CROSS TRACK FLIGHT PLAN
DETAILED DEMO
TUTORIAL

Garmin Integrated Flight Deck Trainer Version 12.00

AND

Updated G1000 aircraft software

FOR

G1000 MISSION PILOTS

MISSION CO-PILOTS

AND

MISSION OBSERVERS

FOR A

PARALLEL GRID SEARCH

MIAMI 4D

USING

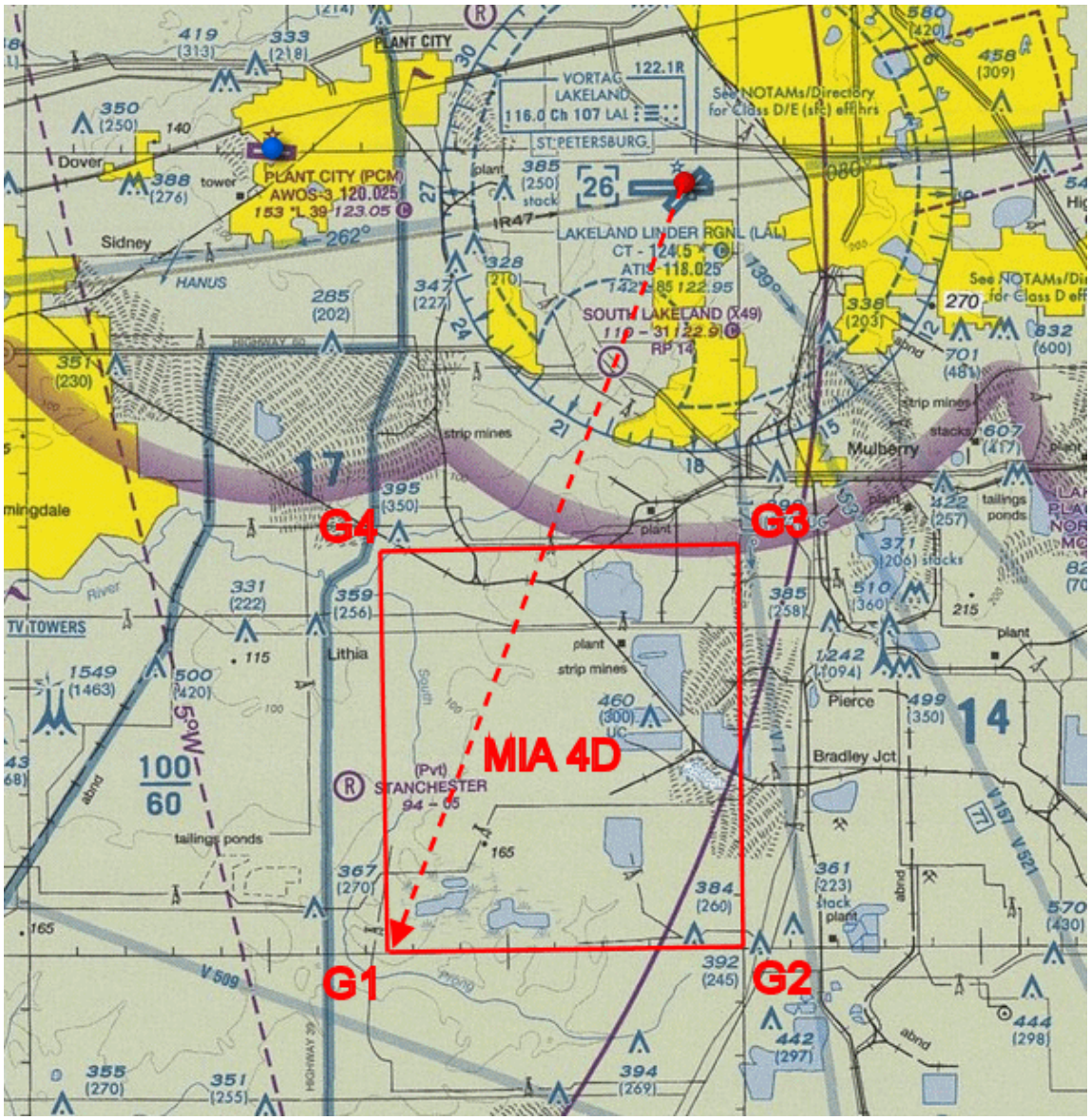
CROSS TRACK FLIGHT PLAN METHOD

South of Lakeland Airport Florida (KLAL)

Start Southwest Corner

East-West Tracks

SEARCH MIA 4D USING
CROSS TRACK FLIGHT PLAN METHOD



The corners of MIA4D are shown as G1, G2, G3, and G4. These are the waypoints used for Cross Track Flight Plan Method. The Commence Search Point (CSP) G1 is the same waypoint used for the Garmin G1000 SAR and the Single Leg Method.

SEARCH SPECIFICATION:

Miami 4D, start SW corner, East-West Tracks, 0.5 nm track spacing

Executing the Cross Track Flight Plan Method to search Miami Grid 4D from Lakeland Airport. We will be doing 0.5 nm track spacing, east-west tracks starting at the SW corner. The GX GPS specification for this grid is: Miami Sectional, Grid 4D4, 0.5 spacing, E-W direction. The second 4 in 4D4 means start SW corner.

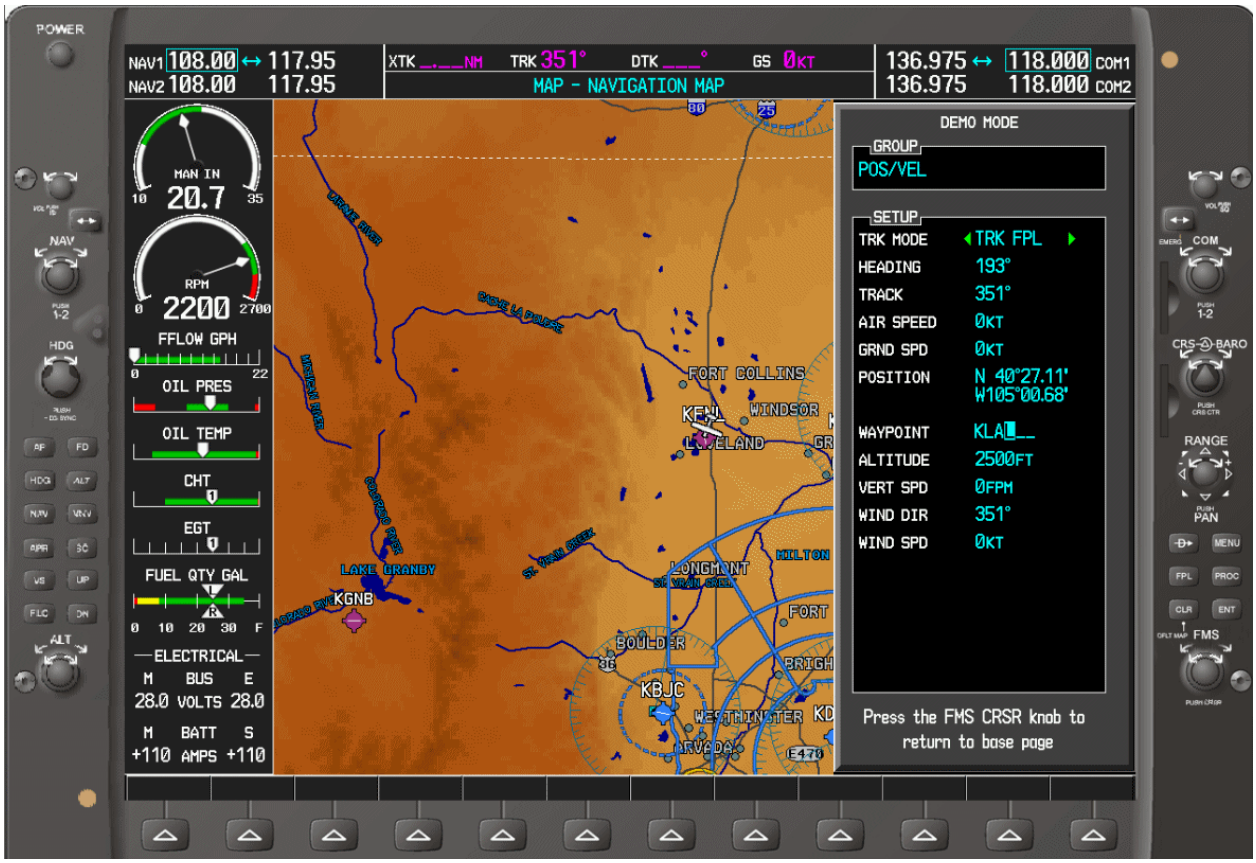
1. You will want to set the parameters on the MFD Data Bar Fields: XTK (Cross Track Distance), we will be flying with XTK = 0.0, 0.5, 1.0, 1.5,…..7.5nm. TRK (Actual Track) is compared to DTK (Desired Track). They will be equal one way or 180 degrees different the other way. GS (Ground Speed) used to determine when to start the 45 deg turn inbound for the next track. GS is an important parameter flying the real airplane to make standard rate turns in other than low winds. i.e. If your GS is inbound for the turn 90k, start the turn 0.25nm short of the desired XTK (Cross Track Distance). If your GS is inbound for the turn 100k, start the turn 0.4nm short of the desired XTK. If your GS is inbound for the turn 80k, start the turn 0.2nm short of the desired XTK. For the trainer use a parameter of your choice in the extreme right position.
2. You will want to set the MFD to Track Up. Some pilots prefer North Up; however for this application Track Up works best. The magenta line representing the Base Track Line will be vertical in the Track Up mode if the aircraft is not drifting right or left of the desired track.
3. If you performed the G1000-Build FPL in Catalog, the flight plan for this search area was built earlier in the Flight Plan Catalog. You need to activate it as the active flight plan. If not, you will need to enter the waypoints and build the flight plan.
4. You will need to set up the course line from Lakeland Airport to the Southwest corner of Miami 4D. This is done highlighting the waypoint represented the Southwest Corner, and going direct Present Position (Lakeland Airport) to the Southwest Corner.
5. Because you want to overfly the Southwest corner, fly parallel to the Present Position course line to the Southwest corner approximately 2 nm to the right in heading mode.

The desired MFD data parameters are: XTK (Cross Track Distance), TRK (Actual Track), DTK (Desired Track), and GS (Ground Speed). Under G1000 Set Ups see "G1000-Set MFD Parameters" to see how to change DATA BAR FIELD.

Under G1000 Set Ups see "G1000- Set Lat Lon Grid" to set up grid pattern, 50nm scale & lower. The grid pattern on the 30nm scale = 7.5min X 7.5min, which is useful to check that the waypoints and flight plan conforms to a 7.5 x 7.5 min grid.

G1000 TRAINER: The simulated aircraft is shown at Ft Collins Loveland Municipal Airport (KFNL) north of Denver, CO. We need to relocate the simulated aircraft to Lakeland Linder Regional Airport (KLAL) east of Tampa, FL.

Press the MENU key twice to get DEMO MODE. Then change waypoint from KFNL to KLAL, and press the ENT key. The simulated aircraft will relocate to KLAL.



Enter the following waypoints:

G1 = N 27-45.0 W082-07.5 G2 = N 27-45.0 W082-00.0
G3 = N 27-52.5 W082-00.0 G4 = N 27-52.5 W082-07.5

See "G1000-User Waypoints-XTK" to enter User Waypoints.

Build the following flight plan in the FPL Catalog:

G2 > G3 > G4 > G1 > G2

See "G1000-Build FPL in Catalog" to build the flight plan.

The MFD is shown in NORTH UP orientation. We want TRACK UP orientation.

See "G1000-North Up to Track Up-XTK" to change NORTH UP to TRACK UP.

Press the FPL key to bring up the ACTIVE FLIGHT PLAN panel.

Turn the Inner FMS knob to bring up the FLIGHT PLAN CATALOG.

The above screen applies to aircraft and later trainers.

Early trainers will go directly to next page.

Aircraft and later trainers: Turn the Inner FMS Knob another click CW.

Press the Inner FMS knob to bring up the cursor.

Rotate either the FMS inner or outer knob to highlight the G2 to G2 flight plan. Set the range knob to the 30nm scale to check FPL corresponds to MIA 4D.

Press the ENTER key to bring up the confirming message.
Press the ENTER key again to activate the G2 to G2 Flight Plan.

The G3 to G4 leg automatically went active. The G3 to G4 leg is the nearest leg to KLAL. When activating a flight plan from the G1000 Flight Plan Catalog, the nearest leg to present position will go active. This is generally true for all GPSs.

Turn the range knob clockwise until the MIA 4D search area is visible. NOTE: The magenta line, the active leg, is the nearest leg to KLAL.

Press the FMS inner knob to bring up cursor.

Highlight G1 using outer FMS knob.

Press the DIRECT TO key to provide a course from Present Position (Lakeland Liner Regional Airport)(KLAL) to the CSP (Commence Search Point) G1.

Press the ENTER key to confirm that you want to go Present Position to G1.

Press the ENT key again to confirm that you want to go Present Position to G1.

Turn the range knob until the whole search area is visible.

The Present Position to CSP direct method of getting from KLAL to G1 is the same for Cross Track Flight Plan and Cross Track Single Leg methods.

Press the FPL key to extinguish the ACTIVE FLIGHT PLAN panel.

G1000 Trainer: Press the MENU key until DEMO MODE appears.

TRAINER: Set TRK MODE to MANUAL and HEADING to 236 deg (DTK + 30 deg).

FLYING THE CROSS TRACK FLIGHT PLAN METHOD:

In this simulation we will use the autopilot. In real flight the use of the autopilot is dependent on the ability of the autopilot to handle rough air at 90 knots. When using the autopilot, make sure you never let the indicated airspeed reduce past 85 knots in a downdraft by adding power. If the air is too rough for the autopilot, fly the aircraft by hand.

In this exercise, we are doing 0.5 nm track spacing. This will require teardrop turns in autopilot. For aircraft equipped with the Garmin GFC700 autopilot, control wheel steering can be used to execute 35 degree bank 180 degree turns. Thirty degree bank turns in calm air at 90 knots will turn 180 degrees in 0.5 nm. The reason for the 35 degree initial bank is to permit shallower bank toward the end of turn.

Half nautical mile track spacing was chosen, because it is more difficult to execute 180 degree turn than one nautical mile track spacing. The autopilot will make near 1 nm spacing in a 180 turn at 90 knots.

G1000 Trainer: Cursor down to AIR SPEED and set the AIR SPEED to 90 knots.

G1000 Trainer: Press the ENTER key to bring the simulated airspeed to 90 knots.

G1000 Trainer: Click OPTIONS to get PFD. Then Press FPL key to get flight plan.

TRAINER or REAL AIRPLANE: When the XTK reaches 2 nm, turn to desired track (DTK = CRS). The final cross track is not too important. XTK of 2.12 nm is OK.

MFD VIEW: SIMULATOR; PRESS OPTIONS and select MFD.

PFD VIEW: TRAINER; Click on OPTIONS and select PFD.

Now that parallel track to G1 has been established, activate the base search leg by turning the Outer FMS Knob to highlight G2, the end of the base search leg, and then, press the MENU key.

Press the ENT key to activate the G1 to G2 leg, the base and first search leg .

Press the ENT key again to confirm activating G1 to G2 leg.

The G1 to G2 leg is shown active. When the XTK approaches 1 nm, turn the HDG knob to a heading that will provide an approximate 90 deg intercept.

At XTK = 1 nm, press the NAV key to arm the autopilot in NAV mode.

The autopilot is shown in NAV mode intercepting the G1 to G2 course line.

When XTK = 0 and cross wind correction is established, press the HDG knob.

After the HDG bug is synchronized with current heading and approaching G2, put the autopilot in HDG mode.

After reaching G2, turn HDG bug right 45 deg to 140 deg.

After the XTK changes by 0.5nm + on the 140 deg heading, perform a 180 deg turn to the left to 320 deg.

When XTK is 0.25nm short of 0.5nm, turn HDG bug left 45 deg to 275 deg.

The PFD shows the aircraft tracking true west with 0.5 nm XTK.

The MFD shows the aircraft tracking 1 deg off true west with 0.5 nm XTK.

After western edge, turn HDG bug left 45 deg to 230 deg.

The aircraft is shown outbound for a 180 deg turn to the right after the XTK changes 0.5nm + past zero to set up for another 45 deg right turn for a XTK = 1.0 nm.

When XTK is 0.25nm short of 1.0 nm, turn the HDG bug right 45 deg to 95 deg.

The PFD shows the aircraft tracking true east with 1.0 nm XTK.

The MFD shows the aircraft tracking true east with 1.01 nm XTK.

The first two procedure turns were made at the search area border with a 45 degree turn away from the direction that the XTK (Cross Track Distance) is increasing. The 180 degree turn is away from the search area border. This is the most efficient way to perform a procedure turn using standard rate turns.

The third procedure turn will be done another way. The aircraft will be flown approximately 1 nm beyond the search area with a 45 degree turn in the same direction that the XTK (Cross track Distance) is increasing. The 180 degree turn is toward the search area border. This method will provide more time for the mission observer and mission scanner to rest their eyes.

When the aircraft is approximately 1 nm beyond the G2 to G3 white course line, turn the heading bug counter-clockwise to the tail of the CDI. Make sure you do not turn heading bug past the CDI soft key causing the aircraft to turn opposite to the desired direction.

Now turn the heading bug another 45 degrees to intercept the desired XTK (Cross Track Distance). Do not rush this change past the CDI soft key label preventing an abrupt turn in opposite direction.

The aircraft is shown in a procedure turn to the left. When XTK = 1.8 nm (1.5 nm + 0.3 nm), immediately turn the heading bug clockwise back to the tail of the Course Deviation Indicator.

At a standard rate turn, 90 knots, and a zero cross wind condition, the immediate turning back of the heading bug to the tail of the CDI, when the aircraft 0.25 nm short of the desired XTK. This time the cross track is slightly over the desired 1.5 nm.

To correct from 1.51 to 1.50 nm cross track, turn slightly left then back.

The aircraft is shown on the PDF headed west with a 1.50 nm cross track.

The aircraft is shown heading eastbound with 1.50 nm cross track on MFD.

The autopilot had to be used in simulation. The techniques making the 180 degree turns used in this simulation apply flying the real airplane using both the KP140 and GFC700 autopilots. For the aircraft equipped with GFC700 autopilot, CWS (Control Wheel Steering) can be used to perform 35 degree bank 180 degree turns. The KP140 autopilot aircraft, the autopilot would have to be turned off to make a 35 degree bank turn, and reengaged on the completion of the turn. The real aircraft can be hand flown without autopilot making 35 degree bank turns easy to perform. 35 degree bank turns are necessary when 180 degree turns must be performed inside the search area. In theory, at 90 knots in zero wind a 30 degree bank would be sufficient. However, it is better to overbank slightly in the beginning so that the need to increase bank at end of turn is unnecessary.