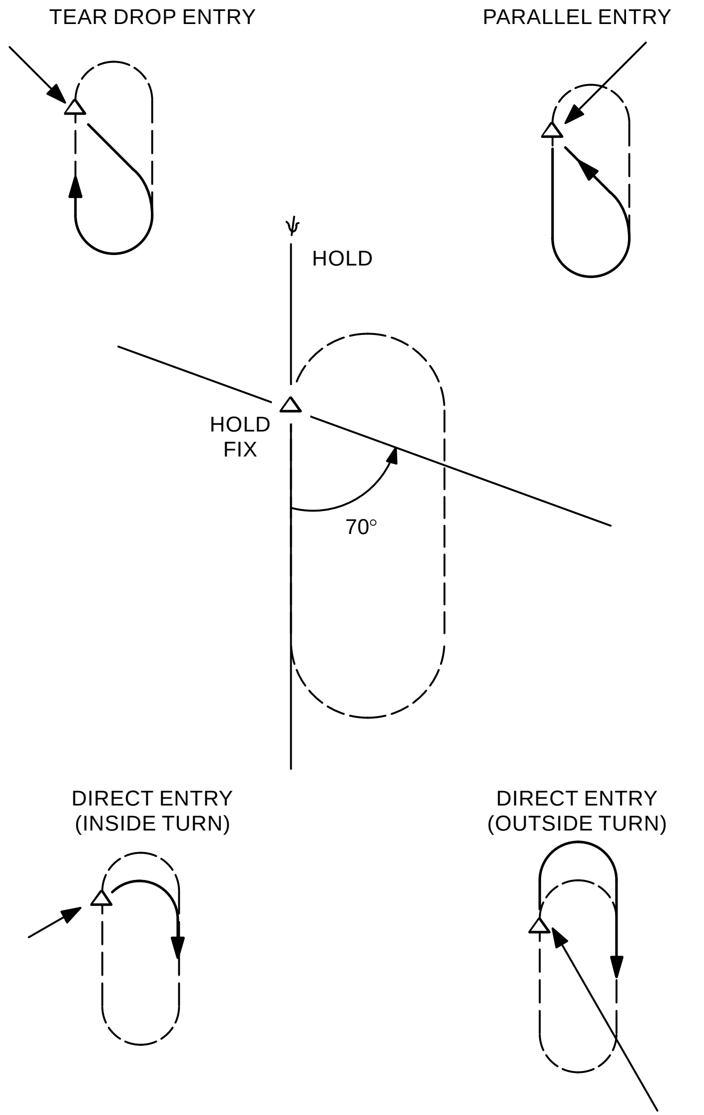


Figure 4–17 Holding Pattern Entry Procedures

The active hold may be MODified while flying the hold. Leg time, leg direction, leg length, and turn direction may be edited at any time.

For U10.0 thru U10.3, the new hold is displayed along with the current hold. The current hold is exited as soon as the hold fix waypoint is the current waypoint. The path to the new hold is flown (RTE HOLD page is not yet active), and the new hold entered. The

RTE HOLD page becomes active and the EXIT HOLD prompt is displayed.

For U10.4 and later, the new hold is displayed along with the current hold, and the EXIT HOLD prompt remains displayed.

- If no action is taken, the current hold is exited and the new hold becomes active when the hold fix waypoint becomes the active waypoint.
- If the EXIT HOLD prompt is selected prior to entering the new hold, the new hold is deleted, the originl hold is displayed and will be flown. Pressing the EXIT HOLD select function again will arm the hold exit, terminating the original hold and proceed to flying the active flight plan course.

DIRECT-TO FUNCTIONS

The active flight plan may be modified at any time by entry of a direct-to command to divert the aircraft directly to a waypoint. The direct-to waypoint need not be one of the waypoints in the current active flight plan; entry of the new direct-to waypoint will create a discontinuity in the current flight plan. It is then necessary to redefine the remainder of the flight to the selected destination, If, however, the direct-to waypoint is one of the future waypoints in the currently active route, the FMCS will reassign this waypoint as the active TO waypoint and eliminate all of the intervening waypoints in the plan.

A direct-to is also accomplished by entering the desired waypoint into the top line (LSK 1L) of the RTE LEGS page. It then becomes the active waypoint and the FMCS computes a course from the aircraft's present position directly to that waypoint.

APPROACH INTERCEPT CRITERIA

Although other possibilities exist, FMCS flight plans will most commonly terminate with transitions to ILS instrument approach procedures. Considerations for non-ILS approaches are discussed below. Assuring the capture of the ILS localizer assumes a high degree of importance in the definition of the last few waypoints in the flight plan. The first waypoint of the approach transition may be the last waypoint in a Standard Terminal Arrival, and is frequently designated as the Initial Approach Fix (IAF). A typical lateral approach scenario is illustrated in the following figure. The bulk of the final approach tasks are handled by the autopilot and autothrottle, guided by the ILS localizer and glideslope signals. The FMCS will position the aircraft so as to best capture the ILS.

In Figure 4–18, the aircraft departs the IAF on a course for waypoint D064M. The illustrated procedure defines a 223-degree heading leg from D064M to intercept the localizer course defined by the data base. If D064M and the heading leg to intercept were not part of the approach, but instead the 172-degree course were continued to intercept the localizer course at an 81-degree angle, the FMCS would establish a 40-degree intercept angle starting at the computed point for the turn to final approach to facilitate AFDS capture of the localizer. However, in the illustrated case, the dashed lines show the programmed turn at D064M to a 223-degree heading leg, and an FMCS-computed turn from the heading leg to intercept the localizer course, assuming approach is not armed. Given an ILS or localizer approach, the FMCS would maintain the 223-degree heading leg as shown, instead of turning to final approach course. This provides a 30-degree course cut for AFDS localizer capture. Assuming that localizer capture is accomplished, the autopilot disconnects LNAV and the aircraft turns inbound to the runway heading under the sole control of the ILS-coupled autopilot. A fixed waypoint GS-25R is generated by the FMCS (GS-xxx, where xxx is is the selected runway) at the predicted glide slope intercept point, where the center of the glide slope beam passes through glide slope intercept altitude.

A default speed restriction of 150 knots is assigned at this point. The LNAV guidance commands are discontinued at the last waypoint in the flight plan, VNAV when flaps extend beyond 15 degrees or at the GSxxx waypoint.

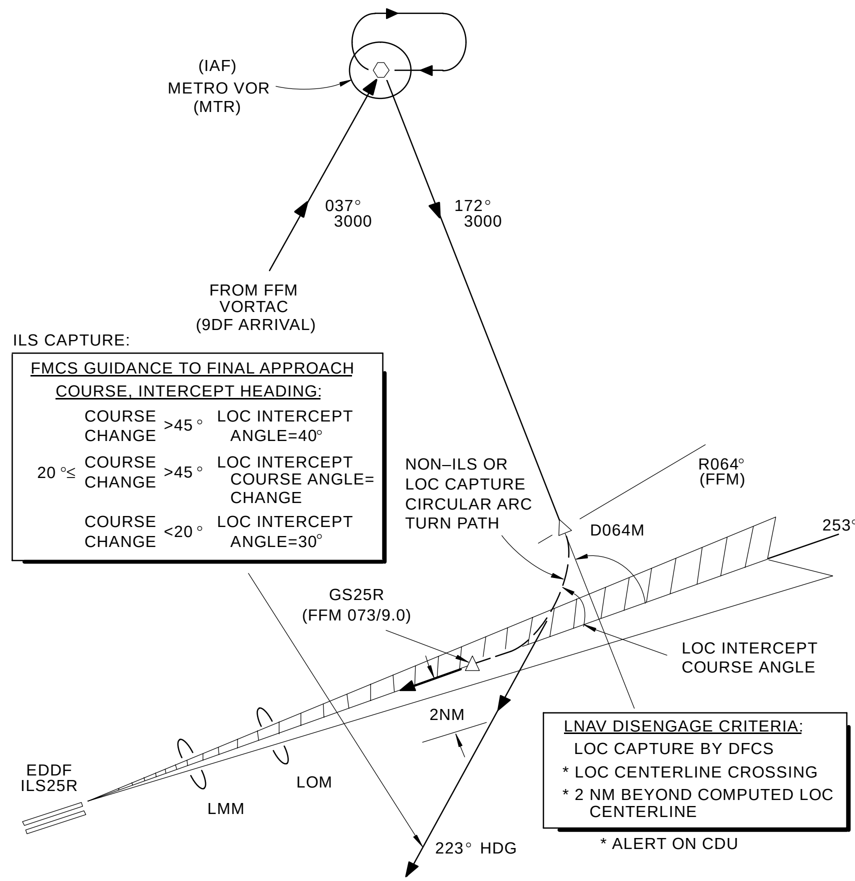


Figure 4–18 Typical FMCS Approach Transition
ILS or Localizer Procedure

If the localizer is not captured, the LNAV guidance routine will continue to steer the aircraft on the 223-degree intercept leg until missed capture is detected. Missed capture is detected by the occurrence of either of the following conditions before LOC ENGAGE is signalled by the autoplot:

- FMCS detects crossing of the localizer centerline.
- FMCS computes cross-track deviation of 2 nautical miles beyond the expected location of final approach course.

When missed capture is detected, the FMCS will set both VNAV and LNAV invalid and display a MISSED CAPTURE message on the CDU.

A variety of non-ILS approaches may also be provided in the FMCS navigation data base. These non-precision approaches may include VOR, RNAV, NDB, and Localizer Back-Course procedures, except those requiring a DME arc. A customer option is available that allows for approaches that include procedure turns or holding patterns. For non-ILS approaches such as these, the FMCS uses its normal lateral guidance procedures. Assuming it was not a precision approach, the FMCS would initiate the turn to the 223-degree heading leg at D064M shown in the illustration and then make the turn as shown by the dashed lines to the final approach course. Also, the FMCS will attempt to tune the procedure-recommended navaid for these types of non-precision approaches.

If a runway or approach has not been selected for the destination airport, a PATH descent is available to the last waypoint with an "at" altitude constraint beyond the top-of-descent (TD). If no such "at" waypoint exists to define the PATH descent profile, the PATH descent is not permitted, and the descent will be computed to a point 1000 feet above the Airport Reference Point (ARP) elevation in the SPEED descent mode. Automatic entry to the applicable descent will be enabled by dialing down the MCP altitude before the TD is reached. An early descent can be started by dialing down the MCP altitude, selecting the CAPTURE prompt on the applicable descent page, and executing. To manually select the SPEED descent mode, depress DES, select the SPEED prompt and EXEC, which will display the ECON SPD DES page. SPEED descents follow the displayed MACH/CAS schedules and the airport speed restrictions as well as any speed and/or altitude constraints assigned to the waypoints. SPEED descents end at an altitude 1000 feet above the ARP elevation or the last waypoint altitude constraint if lower.

If an instrument approach has not been selected but a runway at the destination airport has been, the FMCS will permit a runway extension waypoint to be defined at a selected distance (0.1 to 25.0 miles) before the runway threshold along runway heading. This final approach waypoint is identified on displays as RX-yyy, where yyy is the runway identifier (such as RX-34R).

MISSED APPROACHES

The guidance function includes the provision to execute missed approach procedures for approaches which include them in the navigation data base. Lateral and vertical guidance is provided throughout execution of the procedure. The FMCS will initiate missed approach procedure guidance automatically under the following conditions:

While in descent and any of the following occurs:

- Activation of the TO/GA switch.
- Go-Around Thrust Limit selected while in N_1 autothrottle mode and below the MCP altitude.
- Below MCP Altitude, Climbing (where climbing is determined by a vertical speed greater than zero), go-around thrust limit selected, and flaps retracting from 30–15 or 15–1.

When direct-to a waypoint in the missed approach (other than the missed approach point) is selected.

The FMCS will automatically delete any descent altitude constraints remaining in the approach and will replace the constraints with predicted altitudes. Note that predictions for missed approach waypoints will not be generated until the missed approach procedure is initiated.

When the missed approach procedure is initiated, the origin airport will be set to the destination airport. This allows the crew to select a SID while executing the missed approach (as in the case of a diversion due to weather minimums) to exit the terminal area. If a SID is selected, the current go-to waypoint in the missed approach will be retained, a discontinuity will be inserted, and the SID will follow.

Missed approach can also manually constructed by adding waypoints after the runway. Activation and operation are identical to the missed approach criteria defined above.

ALT NAV GUIDANCE

ALT NAV PATH COMPUTATIONS

The (lateral) ALT NAV flight plan lists the sequence of fixed waypoints to be used for computing a lateral path to fly. The TO waypoint is the current active waypoint and is listed first (and highlighted) on the ALT NAV pages. For each of the waypoints, the ALT NAV MCDU computes the lateral path profile to provide the following display data:

- True course to the TO waypoint.
- True course out of each down–path waypoint.
- Distance from the preceding waypoint.

- Estimated time of arrival to the next waypoint (providing ground speed is greater than 100 knots).

ALT NAV WPT TRANSITIONS, LEG SWITCHING, AND PATH CAPTURE

In defining the guidance maneuver requirements for leg–to–leg transitions at waypoints, the ALT NAV MCDU only recognizes non–fly–over (NFO) transitions. The ALT NAV MCDU handles these transitions the same fashion as the FMC, however, because the waypoint sequencing logic in the ALT NAV MCDU is much simpler, a waypoint may not be sequenced at the same time as the FMC. If this occurs, simply select the next desired waypoint in the ALT NAV flight plan to the go–to position and execute the modification.

DiIRECT–TO FUNCTION

The Direct–To function may be initiated in the ALT NAV flight plan at any time. The execution of a direct–to modification can be usedto divert the aircraft directly to a desired waypoint.

If the desired waypoint is not in the active flight plan, it will be inserted into the route.

If the desired waypoint is in the active flight plan, it will be moved to the go–to position, and any waypoints between the original go–to waypoint and the selected go–to waypoint will be deleted from the flight plan.

FMCS STEERING

In its normal, fully automatic mode of operation, the FMCS provides both lateral (roll) and longitudinal commands to the autopilot, from its initial engagement at the start of the climb profile to the point in the final approach at which ILS localizer and glideslope interception normally occurs. The system also provides corresponding thrust limits to the autothrottle system, thus ensuring that the aircraft follow the computed flight profile throughout the trip with minimal crew attention. The AFDS can be engaged to modes which control the aircraft. The LNAV mode, when engaged, controls the aircraft along the desired lateral track for the route; the VNAV mode follows the desired vertical profile. Alternatively, the profile may be flown without autopilot/flight director or autothrottle by using the FMCS CDU display and the lateral and vertical deviation displays provided by the FMCS on the HSIs as references. The cursors in the Mach/Airspeed indicators are driven to the FMCS target speed only when the VNAV mode is engaged.

TYPICAL FLIGHT PROFILE

Figures 4–19 through 4–24 illustrate the sequence of operations for a typical flight profile. The sequence is broken down into phases of the flight with representative illustrations of the FMCS CDU displays and FMA status. The flight profile is based on a 737–800 with U10.2A software and color display.

PRE-FLIGHT

Pre-flight is shown in Figure 4–19. During pre-flight, The system is powered-up, and initiates to the IDENT page. Pre-flight performance data, route, and departure information are loaded into the system. The TAKEOFF REF page is selected for review as the aircraft taxies into the departure position.

TAKEOFF

Takeoff is shown in Figure 4–20.

CLIMB

Climb is shown in Figure 4–21. The climb phase begins at liftoff and activates the CLB page. The crew can monitor the CLB and active RTE LEGS pages for advisory guidance data. The crew dials up the MCP altitude as their clearance from ATC permits. If the aircraft levels at some MCP altitude below the FMCS cruise altitude, climb is restarted by dialing up the MCP altitude and pressing VNAV on the MCP to reengage that AFDS mode.

CRUISE

Cruise is shown in Figure 4–22. During the cruise phase, the crew will find flight advisory information on the CRZ, active RTE LEGS, FIX INFO, and PROGRESS pages. Step-climb, or step-descent can be initiated by entry of a new cruise altitude. Information for the step is predicted for the new altitude.

DESCENT

Descent is shown in Figure 4–23. During the descent phase, the active RTE LEGS, ARRIVALS, and DES FORECASTS pages provide guidance advisory information. Guidance advisories for the active descent phase are displayed on the DES page. The example in Figure 4–23 shows a path descent. If the MCP altitude was dialed down prior to the top of descent, the path descent will begin automatically.

APPROACH, GO-AROUND, AND LANDING

Approach, go-around, and landing are shown in Figure 4–24. The APPROACH REF page provides advisory information during the approach phase. The crew selects and arms the required AFDS modes as the FMCS positions the aircraft to pick up the ILS. The AFDS and A/T perform most of the approach tasks.

PRE–FLIGHT

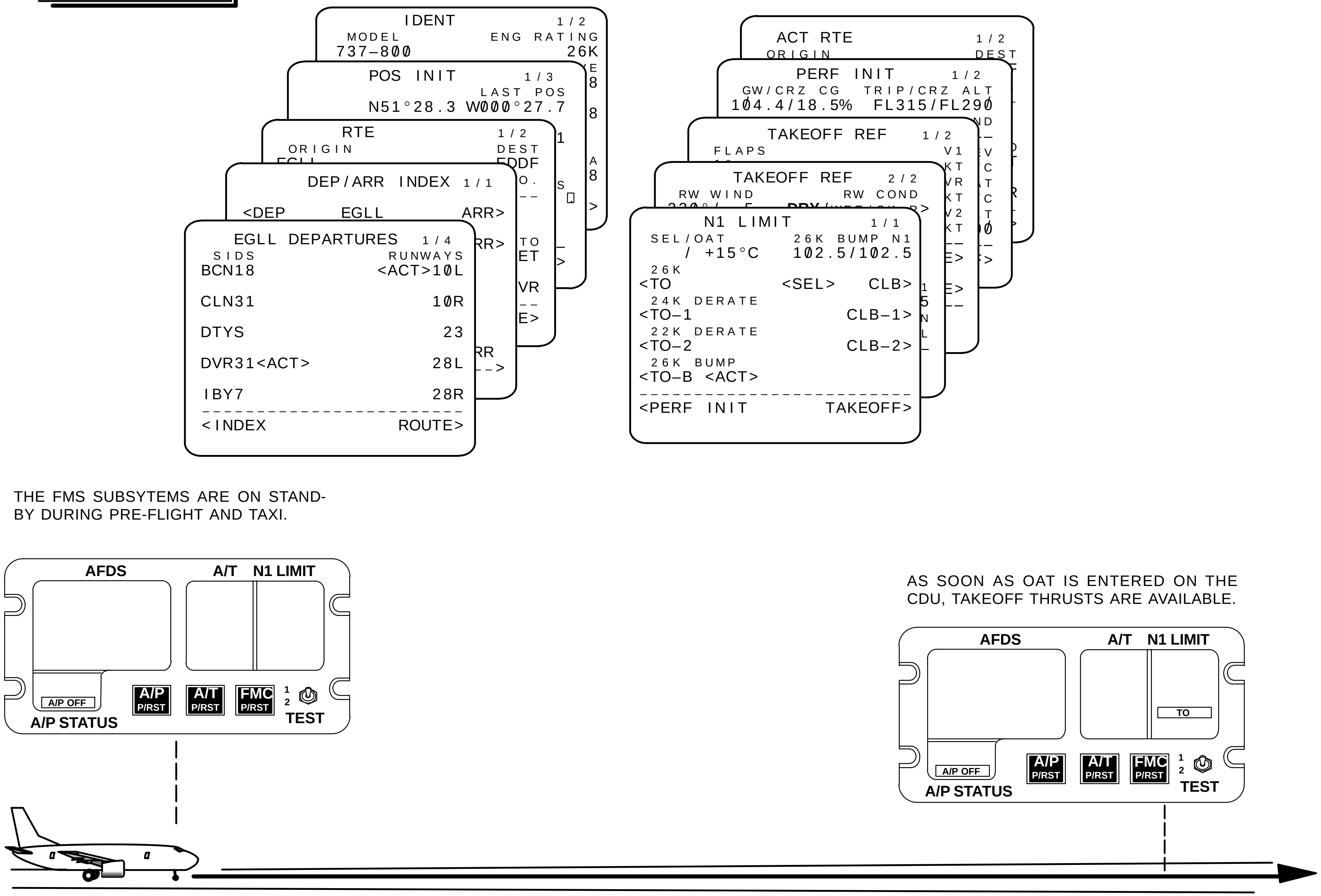


Figure 4–19 Typical Flight Profile – Pre-Flight

TAKEOFF

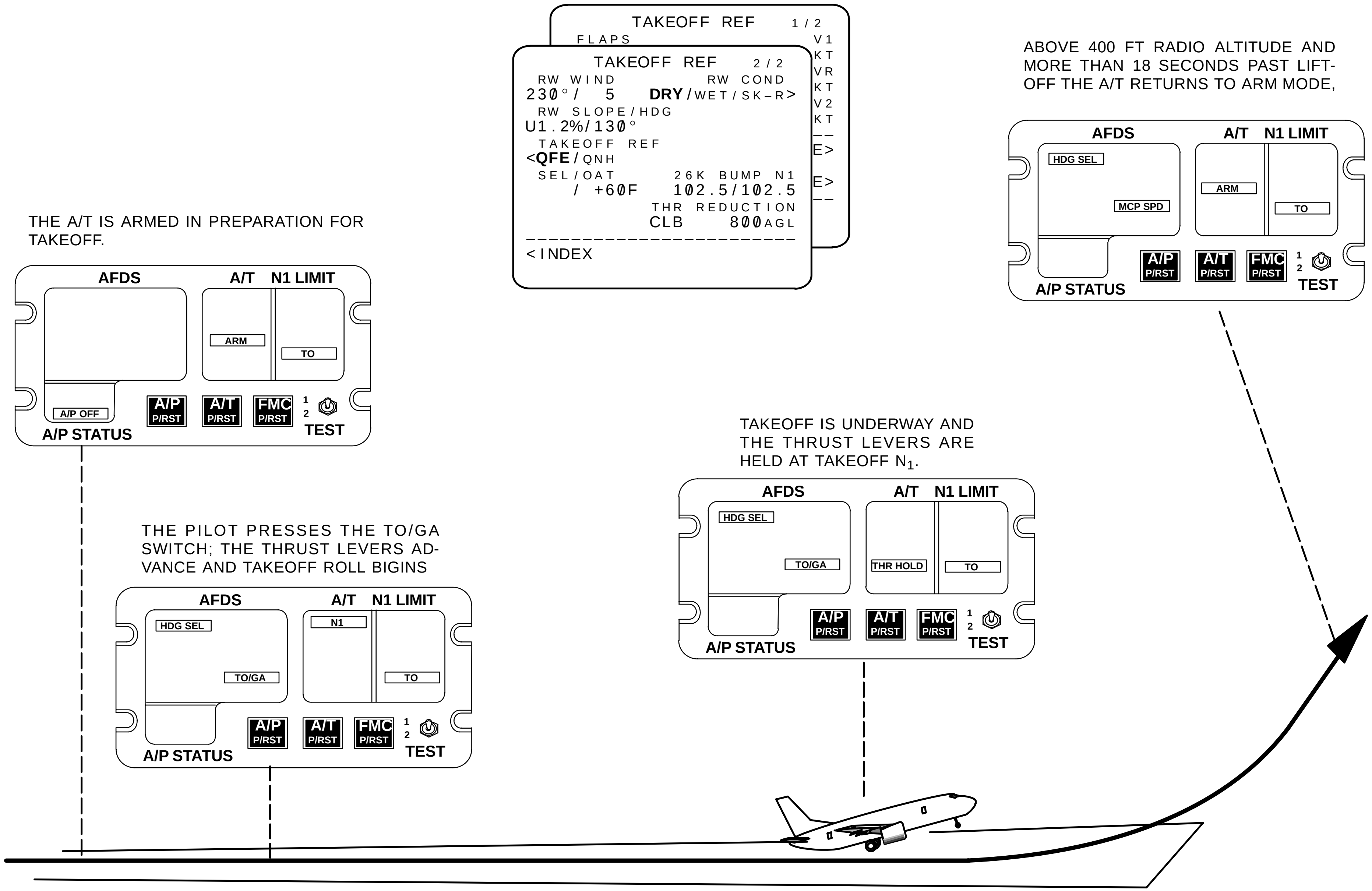


Figure 4–20 Typical Flight Profile – Takeoff

CLIMB

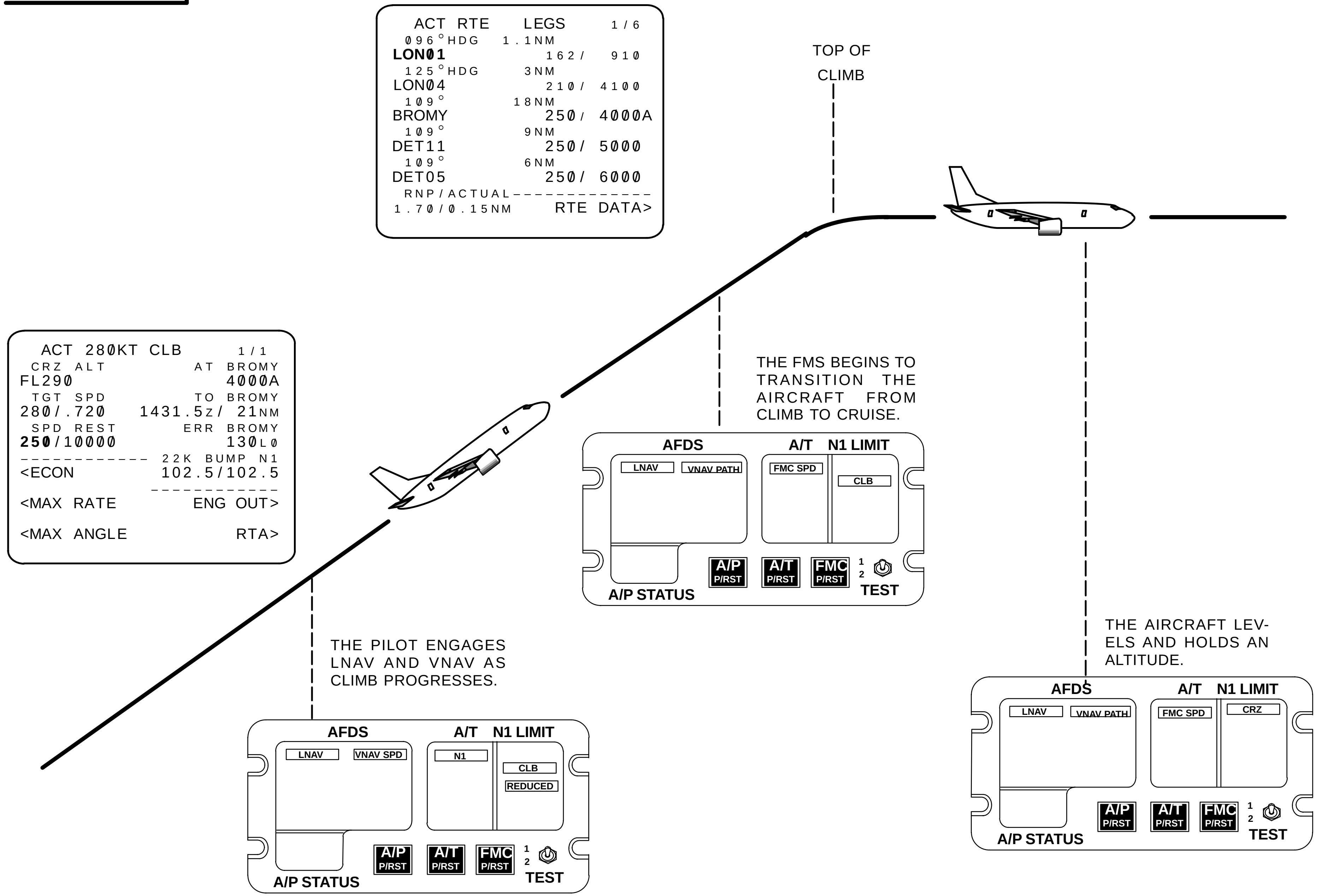


Figure 4–21 Typical Flight Profile – Climb

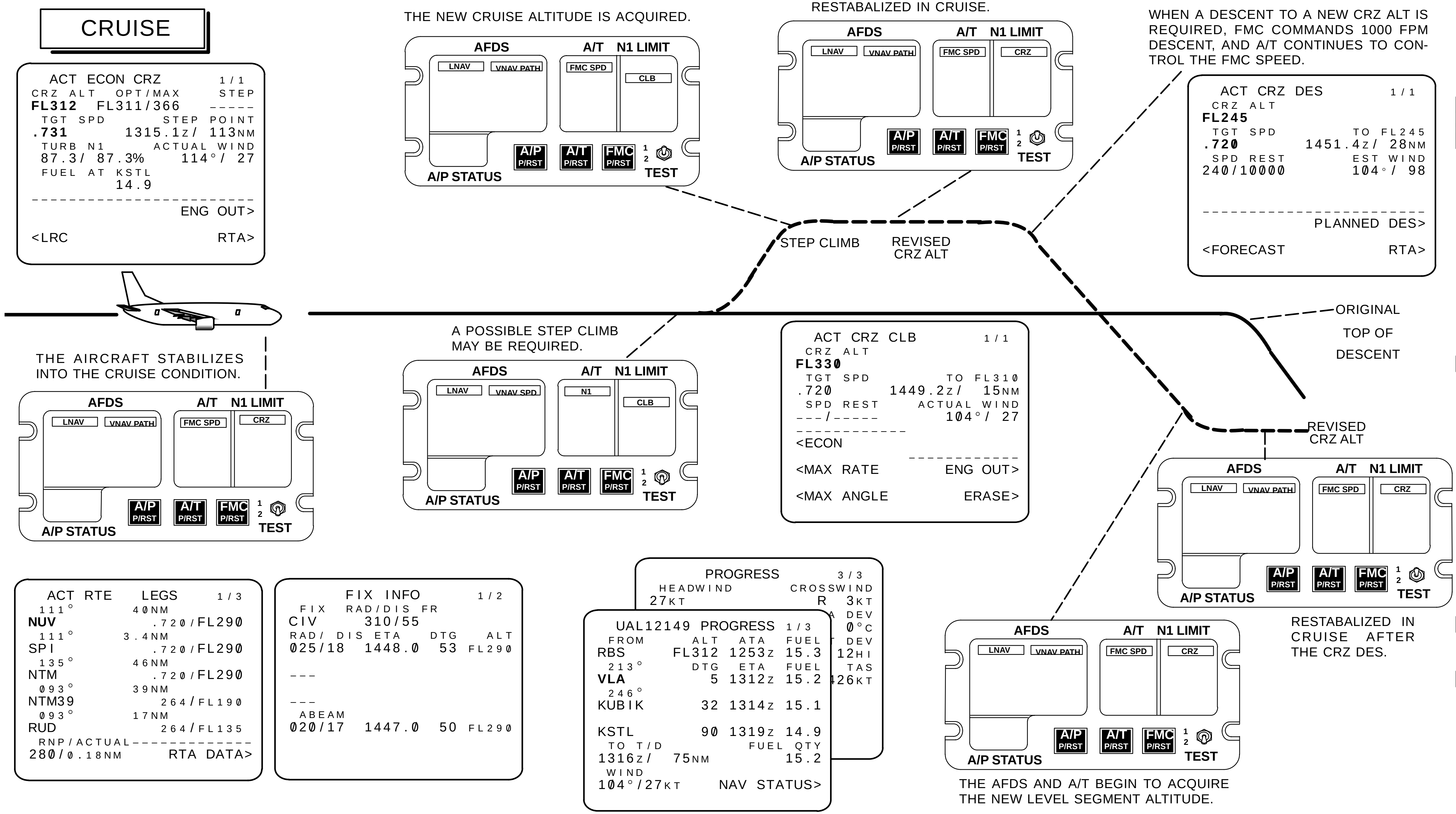


Figure 4–22 Typical Flight Profile – Cruise

DESCENT

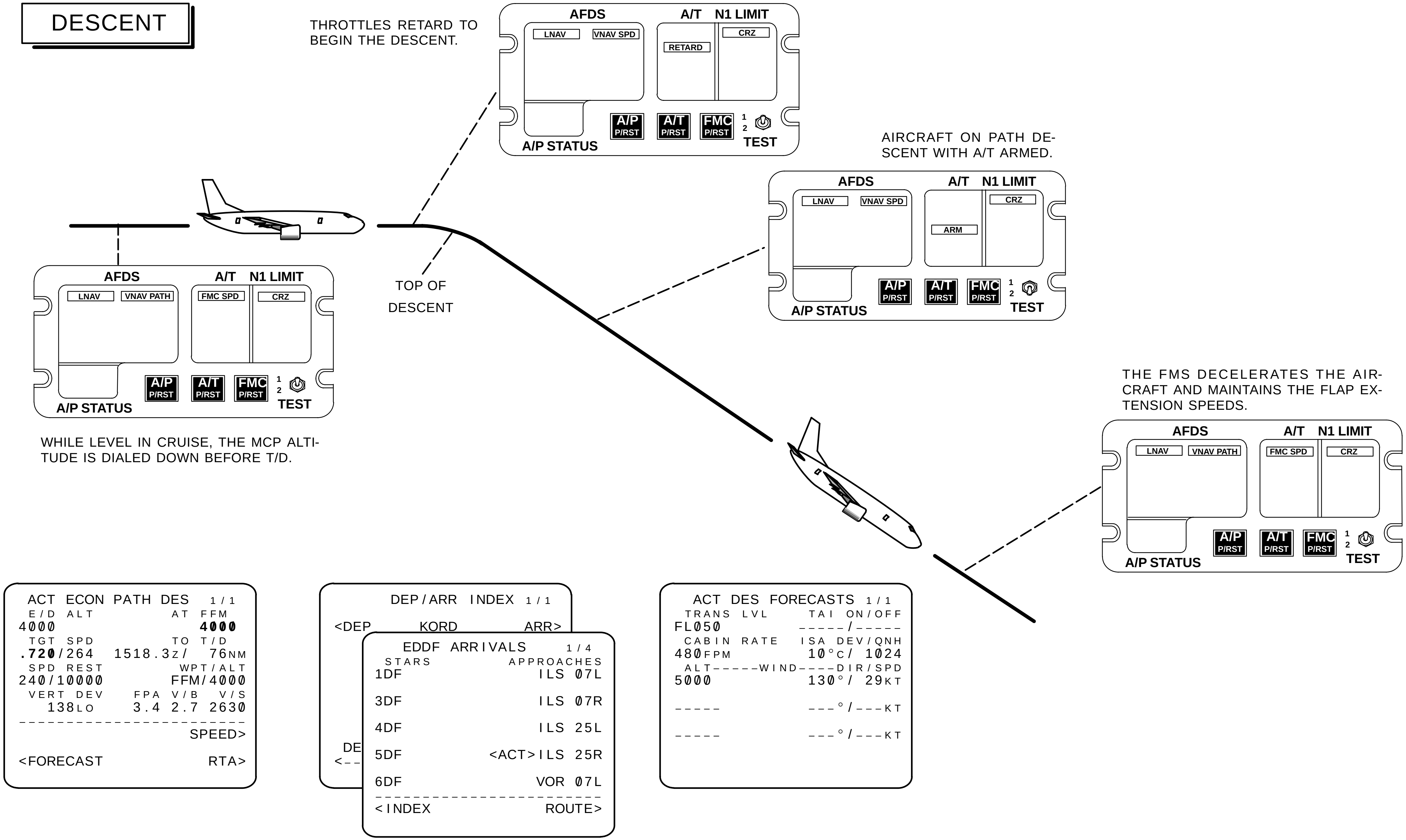


Figure 4–23 Typical Flight Profile – Descent

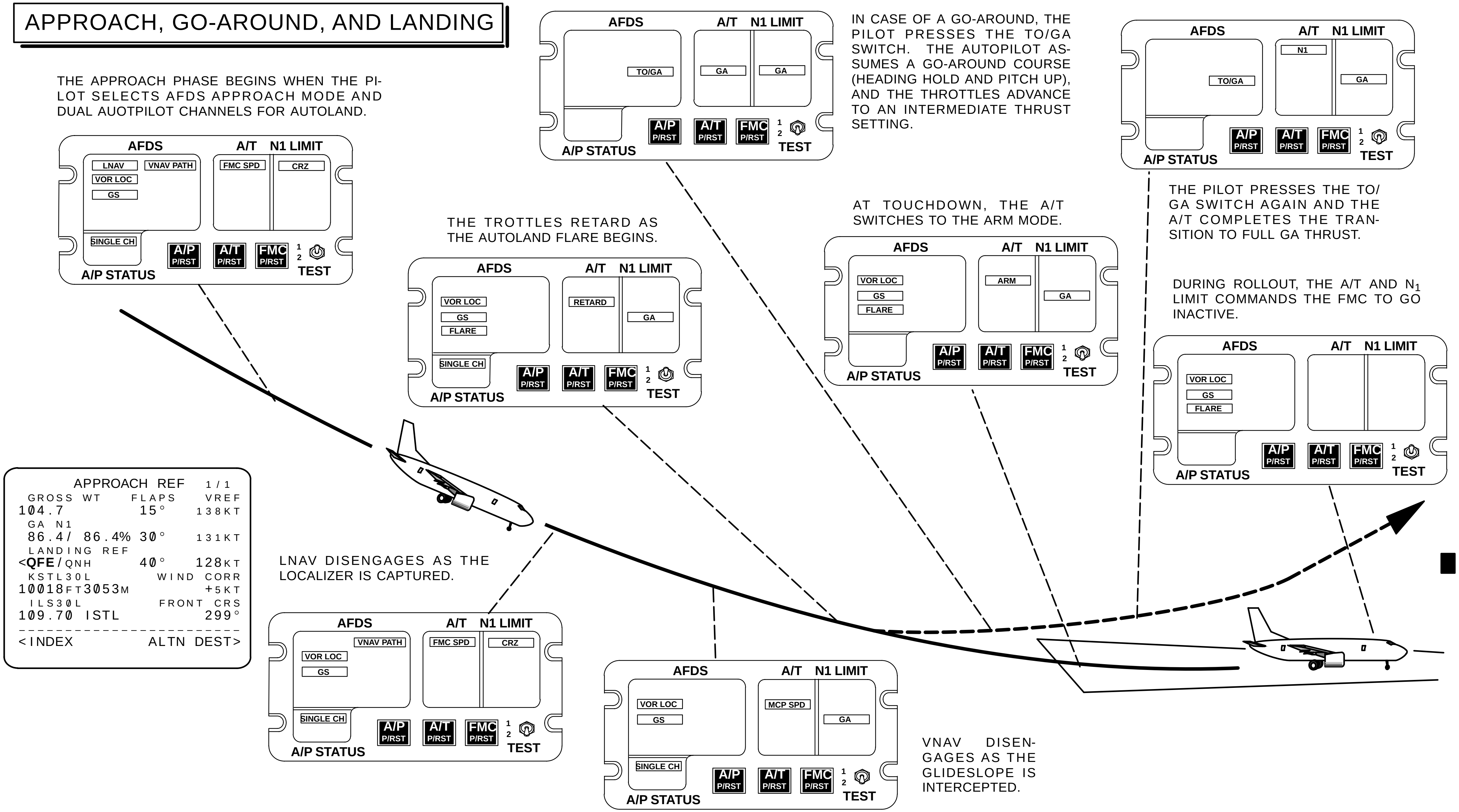


Figure 4–24 Typical Flight Profile – Approach, Go-Around, and Landing

APPENDIX A

WAYPOINT NAMING

Waypoint identifiers contained in the Navigation Data Base are named in the following manner:

Nondirectional Beacons	– Use station identifier followed by the letters “NB”.
Named Waypoints, Intersections, and Reporting Points	– Use assigned five-character name. If not assigned a name, then: • Use full name if five or less characters. • Eliminate double letters. • Keep first letter, first vowel, and last letter — drop other vowels from right to left. • Drop consonants from right to left. • For multiple word names, use first letter of first word and abbreviate last word.
Unnamed Turn Points and Intersections	– If co-located with a waypoint or NAVAID, then use that identifier. – If not co-located with a waypoint, then use identifier of nearest NAVAID and the distance from the same NAVAID. If the distance is 99 NM or less, place NAVAID identifier first. If the distance is 100 NM or more, place the last two distance digits ahead of the NAVAID identifier.
VHF NAVAIDS	– Use the facility identifier.

Capture Fix	– First fix of the final course. • First two characters are “CF”. • Remaining characters are the runway identifier.
Pilot Defined Waypoints	– Waypoints entered as longitude/latitude are identified with “WPT” followed by a two-digit sequence number.
	– Place bearing/distance or place bearing/place bearing waypoints are identified by the first three characters of the first place entered, followed by a two-digit sequence number.
	– Waypoints entered as “along track offset” (ATO). • Waypoint/+ distance entered from the scratch pad back over the reference waypoint. • Identified by the first three characters of the reference waypoint followed by a two-digit sequence number.
Bearing/Distance Waypoints	– First character is a “D”.
	• Second through fourth characters are the VHF NAVAID radial on which the waypoint lies.
	• Last character is the DME distance defined with the equivalent letter of the alphabet (A=1, E=5, etc.)
Final Fix of Approach Procedure (Single approach procedure for a given runway.	– First two characters are “FF”. • Remaining characters are the runway identifier.

Runway Extension	–	Located before runway at distance entered in “RWY EXT” field on ARRIVALS page. • First three characters are “RX-”. • Remaining characters are the runway identifier.
Runway Centerline Extension	–	Located where approach intersects the runway centerline. • First two characters are “RC”. • Remaining characters are the runway identifier.

PAGE NAME ________ PROMPT	NOTES	ALTERNATE DEST	APPROACH REF	ARRIVALS	CLB	CRZ	CRZ CLB	CRZ DES	DEP/ARR INDEX	DEPARTURES	DES	DES FORECASTS	DIR/INTC	FIX INFO	IDENT	INIT/REF INDEX	MENU	MESSAGE RECALL	N1 LIMIT	NAV OPTIONS	NAV STATUS	NEAREST ARPTS	OFFSETS	PERF INIT	PERF LIMITS	PROGRESS	POS INIT	POS REF	POS SHIFT	REF NAV DATA	RTA PROGRESS	RTE	RTE DATA	RTE HOLD	RTE LEGS	SELECT DESIRED WPT	SUMMARY	SUPP NAV DATA	TAKEOFF REF
ABEAM PTS																																			●				
ABM														●																									
ACCEPT																																							●
ACTIVATE																																●							
ALTN DEST	*		●													●																●							
APPROACH																●																							
ARR									●																														
AUTO																			●																				
CANCEL																													●										
CANCEL UPD																																							●
CLB																			●																				

NOTES:
1. U10.0
2. U10.1
3. U10.2

A. 737–300/400/500
B. 737–300/400/500 w/EFIS
C. 737–600/700/800
D. MCDU only
E. ANCDU only

* Airlines selectable software option enabled
&.

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CLB–1																			●																				
CLB–2																			●																				
CON																			●																				
CRZ																			●																				
DEP									●																														
DEPARTURE																																							●
DIRECT–TO		●																																					
DME UPDATE ON/OFF																					●																		
ECON					●	●	●				●																												
ENG OUT					●	●	●																																
ERASE				●	●		●	●		●	●	●											●	●	●						●	●	●	●	●				
FMC POS UPD																																							●

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FORCAST								●			●									
GA																			●	
GPS UPDATE ON/OFF																				
IDENT										●						●				
INDEX		●	●	●					●						●			●		
IRS NAV	A, E															●				
LEGS																				
LIMITS																				
LOAD												●								
LRC						●														
LT ENG OUT					●															
MISSED APP		●																		

PAGE NAME / PROMPT	NOTES	NAV STATUS	NEAREST ARPTS	OFFSETS	PERF INIT	PERF LIMITS	PROGRESS	POS INIT	POS REF	POS SHIFT	REF NAV DATA	RTA PROGRESS	RTE	RTE DATA	RTE HOLD	RTE LEGS	SELECT DESIRED WPT	SUMMARY	SUPP NAV DATA	TAKEOFF REF
FORCAST																				
GA																				
GPS UPDATE ON/OFF		●																		
IDENT																				
INDEX		●			●	●		●		●	●								●	●
IRS NAV	A, E																			
LEGS														●						
LIMITS												●								
LOAD					●	●						●		●		●				
LRC																				
LT ENG OUT																				
MISSED APP																				

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MAINT																●																							
MAX ANGLE					●		●																																
MAX RATE					●		●																																
MSG RECALL	D, *															●																							
N1 LIMIT																								●															●
NAV DATA																●																							
NAV OPTIONS																														●									
NAV STATUS																●										●			●										
NEAREST ARPTS		●																																					
NEXT HOLD																																		●					
OFFSET	B,C															●																●							
PATH											●																												

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PERF																●																							
PERF INIT																			●													●							●
PLANNED DES								●																															
POS																●																							
POS INIT															●																								●
POS SHIFT																					●																		
PPOS																																			●				
PREVIOUS		●																																					
PRIOR RTA																															●								
QRH ON/OFF																																							●
REJECT																																							●
REPORT																									●	●												●	

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REQUEST		•										•												•	•	•						•	•					•	•
ROUTE				•					•	•																	•												•
RT ENG OUT					•																																		
RTA					•	•		•			•														•														
RTE DATA																																			•				
SEL CONFIG	C															•																							
SPEED											•																												
STEP																																			•				
SUMMARY																														•								•	
SUPP DATA																																						•	
TAKEOFF																•			•					•								•							
TO	2, 3																		•																				

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TO–1	2, 3																		•																				
TO–2	2, 3																		•																				
TO–B	2, 3																		•																				
VIA		•																																					
VOR UPDATE ON/OFF																					•																		
VSPDS ON/OFF																																							•

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