



**Garmin GX55 Visual  
Search Patterns  
National Emergency Services  
Academy  
Mission Aircrew School  
(June 2013 Rev D)**



# **Standardized Visual Search Pattern method**

- **Visual search pattern techniques include:**
  - **Minimum # of user waypoints**
  - **GPS nav data displays - Track (TRK), Bearing to Waypoint (BRG), Distance to Waypoint, Cross Track Error "<" and Ground Speed (GS)**
  - **GPS OBS course line selection**
  - **Setting Magnetic Variation to true North**
- **Five primary visual search patterns - Parallel Line, Creeping Line, Sector Search , Expanding Square and Route Search**
- **Two less common search patterns - Parallelogram and Random Polygonal shapes**



# **GX55 Setup**



# Garmin GX55 - True North

## True North

- **Nav button, SYS softkey**
- **Hit SYS softkey, choose Nav Setup**
- **Large knob to Mag Variation**
- **SELECT button**
- **Set Manual**
- **Set 0 degrees - ENTER**



# Garmin GX55 - True North





# Garmin GX55 Map setup

- **Map button - large knob to Route Line page**
- **Use softkeys to select:**
  - **Route line - Yes**
  - **Map Orient - North**
  - **Map Ref - Plane**



# Garmin GX55 Map setup



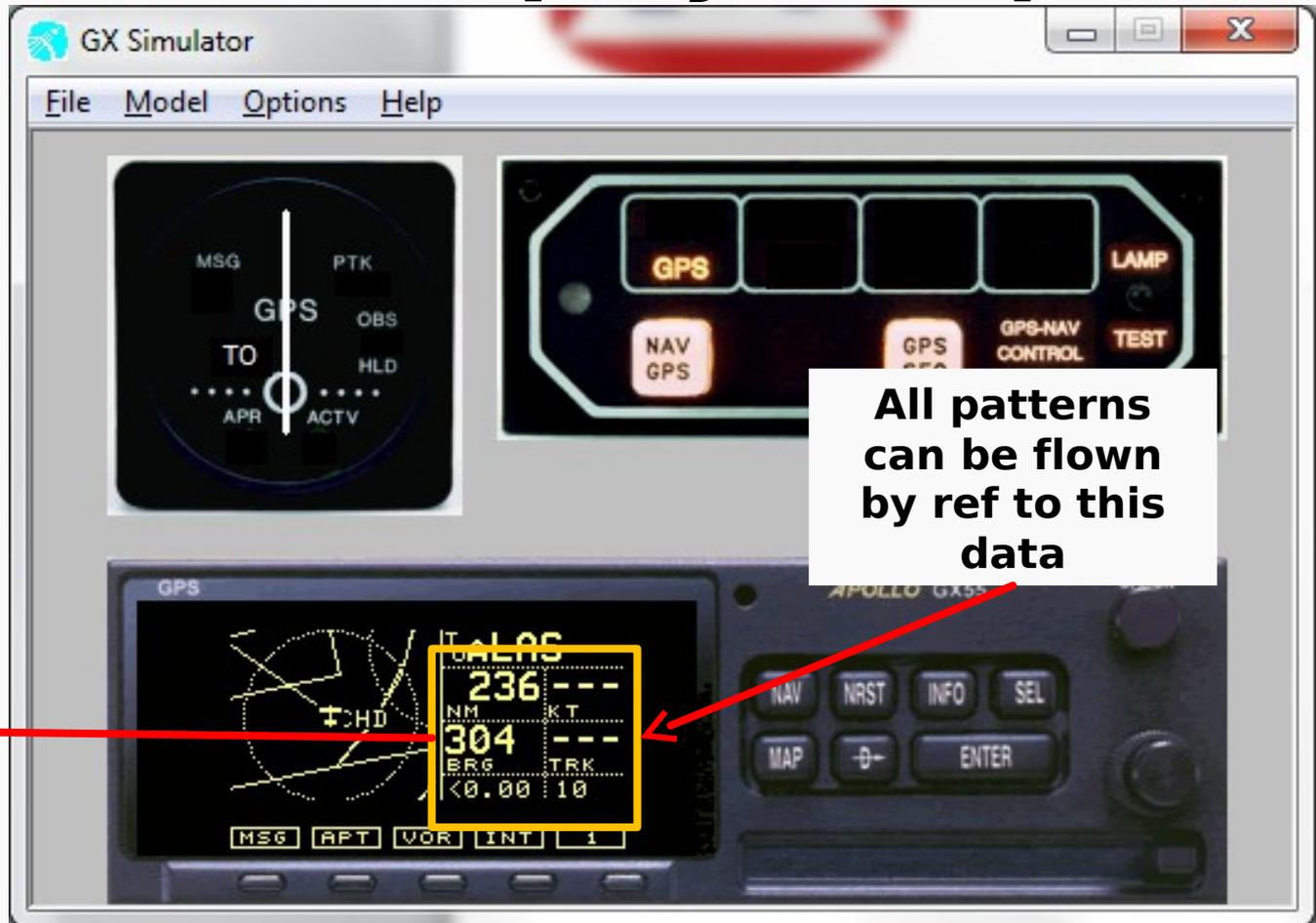


# Garmin GX55 - Map display setup

- **The map page can be configured to display nav data or not. Always choose the page with nav data.**
- **The map will display dist, GS, Brg to the waypoint and track. Crosstrack Error will be just below Brg. It is NOT labeled but is displayed with a “<” or “>” symbol indicating the direction to the course line**
- **The map display can be configured to show airports, VORs, NDBs etc. Turn off what you don't need with the softkeys.**



# Garmin GX55 - Map display setup



All patterns can be flown by ref to this data

DIST	Ground Speed
BRG	TRK
XTK	Map Scale



# Garmin GX55 - Entering User Waypoints

## Creating a User Waypoint by Lat/Long

- Press NAV then press DB smart key
- Turn LARGE knob to the “Create User Wpt by Lat/Lon” page - press ENTER
- Set the Waypoint name - using SMALL knob to set characters, LARGE knob moves cursor to next field
- Continue turning LARGE knob CW until LAT is flashing then change value using SMALL and LARGE knobs
- Press ENTER when finished entering LAT and LONG
- If desired to enter by Radial/Dist, turn large knob 1 to right. Enter reference point and radial/distance. **NOTE: you cannot select a**



# Garmin GX55 - Entering User Waypoints





# **Flying the search patterns**

**Parallel Line**  
**Creeping line**  
**sector**  
**expanding square**  
**route search**  
**Parallelogram**  
**Random Shapes**



# Flying the Patterns using OBS

- **All patterns can be flown with one or two user waypoints using the OBS function and reference to Distance, Ground Track (TRK), Bearing to Waypoint (BRG) and Cross Track Error “<”**
- **Typically GX55 equipped aircraft do not have a HSI installed, the OBS course is selected on the GX55**
  - **Press DD (direct twice)**
  - **Set the course with the knobs.**
  - **Press Enter Enter (must press enter twice)**
  - **This will give a course line to the waypoint at the entered course.**
  - **Unlike the G1000, it will NOT extend the course line outbound beyond the waypoint. However, distance and crosstrack will work and can be used to fly the outbound course**



# **Flying the Patterns using OBS**

- **GX55 will allow you to fly an OBS course to any waypoint you select in a flight plan or “direct to”.**
- **After making the desired waypoint active, set up the OBS function as described in the previous slides.**
- **Fly the aircraft to intercept the course line**
- **Fly inbound to the waypoint on the course line.**
- **After passing the waypoint you may continue flying outbound on the OBS course, but keep in mind that unlike the G1000, it will NOT extend the course line outbound beyond the waypoint. However, distance and crosstrack will work and can be used to fly the outbound course.**



# Flying the Patterns using OBS





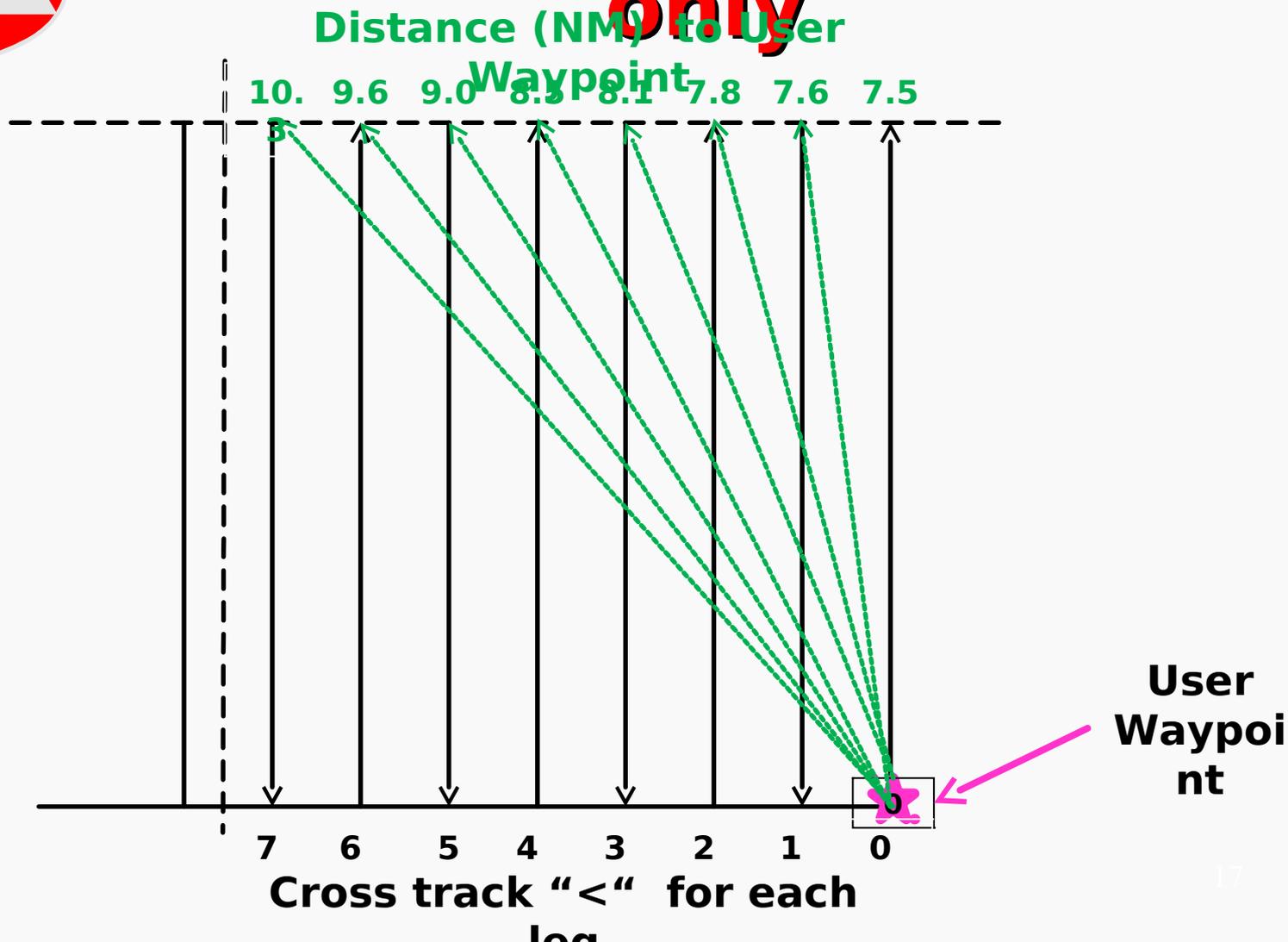
# Parallel Line (Grid) Search

Single User waypoint, “<” cross track, TRK, BRG, distance (NM) and OBS

1. Input user waypoint at grid entry point by Lat/Long
2. Load a “direct to” user waypoint flight plan
3. Rotate the course line (OBS) to the direction of the first track then fly the track. This first track will establish the “base line” for subsequent parallel tracks
4. At the end of the first track and at least 0.5NM outside the grid turn to establish a new track in the opposite direction at a distance “<” or “>” = track spacing (e.g. 1 nm for the second track and 2 nm for the third track etc.)
5. For NS tracks end of grid can be established by distance (NM) from User Waypoint , see next slide
6. Fly each track adjusting heading to achieve the desired TRK while maintaining desired track spacing from the base line
7. The entry edge of the grid can be established by BRG to WPT, in the example given BRG=090 on



# Parallel Line DIST to Wpt - for N-S Tracks only





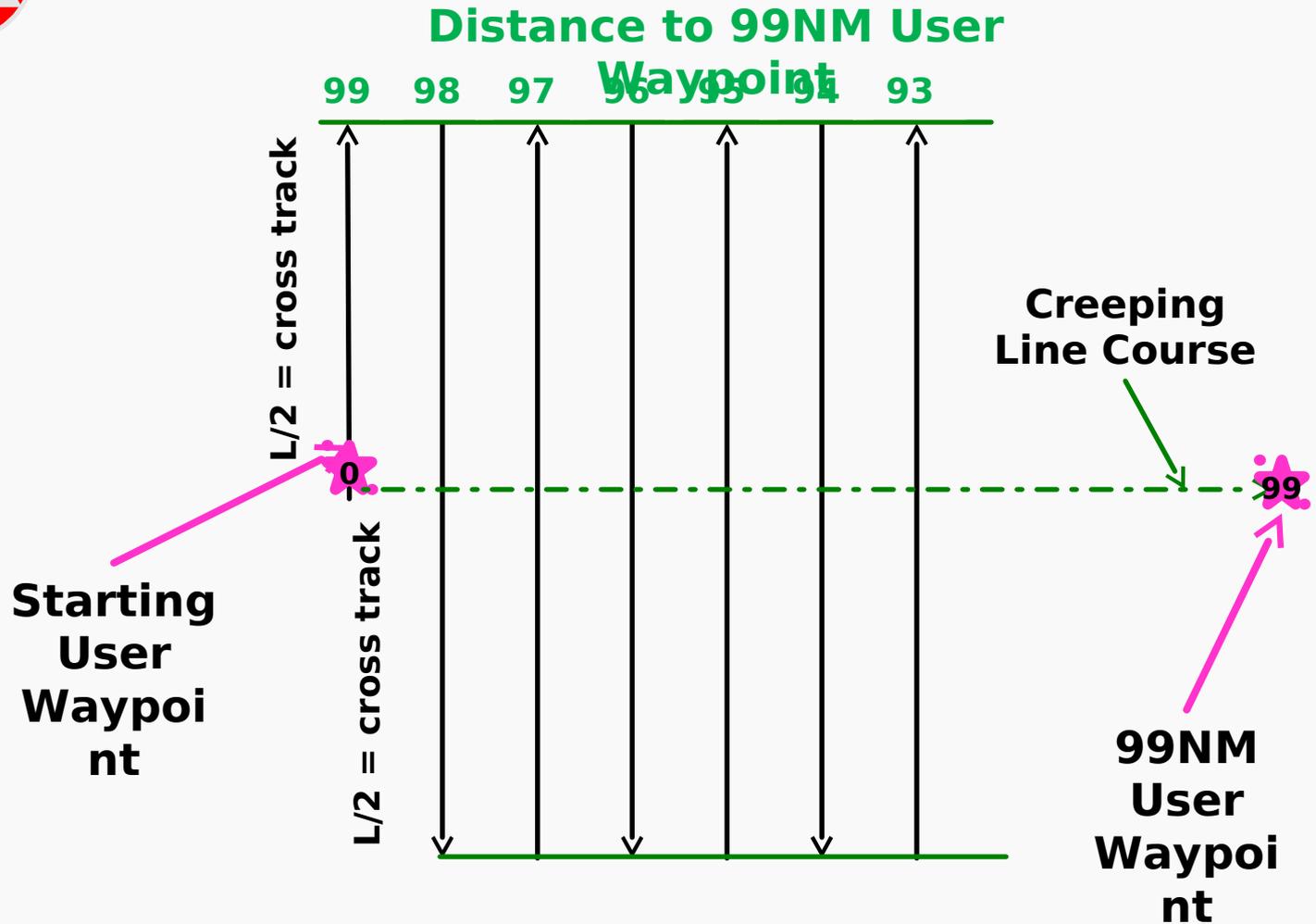
# Creeping Line Search (GPS arc method)

## Two User waypoints cross track, DIST, and OBS

- 1. Determine true course between beginning point and end point of search from sectional**
- 2. Insert a waypoint 99 miles beyond the start point of the creeping line enter a flight plan from start to waypoint 99 miles beyond start point (this must not be >99 miles since GX55 will not display 1/10<sup>th</sup> miles at 99 NM or more)**
- 3. Desired track for left offset of creeping line is  $DTK - 90^\circ$ , Right offset of creeping line is  $DTK + 90^\circ$ .**
- 4. Approach the beginning point from the right side of the search course so that aircraft is established on creeping line track ( $DTK - 90^\circ$ ) prior to crossing search course.**
- 5. When the Cross Track Error "<" readout indicates that the aircraft is at the Offset plus at least  $+ 0.5$  NM from the course line, perform a turn to intercept the reciprocal track ( $DTK + 90^\circ$ )**
- 6. Adjust the turn as necessary so that the aircraft is closer to the course end point by distance equal to track spacing and on a ground track perpendicular to the course line**
- 7. Continue this process until the search pattern is completed.**

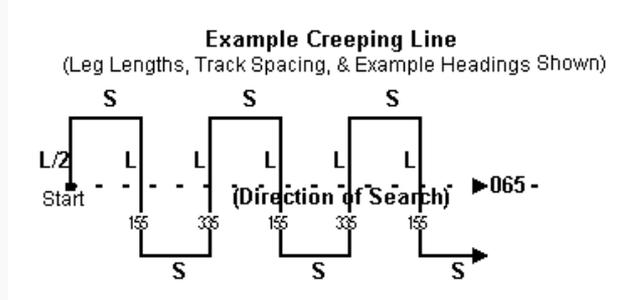


# Creeping Line

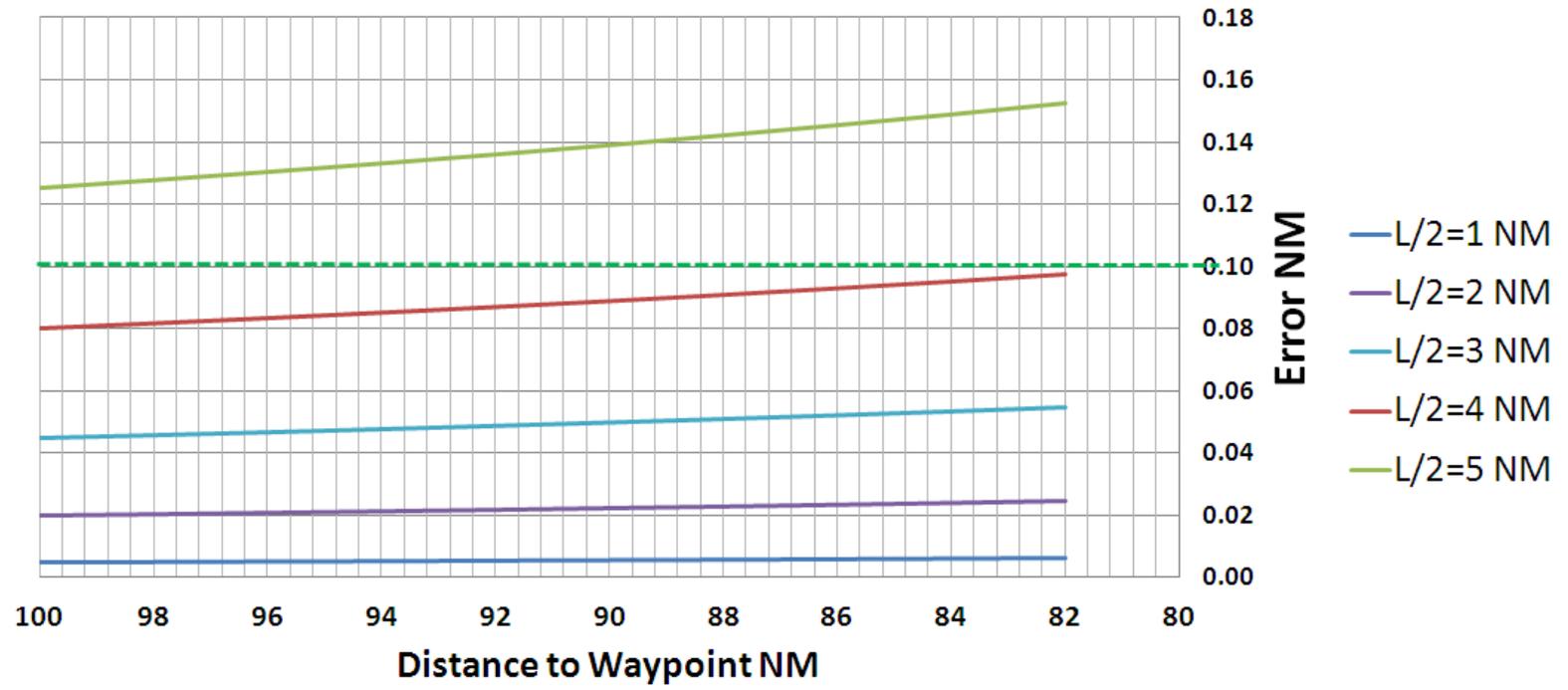




# Creeping Line Error



**Creeping Line Error - GPS arc method**





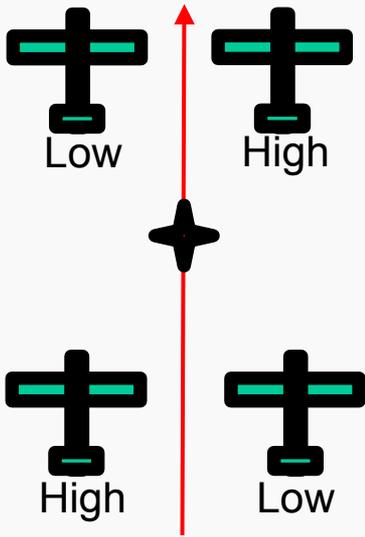
# Sector Search

## Single User waypoint Distance, BRG, TRK and OBS

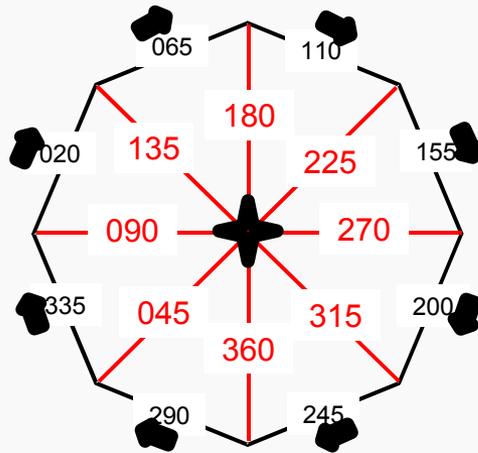
- 1. Input user waypoint for center of sector search by Lat/Long.**
- 2. Load a “direct to” user waypoint flight plan**
- 3. Fly aircraft to intercept and fly inbound to the search center on the radial closest to the direction of flight. Select this radial using the OBS function.**
- 4. After arrival at the search center continue to fly the same track TRK out to the search radius on the other side of the center using Distance to verify position from the center and the OBS line for course guidance**
- 5. When Distance > search radius, select next radial using OBS, and turn right to intercept the next inbound radial track. The next radial bearing -90 degrees is a good heading to fly to intercept the next radial inbound.**



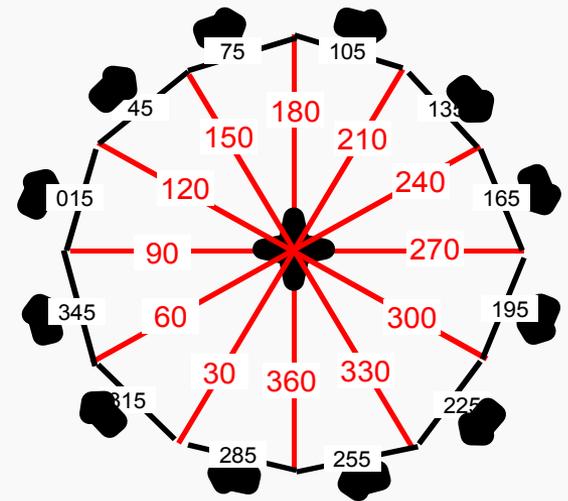
# Sector Search



Bearing to  
wpt.



Example sector search  
Bearing to wpt. in red  
interim headings in black -  
use up to 3 NM from  
centerpoint



use up to 6 NM from  
centerpoint



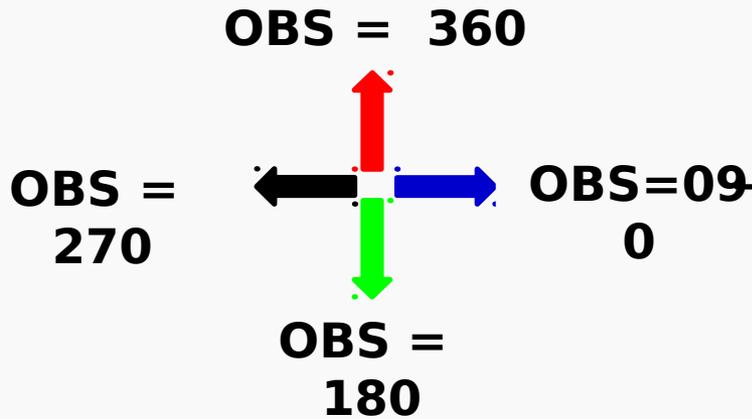
# Expanding Square Search

## Single User waypoint crosstrack " $<$ ", Distance, TRK and OBS

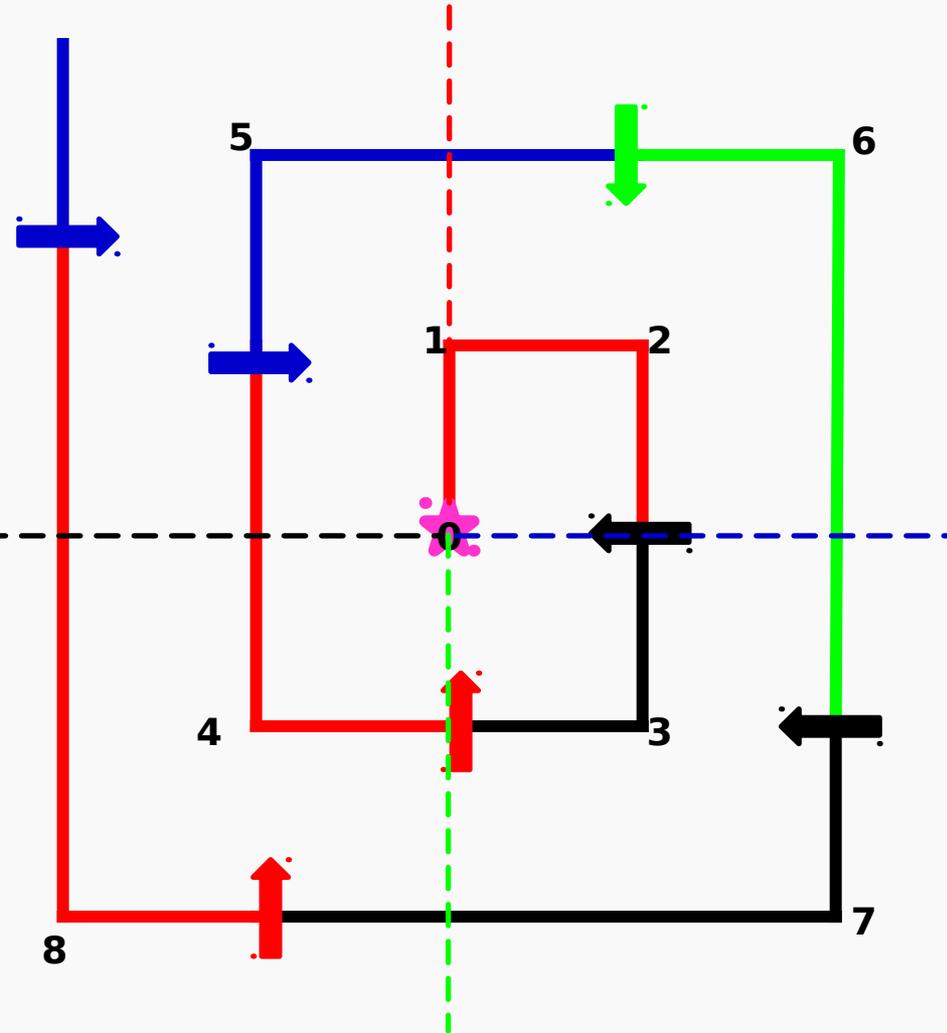
- m Input user waypoint for center of expanding square search by Lat/Long
- m Load a "direct to" user waypoint flight plan
- m Set OBS to 360, intercept course line and cross waypoint at designated ground speed and altitude
- m At Distance=0.7, turn right using a 20 degree bank angle to a TRK of 090. when " $<$ "=0.7 turn right to 180 using a 20 degree bank angle, roll out " $<$ "=1.
- m Establish heading to stay on " $<$ " = 1.0 and TRK=180, use ground track bug if able
- m When ground track stable, set OBS=270; at " $<$ "=0.7 turn right using 20 degree bank angle, roll out to achieve TRK=270 and " $<$ "=1.0
- m Establish heading to stay on " $<$ " = 1.0, TRK=270
- m When ground track stable, set OBS=360; at " $<$ "=0.7 turn right using 20 degree bank angle, roll out to achieve TRK= 360 and " $<$ "=1.0
- m Establish heading to stay on " $<$ "= 1.0, TRK=360
- m When ground track stable, set OBS=090; at " $<$ "=1.7 turn right using 20 degree bank angle, roll out to achieve TRK= 090 and " $<$ "=2.0



# Expanding Square



Approx. location  
of OBS change  
for next leg





# Route Search

## Using flight plan and crosstrack “<”

**Enter and activate a flight plan for the route using a combination of Airports, VORs, NDBs and user waypoints as appropriate. Note the true course for each leg of the flight plan**

**Fly the required parallel track offset by using the GX55 display for cross track “<” relative to the flight plan route**



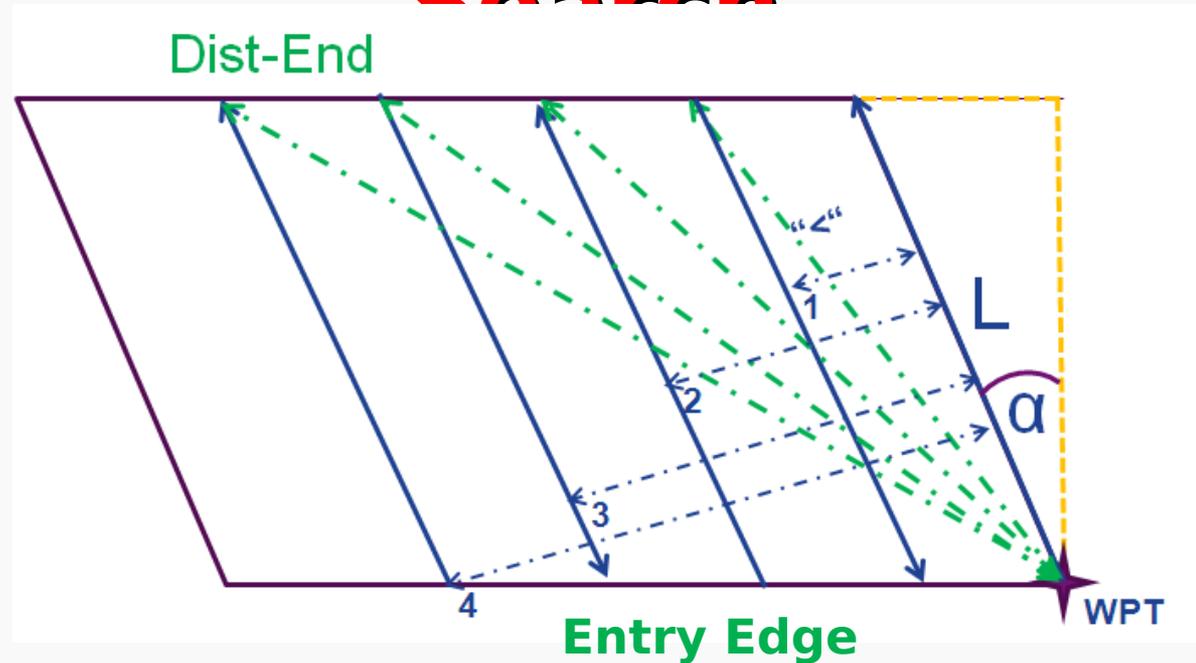
# Parallelogram Grid Search

Single User waypoint, crosstrack “<”, TRK, Distance, BRG and OBS

1. Input user waypoint at grid entry point by Lat/Long
2. Establish angle  $\alpha$  (360 - true track) and L (track length)
3. Load a “direct to” user waypoint flight plan
4. Rotate the course line (OBS) to the direction of the first track then fly the track. This first track will establish the “base line” for subsequent parallel tracks
5. End of the track can be established by Distance using tables given using your Track Length L and Angle  $\alpha$  (see next slide).
6. At the end of the first track and at least 0.5NM outside the grid turn to establish a new track in the opposite direction at a distance “<” = track spacing (e.g. 1 nm for the second track and 2 nm for the third track etc.)
7. Fly each track adjusting heading to achieve the desired TRK while maintaining desired “<” from the base line
8. The entry edge of the grid can be established by BRG to WPT, in the example given BRG=090 on entry edge of grid
9. Repeat until the grid is complete



# Parallelogram Grid Search



**L = distance along track start- end of grid**

**"<" = Track Spacing (usually 1NM)**

**$\alpha$  = angle between track and entry edge (360-true track)**

**Dist-End = Distance from WPT to End of grid**

**Entry Edge of grid can be established from BRG to WPT in this example BRG= 090 along entry edge**



# Parallelogram Grid Search

Angle Alpha	L									XTC							
	10	15	20	25	30	35	40	45	Dist - End								
1	8									4.3	4.4	4.5	4.5	4.6	4.7	4.7	4.8
2	10									4.8	4.9	5.1	5.2	5.3	5.4	5.5	5.6
3	10.2	10.3	10.4	10.5	10.5	10.6	10.7	10.7	10.1	10.4	10.6	10.9	11.1	11.2	6.3	6.4	6.5
4	10.5	10.7	10.9	11.0	11.2	11.3	11.4	11.5	10.8	11.1	11.4	11.7	11.9	12.1	6.3	6.4	6.5
5	10.9	11.2	11.4	11.6	11.8	12.0	12.2	12.3	10.6	11.9	12.2	12.5	12.8	13.0	7.2	7.3	7.4
6	11.4	11.7	12.0	12.3	12.5	12.8	13.0	13.2	10.4	12.8	13.1	13.4	13.7	14.0	7.2	7.3	7.4
7	12.0	12.3	12.7	13.0	13.3	13.6	13.8	14.1	10.2	13.6	14.0	14.3	14.6	14.9	8.1	8.2	8.4
8	12.6	13.0	13.4	13.7	14.1	14.4	14.7	14.9	10.1	14.5	14.9	15.2	15.5	15.8	8.1	8.2	8.4
9	13.2	13.7	14.1	14.5	14.9	15.2	15.6	15.8	10.1	15.4	15.8	16.1	16.5	16.8	9.0	9.2	9.4
10	13.9	14.4	14.9	15.3	15.7	16.1	16.4	16.8	10.1	16.3	16.7	17.1	17.4	17.8	9.0	9.2	9.4
11	14.7	15.2	15.7	16.1	16.6	17.0	17.3	17.7	10.1	17.2	17.6	18.0	18.4	18.7	10.0	10.2	10.3
12	15.4	16.0	16.5	17.0	17.5	17.9	18.3	18.6	10.1	18.1	18.5	19.0	19.3	19.7	10.0	10.2	10.3
13	16.2	16.8	17.4	17.9	18.3	18.8	19.2	19.6	10.1	19.0	19.5	19.9	20.3	20.7	10.9	11.1	11.3
14	17.1	17.7	18.2	18.7	19.2	19.7	20.1	20.5	10.1	20.0	20.4	20.9	21.3	21.6	10.9	11.1	11.3
15	17.9	18.5	19.1	19.6	20.2	20.6	21.1	21.5	10.1	20.5	20.9	21.3	21.6	11.9	12.1	12.3	
16	18.7	19.4	20.0	20.5	21.1	21.6	22.0	22.4	10.1	21.5	21.9	22.3	22.6	12.9	13.1	13.3	
17	19.6	20.3	20.9	21.5	22.0	22.5	23.0	23.4	10.1	22.5	22.9	23.3	23.6	13.9	14.1	14.3	
18									10.1	23.5	23.9	24.3	24.6	14.8	15.1	15.3	
19									10.1	24.5	24.9	25.3	25.6	15.8	16.1	16.3	
20									10.1	25.5	25.9	26.3	26.6	16.8	17.1	17.3	
21									10.1	26.5	26.9	27.3	27.6	17.8	18.1	18.3	



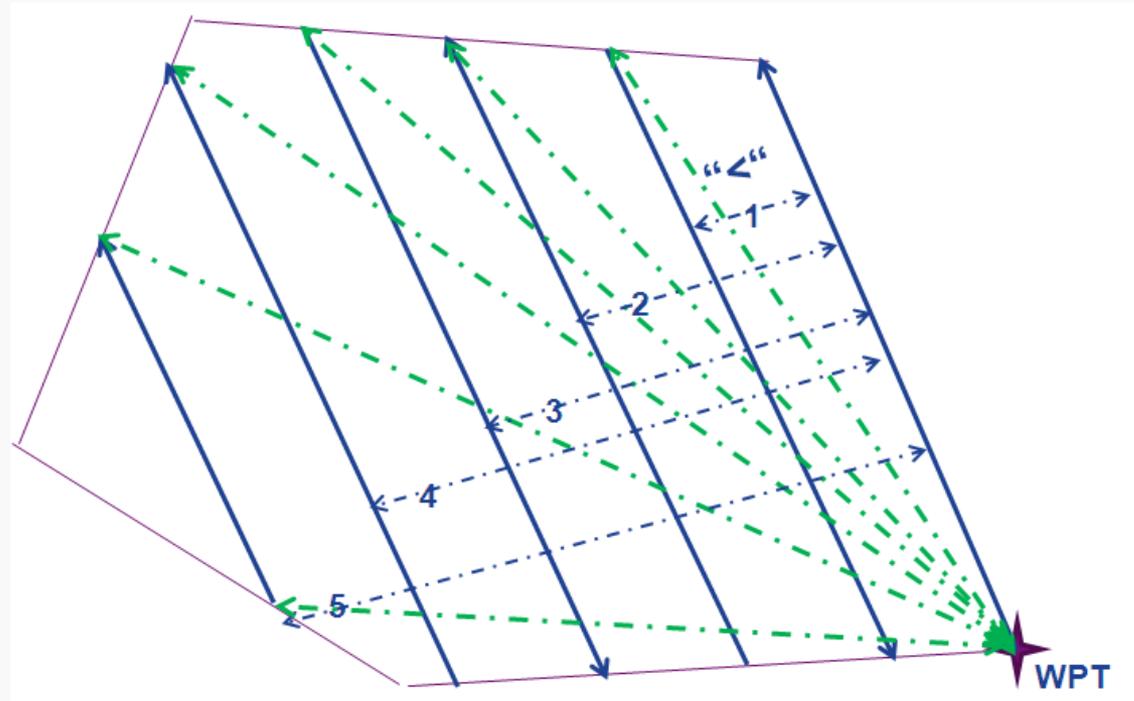
# Random Shapes Grid Search

## Single User waypoint “<”, TRK, Distance, BRG and OBS

1. Draw shape on sectional , select longest edge for initial track, measure initial track direction and reciprocal track direction
2. Input user waypoint at grid entry point by Lat/Long
3. Load a “direct to” user waypoint flight plan
4. Rotate the course line to the direction of the first track then fly the track. This first track will establish the “base line” for subsequent parallel tracks
5. End of the track can be established by measuring distance on sectional
6. At the end of the first track and at least 0.5NM outside the grid turn to establish a new track in the opposite direction at a distance “<”= track spacing (e.g. 1 nm for the second track and 2 nm for the third track etc.)
7. Fly each track adjusting heading to achieve the desired TRK while maintaining desired “<” from the base line
8. The ends of the track can be established by either BRG to WPT or by Distance from user waypoint whichever makes most sense
9. Repeat until the grid is complete



# Random Shapes Grid Search



“<” = Track Spacing (usually 1NM)

End of tracks can be established by either distance from WPT to End of grid measured from sectional or by BRG to WPT



**Questions?**