

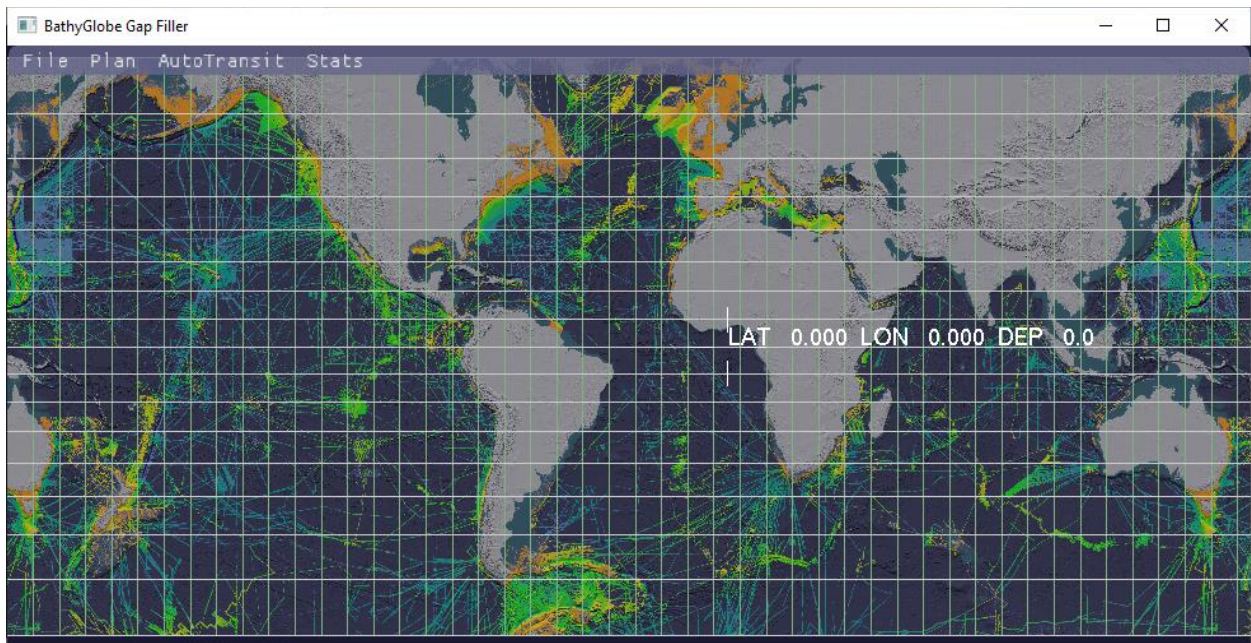
BathyGlobe Gap Filler User Manual

The BathyGlobe Gap Filler application supports transit planning with a view to filling gaps in existing multibeam coverage given a multibeam equipped ship. GEBCO bathymetry is provided as a background for planning and GEBCO depth values used to calculate an estimated swath width at every point along each survey line. It is limited to depths of greater than 200 meters.

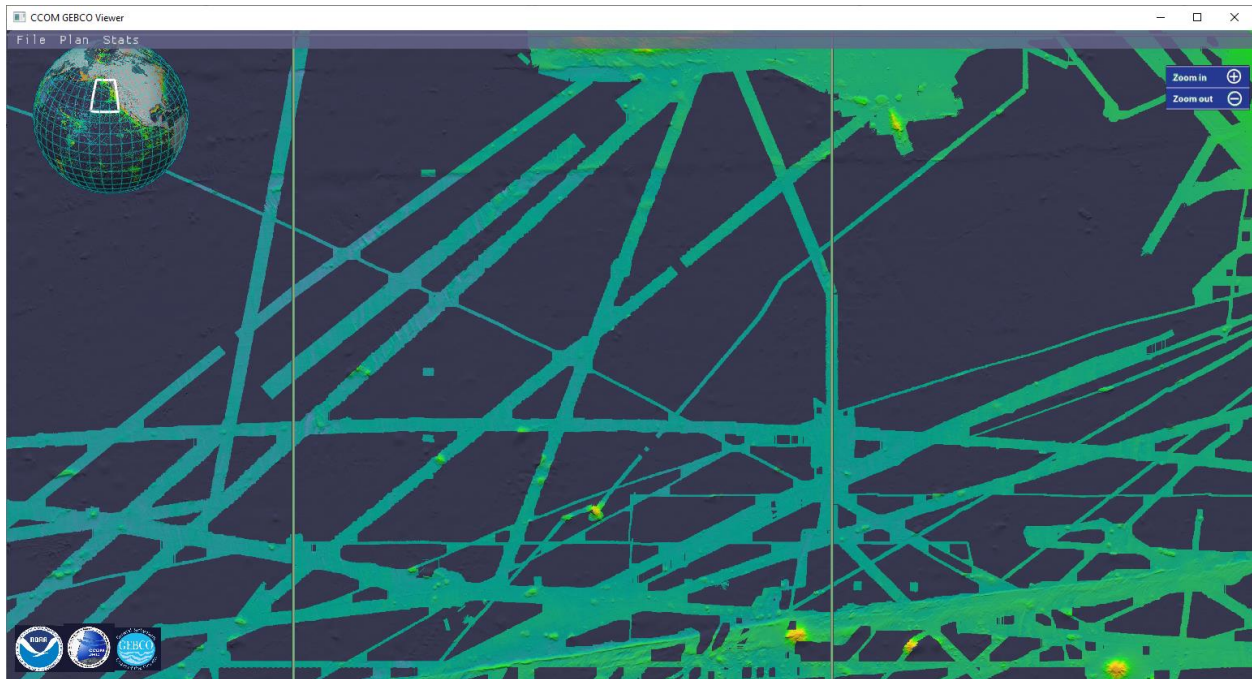
Two of the features of the Gap Filler are: a method for adjusting lines so that they abut existing lines with a pre-defined overlap (e.g. 10%) and a method for creating and filling polygon areas, taking depth variability into account. The Gap Filler only works with the Windows Operating System and with a screen resolution of at least 1920x1080. You should not shrink the viewing window, although you can maximize it.

To Start

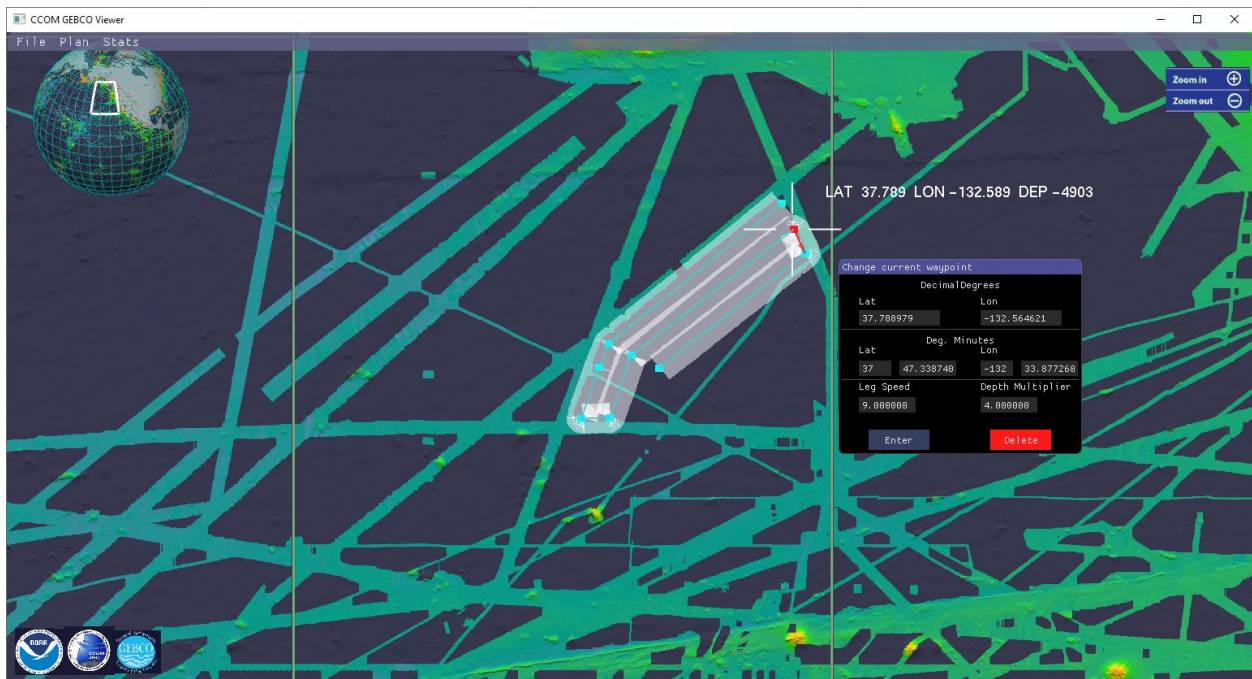
Double click on the executable to start the application. You will see a Mercator projection of the Earth.



Clicking on any of the grid cells results in full resolution seabed 2022 data being loaded for that region. Click on the loaded region, drag it to the center and use the mouse scroll wheel to zoom in.



You can use the keyboard arrow keys (↑↓←→) to translate the image and the mouse scroll wheel to scale up/down. You can also click on blank areas to add more map coverage.



Setting Waypoints

Use the **[Plan]** pull-down menu and select **[Add Waypoints]**. Click on the display with the left mouse button to generate a sequence of waypoints. The initial placement can be approximate since there is ample opportunity for plan refinement.

The **[Edit Waypts]** option on the **[Plan]** menu allows for waypoints to be selected and moved by dragging with the left mouse button depressed. This option also causes a special **Change Current Waypoint** panel to be displayed as shown above. It allows for precise Lat, Lon coordinates to be entered for the currently selected waypoint (highlighted in red). In addition the speed and depth multiplier can be altered for the current leg.

A selected waypoint can be deleted with the keyboard **[Delete]** key or using the waypoints panel. Waypoints can be inserted anywhere in the sequence. Just select the waypoint before the desired interval (the interval is shown with a red line) and change back to **[Add Waypoints]** mode to click in additional waypoints.

As waypoints are added, the application computes the swath width based on bathymetry available from Seabed 2020. Swath widths are determined from an extinction curve table specified in the config.txt file. A single depth multiplier constant can be used as an alternative.

Stats

When a transit or survey has been planned use the **[Stats]** menu bar option to compute survey statistics including area of coverage, area of *new* coverage (excluding mapped areas already in Seabed 2022) and self overlap. Selecting the Stats option will cause a lot of patterns to appear on the screen. The program uses the frame buffer and some simple image processing to compute these statistics. The calculation can take a few seconds especially for long tracks or large areas.

The same information will be provided in the form of a report when a plan is saved.

Saving Plans

Use the **[Save Plan]** menu item to save the current set of waypoints.

Three files are created.

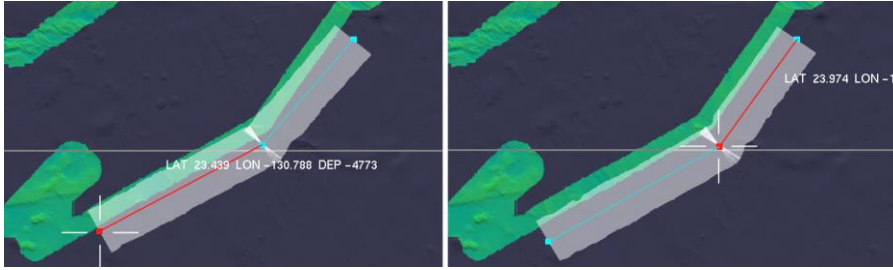
A .csv file: this enables the waypoints to be loaded into Excel. In addition this file can be re-loaded so that the plan can be modified.

A .cvt file designed to be loaded into an ECDIS

A Report in the form of a text file. This details the coverage stats but only if you have already run **[Stats]**.

Overlap Adjustment

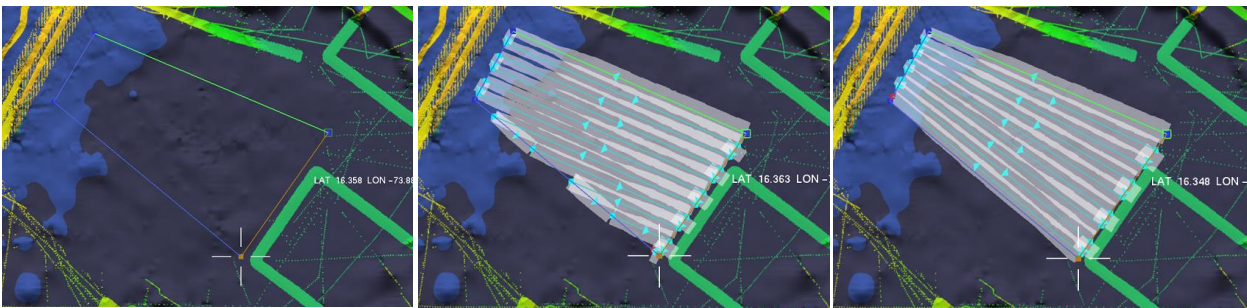
When a planned swath is intended to overlap with an area that has already been mapped, the overlap can be adjusted to 10% by first selecting the segment then hitting the 'o' key on the keyboard. The default is 10% but this can be set between 5% and 50% using the *config* file. Sometimes a second hit on the 'o' key may help.



Mapping Polygonal Regions

The gap filler also supports the construction of polygons to define survey regions. Once constructed, a polygon can be automatically filled. To proceed, select **[Draw Polygon]** from the **[Plan]** menu. Following this a polygon can be clicked out in the same way as a survey line. The **[Plan]** menu also has provision to adjust polygon points using a dialog brought up with the **[Fill Polygon]** menu option.

The first two points of the polygon define first survey line and successive lines are created parallel to it.



A polygon. Start line in green.

Applying **[Fill Polygon]**

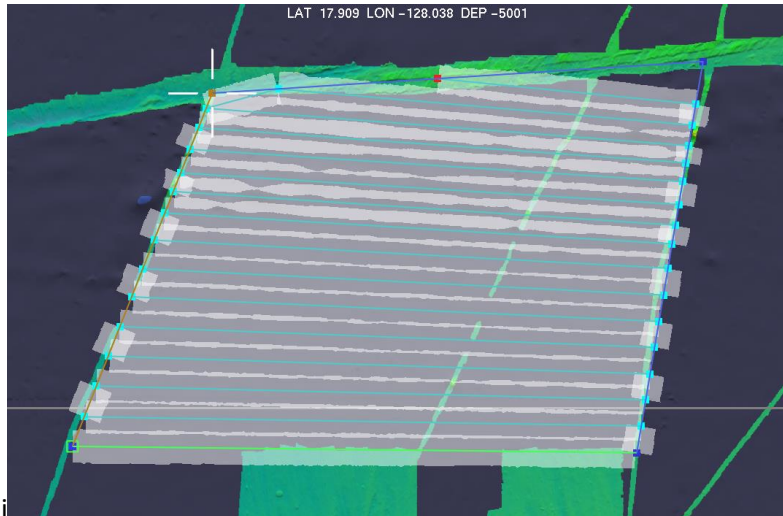
Applying **[Fill Extra]**

To activate automatic filling of polygons use the **[Fill Polygon]** menu option then select the **green [Fill Poly]** option in the dialog panel. You can also simply hit the ‘f’ key on the keyboard. This causes a series of parallel lines to be laid down. The amount of overlap can be adjusted using the *config* File.

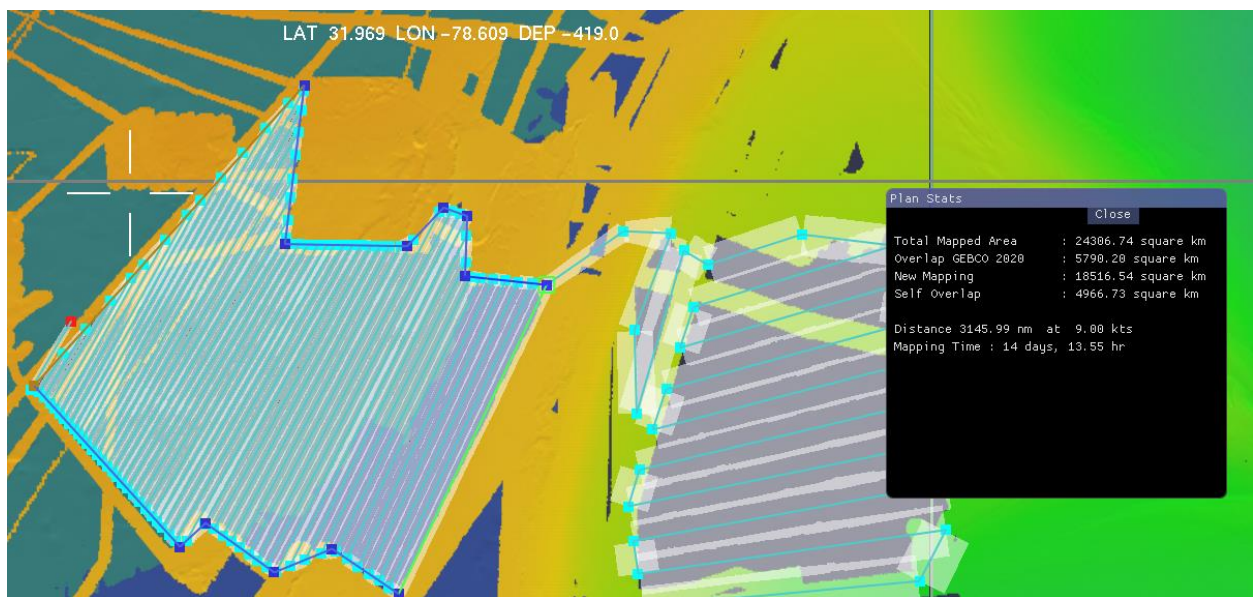
To cause the line overlap to be adjusted individually for each line can use the **[Fill Extra]** button. This will, for example, result in a fan shaped pattern of lines if the survey is oriented up or down slope. However, this refinement is only approximate and there may still be (predicted) gaps.

Deleting and Starting Over

The **[Delete Track]** plan menu option deletes a track. The **[Delete Plan]** menu option deletes both a track and a polygon if one has been drawn. **[Delete Polygon]** just causes the polygon to be deleted. It can be used when multiple polygons are needed in a sequence.



A series of connected polygons can be created. Once the first polygon has been created and drawn select **[Delete Polygon]**, use add **[Add Waypoints]** to get close to the start of the next polygon, then use **[Draw Polygon]** and draw another polygon. This can be filled with the 'f' key as before.

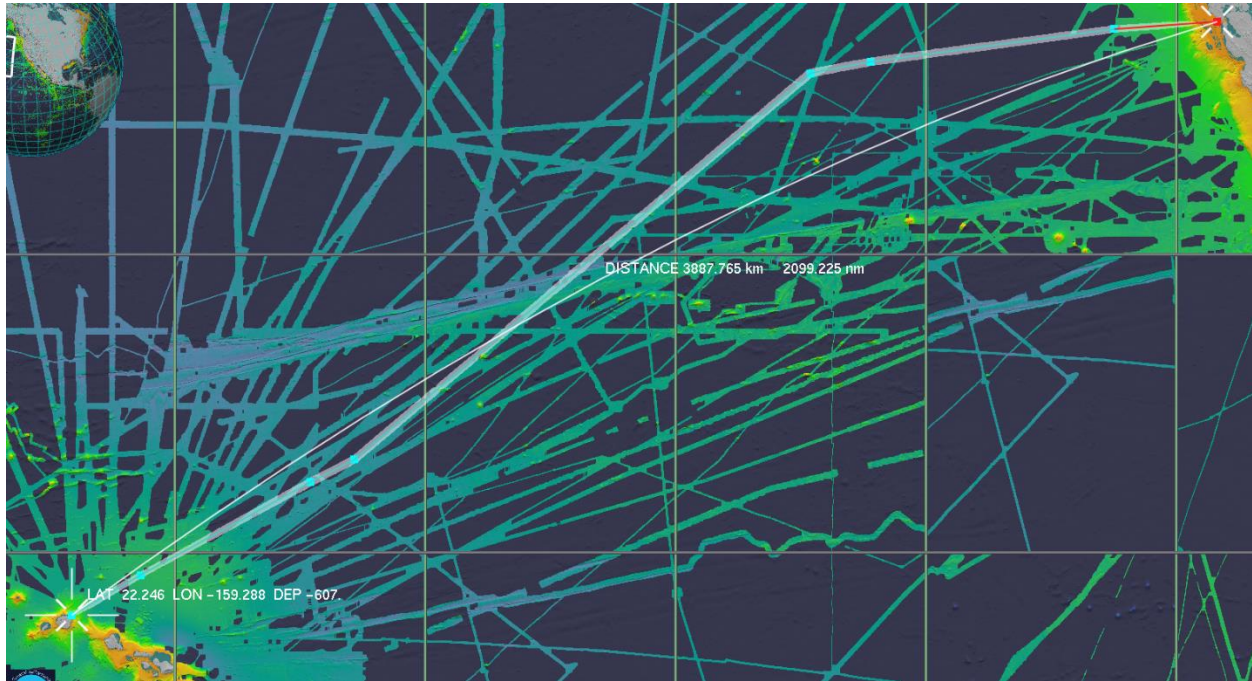


Automatic Transit Planning

The GapFiller can facilitate the transit planning, where the goal is to map during a transit and thereby contribute to the Sebed2030 project. The algorithm is designed find survey lines adjacent to and slightly overlapping existing lines while at the same time minimizing the extra cost of the transit as compared to a great circle transit.

To use the automatic transit planning feature first click on the globe to load Mercator tiles in the start area. Then use the **[PlanTransit]** menu and select **[Set Start Pt]** then click on the map the set a start location. Next set the end point in the same way. Once start and end points are defined you can use

the **[Show Great Circle]** option to display the shortest transit between the start and end points. Finally, select **[Gen Transit]**. This causes the GapFiller to attempt to find a transit according to the above criteria. If it fails to find a transit abutting existing lines, the system will construct a series of waypoints on the great circle. Waypoints on a transit line can be adjusted using **[Edit Waypts]**.



Another way of using the automatic transit planning feature is to create some widely spaced waypoints, then select a leg (by selecting its preceding waypoint). Use the **[Leg Transit Abut]** option to automatically generate a set of waypoints that attempt to abut existing mapping using the endpoints of the leg and a great circle between them as a basis, or the **[Leg Transit Unmap]** option to automatically optimize coverage of unmapped regions.

Config File

There is a *config.txt* file in the GapFiller folder. At present this enables the following three parameters to be set. As a default these will be applied to all survey lines. In this file keywords (in brackets below) are followed by a parameter setting. If any are omitted a default parameter is set. The keyword “end” terminates the values that are read on loading.

Swath width multiplier: (wid_multiplier) Used to compute the swath width based on the depth. It is only used when an extinction curve function is not supplied

Boat Speed: (boat_speed) The default ship speed used to calculate survey time.

Fill_Overlap: (fill_overlap) Defines the amount of overlap used in filling polygons

Edge_Overlap: (edge_overlap) Defines the amount of overlap created with manual adjustment.

Extinction Table: (extinction_table) A table providing swath width multipliers from particular multibeam systems.

Extinction Curve

An extinction table is provided as an ascii text file. It contains a set of depth multiplier pairs in ascending order of depth. For example:

```
0.0    5.0
700.0  5.0
1700.0 4.0
3000.0 2.5
4500.0 1.7
7000.0 0.1
10000.0 0.0
```

Depth multiplier values from this table are linearly interpolated in GapFiller. The table should start with a 0.0 depth value.

HOT KEYS	
[Delete]	Removes the currently selected waypoint
'i'	Change to add waypoint mode
'e'	Change to edit waypoint mode
'o'	Adjust overlap for currently selected swath
'f'	Fill a polygon
[,/<] [./>]	Zoom out/in
↑↓←→	Reposition background map

Contact: cware@ccom.unh.edu