



# **B737 NG CBT - FMS - CRUISE**

## **COURSE OUTLINES**

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## COURSE START

1-LEGAL CAUTION The material contained in this training program is based on the information obtained from current state, local and company regulations and it is to be used for training purposes only. At the time of designing this program contained then current information. In the event of conflict between data provided herein and that in publications issued by the authority, the authority shall take precedence.

## FLIGHT MANAGEMENT SYSTEM- CRUISE

2-FLIGHT MANAGEMENT SYSTEM- CRUISE This part deals with the FMS operation during cruise. This is the outline; -Introduction -Cruise page -Cruise climb -Cruise descent -Step climb cruise -Long range cruise -Progress pages.

## INTRODUCTION

3-INTRODUCTION The cruise phase starts automatically at the top of climb point.

4-During cruise, you mainly refer to CRUISE, PROGRESS and ROUTE LEGS pages. Let's start with the cruise page. The LEGS page is discussed in a different lesson.

## CRUISE PAGE

5-CRUISE PAGE If the climb page is displayed during the climb, the display automatically changes to the cruise page upon reaching the top of climb point.

6-Alternatively, you can use the CRUISE function key to access to the cruise page.

7-The cruise page shows the VNAV related information during the cruise phase. Now, let's take a closer look at the cruise page.

8-The title of the page shows the active cruise mode. Four primary cruise modes are available: economy cruise, required time of arrival cruise, manual speed cruise and long range cruise. You can also select engine out cruise that is discussed in a different lesson.

### Economy cruise

9-ECONOMY CRUISE The economy cruise is the default cruise mode.

10-The page shows the current cruise altitude which comes from the PERFORMANCE INITIALIZATION page or from the CLIMB page.

11-The FMC calculated optimum altitude for the minimum cost in still air is displayed here. The maximum possible altitude is displayed next to the optimum altitude. Note that these values are for your information only.

12-Target speed shows the FMC computed airspeed or Mach number for the related cruise mode.

13-The FMC calculates the economy cruise speed as a function of gross weight, cost index, cruise altitude, and headwind

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or tailwind component. Cruise speed or Mach number may also be entered manually using the keyboard.

14-With the speed intervention active, the MCP label is displayed after the target speed to indicate that MCP controls the speed.

15-Similarly, when decelerating to hold speed prior to the hold entry fix, the HOLD label shows after the target speed. Note that the deletion or modification of hold speed or MCP speed intervention is not allowed.

16-The recommended N1 for the turbulence penetration is shown here. This value is advisory information for the flight crew only and cannot be used by the FMC.

17-The cruise page also shows predicted fuel remaining at destination. The FMC computes this value by assuming continued flight along the active route.

18-If the predicted fuel at destination is less than the fuel reserve value entered on the PERFORMANCE INITIALIZATION page, the CDU message USING RESERVE FUEL is displayed.

19-When a change in conditions or flight plan causes predicted fuel at destination to be 2000 pounds or less, an INSUFFICIENT FUEL message appears on the scratchpad. In this case, modify flight plan or cruising altitude, or divert for additional fuel.

20-In case, the FMC detects an unexpected drop in fuel quantity, the scratchpad message CHECK FMC FUEL QUANTITY is displayed. Check the fuel quantity indications for correctness.

21-The top of descent line displays estimated time of arrival at and distance to go to the top of descent point. The data is always displayed when the distance is less than 100 nm.

22-The computed true wind direction and speed at the current altitude is displayed here.

23-You can also enter the wind data manually. The data line title then changes to estimated wind.

## Rta cruise

24-RTA CRUISE If there is an RTA waypoint along the cruise path, the cruise page then displays the RTA data.

25-The page shows the same data as the economy cruise page with a few exceptions. The target speed line now displays the computed speed required to meet the entered RTA. The turbulence N1 target is replaced by the time error at the RTA waypoint.

## Manual speed cruise

26-MANUAL SPEED CRUISE The cruise page also allows you to enter a cruise speed other than FMC computed target speed.

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27-Let's enter a cruise speed of Mach 0.7. With the new speed put in the scratchpad, push the line select key next to target speed. Execute the modification. Now, the title of the cruise page changes to show the new speed. The FMC makes the airplane cruise at this new speed.

### CRUISE CLIMB

28-CRUISE CLIMB In some cases, you may need to execute a cruise climb.

29-To initiate a cruise climb, you manually enter new altitude in the scratchpad.

30-You can also use the altitude selector on the MCP to have the new altitude automatically put in the scratchpad. Note that the scratchpad shows MCP altitude changes only when the cruise page is in view.

31-With the new altitude put in the scratchpad, push the line select key next to the cruise altitude. The display automatically changes to modified cruise climb page. Execute the modification.

32-The airplane starts to climb at climb thrust and cruise target speed to the new altitude, if VNAV is active. This line displays time of arrival at and distance to the new cruise altitude.

33-The actual wind header changes to estimated wind to tell you the FMC uses wind data at the original cruise altitude to compute the target speed for the new altitude. You may enter the wind data at the new altitude manually provided the wind information used is reliable.

34-The page also shows predicted cost savings or penalty associated with flying the displayed speed.

35-Upon reaching the selected altitude, the cruise climb mode then automatically changes back to cruise.

### CRUISE DESCENT

36-CRUISE DESCENT To change to a lower cruise altitude before the top of descent, you put the new altitude in the scratchpad.

37-With the new altitude entered in the scratchpad, push the line select key next to cruise altitude. The display automatically changes to modified cruise descent page. Execute the modification.

38-The RTA cruise descent and climb page displays the same data as the cruise descent and climb page except for the TIME ERROR line.

### STEP CLIMB CRUISE

39-STEP CLIMB CRUISE Flight plans not constrained by short trip distance are usually based on conducting the cruise phase of the flight as close to optimum altitude as possible to minimize the cost.

40-Since the optimum altitude increases as fuel is consumed during the flight, it would be better to climb to a higher

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cruise altitude to reduce the trip cost. This technique is referred to as a Step Climb Cruise.

41-When altitude changes are difficult to obtain on specific routes, it may be advantageous to request an initial STEP TO altitude above optimum. This minimizes the possibility of being held at a low altitude/high fuel consumption condition for long periods of time.

42-The FMC shows the STEP to altitude line to let you examine the step climb altitudes for better economy. The line is displayed only when you are more than 100 nautical miles from top of descent or RTA mode is not active.

43-Let's try flight level 380 for a step climb to see if it provides fuel savings or penalty. Put the flight level 380 in the STEP TO altitude line. Below the STEP TO altitude line, the FMC displays the computed estimated time of arrival at and distance to the first possible step climb point based upon gross weight.

44-You can also enter the new wind data, at the STEP TO altitude to refine your analysis, provided the wind information used is reliable.

45-This data line indicates the predicted fuel remaining at the destination assuming the step climb is performed at the step point.

46-The FMC also computes and displays fuel savings or penalty if the step climb is performed.

47-In this example, the step climb provides better fuel economy. When you are as close as practicable to the step climb point, put the step climb altitude in the scratchpad and move it to cruise altitude data line. Execute the modification to initiate a cruise climb.

## LONG RANGE CRUISE

48-LONG RANGE CRUISE Other cruise mode that you can select is long range cruise.

49-Here is a typical diagram of cruise Mach versus fuel mileage. This is the maximum range cruise speed. Long range cruise speed is defined as the speed above maximum-range cruise speed that will result in a 1 percent penalty in fuel mileage. Thus, the advantage is that 1 percent of range is sacrificed for 3 to 5 percent higher cruise velocity.

50-The long range cruise speed is usually higher than the economy speed that results from using the cost index selected by most carriers.

51-Note that the FMC does not apply wind corrections to the long range cruise speed. Therefore, it may give a higher fuel burn than the economy speed which is optimized for all cruise wind conditions.

## PROGRESS PAGES

52-PROGRESS PAGES The progress pages show you how your flight is progressing.

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53-You can access the progress pages by using the PROGRESS function key during any phase of the flight.

54-There are four progress pages. Two flight progress pages, one RTA progress page and one RNP progress page. The RNP progress page is discussed in a different lesson.

### Flight progress pages

55-FLIGHT PROGRESS PAGES The first page displays airplane progress on the active route. The flight number entered on the ROUTE page shows in the title line.

56-The FROM line indicates the identifier of the last waypoint you flew over and the altitude, the actual time of arrival and the fuel at that waypoint.

57-The active waypoint line shows these data: The identifier of the active waypoint, the flight plan course and distance to go from present position to the active waypoint, the estimated time of arrival and predicted fuel remaining at that waypoint.

58-Below the active waypoint line is the Next Waypoint line. This line displays the identifier of the next waypoint which follows the active waypoint, the flight plan course and distance to go from present position to the next waypoint, the estimated time of arrival and predicted fuel remaining at that waypoint.

59-Next data line is for destination airport. This line displays the identifier of the destination airport, the distance to go from present position to the destination, the estimated time of arrival and predicted fuel remaining at the destination.

60-This is the altitude change point line. In this example, it shows the estimated time of arrival at and distance to go to top of descent point. The line also displays the same data for top of climb, STEP POINT and end of descent.

61-The WIND line shows the current true wind direction and speed.

62-The FUEL QUANTITY line displays the present total fuel quantity from the fuel quantity indicating system.

63-When the FMC is not receiving the required fuel data, the CDU shows the VERIFY GROSS WEIGHT AND FUEL message. The FUEL line changes to dashes on the PERFORMANCE INITIALIZATION page. The FMC uses the last valid fuel quantity for performance predictions.

64-You should manually enter fuel weight on the PERFORMANCE INITIALIZATION page. The word MAN appears next to the fuel weight. Continue to manually update fuel weight approximately every 30 minutes for the remainder of the flight to keep gross weight current.

65-The VERIFY GROSS WEIGHT AND FUEL message shows again each 30 minutes, if subsequent entries are not performed. This message is not displayed during descent with reference speed selected.

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66-The NAV STATUS prompt lets you select the NAVIGATION STATUS page which is discussed in a different lesson.

67-Now, push the NEXT PAGE key to show the second progress page.

68-The second progress page displays wind, track deviation, path, temperature, and speed data.

69-The HEADWIND or TAILWIND line shows the current headwind or tailwind component.

70-This data line shows the current crosswind component direction, left or right, and speed.

71-The WIND data line indicates present true wind direction and speed.

72-This line shows present static air temperature and equivalent ISA deviation.

73-The CROSSTRACK ERROR line displays the current cross track error direction, left or right, and magnitude from the FMC LNAV course. The display is blank if error is greater than 99.9 nautical miles.

74-The page also shows the current GPS track and true airspeed.

### Rta progress page

75-RTA PROGRESS PAGE Now, push the NEXT PAGE key to show the RTA PROGRESS page. This is what you will see if no RTA waypoint is entered.

76-During flight, the RTA page serves for two purposes. You use the page to initiate the required time of arrival mode. With RTA function active, the page provides advisory data on flight progress in the RTA mode.

77-The dashes in the RTA waypoint line indicate that an entry is allowed. If needed, you may enter an RTA for a waypoint as described in FMS preflight, provided the waypoint is on the remaining part of the route.

78-The LIMITS prompt lets you access to the PERFORMANCE LIMITS page.

79-The page shows PRIOR RTA prompt, if a previous RTA waypoint is still in the flight plan. You can use the prompt to display the last active RTA waypoint and time.

80-When there is an active RTA waypoint in your flight plan, the page shows the progress of flight in the RTA mode.

81-The RTA time line shows the entered arrival time for the waypoint.

82-The RTA SPEED line displays the FMC computed target speed for the current flight phase necessary to meet the RTA. This speed is limited by MINIMUM/MAXIMUM speeds on PERFORMANCE LIMITS page and by the speed in the SPEED RESTRICTION line.

83-The speed restriction affecting the RTA progress during climb and descent is displayed here. The line is blank during



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cruise and on ground.

84-This is the current time error at the RTA waypoint.

85-This line displays distance to, predicted altitude and estimated time of arrival at the RTA waypoint.

86-The RTA WINDOW shows the earliest and latest achievable arrival times at the RTA waypoint.

## **COURSE END**

87-End of course.