



AEROWINX®

NG FMC

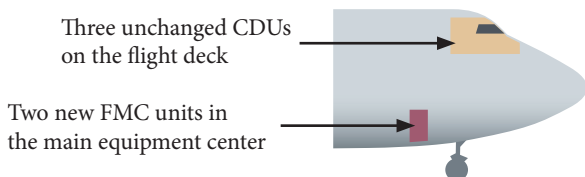
A N D M O R E

Manual

Edition 1

NG FMC Upgrade for Precision Simulator

In 2012 and following years, Boeing and Honeywell introduced new hardware and several software revisions for the B744 FMS under the title **NG FMC**, short for Next Generation Flight Management Computer; all previous versions in this context are called **legacy FMC**. The upgrade replaces the two legacy FMC units in the main equipment center with two NG FMC units. The existing control display units (CDUs) on the flight deck need not be replaced; they are compatible with the NG FMCs.



The NG FMC incorporates more memory, faster processors, and new software that provides enhanced LNAV/VNAV guidance to the autopilots, many additional textual controls to the CDUs, and more routing features to the navigation displays (note that the NG FMC upgrade for the B744 is slightly less comprehensive than the FMS of the B74-8; that would require further hardware components, and B744 aircraft are not fitted with that hardware). These new elements for the B744 are now modeled in Precision Simulator and are described in this *NG FMC Manual*; this manual does not discuss functions that are already included in the legacy FMC. For a description of the entire FMS, please refer to the Aerowinx Operations Manual.

Some features in this NG FMC simulation are based on pilot reports, therefore they may be company specific. The manuals from the original manufacturers have been partially vague, so it was not always possible to verify whether certain features relate to particular airlines or general revisions. Further hints from pilots are welcome. There will be free updates to this simulation package from time to time.

“NG FMC **and more**” is the title of this simulation package; it means **bonus features** are included, selectable at the user’s choice. They are:

- The simulation of multicolor LCD CDUs
- The Wind & OAT corridor tools (advanced weather simulation)
- The SIGMET tools (advanced weather simulation)

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System Requirements

The NG FMC simulation upgrade needs to be activated by a **license** file. Before the license can be applied, Precision Simulator version 10.93 or higher must be installed and must have been started at least once (the start process will generate the subfolder *Extra* which will be the place for the license file). Owners of the Aerowinx DVD version 10.0 or 10.1.7 can update free of charge to Precision Simulator version 10.93 and higher. Please check the aerowinx.com website for the latest version.

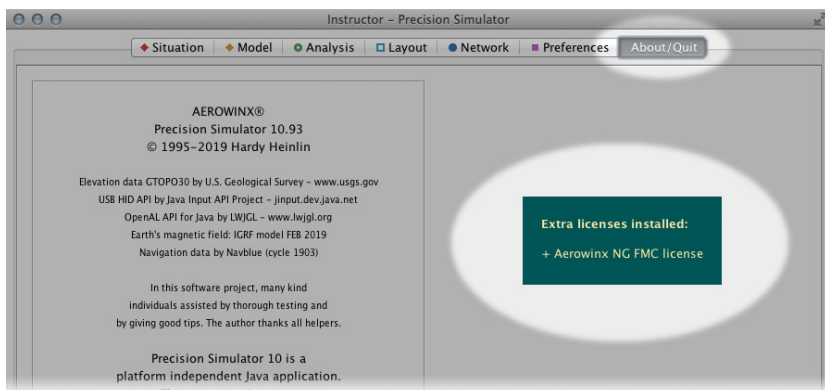
Purchasing the License

The license file for the NG FMC simulation upgrade can be purchased from the retailers listed on the aerowinx.com website. Please keep the invoice you get from the retailer; one license may be applied to up to four networked instances of Precision Simulator within one local flight deck mockup. This is a special, extended right under this license and cannot be resold. (Site licenses for airline and academy classes are available upon request.)

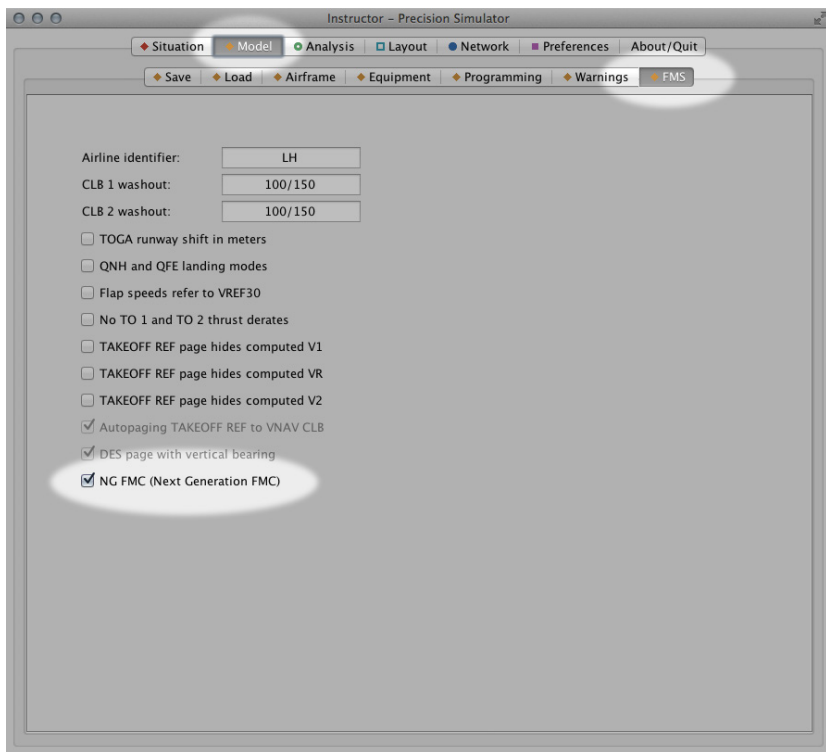
Installing the License

Download the file *NextGenFmc.license* from your retailer's online shop. Do **not** unzip the file. Just copy the file to your subfolder *Aerowinx/Extra* and restart Precision Simulator. — If you run a local flight deck mockup with up to four networked *Aerowinx* folders, copy the file to their *Extra* subfolders as well.

In Precision Simulator on the Instructor's **About** page a green box will show the message **Aerowinx NG FMC license** if the simulator has detected the license:



NG FMC Checkbox



The **NG FMC** checkbox is located on **Instructor > Model > FMS**. The checkbox is no longer grayed out when the NG FMC license is detected. When the checkbox is selected the simulator models the NG FMC, otherwise it models the legacy FMC.

The selection or deselection of this checkbox can be stored in model files and situation files. For example, if you wish a model file or situation file to autoselect the checkbox upon file loading, please do this: Load that file, select the **NG FMC** checkbox, then resave that file. Now whenever that file reloads, the program will select the **NG FMC** checkbox.

(continued next page)

NG FMC Checkbox *(continued)*

Deselecting the **NG FMC** checkbox (switching from the NG model to the legacy model) will reduce the maximum allowable number of route legs from 250 to 120 and will automatically delete the route segment beyond what the legacy FMC can handle. It will also delete NG specific waypoint speed entries on the LEGS pages. Switching back to the NG model will not restore the deleted data. Only a previously saved situation file can restore the scenario.

Toggling the **NG FMC** checkbox during or shortly before the VNAV descent may cause a large discrepancy between the current aircraft altitude and the FMC predicted vertical path. This is a normal consequence as the legacy FMC computes an *idle thrust* descent path, whereas the NG FMC sets an *off-idle* path that is shallower and that shifts the top of descent farther away from the destination.

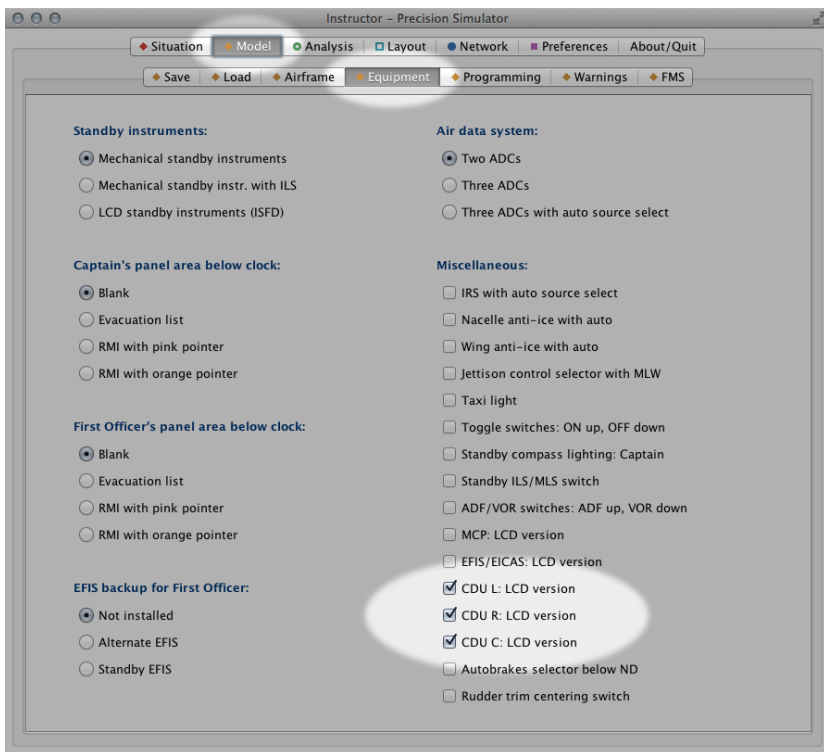
The NG FMC contains special FIX INFO data that is not included in the legacy FMC. For this reason, the simulator stores FIX INFO variables in two different datasets: The one is used by the NG model, the other is used by the legacy model. Therefore, when toggling the **NG FMC** checkbox, the FIX INFO data shown on the CDUs and navigation displays may change respectively.

The STEP SIZE variable too is stored in two different datasets and thus may change according to the currently selected FMC model. This is because the NG FMC uses a higher resolution for the step size and it includes the RVSM option.

When the **NG FMC** checkbox is selected, the checkbox **Autopaging TAKEOFF REF to VNAV CLB** and the checkbox **DES page with vertical bearing** are automatically activated because these two features belong to the default package of the NG FMC; they can only be deactivated when operating with the legacy FMC.



CDU Checkboxes



This upgrade enables three more checkboxes on **Instructor > Model > Equipment** for the CDU version selections. When selected, the respective left, right, or center CDU will be an LCD CDU (multicolor screen), otherwise it will be a CRT CDU (green screen).

The selection or deselection of such a checkbox can be stored in model files and situation files. For example, if you wish a model file or situation file to autoselect a certain checkbox upon file loading, please do this: Load that file, select the desired checkbox, then resave that file. Now whenever that file reloads, the program will select the respective checkbox.

Both the legacy FMC and the NG FMC can be linked with CRT CDUs as well as with LCD CDUs; the FMC versions and the CDU versions are independent of each other.

Differences (Example)

Having **CRT** CDUs on the flight deck does not necessarily mean that **legacy** FMCs are installed. Likewise, having **LCD** CDUs on the flight deck does not necessarily mean that **NG** FMCs are installed. There are four ways of combining CDU versions with FMC versions. On the pictures below notice the differences between the CRZ page of the **legacy** FMC and that of the **NG** FMC: The legacy FMC provides no RVSM step size and no RECMD cruise altitude. This is just an example. Many NG FMC pages differ from the legacy FMC pages. The NG FMC also adds entirely new pages that are not part of the legacy FMC.



Legacy FMC CRZ page



NG FMC CRZ page



Legacy FMC CRZ page



NG FMC CRZ page

CDU Screen Colors

At the time this manual was written, all B744 aircraft, including those fitted with the NG upgrade, were equipped with CRT (cathode ray tube) CDUs that display all text in green. But it is possible to replace a CRT CDU with an LCD (liquid crystal display) CDU — should no other option be available in a maintenance case, for example. The flight deck may be intermixed with LCD and CRT CDUs. — This manual is illustrated with *LCD* screens only; the related *CRT* screens would show exactly the same words and layouts.

The NG FMC provides multicolor text code to the CDUs. If the code is sent to LCD CDUs, the text appears in multicolor; if sent to CRT CDUs, the code is ignored and all text is shown in green. The legacy FMC and the ACARS do not provide any color code. MENU pages and EFIS control pages on LCD CDUs appear in multicolor.

The NG FMC applies the following multicolor scheme (for LCD CDUs):

- **Magenta** indicates the active target parameters of the LNAV/VNAV guidance.
- Text on **gray background** indicates modified LNAV/VNAV parameters when the EXEC light is illuminated.
- **Green** indicates VOR related data on the NAV RADIO page and, in general, the current selection of textual switch functions.
- **Cyan** indicates ADF related data on the NAV RADIO page and is also used for the titles of the inactive RTE and LEGS pages.
- Other text is displayed in white.

The LCD CDU is able to display text in eight different colors; all of them can be activated by CDU subsystems. Developers of subsystem simulations may refer to the Aerowinx network documentation for further details on the color codes.

CDU Screen Blanking

Whenever a CDU line select key is pressed, no matter whether the key has a function or not, the **legacy FMC** sends a blanking command to the associated CDU, causing the entire screen to turn black for a fraction of a second. This effect promptly confirms to the pilot that the FMC has detected the keypress while the computation of the textual response may be in progress for several seconds. The **NG FMC** does not send blanking commands, and it calculates faster. For example, the NG FMC's response to an assumed temperature entry takes less than 3 seconds; in the legacy FMC this may take up to 10 seconds.

INIT/REF INDEX Page

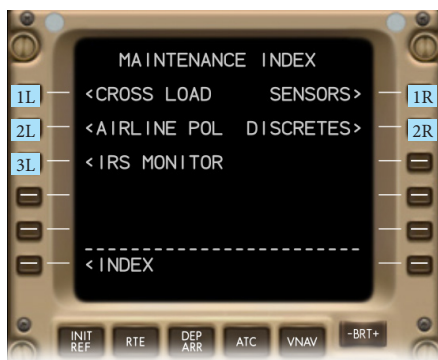


The NG FMC provides several pages for the management of enroute alternate airports (ALTN). One of the access keys to these ALTN pages is **2R** on the INIT/REF INDEX page. The FMC COMM page can be accessed through **3R** or through the FMC COMM function key on the CDU.

Differences:

The **legacy FMC** does not include any ALTN pages, and its FMC COMM pages can only be accessed through the FMC COMM function key on the CDU.

MAINTENANCE INDEX Page

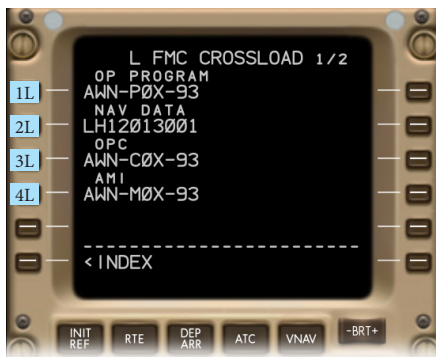


The NG FMC adds new maintenance pages regarding FMC sensors, analog discretes, and airline policy settings. The page titles for the database crossloads and the IRS monitor are unchanged, but the related features have been modified. As usual, all maintenance pages can be accessed through the line select keys on the MAINTENANCE INDEX page when the aircraft is on the ground.

Differences:

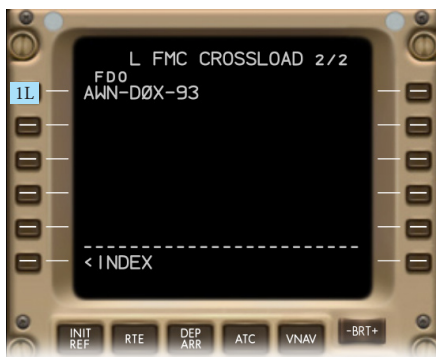
The **legacy FMC** includes a BITE page instead of the SENSORS and DISCRETES pages, and a PERF FACTORS page in lieu of the AIRLINE POLICY pages.

CROSSLOAD Pages 1 and 2



Access to these pages is provided through the INIT/REF key via the MAINTENANCE INDEX page.

The CROSSLOAD pages indicate the part numbers of various datasets installed in the left or right FMC as per the related CDU's onside NAV source selection; the page title displays L FMC or R FMC respectively. On the first page, **1L** indicates the part number (P/N) of the operational program, **2L** shows the P/N of the navigation database, **3L** the P/N of the operational program configuration (OPC), **4L** the P/N of the airline modifiable information (AMI), and **1L** on the second page indicates the P/N of the flight data output (FDO).

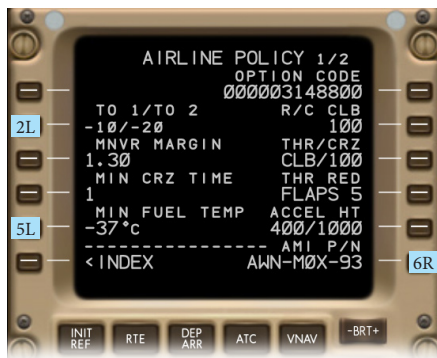


When any of the five datasets in an FMC disagrees with the corresponding dataset in the other FMC, the associated line select key on the right side of the page will show an ARM> prompt. Selecting this prompt will initiate the crossload of the affected dataset from the onside selected FMC to the other FMC. *(In the simulator, the datasets in the left FMC model will always agree with those in the right FMC model, therefore the pages will never show any ARM> prompt.)*

Differences:

The **legacy** FMC includes a crossload function just for the navigation database, and allows a crossload to be initiated even when a disagreement is not detected.

AIRLINE POLICY Page 1 of 2



Access to these pages is provided through the INIT/REF key via the MAINTENANCE INDEX page.

The AIRLINE POLICY page 1/2 of the NG FMC includes the same functions shown on the PERF FACTORS page of the legacy FMC, and adds the following features.

2L allows the modification of the TO 1 and TO 2 thrust derates shown on the THRUST LIM page (this feature is blank when the checkbox **No TO 1 and TO 2 thrust derates** is selected on **Instructor > Model > FMS**). Default values are displayed in small font, manual entries in large font; they can be reset to the default values by deleting the line.

Valid entries

(Positive entries automatically become negative)

TO 1 derate 0 to -30%:

X

XX

TO 2 derate 0 to -30%:

/X

/XX

TO 1/TO 2 derates:

X/X

XX/XX

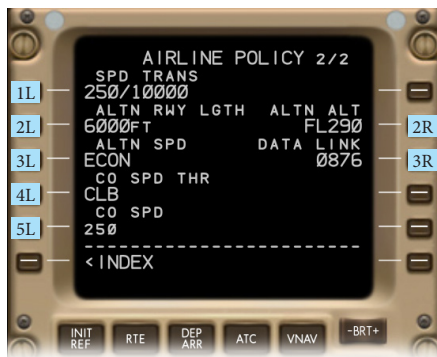
5L indicates the programmed minimum operating fuel temperature. This setting cannot be changed.

6R displays the part number of the airline modifiable information (AMI).

Differences:

The PERF FACTORS page of the **legacy FMC** does not contain functions for the thrust derate, minimum fuel temperature, and part number.

AIRLINE POLICY Page 2 of 2



1L indicates the default transition speed and altitude used when related values cannot be loaded from the navigation database.

Valid entries

CAS 100 to 399 knots / 1500 to 40000 feet:
XXX/XXXX
XXXX/XXXXX

2L shows the minimum runway length used in the FMC's search filter when scanning the database for alternate airports.

Valid entries

Length 0 to 20000 feet:
X
XXXX
XXXXX

3L displays the default speed mode for the cruise to alternate airports.

Valid entries

CAS 100 to 399 knots / Mach 0.40 to 0.99:
XXX/.XXX
Mode word:
LRC, ECON, EO, EOLRC, CO, CO SPD

4L shows the thrust limit mode used when CO SPD (company speed) is entered in 3L.

Valid entries

Mode word:
CRZ
CLB
CON

5L indicates the company speed. Deletion resets to the default value of 250 knots.

Valid entries

CAS 100 to 399 knots:
XXX
Mach 0.40 to 0.99:
.XXX
CAS 100 to 399 knots / Mach 0.40 to 0.99:
XXX/.XXX

2R displays the default cruise altitude for the flight to alternate airports.

Valid entries

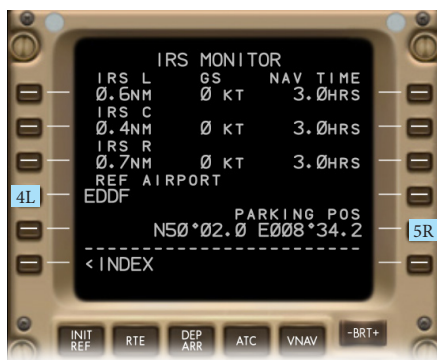
Altitude 1500 to 40000 feet:
XXXX
XXXXX

3R shows the data link option code.

Differences:

The **legacy** FMC does not provide any of the above functions.

IRS MONITOR Page



Access to this page is provided through the INIT/REF key via the MAINTENANCE INDEX page.

After flight completion, the first three lines on this page show the position drift of IRU L, C, and R in nautical miles since the last IRU alignment. The residual groundspeeds (GS) are displayed in the middle of the page. The navigation times (NAV TIME) indicate the hours passed since the last alignment.

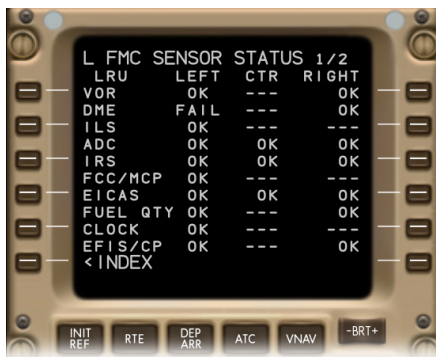
4L displays the reference airport where the last IRS alignment was performed.

5R shows the parking position at the reference airport where the last IRS alignment was performed.

Differences:

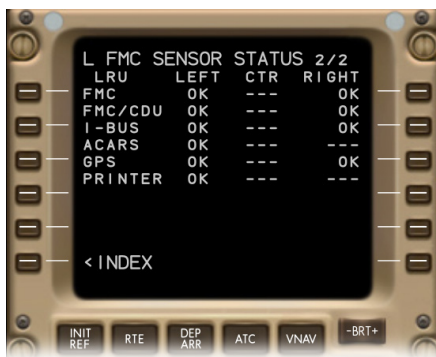
In the **legacy FMC** the IRS MONITOR just displays the residual groundspeeds.

SENSOR STATUS Pages 1 and 2



Access to these pages is provided through the INIT/REF key via the MAINTENANCE INDEX page.

These pages inform engineers about the status of various sensor systems whose digital data is sent to the FMS. The indications on a SENSOR STATUS page refer to the left or right FMC as per the related CDU's onside NAV source selection; the page title displays L FMC or R FMC respectively.



Most sensor systems are dual systems that consist of two identical components, typically labeled “left” and “right”. Some include a third identical component labeled “center”. The pages list the components accordingly in the three columns under LEFT, CTR, and RIGHT.

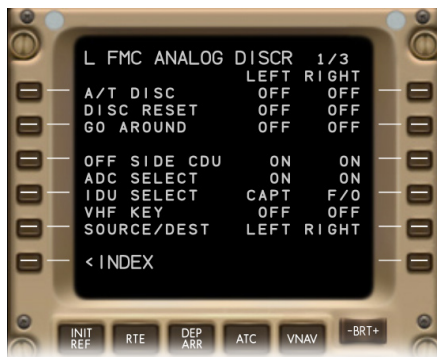
Although there are three ILS and three FCC units installed, either FMC gets sensor data just from one ILS and one FCC. Other systems, for example the IRS, send data from all three IRUs to both FMCs.

Dashes indicate the respective sensor is not supposed to send data to this FMC unit or is by design not installed at all. FAIL indicates that invalid sensor data is being received, and OK indicates the data is valid.

Differences:

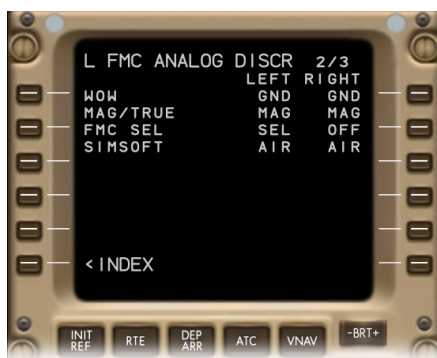
The **legacy** FMC does not provide any of the above functions.

ANALOG DISCRETES Pages 1 to 3



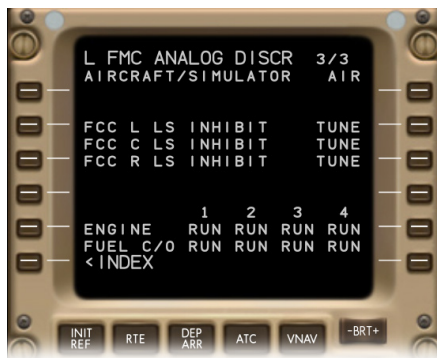
Access to these pages is provided through the INIT/REF key via the MAINTENANCE INDEX page.

These pages inform engineers about the current modes of various systems that are interfaced with the FMS. The respective mode is detected using analog signals. The indications on such a page refer to the left or right FMC as per the related CDU's inside NAV source selection; the page title displays L FMC or R FMC respectively.



Most systems are dual systems that consist of two identical components, typically labeled “left” and “right”. The pages list the components accordingly in the two columns under LEFT and RIGHT.

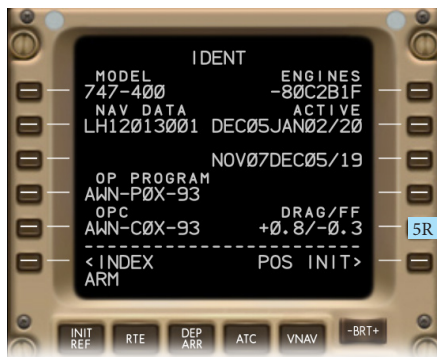
(Note: The Aerowinx software simulates the hardware of an aircraft, not the hardware of a simulator construction, therefore the mode displayed in 1R on page 3 is AIR, not SIM. If a real FMC unit were installed in a simulator construction, that real FMC unit would be in SIM mode.)



Differences:

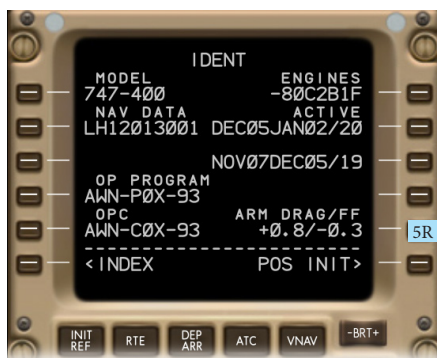
The **legacy** FMC does not provide any of the above functions.

IDENT Page



The IDENT page of the NG FMC does not show any company policy file identifier. In the NG FMC the related file is called airline modifiable information (AMI) and its identifier is displayed on the AIRLINE POLICY page 1/2 and the CROSSLOAD page 1/2.

The NG FMC allows the DRAG/FF data (aerodynamic drag and engine fuel flow correction factors) to be modified on the IDENT page. Authorized engineers may enter the word ARM in 5R (ARM will be shown in the line title); leaving the IDENT page will disable the entry function. As usual, the values are displayed in percent, and the FMC will apply these factors in its aircraft performance predictions.



*(In the simulator, to assure accurate FMC operation, the physical drag and fuel flow factors entered on **Instructor > Model > Airframe** are automatically copied to the factors here on the FMC's IDENT page. Once they are copied, the factors here in the FMC can be changed without being copied back to the physical factors on the Instructor. Such modifications in the FMC may be used for system demonstrations only; disagreements between physical factors and FMC factors cause inaccurate predictions.)*

Valid entries

Drag factor (-9.9 to +9.9):

-X.X/

X.X/

Fuel flow factor (-9.9 to +9.9):

-X.X

X.X

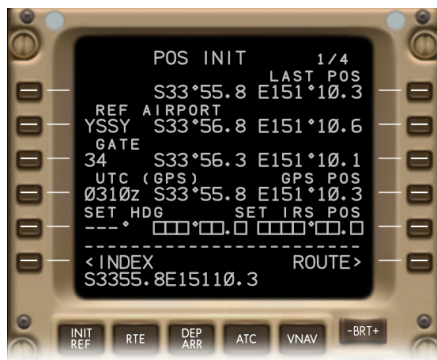
Drag factor/fuel flow factor:

X.X/X.X

Differences:

The IDENT page of the **legacy FMC** shows the company policy file identifier (CO DATA) in 4R and the DRAG/FF correction factors in 3L, and modifications of these correction factors are only allowed on the PERF FACTORS page.

POS INIT Page 1 of 4

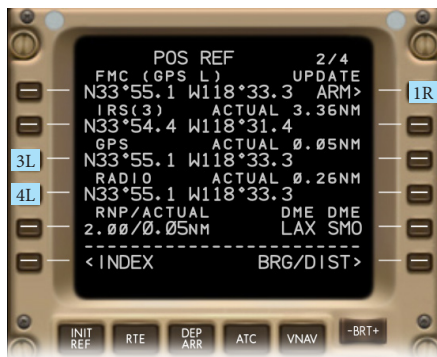


The NG FMC's POS INIT page is identical to that of the legacy FMC, except that the NG FMC shows all POS related data on four pages. Therefore the page title indicates 1/4.

Differences:

The **legacy FMC** includes just three POS related pages.

POS REF Page 2 of 4

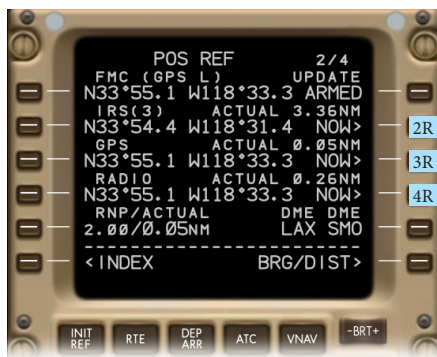


1R allows the selection of the ARM> prompt. When selected, it will display ARMED, and 2R, 3R, 4R will show NOW> prompts.

2R — The line title indicates the actual 95% estimated sensor position error (ANP in nautical miles) of the selected IRS. When the NOW> prompt is displayed and selected, the FMC reference position in 1L will be updated with this IRS position.

3R — The line title indicates the actual 95% estimated sensor position error (ANP in nautical miles) of the selected GPS. When the NOW> prompt is displayed and selected, the FMC reference position in 1L will be updated with this GPS position.

4R — The line title indicates the actual 95% estimated sensor position error (ANP in nautical miles) of the radio related position. When the NOW> prompt is displayed and selected, the FMC reference position in 1L will be updated with this radio related position.



The NG FMC provides a redesigned POS REF page 2 with the following new functions (it still includes a GPS inhibit function, but the NG FMC provides all inhibit functions on an extra page titled NAV OPTIONS 2/2).

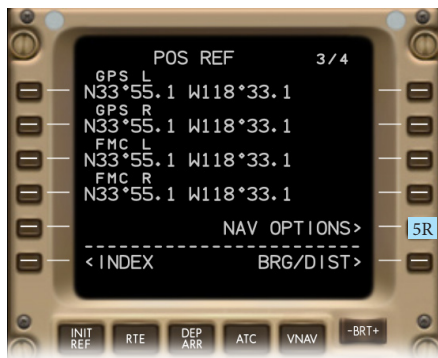
3L indicates the aircraft position derived from the left or right GPS as per the related CDU's onside NAV source selection (GPS L for FMC L, GPS R for FMC R).

4L displays the FMC calculated aircraft position referring to the radio signals from the stations indicated in 5R.

Differences:

The **legacy FMC** shows a <PURGE key in 5L that is identical to the NG FMC's NOW> key in 2R. The **legacy FMC** shows the GPS position on POS REF page 3, and does not show the radio position separately nor any radio or GPS related NOW> prompts.

POS REF Page 3 of 4



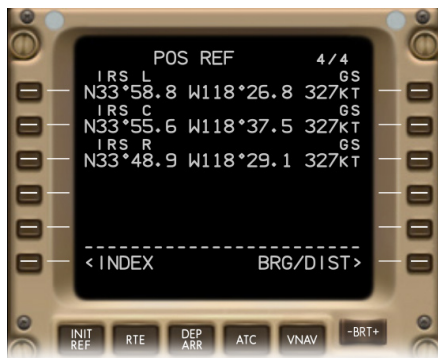
The NG FMC indicates the position calculations of the left and right FMCs in two separate lines so that they can be compared on a single CDU. Groundspeed indications have been removed. IRS position displays have been moved to page 4.

5R opens the NAV OPTIONS page.

Differences:

The POS REF of the **legacy FMC** just shows the position calculation of the onside selected FMC, not that of the other FMC, and it indicates the groundspeed of each position data source. The **legacy FMC** has no NAV OPTIONS page.

POS REF Page 4 of 4

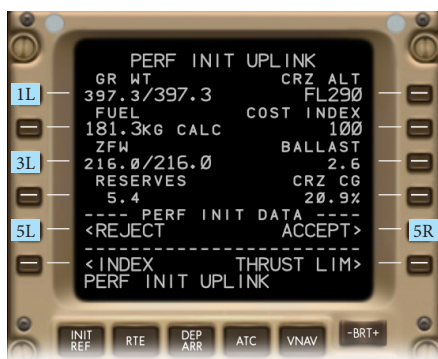
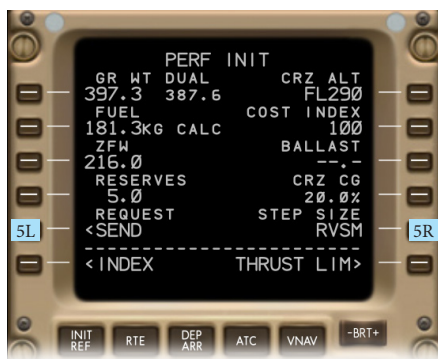


The NG FMC adds a fourth POS REF page that displays the IRS calculated aircraft positions and groundspeeds.

Differences:

The **legacy FMC** does not include a fourth page; it displays the IRS data on page 3.

PERF INIT Page



The NG FMC's PERF INIT page provides some additional features.

5L displays <SEND when no data uplink is pending. Pushing the <SEND key sends a PERF INIT data uplink request to the ground station. When a PERF INIT uplink is pending, 5L displays <REJECT, the page title reads PERF INIT UPLINK, and the uplinked values are shown in the associated lines in small font. Pushing the <REJECT key purges the uplinked data and redisplay the previous values.

1L — When an uplink is pending, the uplinked gross weight is shown in small font and the last confirmed gross weight in large font, separated by a slash.

3L — When an uplink is pending, the uplinked ZFW is shown in small font and the last confirmed ZFW in large font, separated by a slash.

5R — When an uplink is pending, the ACCEPT> prompt is shown that can be selected to overwrite the previous data with the uplinked data, otherwise the step size setting is shown. The step size function of the NG FMC is similar to that of the legacy FMC, but the NG FMC adds the RVSM option and allows 100 feet increments.

Valid entries

1000 to 9900 feet in 100 feet increments:

XX00

One character:

0 (for zero)

I (for ICAO)

R (for RVSM)

Differences:

The **legacy FMC** shows the STEP SIZE in 5L and does not allow RVSM nor 100 foot step size increments (just 1000 feet increments), and it does not provide any PERF INIT uplink system.

THRUST LIM Page



The NG FMC's THRUST LIM page for the B744 is identical to that of the legacy FMC (the "quiet climb" feature may be installed on B74-8 aircraft only). — Company specific TO 1 and TO 2 derate values can be set on the AIRLINE POLICY page 1/2.

Differences:

The **legacy FMC** provides the same THRUST LIM page, but excludes options for changing the fixed TO 1 and TO 2 derates.

CLB 1 and CLB 2 Washout Indication



As usual, the primary EICAS indicates the selected thrust reference mode word that the FMC sends to the EICAS. The NG FMC, however, will not cause the EICAS to change to the CLB word when the CLB derate is washed out during the climb. It will keep indicating the CLB 1 word or CLB 2 word.

Differences:

If the **legacy FMC** is installed, the EICAS will indicate the CLB word when the derate is washed out.

TAKEOFF REF Page 1 of 2



The NG FMC provides more takeoff reference parameters than the legacy FMC, and it displays them on two pages. FMC computed values and uplinked values appear in small font, manual entries in large font.

2L provides the same assumed temperature function shown on the THRUST LIM page in 1L. The entry formats are identical. But in the NG FMC the takeoff thrust data may also be set by takeoff data uplinks.

3L provides the same trim and CG function the legacy FMC displays in 4R. However, the NG FMC's CG entry format additionally allows a resolution to a tenth of a CG unit.

Valid entries

Center of gravity (0.0 to 40.0):

X
XX
X.X
XX.X

4L allows the entry of a runway of the selected origin airport; the entry will not be copied to the RTE page or DEPARTURES selection. If 4L contains no manual entry, it indicates the runway displayed on the active RTE page. After the slash, 4L shows the TO/GA position reference; this may be the distance of the takeoff position from the landing threshold, or the identifier of a database runway intersection. *(In the simulator there is no runway intersection database; any fictitious intersection identifier can be entered.)*

Valid entries

Database runway identifier of the selected departure airport:

XX
XXX

(-30 to 30 meters, or -99 to 99 feet) x 100
(Meters or feet as per airline specification):

/-X00
/-XX00
/X00
/XX00

Runway intersection identifier:

/X
/XX
/XXX
/XXXX

(continued next page)

Differences:

The **legacy FMC** does not display takeoff thrust data on this page, allows just integer values for the CG, and does not allow runway and intersection entries.

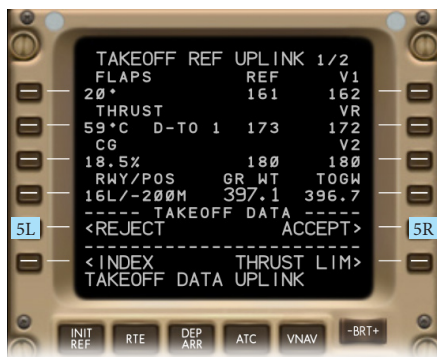
TAKEOFF REF Page 1 of 2 (continued)



4R indicates the gross weight (GR WT) that is also shown on the PERF INIT page, and it displays the takeoff gross weight (TOGW) that can be changed by manual entries. Any uplink request will demand takeoff data referring to this TOGW value.

Valid entries

Takeoff gross weight divided by 1000
 159.5 to 401.4 (744-ER: 417.3) kg
 351.7 to 885.0 (744-ER: 920.0) lb
 (KG or LB as per airline specification):
 XXX
 XXX.X



5R — When an uplink is pending, the ACCEPT> prompt is shown that can be selected to overwrite the previous data with the uplinked data, otherwise the REF SPDS switch is shown that can be pushed to blank or redisplay the FMC computed REF speeds in the middle of the page.

5L displays <SEND when no data uplink is pending. Pushing the <SEND key sends a TAKEOFF REF data uplink request to the ground station. When a TAKEOFF REF uplink is pending, 5L displays <REJECT, the page title reads TAKEOFF REF UPLINK, and the uplinked values are shown in the associated lines in small font. Pushing the <REJECT key purges the uplinked data and redispays the previous values.

Differences:

The **legacy FMC** does not display any weight parameters on the TAKEOFF REF page, and it provides no REF SPDS switch and no takeoff data uplink system.

TAKEOFF REF Page 2 of 2



2L displays the reference outside air temperature used for the takeoff data calculations.

Valid entries

Centigrades (-54 to 99):

X

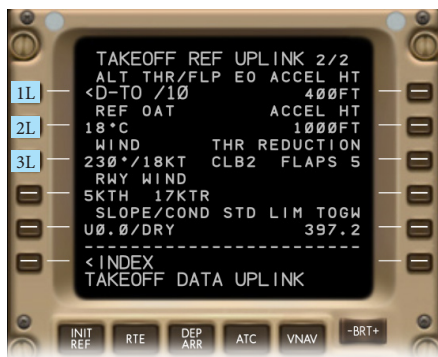
XX

Fahrenheit (-65 to 199):

XF

XXF

XXXF



3L indicates the expected wind direction and speed at the selected takeoff runway. Displays dashes when a manual entry exists in 4L.

Valid entries

Direction degrees / speed 0 to 99 knots:

XXX/X

XXX/XX

Direction over an existing entry:

XXX

Speed over an existing entry:

/X

/XX

1L is blank when no takeoff data uplink is pending, otherwise it displays a prompt that allows the selection of a second takeoff dataset based on different thrust and flap settings provided by the uplink service. The line title then indicates one of the following options:

ALT THR/FLP for alternate thrust/flaps

ALTN THRUST for alternate thrust

STD THR/FLP for standard thrust/flap

STD THRUST for standard thrust

(continued next page)

Differences:

The takeoff references in the **legacy FMC** include no REF OAT and no wind direction settings.

TAKEOFF REF Page 2 of 2 (continued)



5L displays runway slope and condition. Default values appear in small font, manual entries in large font.

Valid entries

Slope (0 to 2.0):

DX.X for downhill

UX.X for uphill

X.X for uphill

Condition:

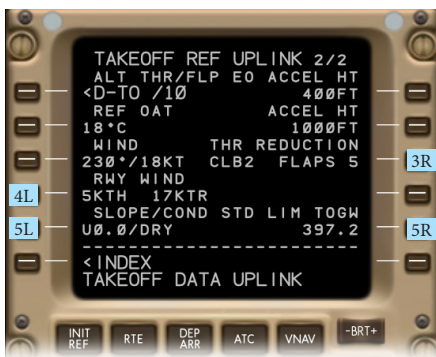
/D for dry

/W for wet

/S for skid resistant runway

Slope/condition:

X.X/X



4L displays the headwind (H or T) and crosswind (L or R) for the selected runway. The values are computed when wind data is entered in 3L. Uplinked and computed values are shown in small font. Manual entries of headwind data in 4L appear in large font and will cause 3L to show dashes, and will blank the crosswind display in 4L.

Valid entries

Headwind 0 to 99 knots:

XX

Tailwind 0 to 99 knots followed by T:

XXT

3R provides the same thrust reduction point function available in the legacy FMC, the only difference being the possibility in the NG FMC to enter flaps 1, not just flaps 5.

5R shows the limit takeoff gross weight. The value appears in KG or LB as per the airline specification. When an uplink is pending, the line title refers to the selected takeoff dataset:

ALT LIM TOGW for alternate data

STD LIM TOGW for standard data

Differences:

The **legacy FMC** provides no condition mode for skid resistant runways, no flaps 1 thrust reduction point, and no takeoff data uplink system.

APPROACH REF Page



The APPROACH REF page of the NG FMC includes a minor textual change and a new feature.

3L provides the QFE/QNH landing reference switch if the feature is installed as per the airline specifications. The function is the same in the legacy FMC, just the text line has been modified.

5R indicates the wind correction that the NG FMC adds to the final flap 25 and flap 30 reference speeds. The default value is 5 knots and is displayed in small font. Manual entries are shown in large font. Deletion resets to the default value.

Valid entries

CAS additive 0 to 20 knots:

X

XX

Differences:

The **legacy FMC** shows the function in 3L in form of a <SELECT prompt, and it provides no wind correction additive.

NAV RADIO Page 1 of 2

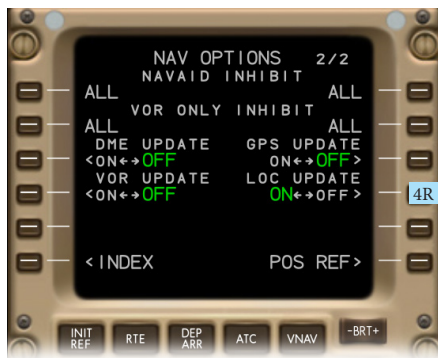


The NAV RADIO page of the NG FMC is identical to that of the legacy FMC, except for the page title indicating that there are two NAV related pages, and the ILS line title in 4L excluding the MLS word; MLS approaches are no longer in use, and any MLS data entries are invalid.

Differences:

The **legacy FMC** provides no second NAV related page, and allows MLS data with MLS channel and azimuth to be entered in 4L and in the preselections 6L and 6R.

NAV OPTIONS Page 2 of 2



The NAV OPTIONS page 2/2 can be accessed from the NAV RADIO page 1/2 by pushing the NEXT PAGE or PREV PAGE keys, or by pushing 5R on the POS REF page 3/4, or by pushing 6R on the REF NAV DATA page.

The NAV OPTIONS page includes the same VOR/DME inhibit functions that the legacy FMC provides on the REF NAV DATA page in line 4, line 5, and in 6R.

The default setting of all four update functions is ON. Flight completion automatically resets to the default.

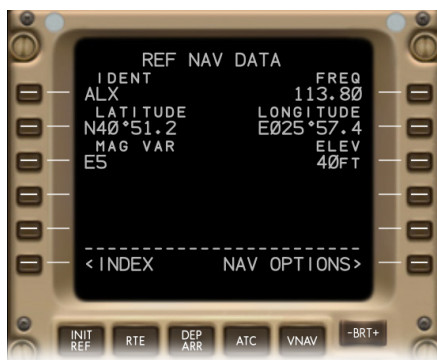
The NG FMC's GPS position update inhibit key is identical to that on the legacy FMC's POS REF page 2/3.

4R indicates the LOC update inhibit status. When selected OFF, or when GPS updating is active, the NG FMC's aircraft position calculation will ignore radio signals from localizer stations.

Differences:

The **legacy FMC** does not include a NAV OPTIONS page; it provides VOR/DME inhibit functions on the REF NAV DATA page and a GPS inhibit key on POS REF page 2/3, and disallows LOC updating inhibits (even during GPS updating).

REF NAV DATA Page

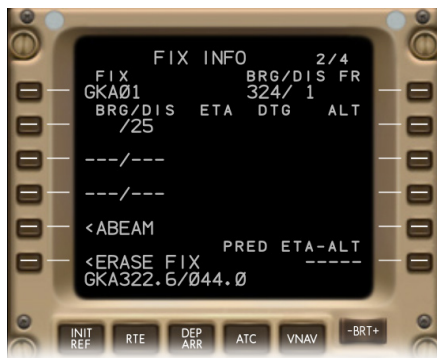
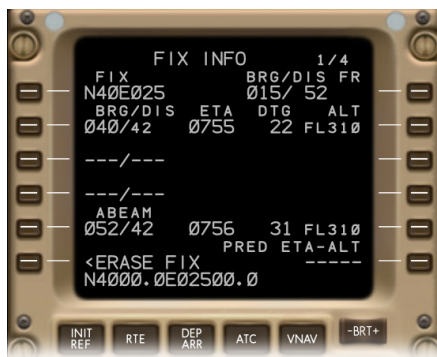
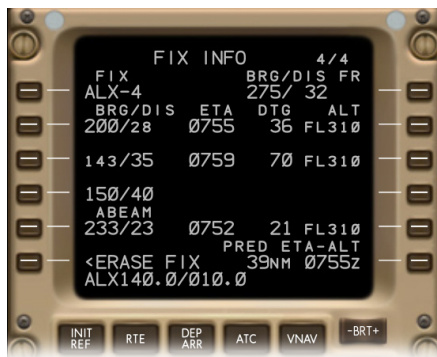


The IDENT function on the NG FMC's REF NAV DATA page is the same as that of the legacy FMC. Just the VOR/DME inhibit functions on the lower half of the page have been moved to the NAV OPTIONS page.

Differences:

The **legacy FMC** provides VOR/DME inhibit functions on the lower half of the REF NAV DATA and does not include a NAV OPTIONS page.

FIX INFO Pages 1 to 4



The NG FMC provides four FIX INFO pages, and the BRG/DIS FR display in the first line has been moved from the center to the right side to obtain more space for the FIX identifier on the left side. Valid fix entries in 1L are the same as those in the legacy FMC: Airports, nav aids, and waypoints stored in the navigation database. But the NG FMC also accepts the following entry formats:

- Place-bearing/distance and place-bearing/place-bearing formats. 1L and the related green symbol on the ND will display a generated name with a suffix consisting of a dash and a digit (1 to 4) referring to the related FIX INFO page number.
- Any latitude/longitude standard format. 1L and the related green symbol on the ND will display it in a 7-character format. When downselected, the scratchpad will show the exact coordinates.
- Any pilot created waypoint that exists in route 1 or 2; for example, an along-track waypoint identifier that ends with an FMC generated 2-digit suffix.
- Any runway of the destination airport in the format “RW25L”, for example. The runway need not be in a route.

Differences:

The **legacy FMC** provides just two FIX INFO pages, and 1L just accepts airport, nav aid, and waypoint identifiers that can be found in the navigation database.

RTE Pages



On the first RTE page the NG FMC adds two more functions:

5L prints all relevant data of the displayed route, from the active waypoint to the last, including wind and alternate airport information (refer to the next page of this manual for an example). The print function is available on the active and inactive RTE pages.

5R provides access to the alternate airports pages.



In the VIA column the NG FMC displays approach identifiers in a more legible format with up to 8 characters including a space; for example, "ILSX 17L".



Differences:

The **legacy** FMC provides no functions for route printouts and alternate airports, and it abbreviates approach identifiers to a 6-character format, for example "ILX17L".

Example of a Route Printout

Paper from flightdeck printer

```

===== FLIGHT PLAN DATA =====
2053Z      747-400F      FMC      130430
FLT NO: 5Y47      TAIL NO: N409MC

----- CURRENT AIRCRAFT DATA -----
LAST POS: GUVOK
ATA AT LAST POS: 2047Z
FUEL AT LAST POS: 13.7
FMC LAT/LON: S3129.7W06429.1
NAV SOURCE: GPS
RNP/ACTUAL: 2.00/0.05NM
FLT PHASE: CLB
VNAV MODE: VNAV SPD
THRUST LIMIT: CLB 1
ALT: FL230
TAS: 461KT
GS: 463KT
WIND: 312/35 KT
OAT: -20C
CURRENT FUEL: 11.9
ORIGIN/ATD: SACO/2037Z
DEST/ETA: SCEL/2157Z
CO ROUTE:
CRZ ALT: FL390
ZFW: 261.0
RESERVES: 2.2
CRZ CG: 20.0%
COST INDEX: 100

----- ACT RTE 1 -----
VIA/TO      SPD/ALT      ETA/FUEL
-----
DIRECT
281      41NM      2059Z/ 9.9
PAMAX      (.845) / (FL344)
UW24
268      83NM      2110Z/ 7.8
ORABA      (.845) / (FL390)
UW24
268      79NM      2120Z/ 6.3
JUA      (.849) / (FL390)
DIRECT
258      99NM      2132Z/ 4.5
ASIMO      (280KT) / FL250A
ASIM2C      16NM      2134Z/ 4.5
DILOK      (280KT) / FL250A
ASIM2C      207      22NM      2137Z/ 4.4
DABIT      (280KT) / FL180A
ASIM2C      177      40NM      2142Z/ 4.2
LESTA      (280KT) / FL180A
ASIM2C      202      10NM      2144Z/ 4.1
EL382      (280KT) / FL150A
ASIM2C      201      10NM      2146Z/ 4.1
MUDAR      (280KT) / FL130A
ASIM2C      172      13NM      2148Z/ 4.0
EL273      (280KT) / FL90A
ASIM2C

```

Paper from flightdeck printer

```

2053Z      747-400F      FMC      130430
FLT NO: 5Y47      TAIL NO: N409MC

----- CURRENT AIRCRAFT DATA -----
LAST POS: GUVOK
ATA AT LAST POS: 2047Z
FUEL AT LAST POS: 13.7
FMC LAT/LON: S3129.7W06429.1
NAV SOURCE: GPS
RNP/ACTUAL: 2.00/0.05NM
FLT PHASE: CLB
VNAV MODE: VNAV SPD
THRUST LIMIT: CLB 1
ALT: FL230
TAS: 461KT
GS: 463KT
WIND: 312/35 KT
OAT: -20C
CURRENT FUEL: 11.9
ORIGIN/ATD: SACO/2037Z
DEST/ETA: SCEL/2157Z
CO ROUTE:
CRZ ALT: FL390
ZFW: 261.0
RESERVES: 2.2
CRZ CG: 20.0%
COST INDEX: 100

----- ACT RTE 1 -----
VIA/TO      SPD/ALT      ETA/FUEL
-----
DIRECT
281      41NM      2059Z/ 9.9
PAMAX      (.845) / (FL344)
UW24
268      83NM      2110Z/ 7.8
ORABA      (.845) / (FL390)
UW24
268      79NM      2120Z/ 6.3
JUA      (.849) / (FL390)
DIRECT
258      99NM      2132Z/ 4.5
ASIMO      (280KT) / FL250A
ASIM2C      16NM      2134Z/ 4.5
DILOK      (280KT) / FL250A
ASIM2C      207      22NM      2137Z/ 4.4
DABIT      (280KT) / FL180A
ASIM2C      177      40NM      2142Z/ 4.2
LESTA      (280KT) / FL180A
ASIM2C      202      10NM      2144Z/ 4.1
EL382      (280KT) / FL150A
ASIM2C      201      10NM      2146Z/ 4.1
MUDAR      (280KT) / FL130A
ASIM2C      172      13NM      2148Z/ 4.0
EL273      (280KT) / FL90A
ASIM2C

----- ENTERED WINDS -----
FIX      ALT      DIR/SPD      ALT/OAT
-----
PAMAX      FL450 285/ 70KT      FL370/-48C
          FL410 291/ 76KT
          FL370 299/ 66KT
          FL330 308/ 54KT
ORABA      FL450 296/ 52KT      FL370/-48C
          FL410 293/ 57KT
          FL370 289/ 48KT
          FL330 285/ 41KT
ASIMO      FL450 287/ 44KT      FL370/-49C
          FL410 290/ 48KT
          FL370 294/ 46KT
          FL330 299/ 41KT

----- DESCENT FORECAST -----
ALT      WIND DIR/SPD
FL280      304/35 KT
FL200      315/24 KT
FL120      330/14 KT
4000      000/4 KT

----- ALTERNATE AIRPORTS -----
SAOS <A> 2101Z 10.7
SAOC 2104Z 10.3
SAOR 2110Z 9.3
SAOU 2111Z 9.1

===== END OF MESSAGE =====

```

ALTN Page 1 of 2



This page displays up to four recommended alternate airports, sorted by the earliest ETA when in flight, or sorted by the shortest distance when on the ground. Large font indicates manually entered airports. Small font indicates automatically suggested airports from one of the following sources:

- From a pending data uplink (this will, when accepted, overwrite manual entries).
- If no uplink is pending, then from the ALTN page 2/2 list (this will not overwrite manual entries).
- If ALTN page 2/2 is empty, then from the navigation database that the FMC searches repeatedly (this will not overwrite manual entries). This excludes runways whose lengths are below the minimum set on the AIRLINE POLICY page 2/2.

All four alternate airports are shown on the ND when the ND is in PLAN mode; in MAP mode just the selected airport is shown. As usual, all database airports are displayed when the ARPT switch on the EFIS control panel has been pushed.

1L 2L 3L 4L indicate the ICAO identifiers of the alternate airports. Pushing one of these keys while the scratchpad is empty will select the respective airport so that it is shown on the ND MAP. Just one airport can be selected at a time. The selection is indicated by a <SEL> marker which can be removed by manually deleting the line. When in flight and no <SEL> is shown, the FMC will autoselect the nearest airport referring to the earliest ETA. The automatic selection is indicated by an < A > marker. Pushing a key while the scratchpad contains data will just upselect the scratchpad data.

Valid entries

ICAO identifier of a database airport:
XXXX

Deleting a manual entry that includes no <SEL> will delete that entry; the FMC may then automatically enter an airport as per the data source logic. Manual and automatic airport entries can be intermixed. Whenever any ETA changes, the FMC will sort the list. Airport entries transferred from a data uplink may contain priority numbers from 1 to 4; number 1 being the airline's most recommended airport for the current flight phase. These numbers are displayed in the related line titles. An airport may be preferred for maintenance specific reasons, for example, even if it is farther away than other destinations; therefore the company's priority order may often disagree with the FMC's ETA order.

(continued next page)

Differences:

The **legacy FMC** does not provide any pages regarding alternate airports.

ALTN Page 1 of 2 (continued)



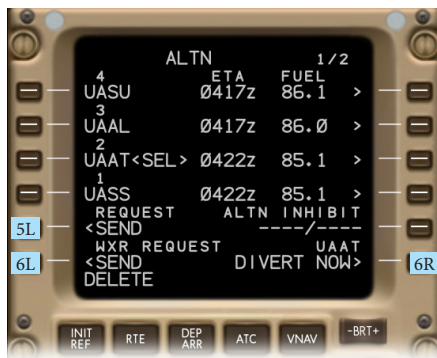
When an uplink of a **four-airports-list** is pending, the page title reads ALTN UPLINK, and up to four uplinked airports appear in the respective lines in small font with priority numbers in the line titles.

When an **airport-inhibit** uplink is pending, the page title reads ALTN INHIB UPLINK, and one or two uplinked airport identifiers appear in 5R in small font.



5L provides a <SEND key that sends a request for an airport data uplink to the ground station; the uplink will contain a four-airports-list or airport-inhibit data. (In the simulator, the virtual ground station will uplink airport-inhibit data on every second uplink request if no manual entry exists in 1L through 4L.)

6L displays <REJECT when an airport data uplink is pending; pushing the <REJECT key purges the uplinked data and redisplay the previous entries. Otherwise 6L displays the WXR REQUEST <SEND key that sends a weather data uplink request for the displayed alternate airports; that function includes no reject-accept logic as the uplinked weather data will be directly sent to the printer.



6R displays ACCEPT> when an airport data uplink is pending; pushing the key overwrites the previous entries with the uplinked data and shows them in large font. Otherwise, 6R displays the DIVERT NOW> key that opens another control page for starting the diversion (refer to the next pages of this manual for further details).

(continued next page)

ALTN Page 1 of 2 (continued)



1R 2R 3R 4R indicate the predicted ETA and fuel remaining at the related alternate airport based on the planned diversion route and entered weather data. The diversion route and weather data can be set on airport specific pages that open when pushing one of the four keys.

UNABLE ALT is displayed if the entered diversion cruise altitude is above the current maximum altitude, or if the top of descent on the planned diversion route is behind the aircraft.

UNABLE FUEL is shown if the predicted fuel remaining at the respective alternate airport is zero; this indication overwrites the UNABLE ALT indication if both conditions exist at the same time.

If an airport is manually selected or entered, the associated data or UNABLE indication appears in large font, otherwise in small font.

5R shows up to two manually entered or uplinked airport identifiers that the FMC will exclude when it searches the navigation database for alternate airports. Dashes are shown when 5R has been deleted.

Valid entries

ICAO identifiers of database airports (single entry without slash sets right slot if right slot is dashed, else sets left slot):

XXXX
XXXX/
/XXXX
XXXX/XXXX

ALTN LIST Page 2 of 2



This page can be accessed from the ALTN page 1/2 by pushing the NEXT PAGE or PREV PAGE key.

The upper four lines may list up to 20 identifiers of alternate airports. Manual entries are not possible. A list can only be entered by a data uplink.

The FMC will repeatedly search this list for the four nearest airports with reference to the current diversion starting point that is selected on the airport specific ALTN pages (refer to the next page of this manual). If the list is empty, the FMC will search the navigation database instead.

5L provides a <SEND key that sends a twenty-airports-list uplink request to the ground station; that function includes no reject-accept logic as the uplinked list will directly overwrite the previously displayed list.

6L opens the INIT/REF INDEX page.

5R provides a PURGE> key when a list is displayed. When pushed, the key is renamed to CONFIRM>, and when pushed again, the list will be deleted.

Airport Specific ALTN Pages 1 to 4



There can be up to four pages of this kind, each specific to one of the recommended airports shown on the ALTN page 1/2. The page title shows the respective airport identifier. The other airport specific pages can be accessed through the NEXT PAGE and PREV PAGE keys, or directly by the associated right line select key on the ALTN page 1/2.

The VIA features on the left side prepare the diversion method. The prepared method is synchronized across all four pages. That is, all airports are linked with the same method; however, each airport's ETA and fuel data may be different due to its specific location and weather.

1L — When pushed, the line will indicate <SEL>, and the diversion route to each alternate airport will be a single direct leg starting at the current aircraft position. The FMC will search for alternate airports near the current aircraft position, thus this function will help the crew to find airports for an immediate landing.

2L — Pushing this key while the scratchpad is empty will indicate <SEL>, and the diversion route to each alternate airport will consist of the current active route plus one final leg starting at the end of the active route. The FMC will search for alternate airports near the last enroute waypoint, thus this function will help the crew to find alternate airports in the destination area when, for example, the planned destination airport has closed unexpectedly.

Pushing 2L while the scratchpad contains data will upselect the data and display it in large font. This will prepare an offset along the active route. The prepared offset will only become active when this diversion method is executed. Deleting the entry will redisplay the default value of zero in small font.

Valid entries

Offset 0 to 99 nm left or right, or zero:

LX
LXX
RX
RXX
0

(continued next page)

Airport Specific ALTN Pages 1 to 4 *(continued)*



3L — Pushing this key while the scratchpad is empty will indicate <SEL>, and the diversion route to each airport will consist of the current active route to a specific enroute exit point followed by one final leg. The FMC will search for alternate airports near the specified exit point, thus this function will help the crew when a landing at the next suitable airport is required while direct legs in the present vicinity should be avoided because of high terrain, for example.

Pushing 3L while the scratchpad contains data will upselect the data and display it in large font. This will specify an exit point on the active route from which the final leg will start. Deleting the entry will redisplay the default. The default is displayed in small font and is always the active waypoint.

Valid entries

Any waypoint identifier in the active route:

X
XX
XXX
XXXX
XXXXX
XXXXXXX

5L provides the same engine-out function available on the CRZ page in 5R.

6L opens the ALTN page 1/2.

1R advises a cruise altitude for the selected diversion route to the respective airport. The FMC takes this value into account when computing the airport specific ETA and fuel remaining. FMC computed altitudes appear in small font and may refer to the default value entered on the AIRLINE POLICY page 2/2 in 2R. When the default value exceeds the current optimum altitude, or when a short distance to the respective alternate airport requires a lower altitude, the FMC computes a lower altitude accordingly. The computed altitudes may be different on each airport page. A manual entry appears in large font and is synchronized across all four airport pages. Deleting the manual entry will redisplay the FMC computed value.

Valid entries

Altitude -1005 to 45100 ft:

XXX
XXXX
XXXXX
FLXXXX

(continued next page)

Airport Specific ALTN Pages 1 to 4 *(continued)*



2R advises a cruise speed for the selected diversion route to the respective airport. The FMC takes this value into account when computing the airport specific ETA and fuel remaining. FMC computed speeds appear in small font and may refer to the default settings on the AIRLINE POLICY page 2/2 in 3L, 4L, 5L. The computed speeds may be different on each airport page. A manual entry appears in large font and is synchronized across all four airport pages. Deleting the manual entry will redisplay the FMC computed value.

Valid entries

Mode word:

LRC, ECON, EO, EOLRC, CO, CO SPD

CAS 100 to 399 knots:

XXX

Mach 0.40 to 0.99:

.XXX

CAS 100 to 399 knots / Mach 0.40 to 0.99:

XXX/.XXX

3R allows a manual wind data entry for the diversion route to the respective airport. These entries are not synchronized across the airport pages. The FMC takes this data into account when computing the airport specific ETA and fuel remaining. Dashes are shown if the entry has been deleted.

Valid entries

Direction degrees / speed 0 to 250 knots:

XXX/X

XXX/XX

XXX/XXX

Direction over an existing entry:

XXX

Speed over an existing entry:

/X

/XX

/XXX

4R allows the manual entry of an OAT at an altitude that is expected on the diversion route to the related airport. These entries are not synchronized across the airport pages. The FMC uses this data for airport specific ETA and fuel computations. Dashes are shown if the entry has been deleted.

Valid entries

Altitude -1005 to 45100 ft / -99 to 60 °C:

XXX/-XX

XXXX/X

XXXXX/-X

FLXXX/-XX

5R shows the same data the ALTN page 1/2 shows for the respective airport; that is, it displays the predicted ETA and fuel data, or indicates UNABLE FUEL or UNABLE ALT depending on the present conditions.

(continued next page)

Airport Specific ALTN Pages 1 to 4 (continued)



6R provides the DIVERT NOW> key. When pushed, it indicates SELECTED and the following effects occur:

- The EXEC light illuminates, and the page title indicates MOD.
- All active LNAV/VNAV related pages become modified pages.
- All legs in the modified route are replaced with the selected diversion route, and the destination airport is replaced with the selected alternate airport.
- If a previous descent route is to be used for cruise, all previous descent constraints are deleted and the scratchpad message DESCENT PATH DELETED appears.
- The non-selected diversion methods and the <ENG OUT prompt are removed. (For the engine-out mode, <ENG OUT must be selected **before** pushing DIVERT NOW>; however, the engine-out mode can also be selected on the CRZ page.)



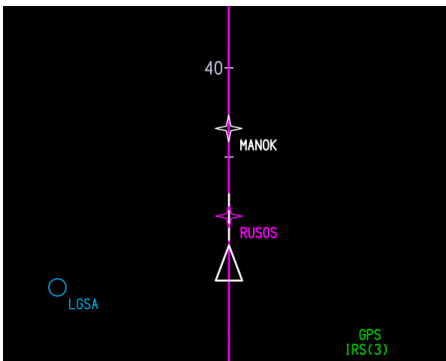
Finally, pushing the EXEC key activates the modifications, and the MOD in the page title and the <SEL> marker change to ACT. This final page display is reset when both CDUs show another page.

The above effects also appear when a diversion method other than the direct-to has been selected; the only difference being the specific <SEL> and <ACT> line positions and the removal of the respective other diversion methods.

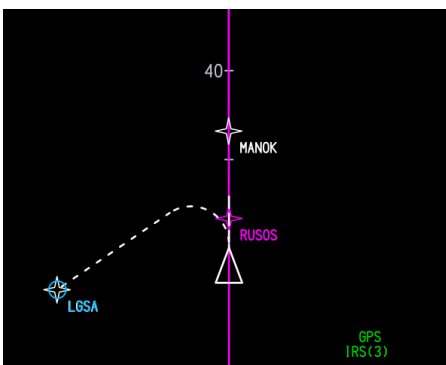


Example — Divert now Direct To

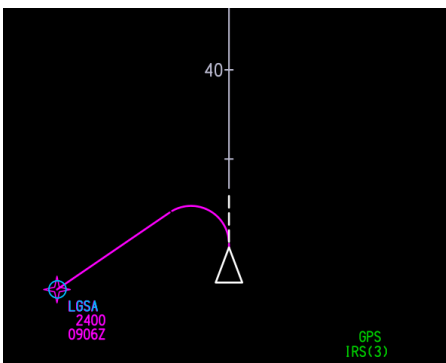
Step 1 — DIRECT TO selected:



Step 2 — DIVERT NOW selected:



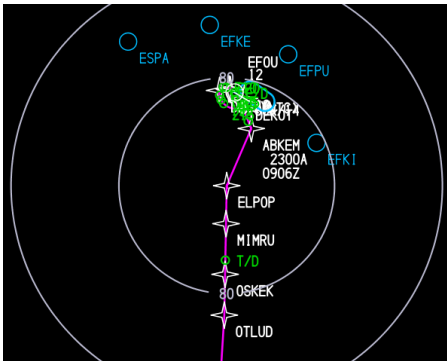
Step 3 — EXEC key pushed:



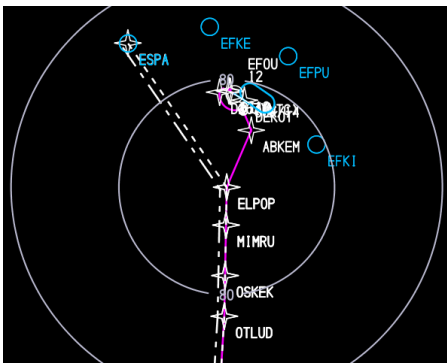


Example — Divert now via Active Route with Offset

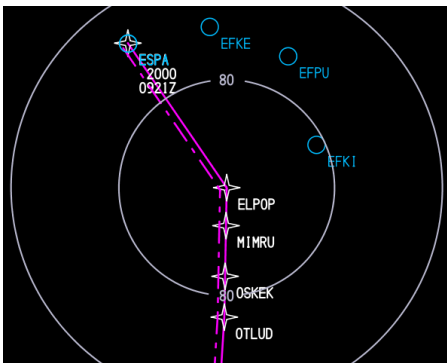
Step 1 — OFFSET selected and offset value entered:



Step 2 — DIVERT NOW selected:



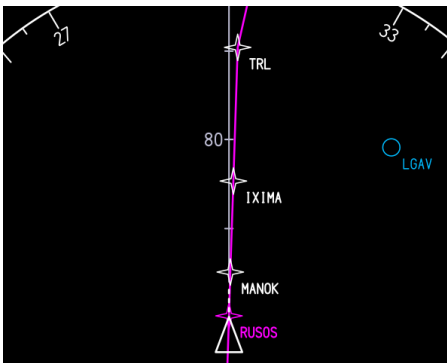
Step 3 — EXEC key pushed:



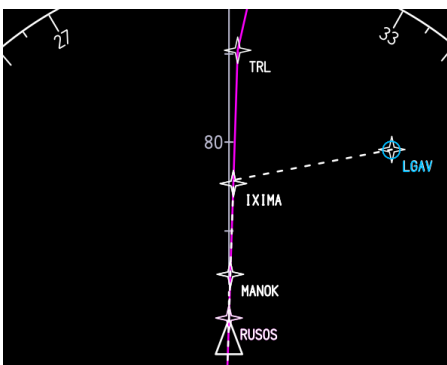


Example — Divert now via Overhead

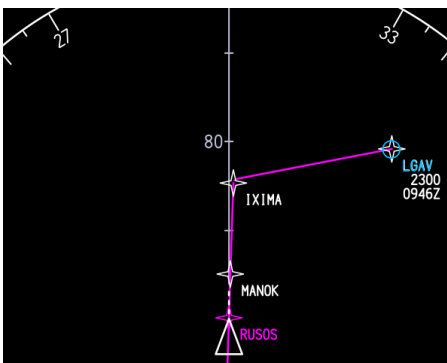
Step 1 — OVERHEAD selected and enroute waypoint entered:



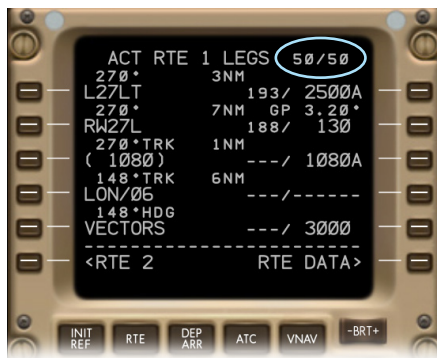
Step 2 — DIVERT NOW selected:



Step 3 — EXEC key pushed:



Maximum Number of Legs

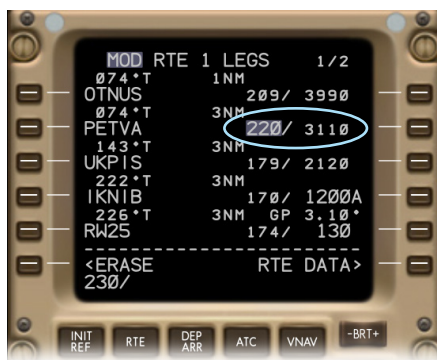


The NG FMC incorporates more memory that is able to store up to 250 legs per route. Modern routes often consist of a higher number of waypoints in order to increase the navigational precision. The extended memory assures that all required legs can be stored within a single FMC route.

Differences:

The **legacy FMC** can store a maximum of 120 legs per route.

Speed Constraints in Climb and Descent



The NG FMC allows speed constraints to be entered without pairing them with altitude constraints. Therefore, a waypoint speed constraint may appear on the LEGS page in large font along with a predicted waypoint altitude in small font.

Like in the legacy FMC, all speed constraints are *at-or-below* speed limits.

Differences:

The **legacy FMC** requires waypoint speed constraints to be entered with an associated altitude or to be entered over an existing altitude constraint.

Cruise Speed Segments (CSS)



The NG FMC allows the crew to program cruise speed segments (CSS). The start of a CSS can be set by entering a speed mode at a cruise waypoint on the LEGS pages. The speed mode may be ECON, LRC, RTA, or a Mach number.

Valid entries

Mode word:

E/ or ECON/

L/ or LRC/

R/ or RTA/

Mach 0.400 to 0.990:

.X/

.XX/

.XXX/

General rules:

- Entries can only be made at cruise waypoints.
- RTA can only be entered in legs that precede an existing RTA fix.
- ECON entry between RTA legs is invalid (entering RTA in front of an ECON entry will change this ECON to RTA).

The entered mode will appear in large font at the respective waypoint on the LEGS pages, and the data will be propagated along the following legs in small font. However, the following text lines will not repeat the mode word; they will show the mode related Mach number. A CSS ends at the start of the next CSS or at the top of descent, whichever occurs first. When a CSS waypoint becomes active, its associated speed mode activates and remains active until the next CSS begins, or until the descent activates, or until the crew selects a different speed mode on the CRZ page.

The ND indicates every CSS speed mode change at the respective route waypoint:

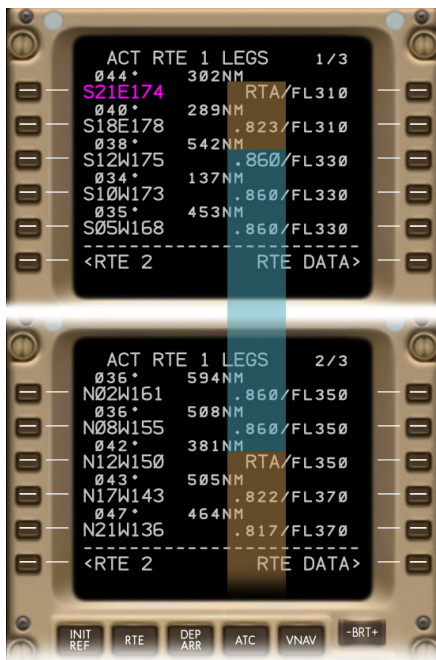


(continued next page)

Differences:

The **legacy FMC** does not allow any speed entries in cruise legs.

Cruise Speed Segments (CSS) *(continued)*



The FMC does not require an RTA route to consist of RTA legs only. An RTA route may include a Mach segment or LRC segment that is preceded by an RTA segment. To compensate for unexpected wind changes along the route, this RTA segment may be flown at variable airspeeds. When the aircraft leaves this initial RTA segment and enters the Mach or LRC segment, the FMC cannot influence the ETA anymore; the remaining RTA precision will then depend on how accurate the weather data entries were during the preceding RTA operation. Accurate weather data entries are essential in this case. If the Mach or LRC segment is followed by another RTA segment, that RTA segment may vary the airspeed again to meet the required time of arrival. The longer the RTA segment, the more flexible the ETA control. — Cruise speed segment data is also displayed on the RTA PROGRESS page 3/4 (refer to page 60 of this manual).

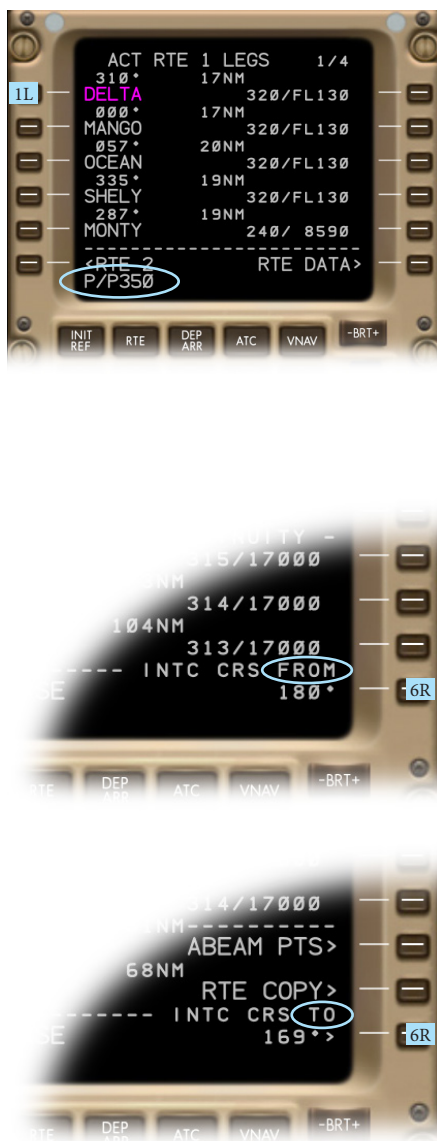
Example of an RTA route with a Mach segment embedded between RTA segments:



Example of an RTA route that includes a LRC segment right before the RTA fix:



Pilot Created Vector without Defined Distance



The NG FMC allows the crew to set a vector in the first route leg without including a defined distance. It is to be set at **1L** on the first LEGS page. The FMC will insert a route discontinuity after it. LNAV will guide along this vector until the crew closes the discontinuity. When closing it with an intersecting leg, the FMC will create a new waypoint at that intersection. — The vector may start at the present position or at any database waypoint.

Valid entries

Present position (P/P) and 3-digit course, for example:

P/P045

P/P359

Waypoint and 3-digit course, for example:

LAX045

ALPHA359

6R — When the vector is entered in the modified route, 6R indicates the course. The line title in 6R shows INTC CRS *FROM* as this function is a course *from* a fix (for direct-to courses, as used in the legacy FMC, the 6R line title shows INTC CRS *TO*).

Differences:

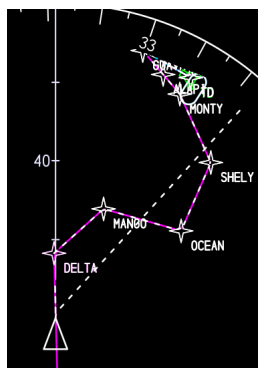
In the **legacy FMC** it is not possible to create a vector manually, and the 6R line title will just show the words INTC CRS as the legacy version can only operate with direct-to courses anyway.

Example — Vector from Present Position



Step 1 —

A vector is to be created in the active route at an initial course of 350°, starting at the present position. Therefore enter **P/P350** in the scratchpad.



Step 2 —

Push 1L on the first LEGS page. The route is now modified. The FMC displays (350°) in 1L and has inserted a route discontinuity in 2L. The ND shows a dashed white vector starting at the present position at a course of 350°.

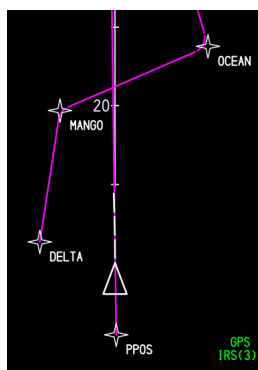


Step 3 —

Push the EXEC key. The modification is now active. The ND shows the vector in magenta, and the FMC has created an anchor waypoint named **PPOS** at the start of the vector.

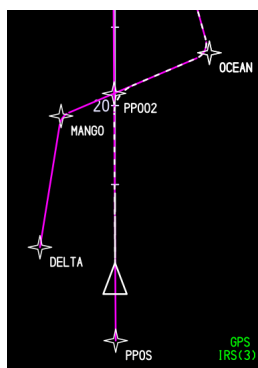
(continued next page)

Example — Vector from Present Position (continued)



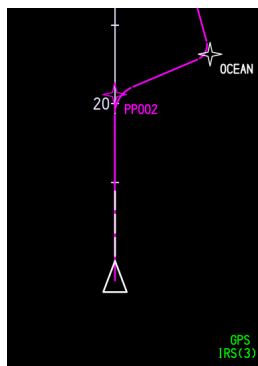
Step 4 —

Assuming ATC instructs to intercept and follow the 057° leg to OCEAN; therefore downselect OCEAN into the scratchpad.



Step 5 —

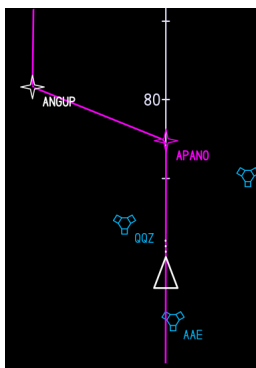
Upselect OCEAN into 2L to close the discontinuity. The route is now modified, and the FMC has created a waypoint PP002 at the intersection to OCEAN.



Step 6 —

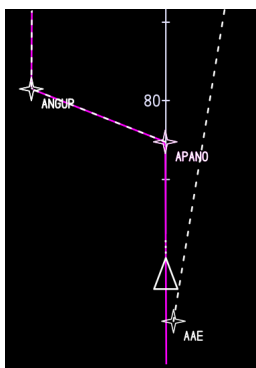
Push the EXEC key. The modification is now active.

Example — Vector from Waypoint



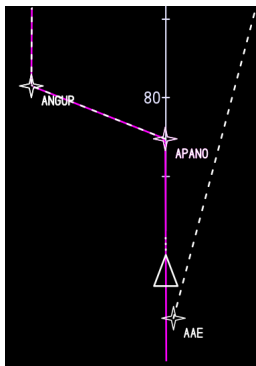
Step 1 —

A vector is to be created in the active route at an initial course of 180°, starting at the AAE fix. Therefore enter **AAE180** in the scratchpad.



Step 2 —

Push 1L on the first LEGS page. The route is now modified. The FMC displays **(180°)** in 1L and has inserted a route discontinuity in 2L. The ND shows a dashed white vector starting at the AAE fix at a course of 180°. The course is also indicated in 6R in small font.

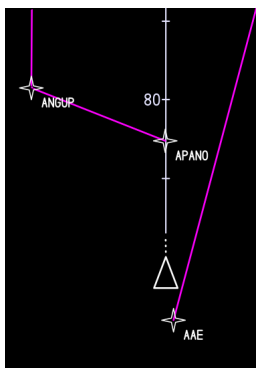


Step 3 —

The course in 6R can be changed. For example, enter **185** in 6R. The entry in 6R now appears in large font, and the ND shows a 185° vector course.

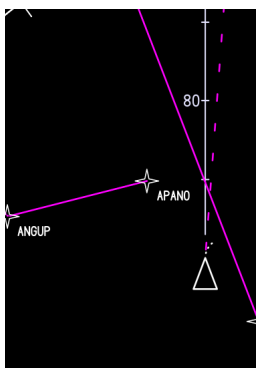
(continued next page)

Example — Vector from Waypoint *(continued)*



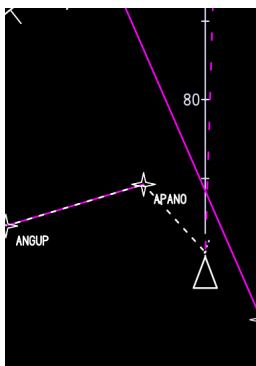
Step 4 —

Push the EXEC key. The modification is now active. Use HDG SEL to intercept the 185° vector.



Step 5 —

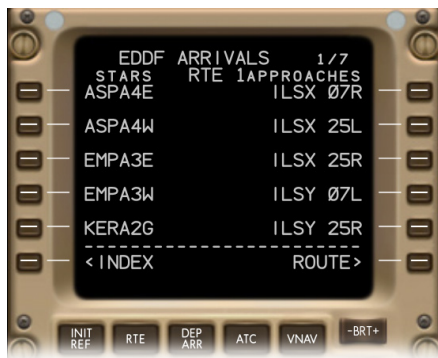
Assuming ATC instructs to proceed direct to APANO; therefore downselect APANO into the scratchpad. In this example, the vector will not intersect any leg.



Step 6 —

Upselect APANO into 1L to remove the vector completely. The route is now modified, leading direct to APANO. Pushing the EXEC key will activate the modification.

DEPARTURE / ARRIVAL Pages



The NG FMC is able to operate with departure and arrival procedures that contain **RF legs**. It includes such procedures in the database and displays them on the DEP/ARR pages. In the example shown to the left, the three ILSX procedures would not appear in the legacy FMC because they contain RF legs. This is just an example. Whether or not a procedure includes an RF leg cannot be determined by the procedure identifier. An RF leg appears on the ND in form of a continuous arc with a fixed radius; it will not vary when the groundspeed changes. The arc construction is similar to that of a DME arc, but the RF leg needs no radio station. Also, an RF leg's initial course is usually in line with the exit course of the preceding leg, and the RF leg's exit course is usually in line with the initial course of the following leg.

For approach identifiers the NG FMC uses an 8-character format with a space to make the RTE and DEP/ARR pages more legible.

Differences:

The **legacy FMC** does not contain procedures with RF legs as it cannot operate with them, and it abbreviates procedure identifiers to a 6-character format.

HOLD Page



The HOLD page of the NG FMC is identical to that of the legacy FMC. The ND, however, will show the planned entry procedure, and LNAV will guide along *fly-by* turns at the hold fix when entering and exiting the hold.

Differences:

The **legacy FMC** includes the same HOLD page, but the ND does not show any entry procedures, and for the entry and exit LNAV always considers the hold fix a *fly-over* waypoint.

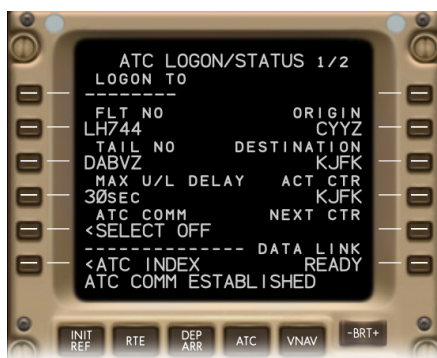
ATC LOGON/STATUS Pages 1 and 2



The NG FMC provides two ATC LOGON/STATUS pages; they can be accessed by the NEXT PAGE key and PREV PAGE key.

The logon station code in **1L** may consist of four to eight characters.

2R **3R** display the origin and destination airports. The default is the data from the active RTE page. Manual entries are allowed and will not be copied to the RTE page. Deletion resets to the default.

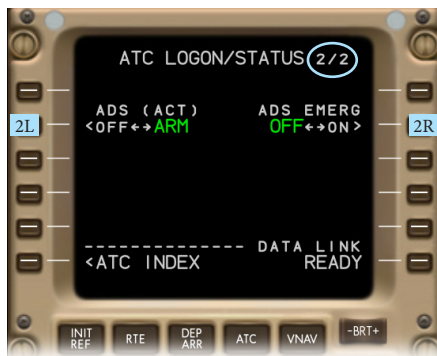


4L displays the entered maximum uplink delay or shows dashes when the entry has been deleted. The first message from ATC after logon may instruct the crew to enter a specific delay value. The system will use the entered value for timeout warnings.

Valid entries

Time delay 1 to 999 seconds:

X
XX
XXX

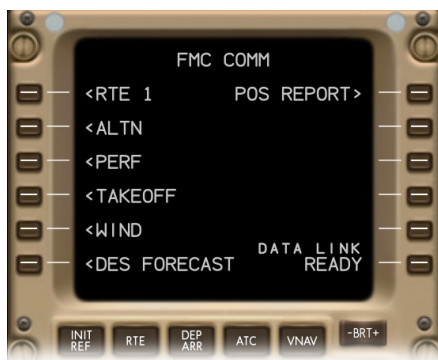


The ADS arming key and ADS emergency key have been moved to **2L** and **2R** on the second page.

Differences:

The **legacy** FMC provides a single logon page, allows just four characters in **1L**, excludes origin and destination airports on this page, and provides no maximum uplink delay function.

FMC COMM Page



The NG FMC displays all access keys to communication related pages on a single FMC COMM page. It includes the access keys to the new uplink features on the ALTN, PERF INIT, and TAKEOFF REF pages. And it excludes the company route request function that is already available on the RTE page.

Differences:

The **legacy FMC** provides two FMC COMM pages with a redundant company route request function, and does not include any uplink features regarding ALTN, PERF INIT, and TAKEOFF REF.

CLB Page



The CLB pages of the NG FMC and legacy FMC are identical. However, the NG FMC's internal logic is slightly different:

When the MCP ALT knob is pushed while a paired speed/altitude constraint exists between the aircraft altitude and the MCP altitude, only the *altitude* portion of this constraint will be deleted. The NG FMC accepts speed-only constraints. Speed constraints can be removed by deleting the respective line on the LEGS pages.

When a SID from the SID database contains no SID specific transition altitude, the NG FMC loads the origin related transition altitude from the airport database.

When the TAKEOFF REF page is displayed after lift-off, the initial flap retraction automatically causes the FMC to change over to the CLB page.

In engine-out conditions, when the E/O acceleration height is passed, the command speed will be VREF+80 (flap up speed).

Differences:

The **legacy FMC** deletes the altitude and the speed when the MCP ALT knob is pushed. SID transition altitudes are only loaded from the SID database. Autopaging from TAKEOFF REF is a company option. And the E/O command speed is VREF+100.

CRZ Page



The NG FMC provides more step size options and adds an indication of the computed recommended cruise altitude.

4L displays the step size used for cruise step climb computations like in the legacy FMC. No step climb will occur when zero is entered. Default entry is RVSM which applies RVSM flight level separation rules for step sizes. Deletion resets to the default.

Valid entries

1000 to 9900 feet in 100 foot increments:

XX00

One character:

0 (for zero)

I (for ICAO)

R (for RVSM)

4R indicates the recommended cruise flight level (RECMD) with regard to the next 250 to 500 nm, depending on the entered step size: 250 nm for a step size of 1000 ft, 333 nm for RVSM or 2000 ft, 500 nm for ICAO or 4000 ft. The FMC computes the recommended flight level by taking account of the current speed mode and cruise speed segments, the center of gravity, the gross weight, and a distance dependent interpolation mix of entered weather data and sensed weather data. The FMC will test multiple flight levels from the current maximum altitude down to 9000 feet below the current cruise altitude, but not lower than FL240. For ECON speed modes the recommendation refers to the minimum costs, for other speed modes it refers to the minimum fuel burn. — The data in 4R blanks when the RTA speed mode is active.

The FMC ignores, as usual, any pilot entered step climb points that are within 200 nm of the top of descent. The NG FMC, however, also ignores those that are within 500 nm of the destination airport.

Differences:

The **legacy FMC** does not allow RVSM nor 100 foot step size increments (just 1000 foot increments), it does not provide recommended altitudes, and 500 nm from the destination is not an inhibit criterion for step climb points.

DES Page



The DES page of the NG FMC displays an overshoot warning in line [2R](#) when the FMC predicts the aircraft will arrive above the active maximum altitude constraint; this function is similar to the undershoot warning on the CLB page.

Also, similarly to the climb phase: When the MCP ALT knob is pushed while a paired speed/altitude constraint exists between the aircraft altitude and the MCP altitude, only the *altitude* portion of this constraint will be deleted. The NG FMC accepts speed-only constraints. Speed constraints can be removed by deleting the respective line on the LEGS pages.

In the NG FMC the vertical bearing feature in [3R](#) and [4R](#) is no longer an airline option but is permanently enabled.

Differences:

The **legacy** FMC deletes the altitude and the speed of a constraint when the MCP ALT knob is pushed, and the vertical bearing feature may be enabled as per airline specification.

PROGRESS Page 1 of 4

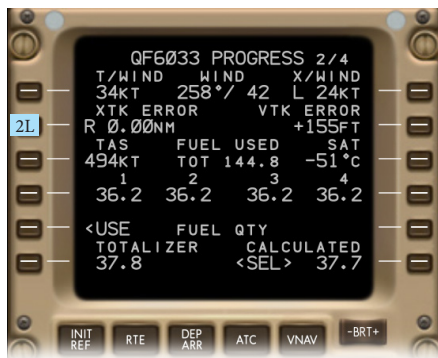


The NG FMC does not display the data of the last waypoint on any PROGRESS page. However, as usual, the last waypoint data is shown on the POS REPORT page. The other text rows on the PROGRESS page 1/4 have been moved up by one line. The page title indicates there is a fourth PROGRESS page.

Differences:

The **legacy FMC** incorporates just three PROGRESS pages, and the first page indicates the identifier, aircraft altitude, arrival time, and fuel recorded at the last route waypoint.

PROGRESS Page 2 of 4



The second PROGRESS page of the NG FMC is identical to that of the legacy FMC, the only difference being the NG FMC's finer cross track error display in **2L**; it provides a resolution of a hundredth of a nautical mile.

Differences:

The second PROGRESS page of the **legacy FMC** provides a cross track error display resolution of a tenth of a nautical mile.

RTA PROGRESS Page 3 of 4

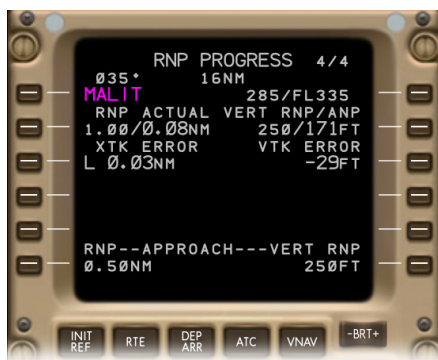


The RTA PROGRESS page of the NG FMC is identical to that of the legacy FMC, except for the cruise speed segment (CSS) display: **3L** shows the mode and waypoint at which the next CSS starts, and **3R** shows the mode and waypoint at which that CSS ends. For more details, refer to page 45 of this manual.

Differences:

The **legacy FMC** does not provide any functions regarding cruise speed segments.

RNP PROGRESS Page 4 of 4



All RNP related variables are summarized on this page. They are shown on various other pages as well, except for the NG FMC specific *vertical* RNP/ANP variables. The vertical RNP is derived from the current lateral RNP, and the vertical ANP is a non-linear function of the current Mach number (the vertical ANP error rises with the Mach number).

Differences:

The **legacy FMC** does not include this page.

Messages Introduced by the NG FMC

High priority messages (accompanied by EICAS advisory)	
ALTN INHIBIT UPLINK	An uplink of alternate airport inhibit data is pending and displayed on the ALTN page 1/2.
ALTN LIST UPLINK	An uplink of up to twenty alternate airports has been loaded on the ALTN LIST page 2/2.
ALTN UPLINK	An uplink of up to four alternate airports is pending and displayed on the ALTN page 1/2.
APP TUNE INHIBITED - MCP	This replaces the legacy FMC specific message ILS TUNE INHIBITED - MCP.
ATC COMM TERMINATED	The ATC datalink communication has been terminated.
CHECK AIRLINE POLICY	An invalid parameter has been detected in the airline maintained file.
CRZ ALT CHANGED TO [altitude]	The FMC has increased the cruise altitude because it was below the highest altitude constraint of the loaded procedure or below the CRZ ALT stored in the loaded company route or below the loaded destination elevation.
LNAV BANK ANGLE LIMITED	The predicted turn radius is too small to be maintained by LNAV at the current performance related bank limit.
PERF INIT UPLINK	An uplink of performance initialization data is pending and displayed on the PERF INIT page.
RW/APP TUNE ERROR	This replaces the legacy FMC specific message RW/ILS FREQ ERROR.
SET TIME/DATE-POS INIT	This replaces the legacy FMC specific message SET CLOCK TO UTC TIME.

(continued next page)

Messages Introduced by the NG FMC *(continued)*

High priority messages (accompanied by EICAS advisory)	
SINGLE FMC L OPERATION	This replaces the legacy FMC specific message SINGLE FMC OPERATION.
SINGLE FMC R OPERATION	This replaces the legacy FMC specific message SINGLE FMC OPERATION.
TAKEOFF DATA LOADED	A new dataset has been loaded on the TAKEOFF REF page.
TAKEOFF DATA UPLINK	An uplink of takeoff reference data is pending and displayed on the TAKEOFF REF page.
UNABLE HOLD AIRSPACE	The airspeed is too high to keep the turn radius within the maximum protected holding airspace at the current altitude.
VERIFY RNP - POS REF 2	This replaces the legacy FMC specific message VERIFY RNP - POS REF 2/3.
VERIFY VERT RNP - PROG 4	The current default vertical RNP has decreased below the manually entered vertical RNP.
VIA OFFSET INVALID	The offset entered on one of the ALTN pages is invalid for the selected diversion route.

(continued next page)

Messages Introduced by the NG FMC (continued)

Low priority messages (not accompanied by EICAS advisory)	
CHECK CONSTRAINT [waypoint]	A waypoint altitude constraint modification conflicts with the constraint at another waypoint.
INVALID ALTN LIST UPLINK	A data uplink to the ALTN LIST page 2/2 contains a fault and the FMC rejects the data.
INVALID ALTN UPLINK	A data uplink to the ALTN page 1/2 contains a fault and the FMC rejects the data.
INVALID ENTRY-RTA ACTIVE	The ECON speed mode has been entered in a leg before the RTA fix during RTA operation or has been entered between RTA speed segments.
INVALID PERF INIT UPLINK	A data uplink to the PERF INIT page contains a fault and the FMC rejects the data.
INVALID TAKEOFF UPLINK	A data uplink to the TAKEOFF REF page contains a fault and the FMC rejects the data.
VERIFY VERT RNP ENTRY	A vertical RNP has been manually entered that is higher than the current default vertical RNP or lower than the current vertical ANP.
[waypoint] - MAX ALT [altitude]	A waypoint starting a cruise speed segment contains a Mach number whose corresponding maximum altitude is lower than the planned step size based altitude at that waypoint.

VNAV Descent with Off-Idle Thrust

For the initial descent from the T/D down to the first hard constraint, the NG FMC plans an *off-idle* thrust path — unlike the legacy FMC's *idle* thrust path. The NG FMC aims at a thrust setting slightly above idle, and for this task, VNAV PTH will be coupled with the SPD mode. When arriving at the T/D with VNAV PTH and the SPD mode, there will be no mode change. This higher thrust setting improves the descent path control as any excess airspeed will be dissipated more often by thrust reduction than by speed brake extension. The descent path will be shallower, therefore the NG FMC's T/D will be placed farther away from the destination than the legacy FMC's T/D.

Differences:

For the initial descent after the cruise phase, the **legacy FMC** plans an *idle* thrust path that is controlled by VNAV PTH coupled with IDLE and HOLD.

VNAV Descent with VNAV PTH and MCP SPD

When the MCP SPD window opens during VNAV PTH operation, the NG FMC keeps VNAV PTH engaged even when the VNAV on-approach logic is inactive. The legacy FMC engages VNAV SPD in this case. The NG FMC will only engage VNAV SPD when the target airspeed and the planned descent path can no longer be maintained; the rules for that are the same as in the legacy FMC. — Secondly, when the MCP SPD window closes while the MCP speed is lower than the current FMC speed, the NG FMC will activate the SEL SPD mode and copy the MCP speed to that SEL SPD. This feature avoids an unwanted autothrottle induced thrust increase when the MCP SPD mode is terminated.

Differences:

When the MCP SPD window opens while the VNAV on-approach logic is inactive, the **legacy FMC** engages VNAV SPD. Closing the window will never cause the **legacy FMC** to activate the SEL SPD mode nor to change any SEL SPD; closing the window may cause an unwanted thrust increase if the FMC speed is higher and the crew has not entered the desired lower SEL SPD before opening the window.

VNAV On-Approach Logic Activation

When the VNAV on-approach logic is active during VNAV PTH operation, resetting the MCP ALT above the current altitude will not engage VNAV ALT. This logic is implemented in the legacy FMC and in the NG FMC. However, for the activation of this logic, the NG FMC uses different conditions than the legacy FMC. The NG FMC accepts any of the following triggers:

- The flaps are out of up while the descent phase is active.
- The aircraft is within 12 nm of the destination airport on a course to the active waypoint, and a manually entered E/D constraint is below 500 ft above the destination elevation.
- The first approach waypoint is sequenced.
- The active waypoint is the missed approach point or the runway, and the aircraft is within 25 nm of the threshold.

Differences:

In the **legacy FMC**, the flap setting and a manually entered E/D cannot influence the on-approach activation.

VNAV Flap Speed Management

From the initial T/D down to the final approach, the NG FMC predicts every point on the path where the flap setting needs to be changed, and it takes the respective flap deceleration phases into account. The flap speed values refer to the entries on the APPROACH REF page. Flap profile points appear on the ND in green.

Additionally, the NG FMC will automatically reset its SEL SPD value for each flap setting: When passing the flap-up point, the SEL SPD decreases to VREF+80. When the crew selects flaps 1, the SEL SPD decreases to VREF+60, and so on. When the crew selects the landing flaps, the SEL SPD resets to VREF plus the entered wind additive. All these automatic SEL SPD changes only occur if the current command speed is higher.

Differences:

The **legacy FMC** does not compute any flap related points, and for the final approach it always assumes 170 KIAS.

VNAV Missed Approach Speeds

For the missed approach climb, the NG FMC plans a target speed of VREF+80 (flap-up speed). When all at-or-above constraints are sequenced and the cruise altitude is reached, the cruise phase activates. At that point the target speed will be 250 KIAS or, if a hold is in the route, the best hold speed.

Differences:

The **legacy FMC**'s target speed during the climb is 250 KIAS.

LNAV Bank Angle Limit

To permit RNP AR operations (required navigation performance authorization required), the NG FMC allows a continuous maximum bank angle of 30°, unless the bank angle is, as usual, limited by any of the following conditions: RA below 200 ft, or engine out below V2+10, or flaps up below VREF+100.

Differences:

The **legacy FMC**'s maximum is 25° instead of 30°.

LNAV Control Gain

On legs where the RNP is at or below 0.30 nm, the NG FMC increases the LNAV control gain to achieve a more vigorous tracking control.

Differences:

In the **legacy FMC** the control gain will not increase.

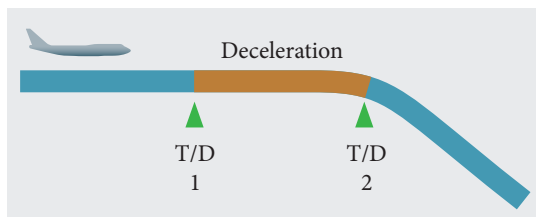
LNAV Waypoint Sequencing

The B744 NG FMC can also sequence *approach* waypoints located *behind* the aircraft that the aircraft has *not* overflown; it will do this when the LOC roll mode is engaged.

Differences:

The **legacy FMC** will not sequence approach waypoints under these conditions.

ND — Top of Descent at Cruise Level



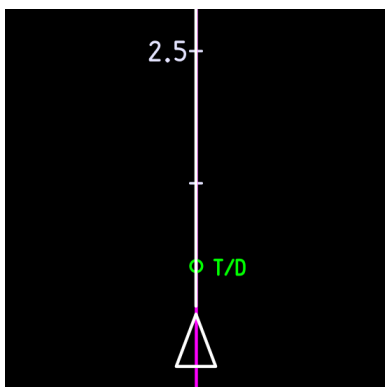
The initial T/D indicates the point where the descent phase will activate. When it has activated and a deceleration at cruise level is required, the NG FMC places the T/D at the knee of the descent path transition.

Step 1 — The cruise phase is active with Mach .88 in this example, and the T/D indicates where the descent phase will activate.



```

ACT .880M CRZ 2/3
CRZ ALT
FL390
SEL SPD 1431z/ 0.5NM
.880 TO T/D
N1 KLAX ETA/FUEL
94.8% 1501z/ 35.9
STEP OPT MAX RECHD
FL390 FL420 FL
  
```

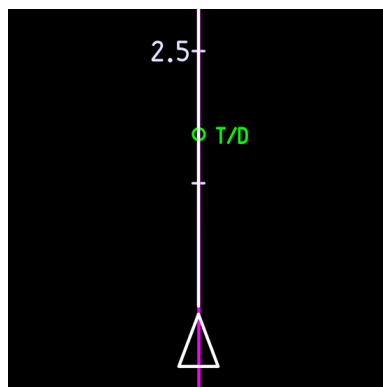


Step 2 — The descent phase has just activated and the aircraft is decelerating to Mach .81 at cruise level; the T/D now indicates where the descent path transition is expected.



```

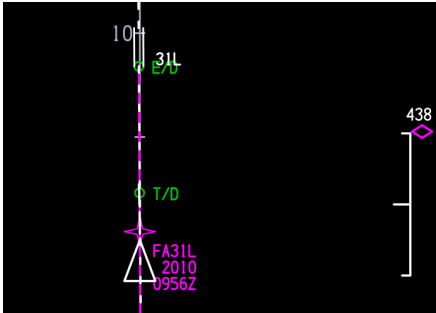
ACT .810M DES 3/3
E/D AT AT DIRBY
180 280/FL190B16000A
SEL SPD
.810
SPD TRANS WPT/ALT
240/10000 DIRBY/FL190
SPD RESTR FPA V/B V/S
0.0 1.9 1.9
  
```



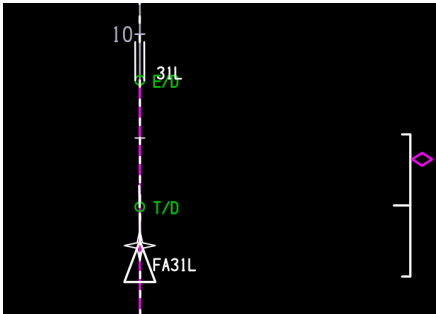
Differences:

The **legacy** FMC keeps the T/D at the descent phase activation point.

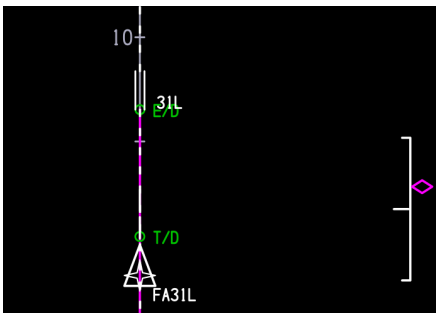
ND — Top of Descent on Constraint



The NG FMC also places a T/D point within the descent phase at the end of a level flight segment. In the example shown to the left, a VFR approach includes a level segment at the 2010 feet constraint. This level segment will continue after the FA31L waypoint until intersecting the final approach glidepath.



The pointer on the vertical path deviation indicator will move down toward the center as the aircraft approaches the intersection of the final approach glidepath.



Shortly before the T/D the VNAV PTH mode will start a smooth transition from the level flight to the glidepath descent.

Differences:

The **legacy FMC** provides just an initial T/D at the end of the cruise phase.

ND — Deviation Indicator Resolution

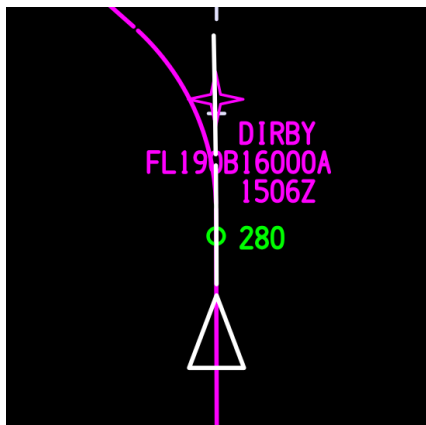


The NG FMC provides a resolution of 1 foot to the digital deviation display that appears, as usual, at the top or bottom of the vertical path deviation scale when the deviation is greater than 400 feet.

Differences:

If the **legacy FMC** is installed, the display is rounded to 10 feet and 50 feet.

ND — Deceleration points

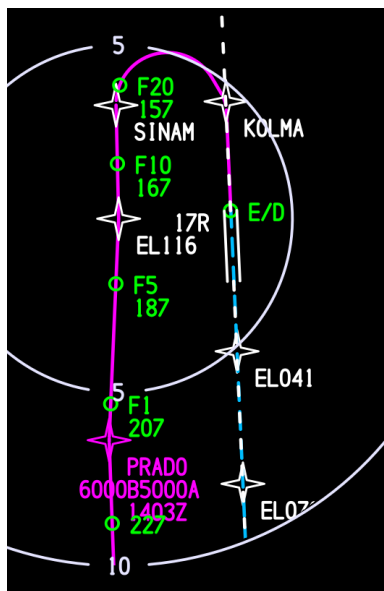
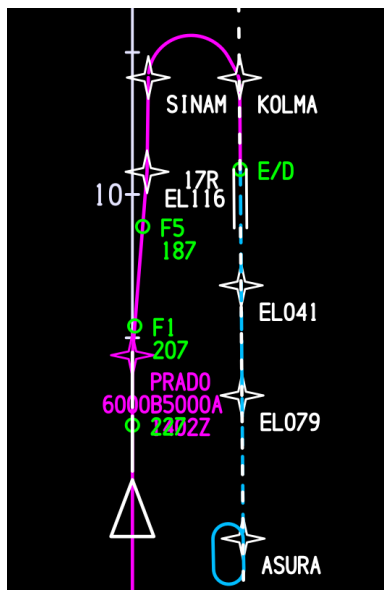


As usual, deceleration points on the descent path are indicated on the ND by small green circles without text labels. However, if the NG FMC is installed, the first deceleration point referring to a *waypoint speed constraint* will be paired with a 3-digit label that displays the respective speed limit.

Differences:

If the **legacy FMC** is installed, all deceleration points are displayed without labels.

ND — Flap Profile Points



If the NG FMC is installed, the ND will show flap profile points. They are symbolized by small green circles labeled with the respective flap settings F1 through F20 and with three digits indicating the related flap speed. The flap-up point has no F-label; it just displays the flap-up speed.

The NG FMC computes the entire flap speed profile with reference to the landing flap data entered on the APPROACH REF page, or, if no data is entered, to the computed VREF30 speed. The target at the end of the profile is the flap 20 speed in the final approach fix area.

Flap profile points are shown on descent legs, not on climb and cruise legs. The ND *MAP* displays the *next two* F-points — and the flap-up point when that is not passed yet. The ND *PLAN* shows *all* planned flap profile points (see picture below).

The calculated distances between the flap profile points are based on standard training procedures. However, speed constraints and procedure turns may force certain flap settings to occur earlier; the ND will then show the affected flap profile point at a suitable, earlier position. Flap profile points that lie within a route discontinuity or on a VECTORS leg will not appear on the ND.

The flap-up point disappears when it is passed or when the flaps are out of up. — The F1 point disappears when the crew sets flaps 1, and so on.

Whenever a flap profile point disappears, the SEL SPD automatically changes to the related flap speed if the current command speed is higher.

Differences:

The **legacy** FMC provides no flap profile points.

ND — Identifiers of Conditional Waypoints

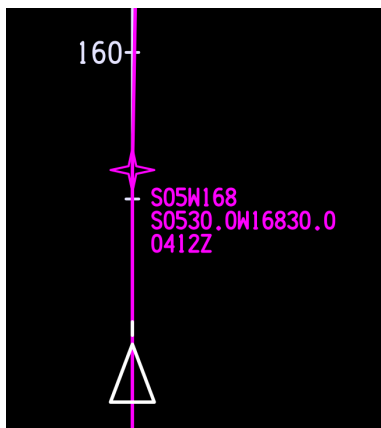


The NG FMC sends all conditional waypoint data of the active route to the ND. The conditional waypoint locations are indicated by small circles on the ND MAP and ND PLAN. The active waypoint data block in the top right corner of the ND is enabled to show the data of any active conditional waypoint. It will also show the identifier of the destination runway waypoint when it is active.

Differences:

If the **legacy FMC** is installed, symbols and identifiers of conditional waypoints — except for *altitude* terminated waypoints — are invisible on the ND route display; and the data block in the top right corner shows dashes when any conditional waypoint is active, and the block will not show the destination runway identifier.

ND — Latitude Longitude Labels

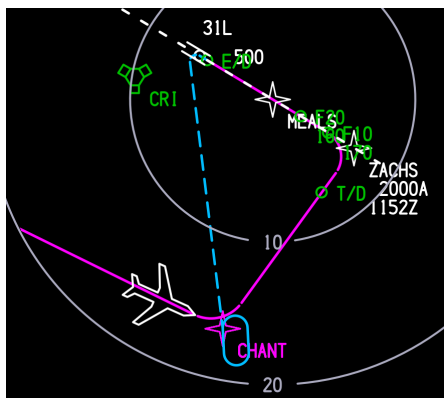


The NG FMC provides 15-character words to the ND that indicate the exact coordinates of latitude-longitude route waypoints. The identifiers of such waypoints are usually abbreviated to seven characters so that the arc minutes are hidden. Some oceanic waypoints, for example, include 30 arc minute fractions; their identifiers may be confused with those of nearby waypoints. When the DATA display mode is selected on the EFIS control panel, the respective waypoint data block will include the complete latitude-longitude information.

Differences:

The **legacy FMC** does not include this feature.

ND — Missed Approach Legs

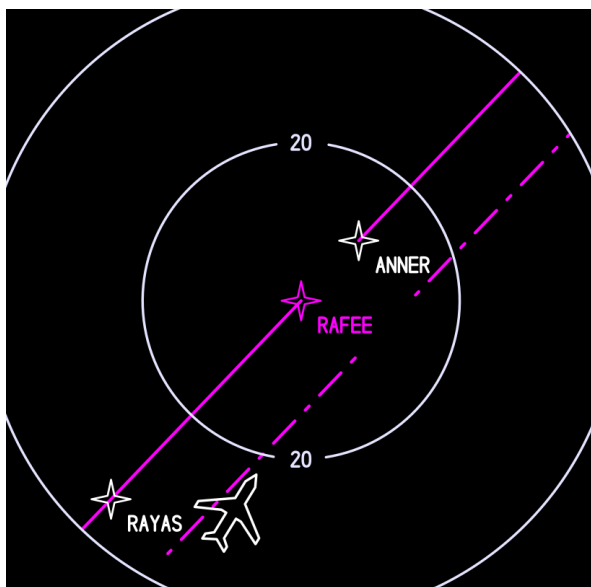


If the NG FMC is installed, the ND shows missed approach legs by dashed cyan lines — even in the active route — until the aircraft enters the missed approach route. Once entered, the missed approach route is displayed by continuous magenta lines.

Differences:

If the **legacy** FMC is installed, the ND shows missed approach legs of the active route always by continuous magenta lines.

ND — Discontinuity within Offset Route

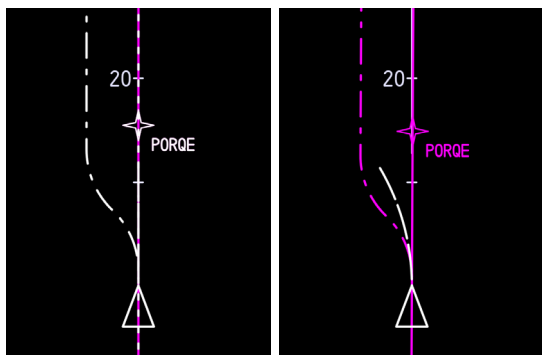


In the NG FMC an offset route does not end at the next discontinuity. The ND shows a gap, but the offset route line continues thereafter.

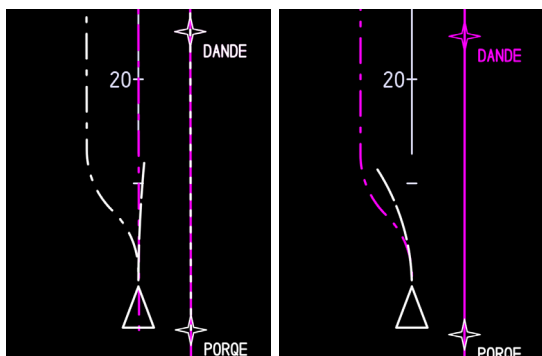
Differences:

The **legacy** FMC does not continue the offset route after a route discontinuity.

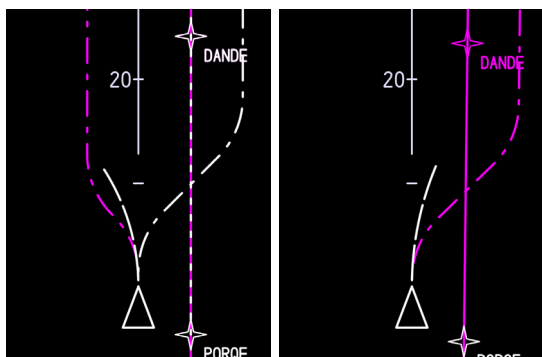
ND — Offset Route Guidance



The NG FMC provides path data to the ND for the transition between the route and the offset route. When the offset route is in the modified state, the offset path is shown in white, the start of the initial turn floats with the aircraft position, and the turn radius may vary with the groundspeed; when the modification is executed, the turn radius is fixed.



Increasing or decreasing an existing offset will generate a transition path to the new offset.



The transition path to a new offset may cross the normal route.

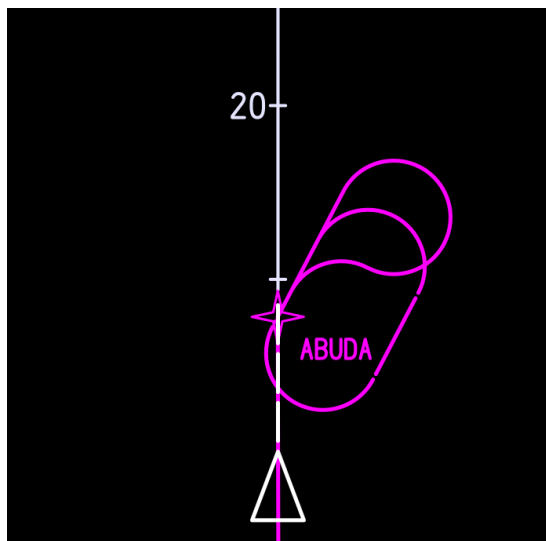
Limitations in the simulator:

When the 45° transition turn radius is greater than the distance to the normal route or to the active waypoint, the transition path is hidden (the real ND behaviour in this context is unknown).

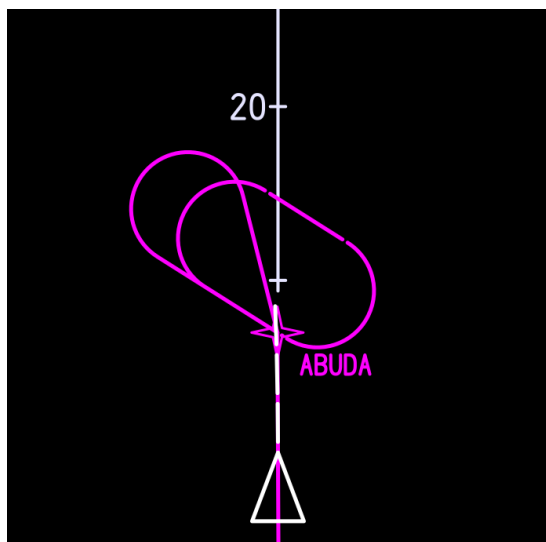
Differences:

The **legacy FMC** does not provide offset route transition paths to the ND.

ND — Holding Pattern Entry Guidance



Parallel entry



Teardrop entry

The NG FMC provides holding pattern transition path data to the ND for parallel entries and teardrop entries. The ND shows the respective entry path when the leg to the hold is active and the ND range is set below 160 nm.

Besides, the NG FMC will command a fly-by turn at the hold fix for the entry and exit.

Limitations in the simulator:

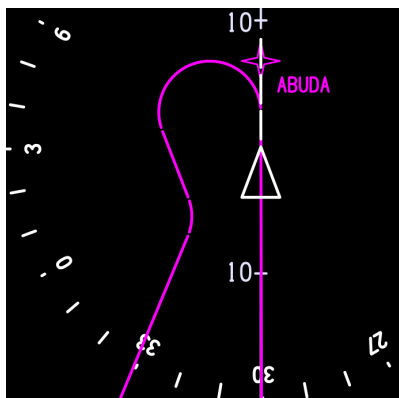
The ND will not show the fly-by turn. (Nevertheless, LNAV will command a fly-by turn.)

Differences:

If the **legacy** FMC is installed, the ND will never show entry paths, and the hold fix will always be a fly-over waypoint for the entry and exit.

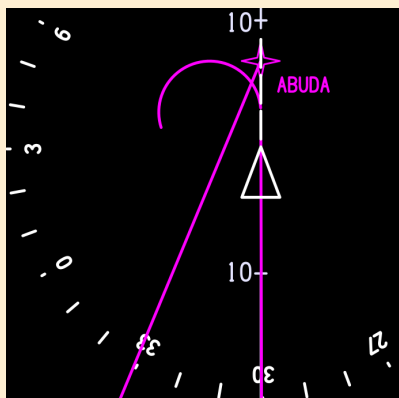
ND — Turns Greater than 135°

If the NG FMC is installed, the ND shows turns greater than 135° by a closed curve that connects with the following leg via a 45° intercept track:

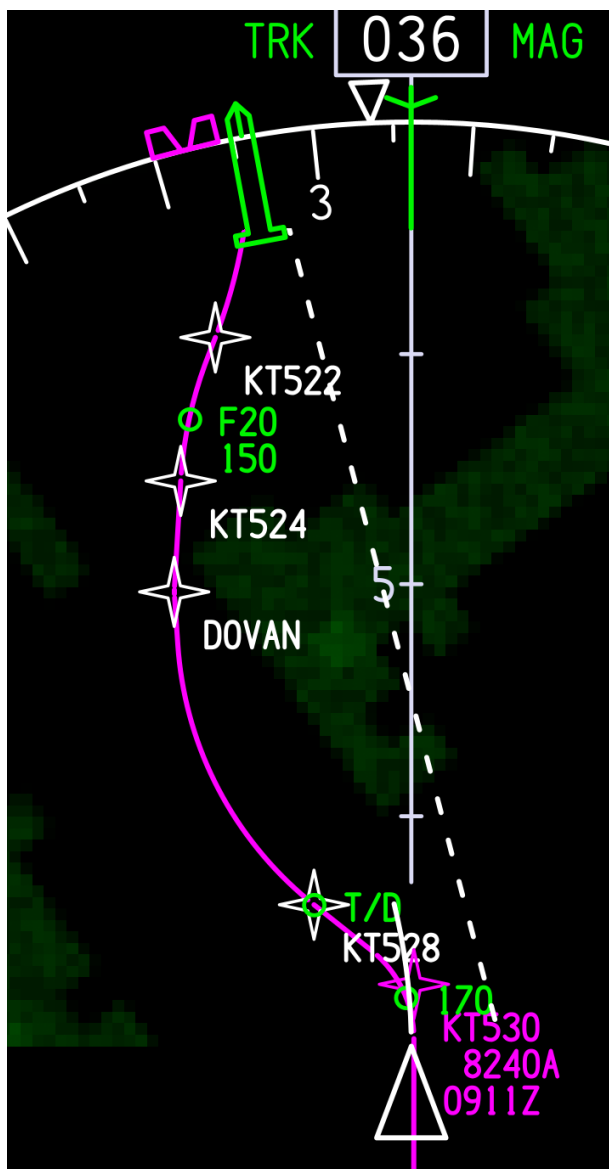


Differences:

If the **legacy** FMC is installed, the ND shows turns greater than 135° by an open curve:



ND — Constant Radius to a Fix (RF Leg)



The NG FMC is able to operate with RF legs loaded from the navigation database. An RF leg consists of a single, continuous, constant radius arc whose entry and exit courses are in line with the courses of the respective previous leg and following leg.

The picture to the left shows an RNAV approach into Kathmandu containing several RF legs; the most significant one being the RF leg to DOVAN. This RF leg to DOVAN guides along a constant radius arc clockwise around the high terrain to the right of the route.

Differences:

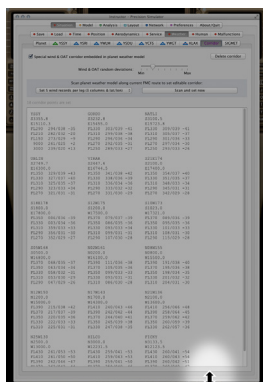
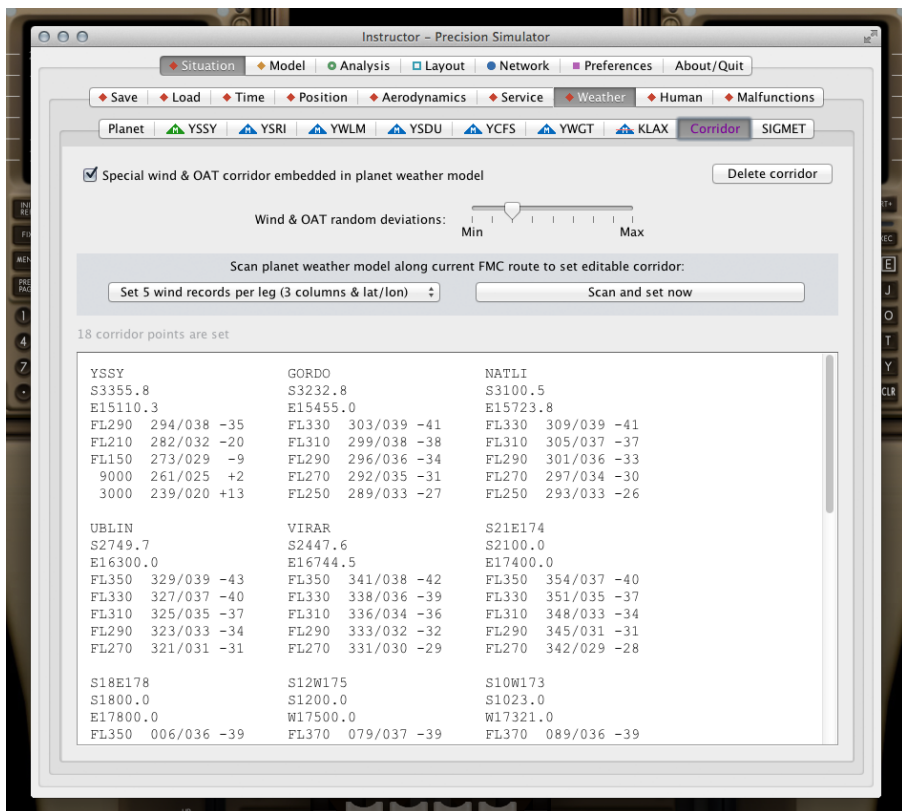
The **legacy** FMC does not contain procedures with RF legs in its database as it cannot correctly operate with them.



Wind & OAT Corridor

Weather Design Tools

Corridor — Page Access



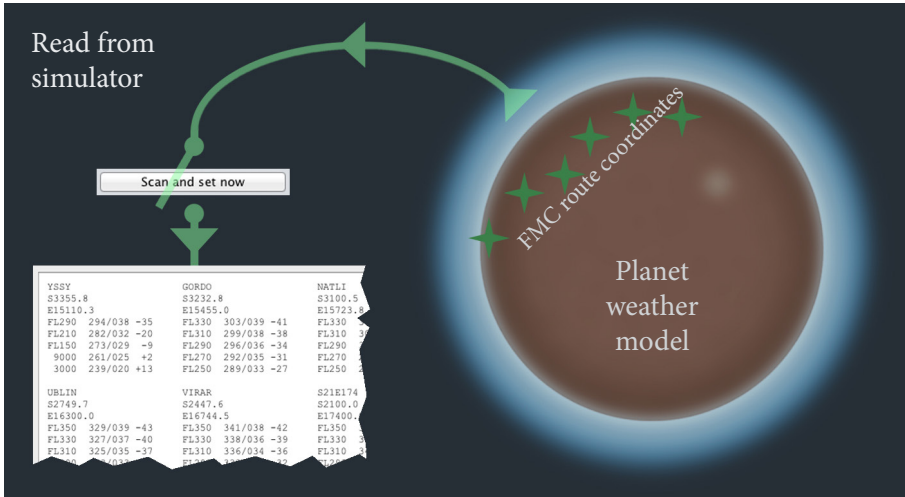
The corridor tools are available on **Instructor > Situation > Weather > Corridor** when the NG FMC license is detected.

The settings and the text field on this page will be stored in situation files; thus they can be reloaded from situation files accordingly. They can also be accessed through the network.

The text may get relatively long, depending on the data format and the number of entered corridor points. Scrollbars are shown when the text field is larger than the frame. The frame can be stretched with the mouse: Click and hold the lower edge of the frame and drag it to the desired position.

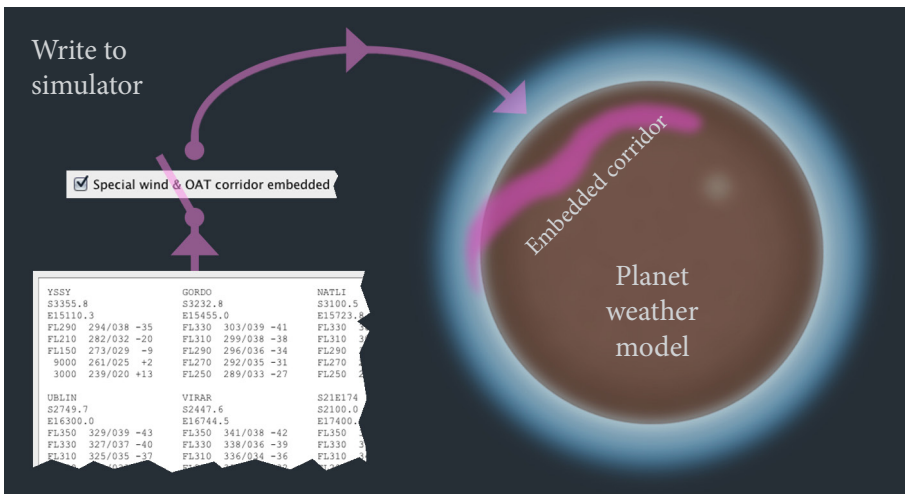


Corridor — Read and Write



Data may be transferred from the planet weather model to the text field — and vice versa:

- The scanner can gather data from the planet weather model along the coordinates of the active FMC route and then fill the text field with the scanned data (see illustration above).
- The data in the text field can be edited or entirely pasted from an external source and then be embedded in the planet weather model (see illustration below).



Corridor — Purposes

The read and write system can be utilized for any of the following tasks:

- When the text field shows scanned data from the simulator, copy this text to your external flight plan documents that you use in your simulator session. The scanner can generate text in five different airline specific formats that most companies use in their standard dispatch operations. This way you will get suitable, simulated weather documents for operational training. For this purpose alone it is not necessary to embed a corridor in the simulator.
- Or use the scanner's generated text as a template and edit the text to design a different enroute weather scenario along a special corridor. Select an airline specific text format of your choice, run the scanner, then edit the generated text. Whenever you have stopped editing for three seconds, the edited corridor data is automatically injected into the simulator.
- Or delete the entire text field and paste a weather data text from an external flight plan weather document in that text field. The system will automatically detect the airline specific text format and generate a respective weather corridor in the simulator. This way your flight plan weather will very much agree with the weather in the simulated flight scenario. Usually, a flight plan does not only display current weather but also slightly uncertain forecast weather; therefore, the simulated weather should not too much agree with that flight plan weather if realistic, minor random deviations are desired. The desired random factor can be set by a slider.

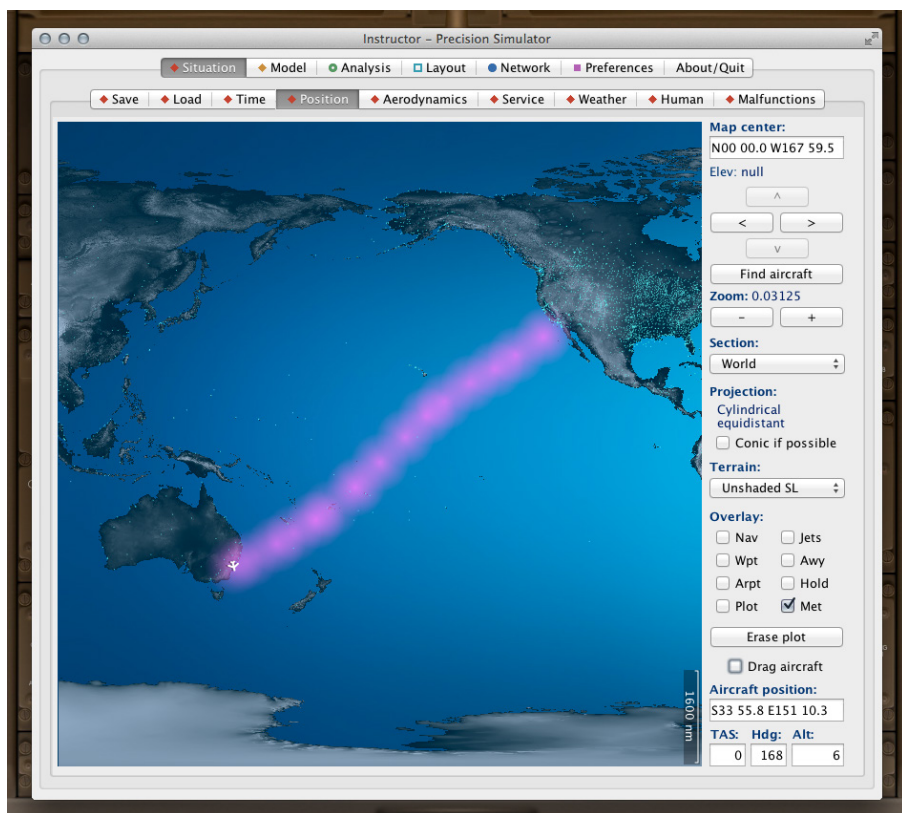
The following pages of this manual will describe the functions in detail.

Corridor — Definitions

The **planet weather model** consists of the variables set on **Instructor > Situation > Weather > Planet** and the variables set on the pages of the **seven local zones**.

The **corridor**, on the other hand, is an additional weather space that can be embedded in the planet weather model. When the simulated aircraft is within the corridor, the flight model will be affected by the wind and OAT values of the corridor rather than by the values of the planet weather model. The height of the corridor is unlimited, and its width extends 500 nm left and right in a smoothly interpolated way: The corridor's lateral center path applies 100% of the corridor values and 0% of the planet weather values. This ratio softly reverses until 500 nm abeam where the ratio is fully reversed. Further smooth interpolations are applied between the corridor points and between their altitude layers.

Corridor — Map Display



The corridor is displayed on **Instructor > Situation > Position** when the **Met** checkbox is selected and when the corridor is embedded in the simulator. It will be indicated by a row of blurry magenta corridor points.

Whenever a corridor point location is edited, the map automatically refreshes after a ten second delay.

Corridor — Text formats

The system can read and write the following five standard formats.

Format A — 6 wind records per leg:

In this format, the first two digits of a wind & OAT record indicate the wind direction divided by 10, the next three digits indicate the wind speed in knots. The M and P stand for minus and plus regarding the OAT which is indicated by the last two digits.

	19000	23000	29000	31000	33000	35000
YSSY	28031M17	29034M24	29038M35	30039M39	30040M42	30042M46
GORDO	28031M16	29033M23	30038M34	30039M38	31040M41	31042M45
NATLI	29031M16	30033M23	31037M33	31039M37	31040M41	31041M44
UBLIN	30030M15	30033M22	32037M32	32038M35	32039M39	33041M42
VIRAR	30030M14	31033M21	33036M31	33038M34	33039M37	34040M41
S21E174	10030M13	08032M19	05036M29	05037M32	04038M35	03040M39
S18E178	11030M12	09032M18	07036M28	06037M31	05038M34	05039M37
S12W175	13029M11	12031M17	10035M26	09036M29	09037M32	08038M35

Format B — 5 wind records per leg (4 columns):

In this format, altitudes are always indicated by 3-digit flight levels, and they may be different at each corridor point. The wind data is always a 7-character set, and the 2-digit OAT value must always be preceded by a minus or plus sign.

YSSY	GORDO		NATLI		UBLIN	
290 294/038	-35 330	305/040	-41 330	311/040	-41 330	322/039 -39
210 282/032	-20 310	302/039	-38 310	308/039	-37 310	318/038 -35
150 273/029	-09 290	299/038	-34 290	305/037	-33 290	315/037 -32
090 261/025	+02 270	296/036	-31 270	302/036	-30 270	311/036 -28
030 239/020	+13 250	293/035	-27 250	298/035	-26 250	308/034 -25
VIRAR	S21E174		S18E178		S12W175	
330 333/039	-37 330	040/038	-35 330	054/038	-34 330	085/037 -32

Format C — 5 wind records per leg (3 columns):

This format is similar to format B, except that it allows flight level as well as feet values and 1-digit OAT values, and that the whole layout is structured by three columns instead of four.

YSSY	GORDO		NATLI	
FL290 294/038 -35	FL330 305/040 -41	FL330 311/040 -41		
FL210 282/032 -20	FL310 302/039 -38	FL310 308/039 -37		
FL150 273/029 -9	FL290 299/038 -34	FL290 305/037 -33		
9000 261/025 +2	FL270 296/036 -31	FL270 302/036 -30		
3000 239/020 +13	FL250 293/035 -27	FL250 298/035 -26		
UBLIN	VIRAR		S21E174	
FL330 322/039 -39	FL330 333/039 -37	FL330 040/038 -35		

(continued next page)

Corridor — Text formats *(continued)*

Format D — 5 wind records per leg (3 columns & lat/lon):

This format is identical to format C, the only difference being the additional latitude-longitude values under each waypoint identifier. Each corridor point will be placed at the related latitude-longitude values. The corridor generator will ignore the waypoint identifiers; that is, it will not search the navigation database for position data.

YSSY S3355.8 E15110.3 FL290 294/038 -35 FL210 282/032 -20 FL150 273/029 -9 9000 261/025 +2 3000 239/020 +13	GORDO S3232.8 E15455.0 FL330 305/040 -41 FL310 302/039 -38 FL290 299/038 -34 FL270 296/036 -31 FL250 293/035 -27	NATLI S3100.5 E15723.8 FL330 311/040 -41 FL310 308/039 -37 FL290 305/037 -33 FL270 302/036 -30 FL250 298/035 -26
UBLIN S2749.7 E16300.0 FL330 322/039 -39 FL310 318/038 -35 FL290 315/037 -32 FL270 311/036 -28 FL250 308/034 -25	VIRAR S2447.6 E16744.5 FL330 333/039 -37 FL310 329/038 -34 FL290 325/036 -31 FL270 321/035 -27 FL250 317/034 -24	S21E174 S2100.0 E17400.0 FL330 040/038 -35 FL310 047/037 -32 FL290 054/036 -29 FL270 062/035 -26 FL250 070/033 -23

Format E — 4 wind records per leg:

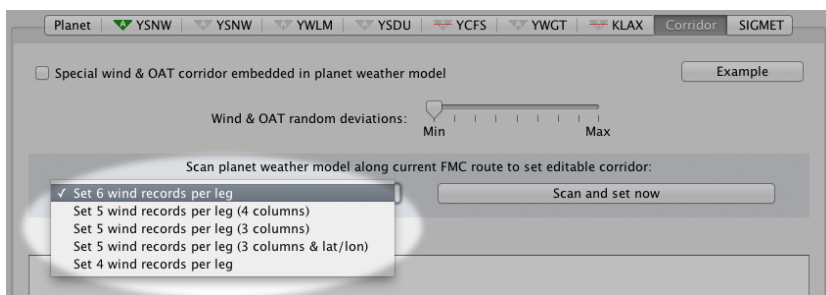
This format includes the additional variables ITT (initial true track) and DIS (distance). These are not used by the corridor system; the scanner generates them anyway because they are part of this standard format used by some airlines. OAT altitudes are displayed under FL by 3-digit flight levels. The OAT is shown by two digits and a P or M prefix for plus or minus. A wind & OAT record always consists of 5 digits, the first two showing the wind direction divided by 10, the last three indicating the speed. Wind altitudes are displayed by 3-digit flight levels at the top of the wind data columns. Each corridor point will be placed at the related latitude-longitude values; the corridor generator will ignore the waypoint identifiers.

LAT	LONG	WAYPT	ITT	DIS	FL	TMP	SECTOR	W/V
S3356.8	E15110.6	YSSY	054	215	030	P13	26026	28032 29035 29038
							250	270 290 310
S3232.8	E15455.0	GORDO	055	157	290	M34	29035	30036 30038 30039
S3100.5	E15723.8	NATLI	058	349	290	M33	30035	30036 31037 31039
S2749.7	E16300.0	UBLIN	056	313	290	M32	31034	31036 32037 32038
S2447.6	E16744.5	VIRAR	058	414	290	M31	32034	32035 33036 33038
S2100.0	E17400.0	S21E174	052	289	290	M29	07033	06035 05036 05037
S1800.0	E17800.0	S18E178	049	542	290	M28	08033	08034 07036 06037
S1200.0	W17500.0	S12W175	045	137	290	M26	11033	10034 10035 09036

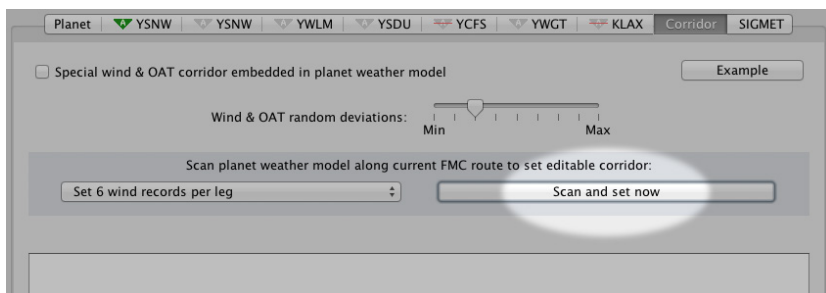
Corridor — Scanning the Planet Weather Model

Step 1 — Check that your desired weather simulation is set on the **Planet** page and on the pages of the **seven local zones**, and that the FMC contains an active route for which you like to create a special wind & OAT corridor. If no active route exists, the scanner will use RTE 1, and if that is empty, it will use RTE 2.

Step 2 — On the **Corridor** page select the desired text format from the menu:



Step 3 — On the **Corridor** page click **Scan and set now**:



(continued next page)

Corridor — Scanning the Planet Weather Model *(continued)*

Step 4 — The scanning is completed when a new text appears in the text field. The checkbox **Set zones by flight track and downloaded METARs** may have been selected on the other **Weather** pages; if this is the case, the scanning may take half a minute. This is because the system will scan the entire downloaded METAR world files for METAR data in the vicinity of each corridor point. METARs do not contain high altitude winds and temperatures, but the system will use their surface data for interpolations with aloft data. If the checkbox **Set zones by flight track ...** is not selected, just the present seven local zones will provide the surface data; in that case the scanning may take a second.

When the new text appears, a green message will indicate how many corridor points are set. In the example below, 18 corridor points are set. The message turns gray after five seconds.

You can now edit the generated text as discussed on the next page of this manual. Or you may want to mark the generated text with the mouse and drag it to an external text editor for use in external flight plan documents; this may be helpful for operational training in a simulator session. Instead of dragging the text with the mouse, the marked text can also be copied by the key combination CTRL+C (Windows) or CMD+C (Mac), and then be pasted in an external text field by CTRL+V (Windows) or CMD+V (Mac).

Scan planet weather model along current FMC route to set editable corridor:

Set 5 wind records per leg (4 columns)

Scan and set now

18 corridor points are set

YSSY	GORDO	NATLI	UBLIN
290 294/038 -35	330 303/039 -41	330 309/039 -41	350 329/039 -43
210 282/032 -20	310 299/038 -38	310 305/037 -37	330 327/037 -40
150 273/029 -09	290 296/036 -34	290 301/036 -33	310 325/035 -37
090 261/025 +02	270 292/035 -31	270 297/034 -30	290 323/033 -34
030 239/020 +13	250 289/033 -27	250 293/033 -26	270 321/031 -31
VIRAR	S21E174	S18E178	S12W175
350 341/038 -42	350 354/037 -40	350 006/036 -39	370 079/037 -39
330 338/036 -39	330 351/035 -37	330 003/034 -36	350 086/035 -36
310 336/034 -36	310 348/033 -34	310 359/033 -33	330 093/033 -34
290 333/032 -32	290 345/031 -31	290 356/031 -30	310 099/031 -31
270 331/030 -29	270 342/029 -28	270 352/029 -27	290 107/030 -28
S10W173	S05W168	N02W161	N08W155
370 089/036 -39	370 068/035 -37	390 111/036 -38	390 191/038 -40
350 095/035 -36	350 063/034 -34	370 105/035 -36	370 195/036 -38
330 101/033 -33	330 058/032 -31	350 099/033 -33	350 198/034 -35
310 108/031 -30	310 053/030 -29	330 093/031 -31	330 201/032 -32
290 115/029 -28	290 047/029 -26	310 086/030 -28	310 204/031 -30
N12W150	N17W143	N21W136	N25W130

Corridor — Editing the Text

You may edit the data in the text field to design a special wind & OAT corridor. Corridor points can be added and deleted, and their coordinates can be changed. The altitude references and all other values can be edited as well. However, the values must be in a reasonable range similar to the valid ranges in the FMC. For example, invalid is an OAT entry of 50°C at FL120, or a wind direction of 361°, and so on. The corridor generator starts whenever you stop moving the text cursor. When the system detects an invalid entry, the text will remain displayed, but the entire corridor will no longer be embedded in the planet weather model. A red message will indicate at which corridor point the error is found and what kind of error it is.

Example 1 — The corridor generator has not found the waypoint GORD in the navigation database and therefore cannot determine its location on the planet:

Not in database: GORD

	19000	23000	29000	31000	33000	35000
YSSY	34025M13	33029M21	32035M33	32037M37	32039M41	31041M45
GORD	28028M16	29031M23	30036M34	30038M38	30039M41	31041M45
NATLI	28028M16	29031M23	30036M33	31037M37	31039M41	31041M44
UBLIN	31023M18	32027M24	32033M34	33035M37	33037M40	33039M43
VTRAR	32022M17	33026M23	33032M32	34034M36	34036M39	34038M42

Example 2 — The OAT at NATLI at 23000 ft is set to plus 23°C. This exceeds the maximum allowed OAT of plus 7°C at that altitude:

At NATLI (at 23000 ft) above 7°C OAT maximum: 23°C

	19000	23000	29000	31000	33000	35000
YSSY	34025M13	33029M21	32035M33	32037M37	32039M41	31041M45
GORD	28028M16	29031M23	30036M34	30038M38	30039M41	31041M45
NATLI	28028M16	29031E23	30036M33	31037M37	31039M41	31041M44
UBLIN	31023M18	32027M24	32033M34	33035M37	33037M40	33039M43
VTRAR	32022M17	33026M23	33032M32	34034M36	34036M39	34038M42

Example 3 — The wind speed at UBLIN at 23000 ft is set to 527 kt. This exceeds the maximum allowed speed of 250 kt:

At UBLIN (at 23000 ft) above 250 kt wind speed maximum: 527 kt

	19000	23000	29000	31000	33000	35000
YSSY	34025M13	33029M21	32035M33	32037M37	32039M41	31041M45
GORD	28028M16	29031M23	30036M34	30038M38	30039M41	31041M45
NATLI	28028M16	29031M23	30036M33	31037M37	31039M41	31041M44
UBLIN	31023M18	32527M24	32033M34	33035M37	33037M40	33039M43
VTRAR	32022M17	33026M23	33032M32	34034M36	34036M39	34038M42

Corridor — Copying from External Sources

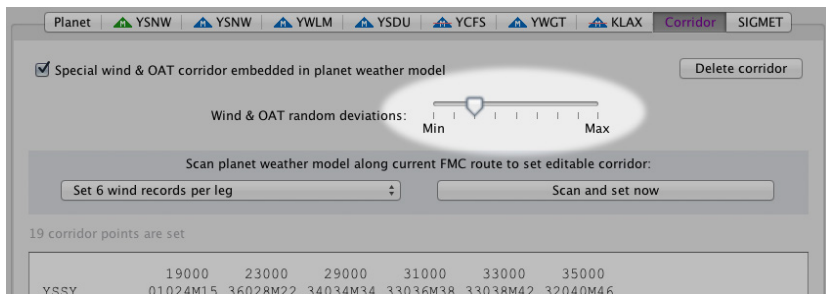
You may copy an external flight plan weather data text to the text field on the **Corridor** page. This way you can quickly embed a corridor in the planet weather model that will simulate the same weather shown on the external flight plan.

On your computer desktop, place the flight plan document and the **Corridor** page side by side. The text field on the **Corridor** page must be empty. Mark the weather data text on the flight plan document with the mouse. Now drag the marked text over to the text field on the **Corridor** page, then release the mouse button. — Instead of dragging the text with the mouse, you can also copy the marked text by the key combination CTRL+C (Windows) or CMD+C (Mac), then click the **empty** text field on the **Corridor** page and press CTRL+V (Windows) or CMD+V (Mac).

The copied text must have one of the five formats shown on page 82 and 83. The simulator will automatically detect the format of the pasted text. For this function, the format selected on the pop-up menu is irrelevant (that menu is only relevant when pressing **Scan and set now**).

Corridor — Random Deviations

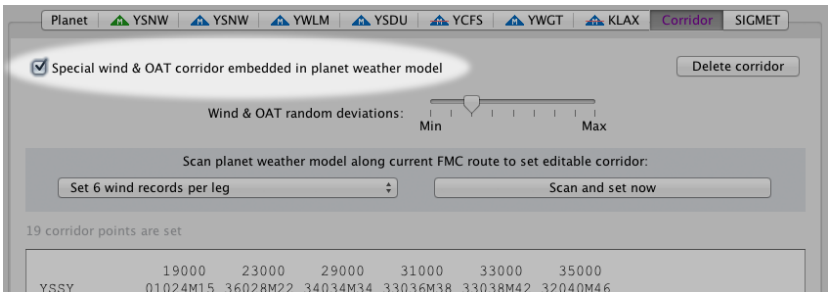
Flight plan documents usually contain forecast weather data that will possibly deviate from the actual weather by a few percent. Such minor random deviations may be desired in the simulator to make the flight operation more realistic. For this purpose you may use the **Wind & OAT random deviations** slider. When it is set to **Min**, the wind & OAT deviations will be nearly zero; when it is set to **Max**, the wind direction may vary by up to 40°, the wind speed by up to 40 kt, and the OAT may vary by up to 7°C. The deviations will randomly vary from corridor point to corridor point. The slider does not set an absolute deviation; it just sets a maximum for the randomizer.



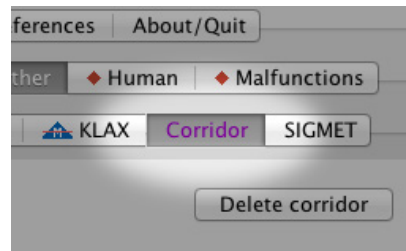
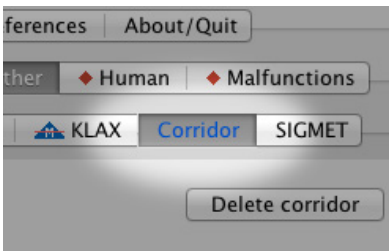


Corridor — Embedding the Data

The checkbox **Special wind & OAT corridor embedded in planet weather model** is the master switch that keeps the generated corridor embedded in the simulator. It is important to remember this checkbox. When it is deselected, there will be no corridor in the simulator. — Selecting this checkbox the first time during a simulator session will autoselect the **Met** checkbox on the **Position** page (see page 81 of this manual).

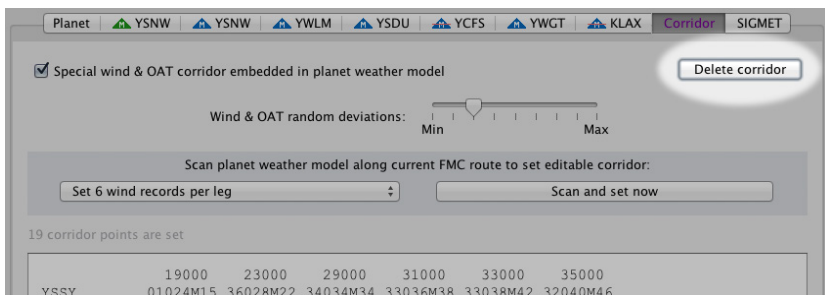


When a corridor is embedded, the **Corridor** tab title will be colored: When the aircraft is outside the corridor, the tab title will be blue; when it is inside the corridor, the tab title will be magenta. As the transitions are smooth, “inside” means the corridor data is influencing the flight model by more than 0%.



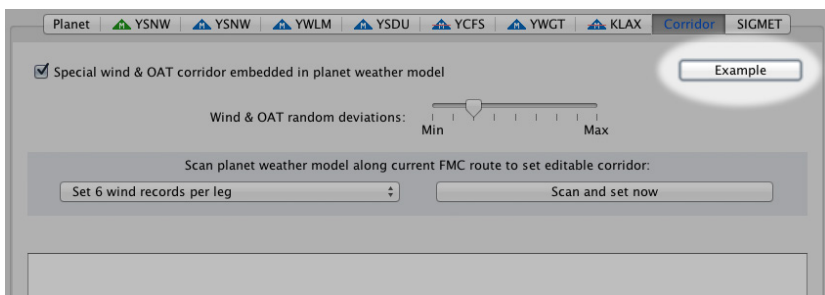
Corridor — Deleting the Data

Clicking the **Delete corridor** button will blank the text field. When there is no intention to embed a corridor in the simulator, it is recommended to blank the text field because the entire text will be saved in situation files. A long, unused text would bloat the files unnecessarily.



Corridor — Quick Example

The **Example** button is displayed when the text field is blank. Clicking this button will generate a sample corridor across the South Atlantic. This sample corridor will always be set using format A with six wind records per leg, regardless of the format selected on the pop-up menu.

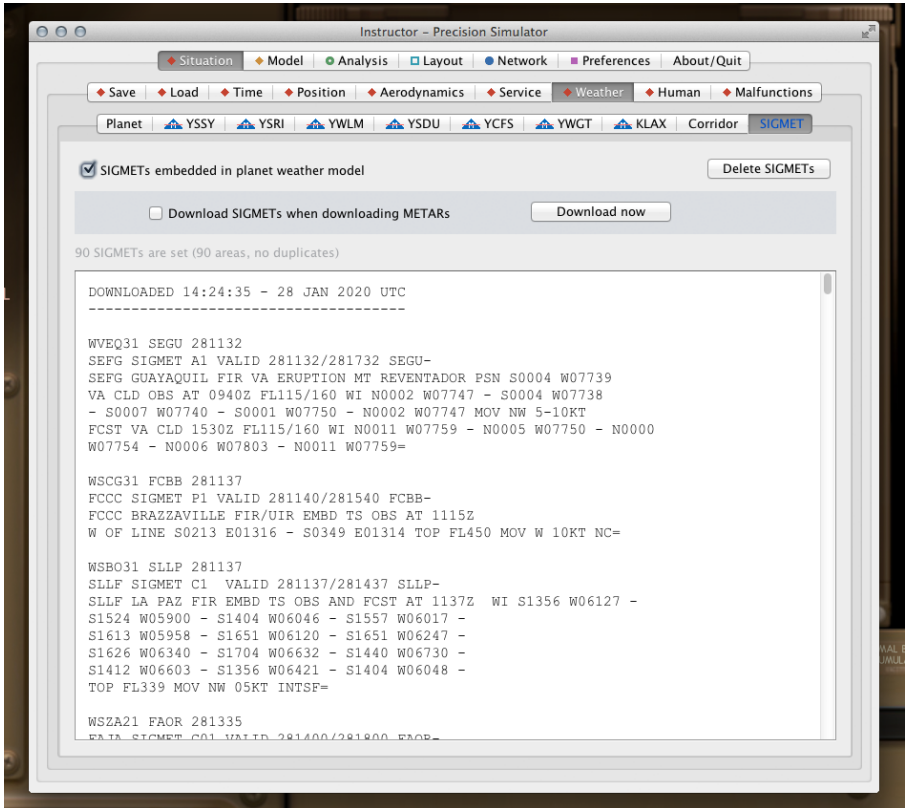




SIGMET

Weather Design Tools

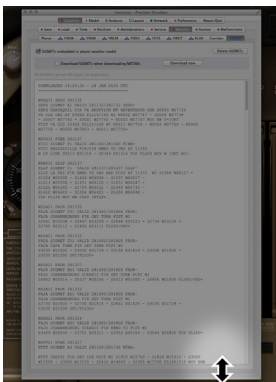
SIGMET — Page Access



The SIGMET tools are available on **Instructor > Situation > Weather > SIGMET** when the NG FMC license is detected.

The settings and the text field on this page will be stored in situation files; thus they can be reloaded from situation files accordingly. They can also be accessed through the network.

The text may get long when a worldwide list of SIGMETs have been downloaded from the Internet. Scrollbars are shown when the text field is larger than the frame. The frame can be stretched with the mouse: Click and hold the lower edge of the frame and drag it to the desired position.



SIGMET — Purposes

The SIGMET tools can be utilized for any of the following tasks:

- Create special weather areas manually using the standard SIGMET format and embed these areas in the planet weather model.
- Or download a worldwide list of current real-world SIGMETs from the Internet and embed these in the planet weather model. This may be done by clicking a button, or the system may do it automatically circa every half an hour.
- Or copy a list of SIGMETs from an external flight plan document, paste it in the text field on the **SIGMET** page, and embed these SIGMETs in the planet weather model so that the weather in the simulated flight will agree with your flight plan documents. However, this method only makes sense if your flight plan does not refer to the current real-world weather or if no Internet connection is available; otherwise it is easier to just click the **Download now** button on the **SIGMET** page.

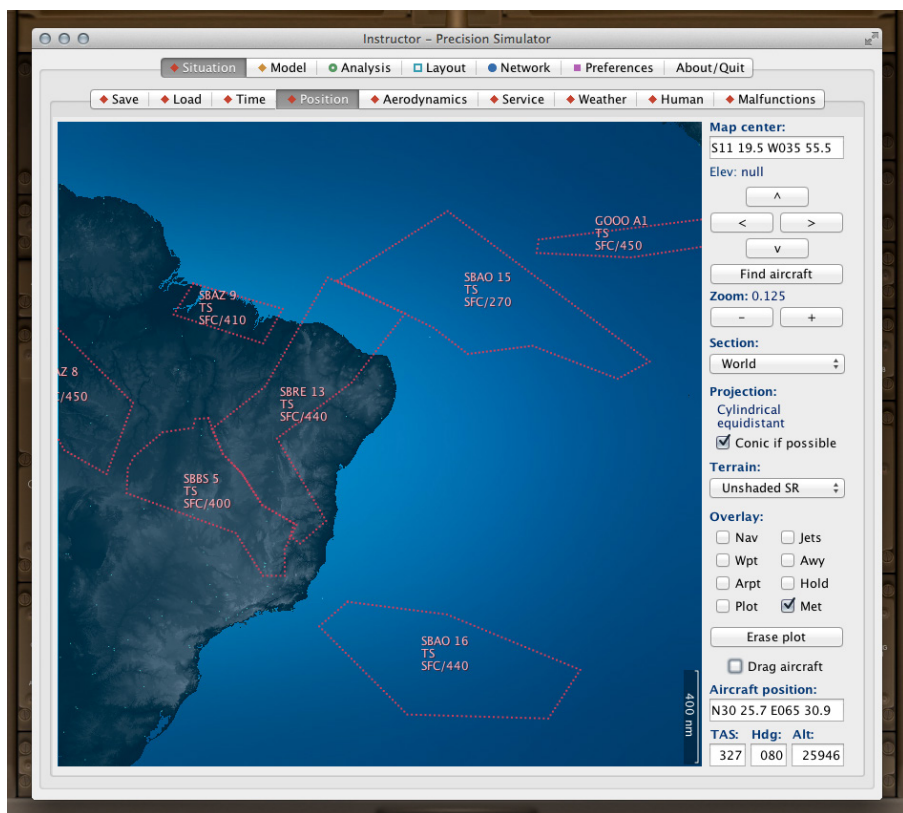
The following pages of this manual will describe the functions in detail.

SIGMET — Definitions

The **planet weather model** consists of the variables set on **Instructor > Situation > Weather > Planet** and the variables set on the pages of the **seven local zones**.

A **SIGMET**, on the other hand, is an additional weather space that can be embedded in the planet weather model. When the simulated aircraft is within a SIGMET area, the flight model will encounter the effects of that SIGMET. These effects will override those of the planet weather model if the respective SIGMET phenomenon includes the more adverse parameters at that location. For example, if the planet weather model at that location dictates warm dry air while a SIGMET at that location dictates icing conditions, the simulator will generate icing conditions because those are more adverse than warm dry air. The same rule of adversity will be applied to winds, thunderstorms, turbulence, and so on.

SIGMET — Map Display



The SIGMETs are displayed on **Instructor > Situation > Position** when the **Met** checkbox is selected and when the SIGMETs are embedded in the simulator. SIGMET areas will be indicated by dotted red outlined polygons. The text block within an area consists of the location identifier and sequence number in the first line, the phenomenon in the second line, and the vertical range in the third line. For example, SBAO 16 (identifier and number), TS (thunderstorm), and SFC/440 (between the surface and FL440).

Whenever a SIGMET is edited, the map automatically refreshes after a ten second delay.

SIGMET — Simplified FIR borders

Some SIGMET area borders are defined by the borders of a specific flight information region (FIR). The simulator does not contain an FIR database. Therefore, the simulator will simplify such an area using a rectangle shape. For example, if an FIR identifier starts with the letters LG (Greece), the simulator will search its airport database for the easternmost, southernmost, westernmost, and northernmost Greek airport. The locations of these four airports will define the outer latitudinal and longitudinal edges of the rectangle. This simplification works very well because in the reality, weather phenomena will not stop exactly at political borders anyway; they will smoothly and randomly transition to the surrounding areas. Using an FIR to define a weather area is just as well a simplification — applied by the authorities that are responsible for just that single FIR. The weather phenomenon might occur in an adjacent FIR too, but the authorities there possibly just did not issue a SIGMET.

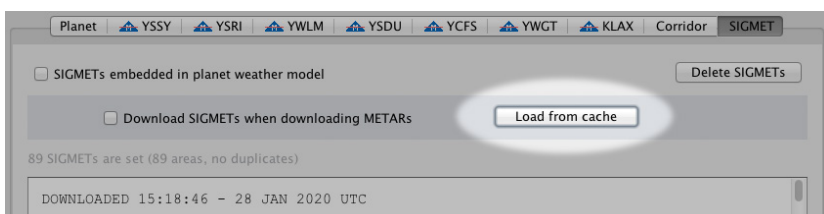
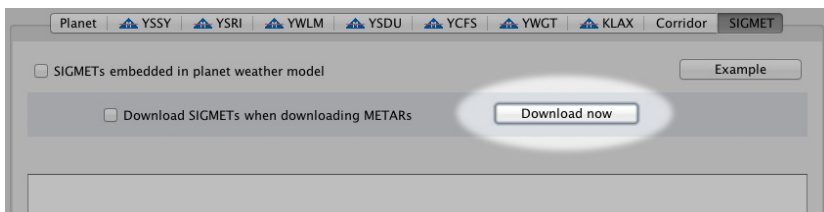
SIGMET — Copying from External Sources

You may copy SIGMETs from an external flight plan document to the text field on the **SIGMET** page. This way you can quickly embed SIGMETs in the planet weather model so that the simulated flight will be affected by the same SIGMET phenomena shown on the flight plan documents.

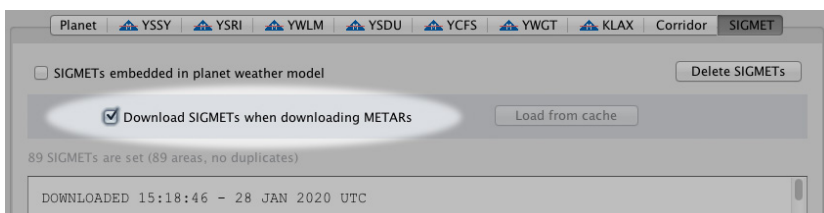
On your computer desktop, place the SIGMETs document and the **SIGMET** page side by side. The text field on the **SIGMET** page must be empty. Mark the SIGMETs on the flight plan document with the mouse. Now drag the marked text over to the text field on the **SIGMET** page, then release the mouse button. — Instead of dragging the text with the mouse, you can also copy the marked text by the key combination CTRL+C (Windows) or CMD+C (Mac), then click the **empty** text field on the **SIGMET** page and press CTRL+V (Windows) or CMD+V (Mac).

SIGMET — Downloading from the Internet

You may download current real-world SIGMETs from the Internet by clicking the **Download now** button. If a download occurred within the past three minutes, the button is replaced by the **Load from cache** button to prevent unnecessary redownloads; when that button is clicked, the text field will load the last downloaded SIGMETs from the local cache.



Another option is the checkbox **Download SIGMETs when downloading METARs**. When this checkbox is selected, the above mentioned buttons are grayed out, and the simulator will download SIGMETs automatically whenever it downloads METARs. The automatic METAR download is started approximately every half an hour if the checkbox **Set zones by flight track and downloaded METARs** is selected on the other **Weather** pages and if the checkbox **Allow METAR files download from Internet** is selected on **Instructor > Preferences > Basics**.



SIGMET — Detecting Errors

The simulator will detect SIGMET records in the text field. Text sections that include no SIGMET specific words will be ignored automatically. Note that SIGMET records from the Internet may contain typos or incorrect conversions from handwritten text. The simulator can autocorrect many of them, but not all; it will skip any SIGMET containing an error that cannot be autocorrected. A blue error message will indicate which SIGMET on the list has been skipped. All other, valid SIGMETs can be embedded in the planet weather model. In the example below the second SIGMET (“FCCC”) contains a latitude value greater than 90° as indicated by the blue message. This invalid SIGMET may be manually corrected or removed, but it is not essential as the simulator ignores it anyway:

#2 skipped: FCCC SIGMET P1 invalid location S9349 E01314

```
DOWNLOADED 14:30:44 - 28 JAN 2020 UTC
-----

WVEQ31 SEGU 281132
SEFG SIGMET A1 VALID 281132/281732 SEGU-
SEFG GUAYAQUIL FIR VA ERUPTION MT REVENTADOR PSN S0004 W07739
VA CLD OBS AT 0940Z FL115/160 WI N0002 W07747 - S0004 W07738
- S0007 W07740 - S0001 W07750 - N0002 W07747 MOV NW 5-10KT
FCST VA CLD 1530Z FL115/160 WI N0011 W07759 - N0005 W07750 - N0006
W07754 - N0006 W07803 - N0011 W07759=

WSCG31 FCBB 281137
FCCC SIGMET P1 VALID 281140/281540 FCBB-
FCCC BRAZZAVILLE FIR/UIR EMBD TS OBS AT 1115Z
W OF LINE S0213 E01316 - S9349 E01314 TOP FL450 MOV W 10KT NC=

WSRQ31 SLIP 281137
```

If complex errors exist in a very long text, it is recommended to mark the entire text and copy this marked text and paste it in an external text editor to correct the errors there using the editor's search tools. The corrected text can then be marked and copied in that editor and be re-pasted in the **empty** text field on the **SIGMET** page.

- To mark the entire text, click in the text field and press CTRL+A (Windows) or CMD+A (Mac).
- To copy the marked text, press CTRL+C (Windows) or CMD+C (Mac).
- To paste the entire text, click in the **empty** target text field and press CTRL+V (Windows) or CMD+V (Mac).

SIGMET — Errorfree List

When no errors exist in the text field, a green message will indicate how many SIGMET *records* and how many SIGMET *areas* are set; a SIGMET record can refer to multiple isolated area polygons. Therefore, the number of areas may sometimes be higher than the number of SIGMET records.

Occasionally, a SIGMET may be listed more than once. The simulator automatically detects and deletes such duplicates; the green message indicates how many duplicates have been removed.

In the example below, 89 SIGMETs are set with 89 polygons, and no duplicates have occurred. The green message turns gray after five seconds.

☒ Download SIGMETs when downloading METARs

89 SIGMETs are set (89 areas, no duplicates)

DOWNLOADED 14:30:44 - 28 JAN 2020 UTC

```

WVEQ31 SEGU 281132
SEFG SIGMET A1 VALID 281132/281732 SEGU-
SEFG GUAYAQUIL FIR VA ERUPTION MT REVENTADOR PSN S0004 W07739
VA CLD OBS AT 0940Z FL115/160 WI N0002 W07747 - S0004 W07738
- S0007 W07740 - S0001 W07750 - N0002 W07747 MOV NW 5-10KT
FCST VA CLD 1530Z FL115/160 WI N0011 W07759 - N0005 W07750 - N0000
W07754 - N0006 W07803 - N0011 W07759=

WSCG31 FCBB 281137
FCCC SIGMET P1 VALID 281140/281540 FCBB-
FCCC BRAZZAVILLE FIR/UIR EMBD TS OBS AT 1115Z
W OF LINE S0213 E01316 - S0349 E01314 TOP FL450 MOV W 10KT NC=

WSBO31 SLLP 281137
SLLF SIGMET C1 VALID 281137/281437 SLLP-
SLLF LA PAZ FIR EMBD TS OBS AND FCST AT 1137Z WI S1356 W06127 -
S1524 W05900 - S1404 W06046 - S1557 W06017 -
S1613 W05958 - S1651 W06120 - S1651 W06247 -
S1626 W06340 - S1704 W06632 - S1440 W06730 -
S1412 W06603 - S1356 W06421 - S1404 W06048 -
TOP FL339 MOV NW 05KT INTSF=
          
```

SIGMET — USA Specific Data

USA specific SIGMETs describe their areas by place-bearing-distance records rather than by latitudes and longitudes. When USA specific SIGMETs appear in the text, the simulator needs a few more seconds to allocate the area data because every reference point of a place-bearing-distance record must first be searched in the simulator's navigation database.

The snapshot below was taken while the simulator was searching the database for the ADM VOR (which took just a few milliseconds). This is indicated by the green message above the text field. The WSUS32 SIGMET in this text includes, for example, the record "40SSW ADM" which means 40 nm south-southwest of ADM.

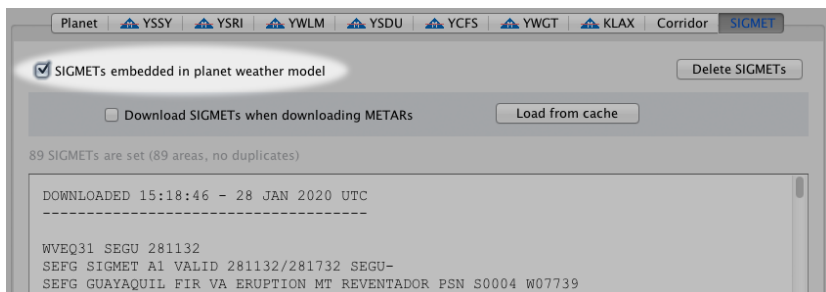
Searching database for location of ADM

```
WSUS32 KRCI 282055
SIGC
CONVECTIVE SIGMET 40C
VALID UNTIL 2255Z
TX AND CSTL WTRS
FROM IAH-30ESE IAH-90SE PSX-80ESE CRP-IAH
AREA TS 25 NM WIDE MOV FROM 26030KT. TOPS TO FL280.
  OUTLOOK VALID 282255-290255
FROM MLC-TXK-50NNW AEX-50SE LCH-110SSW LCH-100SE PSX-90E
BRO-BRO-CRP-50NNW PSX-ACT-50NW TTT-ADM-MLC
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

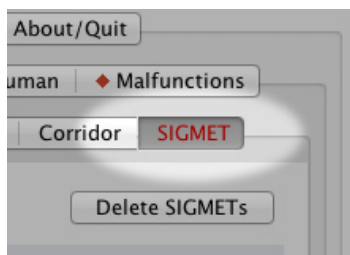
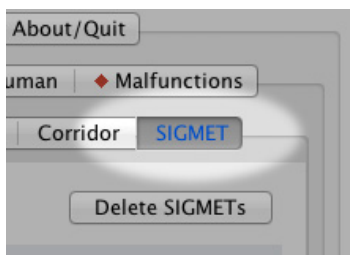
WSUS32 KRCI 282055
SIGC
CONVECTIVE SIGMET 39C
VALID UNTIL 2255Z
TX OK
FROM 30W ADM-40SSW ADM
LINE EMBD TS 20 NM WIDE MOV FROM 24025KT. TOPS TO FL250.
  OUTLOOK VALID 282255-290255
FROM MLC-TXK-50NNW AEX-50SE LCH-110SSW LCH-100SE PSX-90E
BRO-BRO-CRP-50NNW PSX-ACT-50NW TTT-ADM-MLC
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.
```

SIGMET — Embedding the Data

The checkbox **SIGMETs embedded in planet weather model** is the master switch that keeps the generated SIGMETs embedded in the simulator. It is important to remember this checkbox. When it is deselected, there will be no SIGMETs in the simulator. — Selecting this checkbox the first time during a simulator session will autoselect the **Met** checkbox on the **Position** page (see page 93 of this manual).

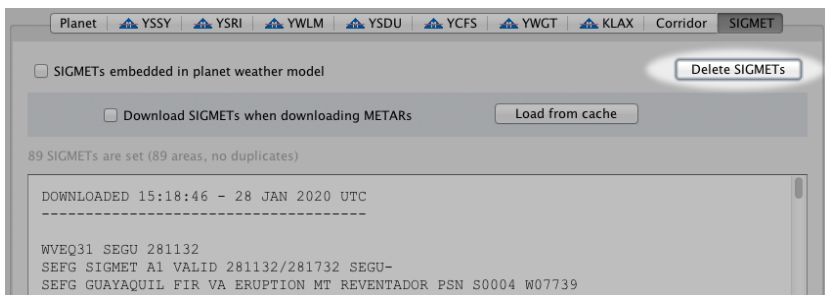


When SIGMETs are embedded, the **SIGMET** tab title will be colored: When the aircraft is outside all SIGMETs, the tab title will be blue; when it is inside a SIGMET, the tab title will be red.



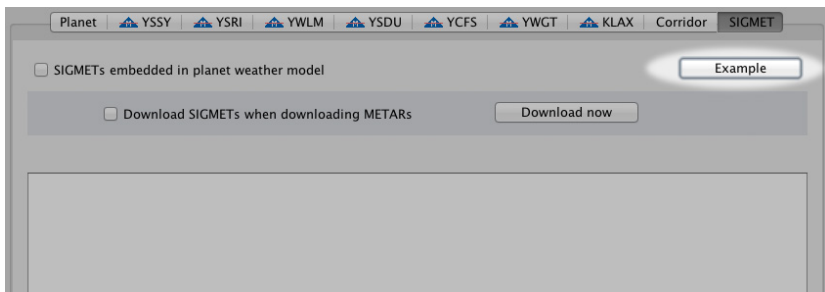
SIGMET — Deleting the Data

Clicking the **Delete SIGMETs** button will blank the text field. When there is no intention to embed SIGMETs in the simulator, it is recommended to blank the text field because the entire text will be saved in situation files. A long, unused text would bloat the files unnecessarily.



SIGMET — Quick Example

The **Example** button is displayed when the text field is blank. Clicking this button will generate seven sample SIGMETs at various places around the planet. These samples can be edited like any other copied or downloaded SIGMETs.



SIGMET — Effects in the Simulator

Note that the simulator will ignore SIGMET date and time values; the simulator will model a SIGMET weather phenomenon within its defined lateral and vertical area whenever the related SIGMET is included in the text field.

The simulator will generate one or multiple thunderstorm (TS) cells at random locations within a defined SIGMET area when the related SIGMET includes any of the following standard phenomena: Obscured TS (OBSC TS), embedded TS (EMBD TS), frequent TS (FRQ TS), or squall line TS (SQL TS). The map will indicate TS.

The above thunderstorm phenomena will be accompanied by hail when the suffix GR is attached, such as SQL TSGR, for example. The map will indicate TS+HAIL.

Severe turbulence will occur within SEV TURB areas. The map will indicate TURB.

The simulator will generate clouds or fog and freezing temperatures when the aircraft is within a SEV ICE area. The map will indicate ICE.

The simulator will generate clouds, freezing temperatures, and rain when the aircraft is within a SEV ICE (FZRA) area. The map will just indicate FZRA.

Severe mountain waves will be modeled within a SEV MTW area. The simulator will keep the local wind direction set in the planet weather model (which may refer to METARs or aloft wind data), but it will vary the wind speed along the flight path to generate typical mountain wave amplitudes. The map will just indicate MTW.

Heavy duststorms (HVY DS) and heavy sandstorms (HVY SS) are simulated equally; the visibility will decrease, and small particles will randomly hit the windshield. Engines may flame out at random. The map will indicate DUST ST or SAND ST.

The simulator will not model any effects within radioactive clouds (RDOACT CLD). The map will indicate RADIOACT.

The simulator's volcanic ash (VA) effects within VA SIGMET areas are similar to those within the simulator's conventional volcanic ash area defined on **Instructor > Situation > Weather > Planet**: Pitot tubes will get clogged, and engines will flame out at random; restarts will be possible when the aircraft is outside the ash cloud. Volcanic lightning may occur as well (not to confuse with thunderstorm lightning). The map will indicate VOLC ASH.

The simulator will generate multiple thunderstorms at random locations within TC SIGMET areas. TC are tropical cyclones. The map will indicate CYCLONE.

SIGMET — Recommended Reading

Quick Reference Guides are available on the ICAO website.

WC SIGMET (cyclones):

<https://www.icao.int/APAC/Documents/edocs/WC-SIGMET.pdf>

WV SIGMET (volcanic ash)

<https://www.icao.int/APAC/Documents/edocs/WV-SIGMET.pdf>

WS SIGMET (all other phenomena):

<https://www.icao.int/APAC/Documents/edocs/WS-SIGMET.pdf>

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