



# 'Pattern Commander' Help

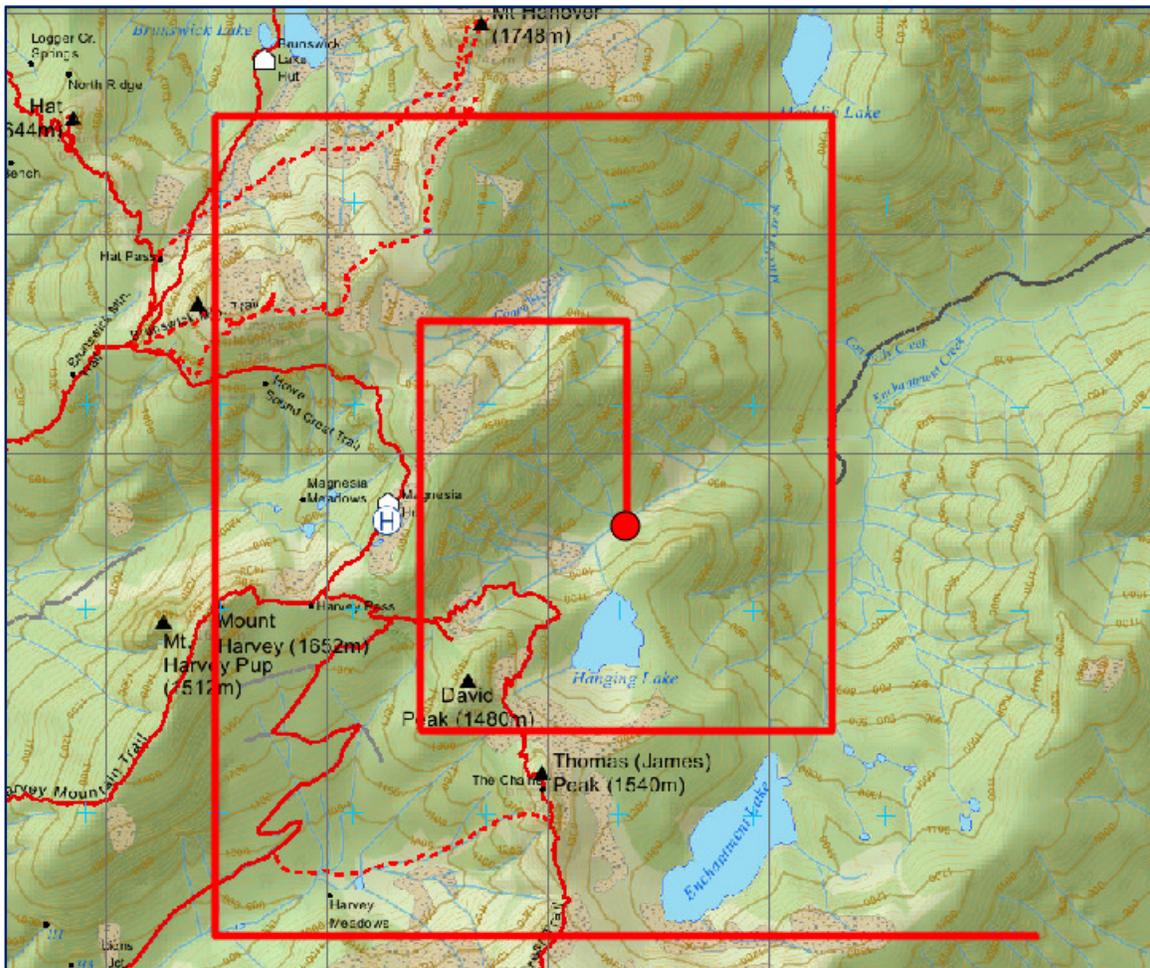
## Introduction

'Pattern Commander' is a unique program designed to quickly create standard and custom SAR search patterns for convenient display on the 'Incident Commander Pro' GIS mapping module.

Standard search patterns, including Expanding Square, Parallel Track, Sector Search and custom Point-to-Point patterns, can all be created by 'Pattern Commander'.

'Pattern Commander' generates both GPX and KML search pattern files, for immediate display in 'Incident Commander Pro' and Google Earth.

'Pattern Commander' provides clear examples of the type of search pattern being created and also has the ability to calculate the generated search pattern's Coverage and Probability of Detection, when the area's search speed and sweep width are entered into its calculator.





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## **Search Patterns**

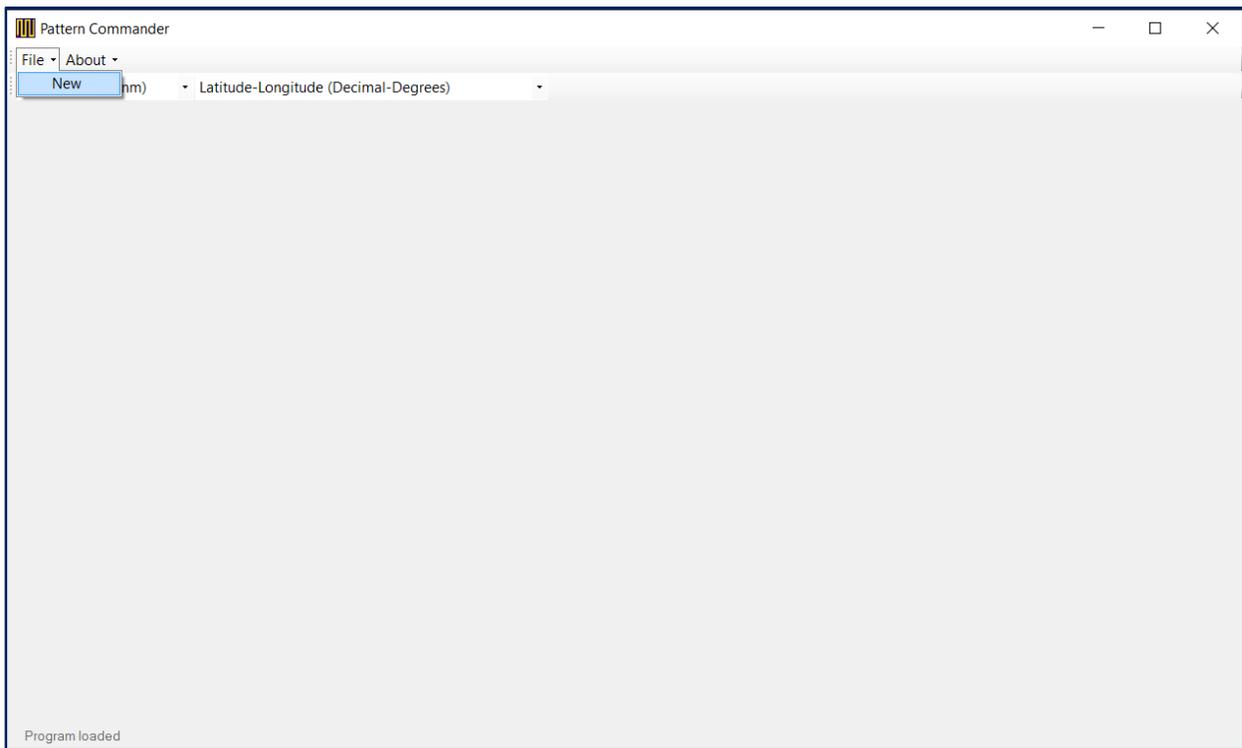
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# Getting Started

Click on *File*.

From the dropdown,... click on *New*.





# Generate a Search Pattern

## Search Pattern Selection

Select *File... New* to begin generating a new search pattern, then go to the lower left corner of the window to the *Select Search Pattern* dropdown.

## Select Search Pattern

The screenshot shows the 'Pattern Commander' application window. The title bar indicates the 'Currently selected pattern name displayed here' is 'Expanding Square'. The interface includes a menu bar (File, About), unit settings (Nautical Miles (nm), Latitude-Longitude (Decimal-Degrees)), and a configuration panel for the 'Datum Location' (Latitude: 0, Longitude: 0), '1st Turn Direction' (Right), '1st Leg Orientation', 'First Leg Distance' (0 nm), and 'Number of Legs' (0). A 'Select Search Pattern' dropdown menu is open, showing options: Expanding Square, Sector Search, Parallel Search, and Point-to-Point. The 'Expanding Square' option is selected. Below the dropdown is an 'Export GPX' button and a 'New pattern created' status message. The main display area shows a diagram titled '10-Leg Expanding Square Search Pattern'. The diagram illustrates a search pattern starting from a 'Start (CSP)' point (marked with an aircraft icon) and expanding outwards in concentric squares. The pattern consists of 10 legs, numbered #1 through #10, forming a square with side length 10. The 'Target Location Datum Point' is marked with a red dot. The 'Searched Area' is indicated by a dashed line. The diagram also shows 'Track Spacing' and 'Square Size' parameters. The text below the diagram states: 'The Expanding Square Search begins at the reported position or most probable location (Datum) and expands outwards in concentric squares. It is a very precise pattern and requires accurate navigation. - To minimise navigational errors, the first leg is usually oriented (down) directly into the wind.' The diagram is labeled 'Sector Search Pattern - Aircraft'.

After clicking the *Select Search Pattern* dropdown, select one of the four types of search patterns available:

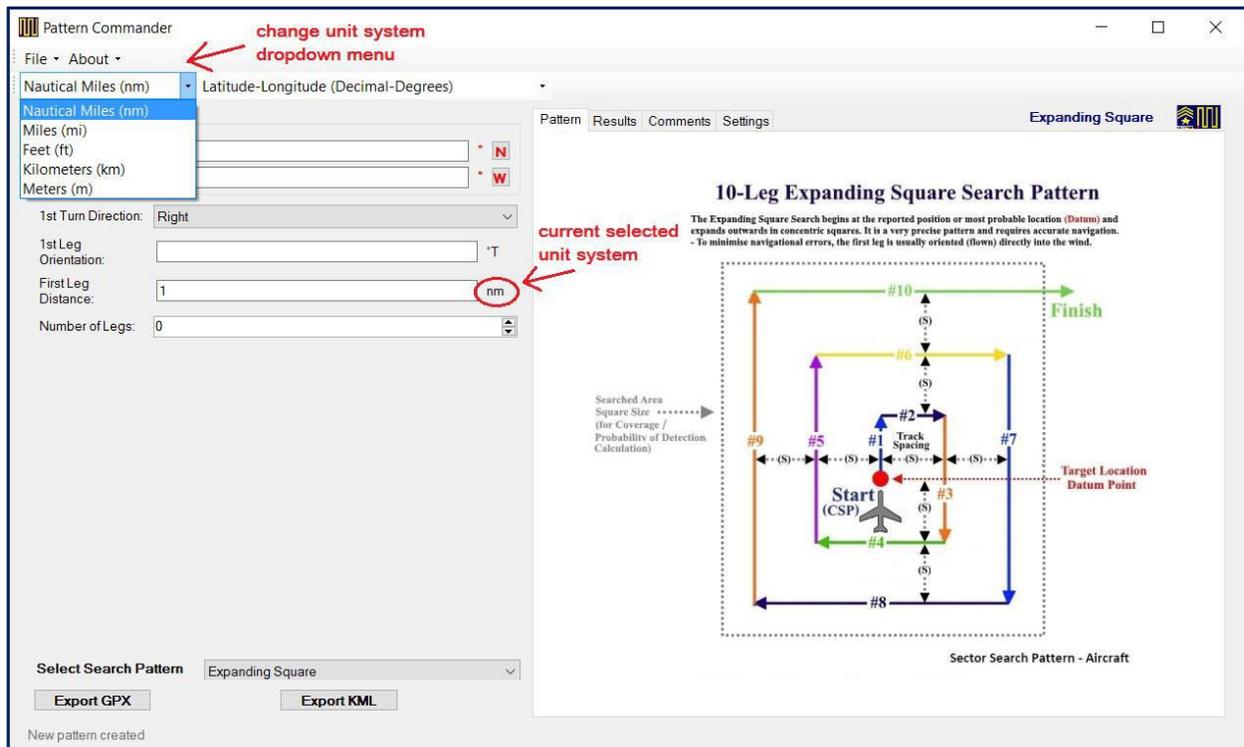
- *Expanding Square*
- *Sector Search*
- *Parallel Search*
- *Point-to-Point (Custom) Search*

**Note:** The name of the search pattern that you have currently selected will then be displayed on the top right of the main application window.

## Distance Units

Pattern Commander uses *Nautical Miles* as its default distance units.

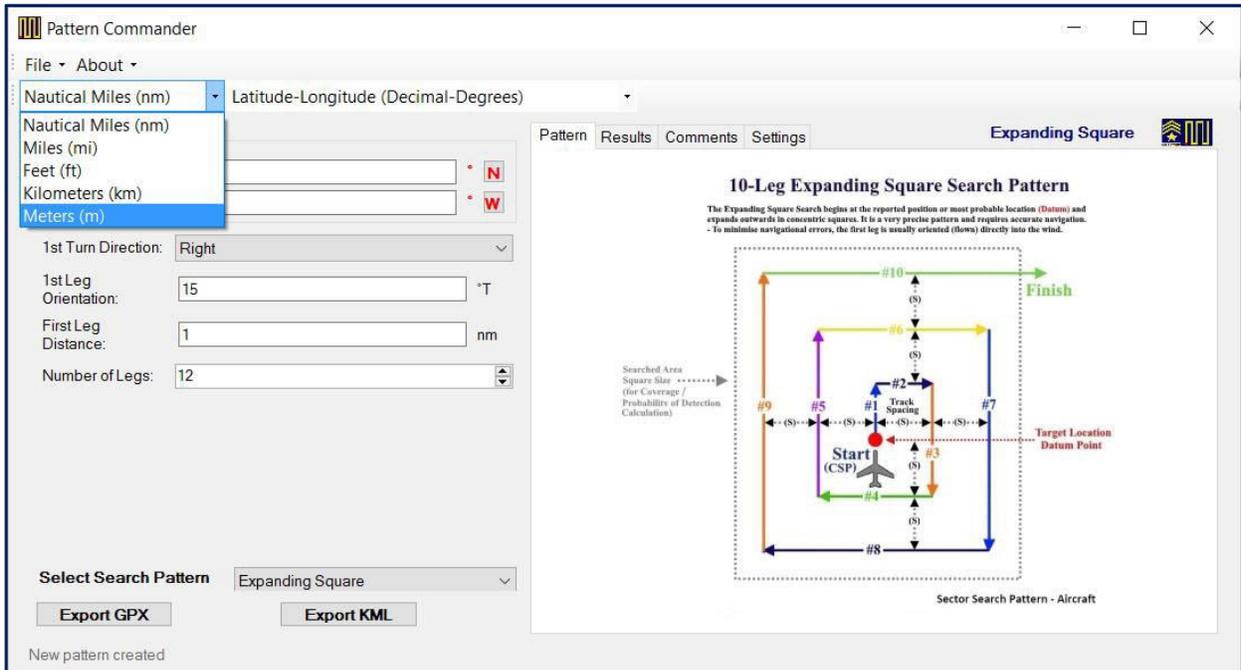
Clicking on the *Nautical Miles* distance dropdown menu at the top left corner of the main application displays the five available distance units:



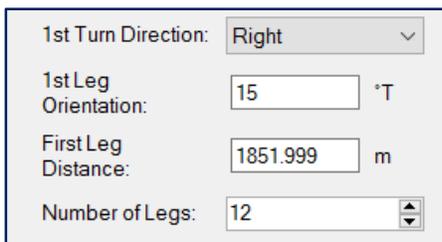
The five available distance units are:

- **Nautical Miles (nm)**
- **Miles (m)**
- **Feet (ft)**
- **Kilometers (km)**
- **Meters (m)**

Changing the currently selected distance units will change the distance unit abbreviation of the *Leg Distance* input, the *Track Spacing* input for *Sector* and *Parallel search* patterns, and also distance convert whatever number is currently entered into the *Leg Distance* input field.



Example distance conversion from 1 nautical mile (entered) to 1851.999 meters.



## Coordinate Systems and Datum Location ●

‘Pattern Commander’ uses Latitude-Longitude (Decimal-Degrees) as its default coordinate system.

*Latitude-Longitude (Decimal-Degrees) is the recommended coordinate system for maximum compatibility with ‘Incident Commander Pro’, Google Earth etc.*

By clicking on the Coordinate System dropdown menu three additional coordinate system types are listed:

The screenshot shows the Pattern Commander software interface. The 'Coordinates systems dropdown menu' is highlighted, showing options: Latitude-Longitude (Decimal-Degrees), Latitude-Longitude (Degrees Decimal-Minutes), Latitude-Longitude (Degrees Minutes Seconds), and UTM/Zone. The 'Datum Location' section shows 'Zone: 0', 'Northing: 0', and 'Easting: 166021.443'. The '10-Leg Expanding Square Search Pattern' diagram illustrates a search pattern starting from a 'Start (CSP)' point and expanding outwards in a square pattern, with legs numbered #1 through #10. The diagram also shows a 'Target Location Datum Point' and a 'Finish' point.

- Decimal-Degrees

**Datum Location ●**

Latitude: 49.45137 ° N

Longitude: 122.84495 ° E

- Degrees Decimal-Minutes

**Datum Location ●**

Latitude: 49 ° 27.0822 min N

Longitude: 122 ° 50.697 min E

## - Degrees Minutes Seconds

<b>Datum Location •</b>							
Latitude:	<input type="text" value="0"/>	°	<input type="text" value="0"/>	min	<input type="text" value="0"/>	sec	<input type="text" value="N"/>
Longitude:	<input type="text" value="0"/>	°	<input type="text" value="0"/>	min	<input type="text" value="0"/>	sec	<input type="text" value="W"/>

## - UTM/Zone

The screenshot shows the 'Pattern Commander' software interface. On the left, the 'Datum Location' section is set to 'UTM/Zone'. The 'Zone' is set to '30' and 'N'. The 'Northing' is '0' and the 'Easting' is '833978'. The '1st Turn Direction' is 'Right', '1st Leg Orientation' is 'L', 'First Leg Distance' is '0', and 'Number of Legs' is '0'. The 'Select Search Pattern' is set to 'Expanding Square'. Below this are 'Export GPX' and 'Export KML' buttons. On the right, a diagram titled '10-Leg Expanding Square Search Pattern' illustrates the search pattern. It shows a central 'Start (CSP)' point with an aircraft icon. The pattern consists of 10 legs, numbered #1 to #10, forming concentric squares. The 'Finish' point is at the end of leg #10. A 'Target Location Datum Point' is marked with a red dot. A 'Searched Area' is indicated by a dashed line. The diagram also shows 'Track Spacing' and 'Sector Search Pattern - Aircraft'.

The selected Coordinate System will then be used for entering your

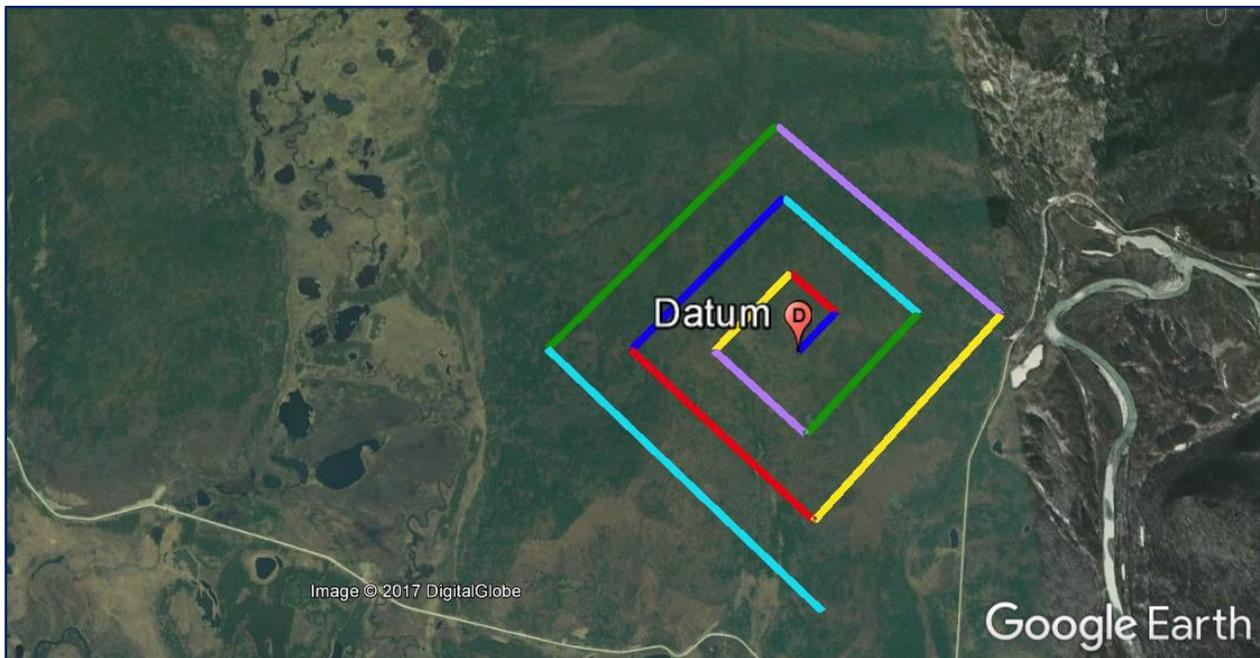
● **Datum Location.**

## ● Datum Location

‘Pattern Commander’ will use your selected coordinate system to enter your search pattern’s originating **Datum Location** point value.

The search pattern is then generated based on this original datum point location.

- The exported KML datum location is displayed as a red map marker in the file.
- The exported GPX datum location colour (property) is selected after importing the waypoint file into ‘Incident Commander Pro’s GIS module.



KML file of the **Expanding Square** search pattern

- First leg orientation 45 degrees T, a left first-turn and 12 search legs.

## Data Input Fields

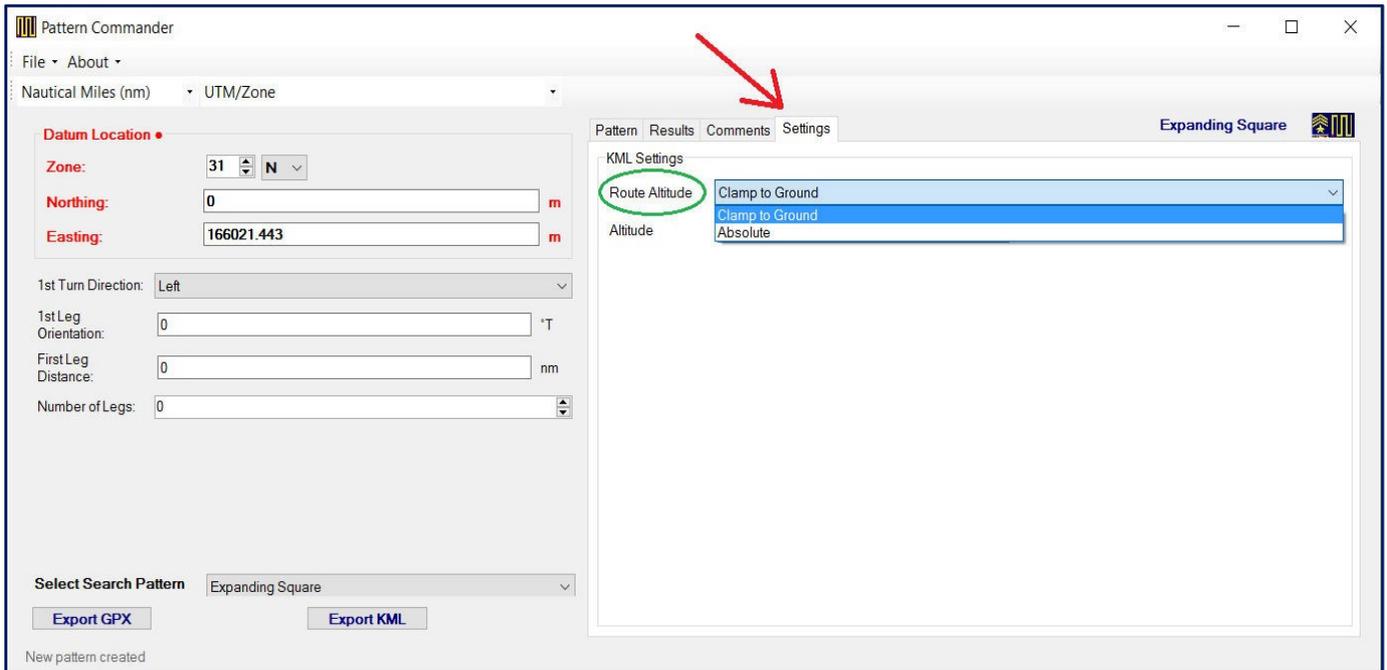
**Note:** For more information see the *Coordinate Systems and Datum Location* sections above.

Field Name	Field Description	Expanding Square Search	Sector Search	Parallel Track Search	Point-to-Point Search
<b><i>Search Type</i></b>	This dropdown contains three choices of where the <b><i>Parallel Track Search Pattern</i></b> should be drawn in relation to the originating <b><i>Datum Location</i></b> . The selectable datum point locations are displayed as three red dots ● on the example search pattern diagram.	N/A	N/A	Yes	N/A
<b><i>First Turn Direction</i></b>	After completing the first search leg, the standard search patterns require turning in either a <b>left</b> or <b>right</b> direction to begin the subsequent legs.	Yes	Yes	Yes	N/A
<b><i>First Leg Orientation</i></b>	The standard search patterns First Leg Orientation (i.e. travel direction) can be entered in <i>Degrees True</i> (°T). The example search pattern diagrams display a <i>0 Degrees True</i> First Leg Orientation.	Yes	Yes	Yes	N/A
<b><i>Leg Distance</i></b>	The length of the search legs in the selected search pattern. Note: For the <b><i>Expanding Square search pattern</i></b> Leg Distance is labeled as the “First Leg Distance” because each pair of legs is longer than the previous pair.	Yes	Yes	Yes	N/A
<b><i>Track Spacing</i></b>	<b><i>Parallel Track Search</i></b> . Track Spacing is the distance (spacing) between the parallel search legs. This is also known as the “ <i>crossing distance</i> ”.	No	No	Yes	N/A

<b><i>Number of Legs</i></b>	The number of search legs the pattern will contain.	Yes	Yes	Yes	N/A
<b><i>Point #</i></b> <b><i>“Latitude”,</i></b> <b><i>“Longitude”</i></b>	Labeled “ <b><i>Point #</i></b> ” for <b><i>Point-to-Point search pattern</i></b> only. <ul style="list-style-type: none"> <li>● For creating a custom waypoint-to-waypoint search route. Enter each waypoint’s Latitude and Longitude value into the numbered waypoint table.</li> </ul>	<b><i>Datum Location only</i></b>	<b><i>Datum Location only</i></b>	<b><i>Datum Location only</i></b>	Yes

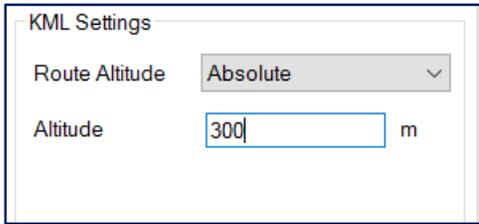
## KML Export Settings

The *Settings* tab can be found above the example pattern display on the right side of the main application window.



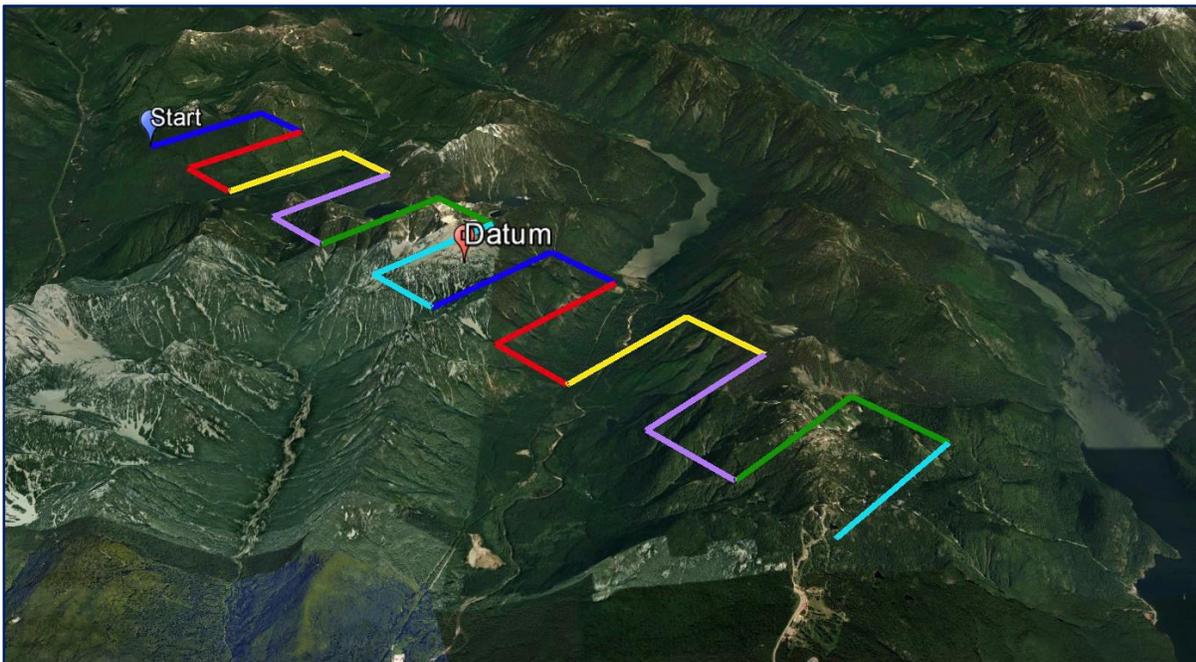
The *Route Altitude* dropdown provides two options: *Clamp to Ground* and *Absolute*.

- ***Clamp to Ground*** will export the search pattern “clamped to the ground”, i.e. following along the changing elevation of the terrain. This is usually the preferred option when performing a ground-based search.
- ***Absolute*** will export the search pattern set to an *Altitude relative to Sea level*. These search patterns always lie “flat” at the altitude value entered. This option is useful for searches involving aircraft, after entering an appropriate value in the *Altitude* field.

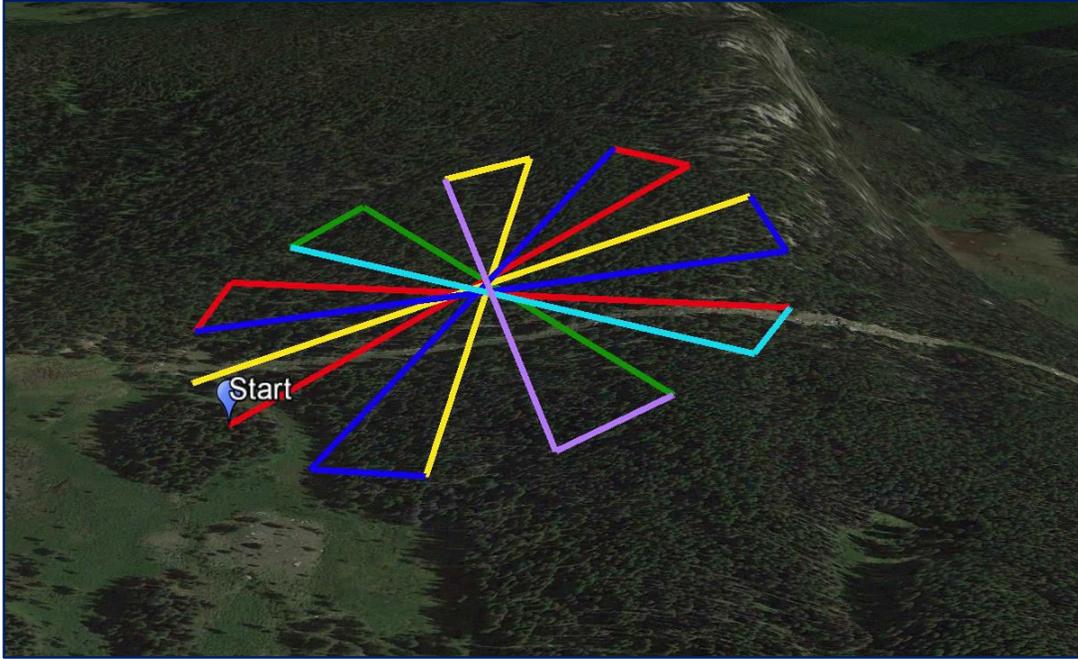


**Note:** Altitude values will only be in effect when in *Absolute* mode. *Clamp to Ground* overrides the altitude value as it is always clamped to the ground.

The default altitude value is set to 300m above sea level.



KML export example in *Absolute* mode with an *Altitude* of 300m.



KML export example in *Clamp to Ground* mode,  
following the terrain's ground level profile.

## Export GPX and KML files

After entering all the input fields for the selected search pattern and (*optionally*) changing any KML settings, navigate to the bottom of the form and click either *Export GPX* or *Export KML*:

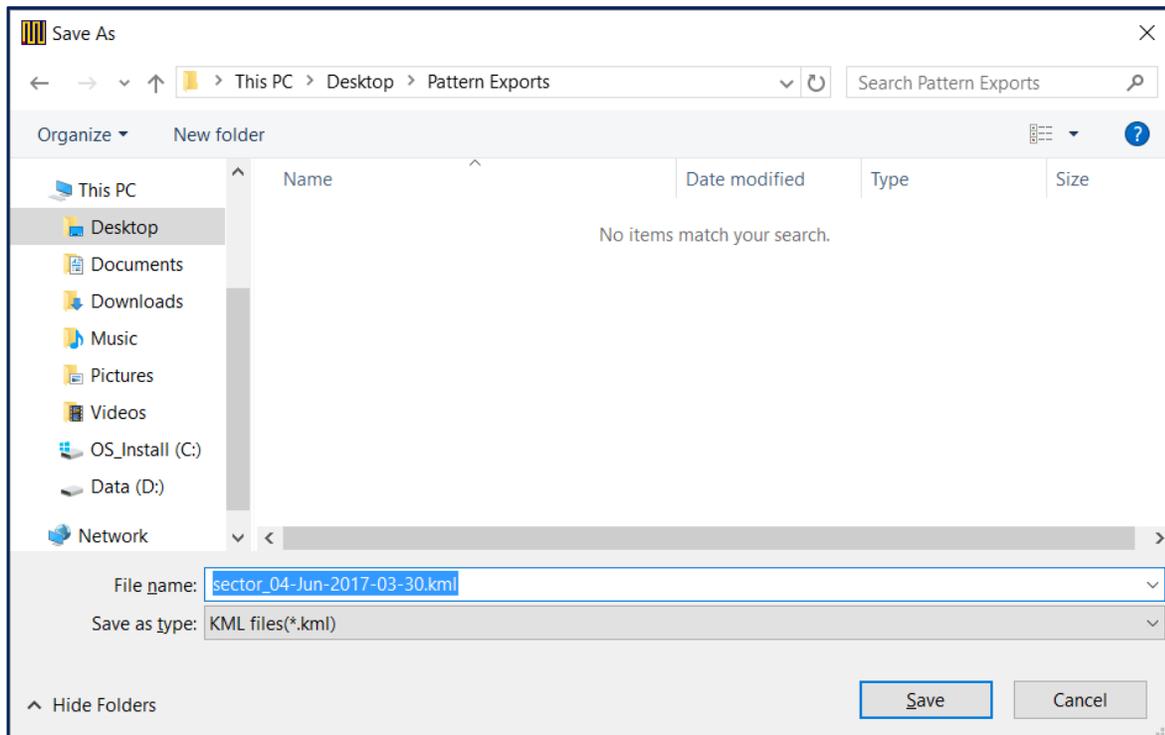
The screenshot shows the 'Pattern Commander' software interface. On the left, there are input fields for 'Datum Location' (Latitude: 49, Longitude: 120), '1st Turn Direction' (Left), '1st Leg Orientation' (45), 'Leg Distance' (350), and 'Number of Legs' (9). Below these fields, there is a 'Select Search Pattern' dropdown menu set to 'Sector Search'. At the bottom left, two buttons are visible: 'Export GPX' (circled in red) and 'Export KML' (circled in green). A red arrow points from the 'Export GPX' button towards the 'Datum Location' fields. The main window displays a '3-Leg Sector Search Pattern' diagram with a central 'Target Location Datum Point', a 'Start (CSP)' point, and a 'Finish' point. The diagram includes a table with the following data:

Mean Track Spacing (M)	Area	Sector Degrees & Total Track Distance (D)
5 NM Search Radius	79 Sq.NM	24deg 50NM 48deg 45NM
10 NM Search Radius	314 Sq.NM	12deg 230NM 24deg 180NM
20 NM Search Radius	1,256 Sq.NM	6deg 720NM 16deg 175NM
4 NM		100deg 38NM
8 NM		48deg 90NM
12 NM		32deg 51NM

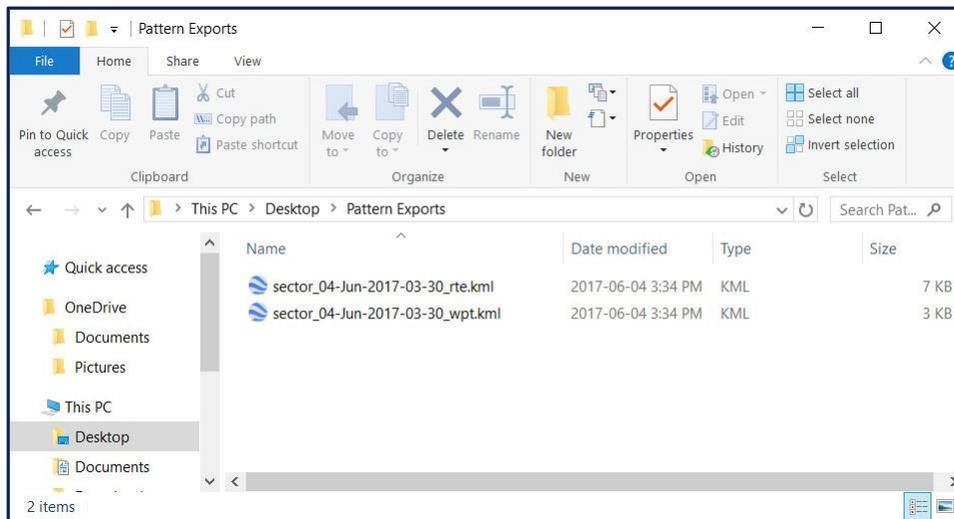
By default, 'Pattern Commander' exports two files for each search pattern:

- A "waypoint" file (.wpt) contains the Start and Datum waypoint markers/labels.
- A "route" file (.rte) contains the search pattern route.

Import the GPX waypoint and route files into ‘Incident Commander Pro’s GIS module to view the search pattern as map layers. In the map legend, check to view or uncheck to hide, the search pattern waypoints and route layers.



‘Pattern Commander’ provides its own default file naming format e.g. *sector\_04June-2017-3-30.kml*, but this filename may be changed to any other name that is convenient.

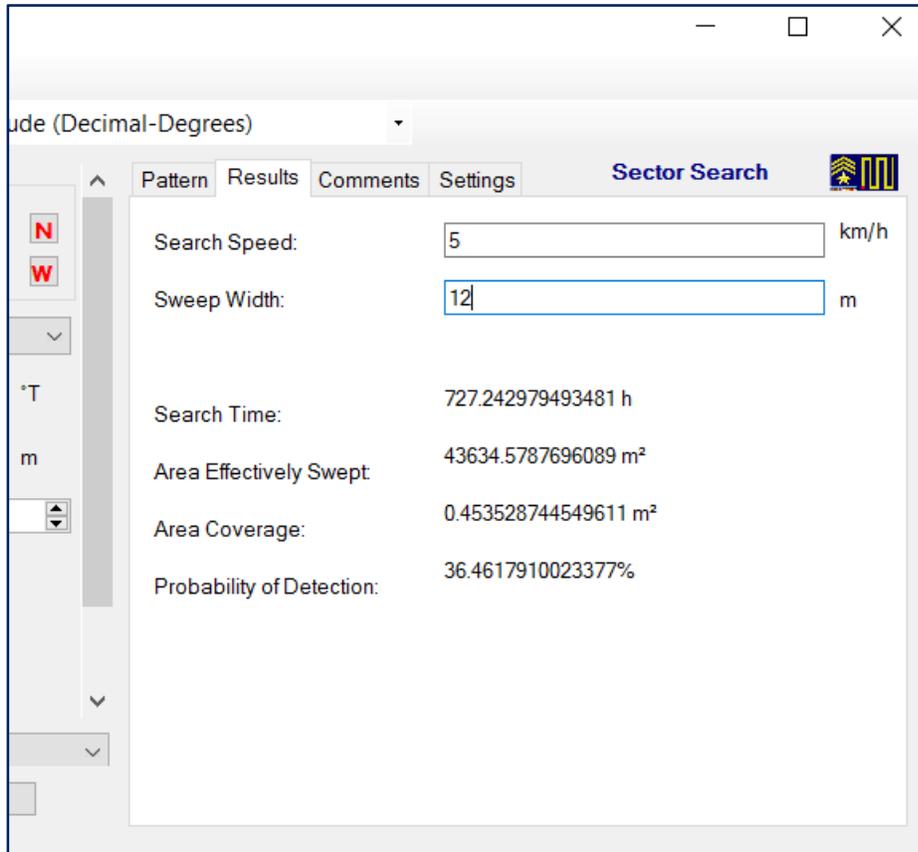


‘Pattern Commander’ always goes to the last directory used to save the exported search pattern files.

## Results

The *Results* tab on the right side of the screen allows you to enter a search area's *Search Speed* and *Sweep Width*.

'Pattern Commander' will then use the current pattern data input, pattern type, search speed and sweep width, to calculate the search area's Coverage and Probability of Detection (%POD):



The screenshot shows a software window titled "Sector Search" with a "Results" tab selected. The interface includes a sidebar with navigation buttons (N, W, T, m) and a main display area. The main display area shows the following data:

Field	Value	Unit
Search Speed:	5	km/h
Sweep Width:	12	m
Search Time:	727.242979493481	h
Area Effectively Swept:	43634.5787696089	m <sup>2</sup>
Area Coverage:	0.453528744549611	m <sup>2</sup>
Probability of Detection:	36.4617910023377	%

Entering values into the *Search Speed* and *Sweep Width* fields will automatically calculate the results. The calculated results are:

- *Search Time*
- *Area Effectively Swept*
- *Area Coverage*
- *Probability of Detection (%POD)*

These results can be very useful in determining realistic search pattern assignments.



# Search Patterns

'Pattern Commander' includes three commonly used search patterns as well as the ability to make a custom point-to-point search pattern by manually entering a series of waypoint coordinates.

## - Expanding Square Search

This procedure is referred to as an expanding square search as it begins at the reported position or most probable location (datum point) and expands outwards in concentric squares. It is a very precise pattern and requires accurate navigation.

To minimize navigational errors, the first leg is usually oriented directly into the wind.

The expanding square search pattern is used when the target is known to be in a relatively small area, no more than 15-20 NM from the start point (datum point).

The first two legs are travelled to a distance equal to the track spacing (S) and every successive two legs are increased by another track spacing length. Turns may be to the left or right, depending upon the observer positions.

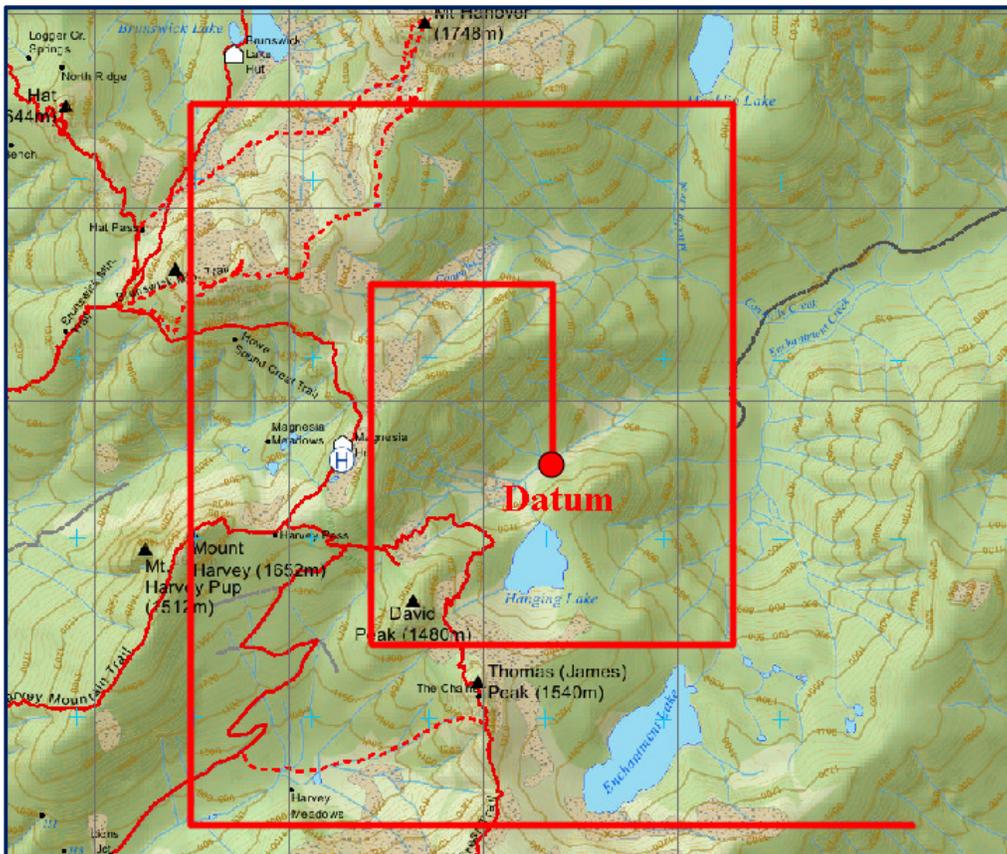
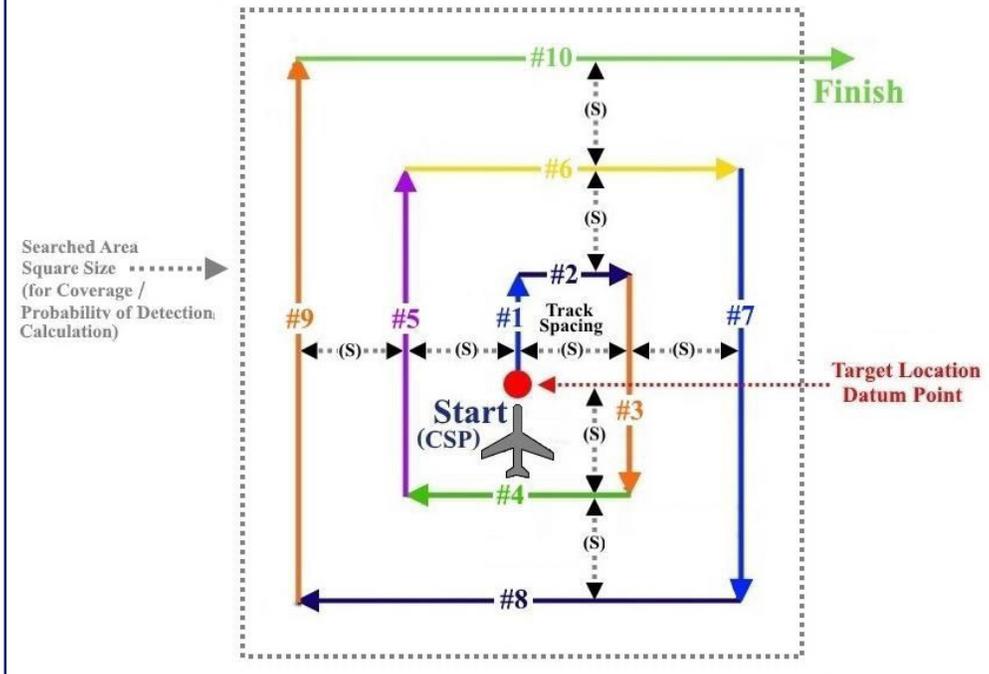
For subsequent searches, the direction of the search legs should be rotated by 45 degrees. The final track should be the same as the initial search track from the start point. The number of search legs may be 5, or, increasing by increments of 4, 9, 13, 17 etc.

Scanning should start at a distance of one track spacing (S) before reaching the most probable position to avoid leaving an area not scanned near the start point. Observers should be briefed to pay particular attention to the areas outwards of each turn to avoid leaving areas not scanned.

The search should be planned so that, whenever possible, the approach to the most probable position, and the first leg, is made into the wind.

# 10-Leg Expanding Square Search Pattern

The Expanding Square Search begins at the reported position or most probable location (**Datum**) and expands outwards in concentric squares. It is a very precise pattern and requires accurate navigation.  
 - To minimise navigational errors, the first leg is usually oriented (flown) directly into the wind.



## - Parallel Track Search

Parallel track patterns are normally used when:

- a) The search area is large and the terrain is relatively level, e.g. desert and maritime areas;
- b) Uniform coverage is required; and
- c) The location of the target is not known with any precision.

Search legs are aligned parallel to the long axis of the individual search area.

The pattern is best used in rectangular or square areas. It is a very suitable pattern for a search conducted over water. The search aircraft proceeds from one corner of the search area maintaining parallel tracks, the first of which is at a distance equal to one-half the track spacing from a side of the area.

Successive tracks are maintained parallel to each other and one track spacing (S) apart. This type of search may be carried out by one aircraft or by several aircraft following parallel tracks or each searching smaller rectangular areas separately.

When aircraft search hours and adjacent traffic permits, turns will be conducted outside the search area boundaries. This allows observer rest and crew position changes.

- The parallel track search pattern is used for three different Search Types, each with a different **datum location** with respect to the search pattern. From the Search Type dropdown list select one of the three available Parallel Track Search Types:

The three search types that use different **datum locations** for the parallel track search are:

- **Parallel Track Search**

This pattern is typically wider than its direction-of-travel length. Typically used by aircraft or ships searching large areas over water or relatively level, open terrain.

The datum location is at the center of the search pattern.

- **Creeping Line Ahead Search**

This pattern's width is typically narrower than its direction of travel length. Typically used by aircraft or ships when the target may have drifted in a predicted direction, the pattern crosses back and forth across this drift/predicted direction of travel.

The datum location is at the midpoint of the search pattern's width, one half track spacing away (outside of) the first search leg.

*The GPX file example shown below is of a Creeping Line Ahead search.*

- **Baseline Gridsearch**

The datum point is located midway along a relatively linear baseline, which often may be a road, trail, fence-line, creek-bed etc. This physical baseline makes it easier to locate and orient the ground-based grid-searchers to the terrain.

The baseline datum location is at the midpoint along the baseline length of the grid-search pattern.

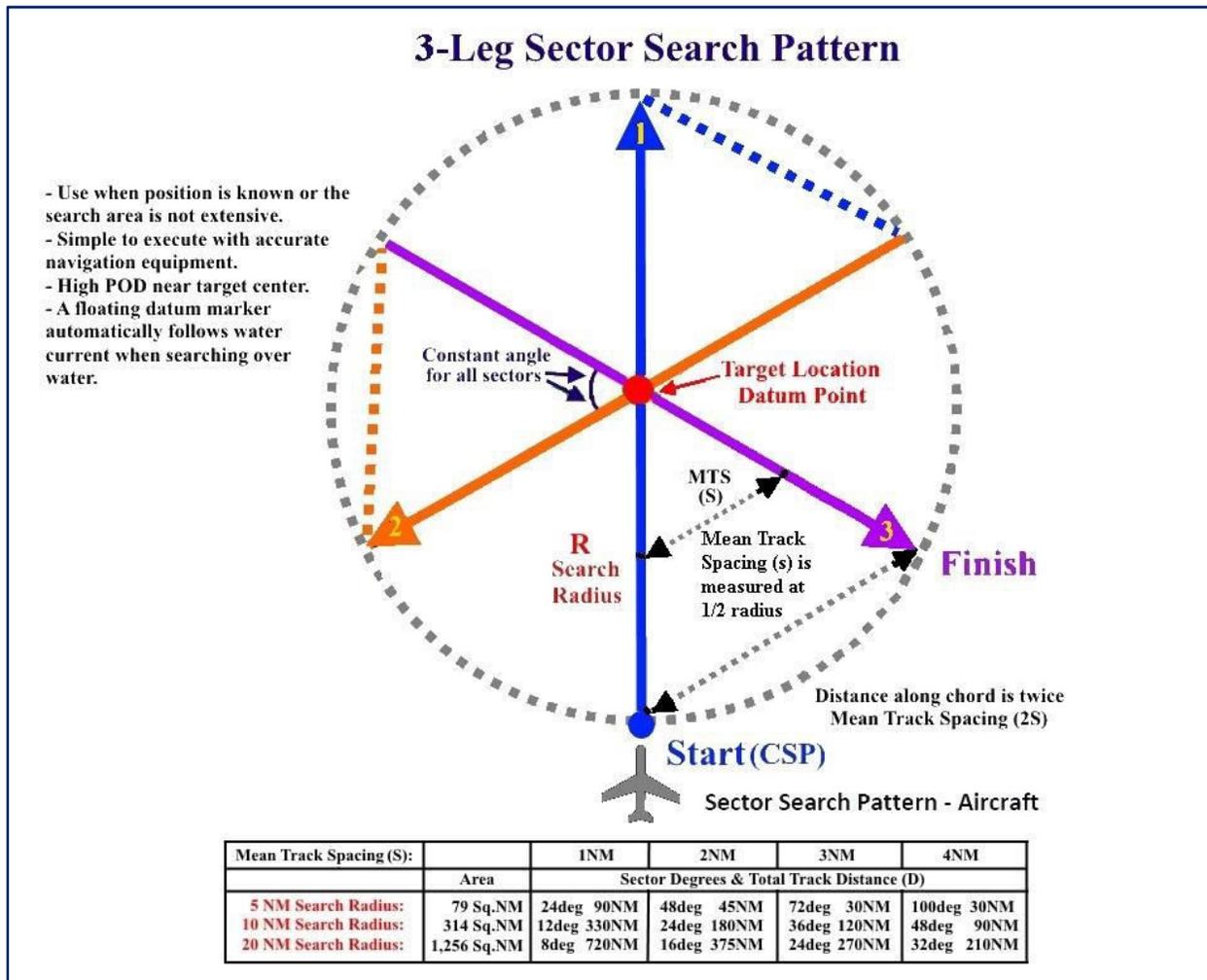


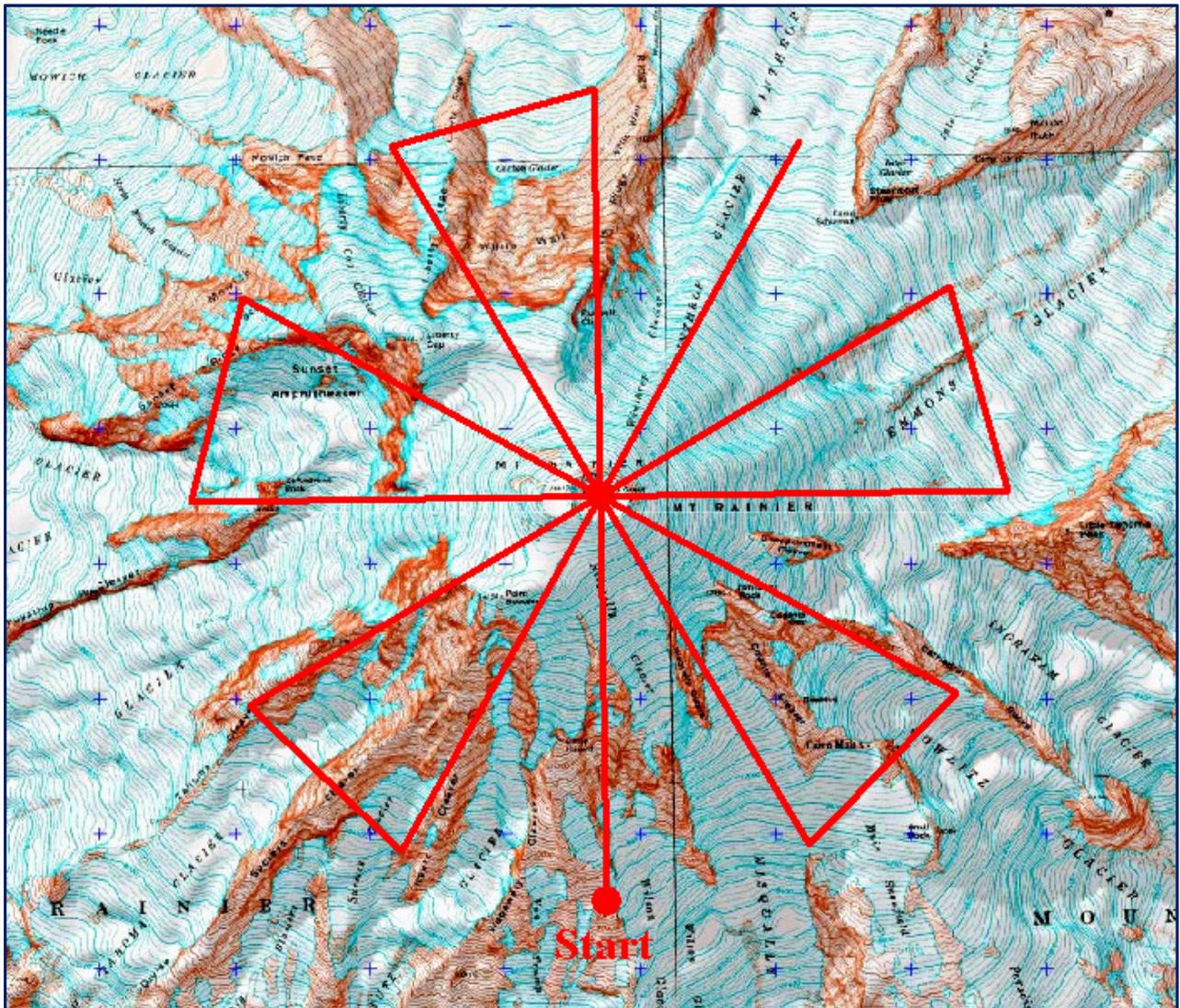
## - Sector Search

This search pattern is used when the target position is known or the search area is not extensive. The sector search pattern is simple to execute with accurate navigational equipment.

A high Probability of Detection (POD) is obtained near the target center. A floating datum marker will automatically follow the water current when searching over water.

A sector search pattern, moving outwards from the central datum point, is sometimes used in ground SAR when the subject's (target) original location is known and the terrain in all directions is reasonably uniform and level.

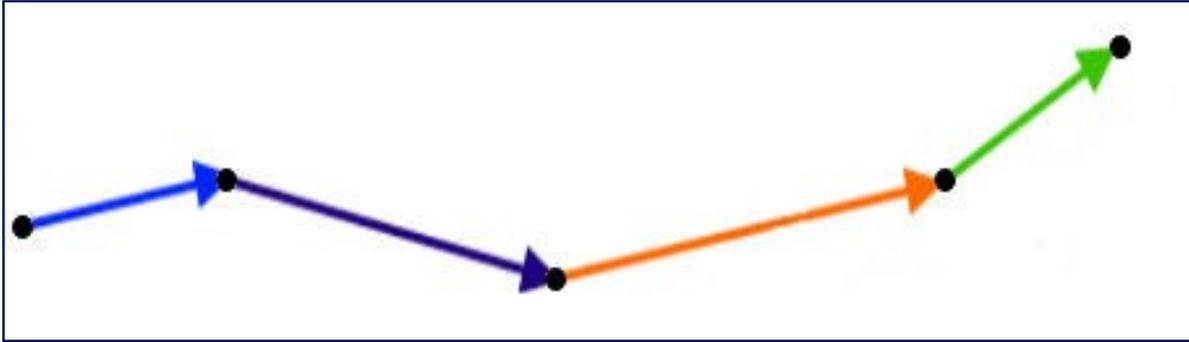




GPX file of the *Sector Search* pattern  
- First leg orientation 0 degrees T, a left first-turn and 6 search legs.

- **- Point-to-Point (Custom) Search**

The point-to-point search pattern permits a custom search pattern or search route to be created by entering a series of waypoints into a table. These points could be waypoints along a known flight path, coastline, riverbed or hiking trail etc., as well as any other custom geometric shape or pattern.



*Five Waypoint Point-to-Point (Custom) Search*



*GPX file of the Point to Point*

(custom) search pattern.  
- Example includes six waypoints.



## **'Pattern Commander' Installation Instructions:**

- 1.** Download 'Pattern Commander' from the SAR Technology website.
  - 2.** Extract the all the files from the zip file.  
This will extract the two files: PatternCommanderSetup.msi and setup.exe
  - 3.** Run setup.exe  
'Pattern Commander' will then be installed on your computer.  
If Windows requires any additional files (the .NET framework) follow the prompts to also install these Windows files.  
On completion 'Pattern Commander' will be installed as:  
C:\Program Files (x86)\Pattern Commander\SARSearchPatternGenerator.exe  
The 'Pattern Commander' shortcut icon will be displayed on the Windows desktop and Start Menu.
  - 4.** Set the 'Pattern Commander' program (.exe) to 'Run as Administrator'.
-