TZTouch3 PBG with DFF3D

NAVnet TZtouch3

FURUNO

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1. TZT3 PBG Bottom Mapping with the DFF3D

NavNet TZtouch3 series MFDs – TZT9F/12F/16F/19F can create precision bottom maps when matched with the DFF3D Multi Beam Sonar. Utilizing Furuno's unique multi-beam technology, amazingly precise shaded relief maps are created in real time and displayed on TZT3 MFDs with a clean, simple User Interface. Bottom images are drawn with shaded relief, depth contours, and variable colors represented by highly granular measured depth information in a wide swath under the vessel. This feature identifies bottom structure and reveals structure like terrain, fishing spots and ridges in clear detail that is simple to interpret. Furuno's Bottom Mapping PBG incorporates inertially stabilized and tide compensated calculations that yield accuracy which was previously only available with much more elaborate survey grade acoustic measuring systems. The Furuno DFF3D, which has won the NMEA Fish Finder Product of Excellence Award for 2018, 2019, and 2020 by itself, now provides the data to enable TZT3 PBG and leverages our unique multi-beam technology in a revolutionary way. **PBG (Personal Bottom Generator)**, is easy but, rest assured that it has been painstakingly developed over many years of hardcore truth-testing by the world's commercial fishing industry. PBG is powered by TIMEZERO software, crafted by the dedicated staff at Nobeltec and MaxSea.

The following table summarizes the overview of PBG function available with TZtouch3 MFDs.

Category	Descriptions
Compatible Display	**TZT9F/12F/16F/19F v2.01** and later
Compatible Sonar	**DFF3D (all software versions)** **Note:** There is **NO** compatibility with single beam Fish Finders such as built-in Fish Finder, DFF1, BBDS1, DFF3, or DFF1-UHD.
Sensor Input Requirement	**Position and heading data input are required**: SATELLITE COMPASS™ models such as SCX-20 and SC-33 are highly recommended. These models have higher accuracy than magnetic compasses are and also utilize heave correction, as well as requiring no time lag setting for PBG.
License	No special unlock code is required: The PBG feature is freely available when a DFF3D is connected, to a TZT3 MFD as well as having position and heading data input
Detection Range (Port-Starboard)	The mapping width is approximately double the depth: If the depth is 10 m, a 20 m area in width is mapped. While the DFF3D Cross Section and Multi-Sounder modes utilize a 120° beam to detect a wide area, i.e. around 3 times depth, PBG and 3D History mode, utilize a 90° beam for more accuracy. This means the PBG mapped bottom will be approximately double the depth. **Note:** The width can be narrower depending on bottom structure.
Detection Depth	The bottom mapping depth can be influenced by the bottom structure, bottom hardness (strength of echo), conditions of transducer installation, water quality, etc., so that the specific figure is not declared. As guideline, the detection depth for PBG will be approx. 200 m for full beam or 300 m for down beam, which is the same as the rated specification of target detection.

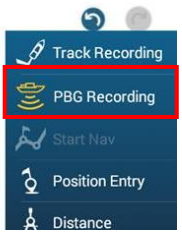
<table>
<tr><td>Depth Contour Resolution Table</td><td>
<table>
<tr><th>Depth</th><th>Contour Step</th><th>Depth</th><th>Contour Step</th></tr>
<tr><td>10 to 30 ft</td><td>0.5 ft</td><td>200 to 400 ft</td><td>10 ft</td></tr>
<tr><td>30 to 50 ft</td><td>1 ft</td><td>400 to 800 ft</td><td>20 ft</td></tr>
<tr><td>50 to 100 ft</td><td>2 ft</td><td>800 to 1000 ft</td><td>40 ft</td></tr>
<tr><td>100 to 200 ft</td><td>4 ft</td><td>Over 1000 ft</td><td>100 ft</td></tr>
</table>
</td></tr>
<tr><td>Tidal Current Offset</td><td>Automatically offset referring to the information from the closest tide station</td></tr>
<tr><td>Data Storage</td><td>The bottom mapping data is saved to the microSD card in the MFD.
The standard 256GB card supplied in every TZT3 MFD from Furuno USA has enough memory to store a lifetime of PGB data!! The saved PBG file can be exported to USB memory device at any time.
Note: Data is stored to the microSD card of any MFD that has PBG Recording enabled. Due to the size of the PBG file, it is not shared to other MFDs across the Ethernet network.</td></tr>
<tr><td>Data Size</td><td>The PBG file size is very efficient and varies depending on the depth (detected bottom width) and bottom structure. A specific size cannot be stated. Note that in the most memory extensive case, 3650 days(10 years) of 24 hour/day recording would require roughly 65GB! The included memory card has about 75GB available.
<u>Case 1</u>
• Depth: 200 m, bumping structures, no data overwritten, SOG: 10 kt
• 13 MB for 24 hours recording
<u>Case 2</u>
• Depth: 30 m, flat structures with a sunken vessel, partially overwritten, SOG: 5 kt
• 2 MB for 24 hours</td></tr>
</table>

2. Starting PBG Recording

2.1. Start Recording

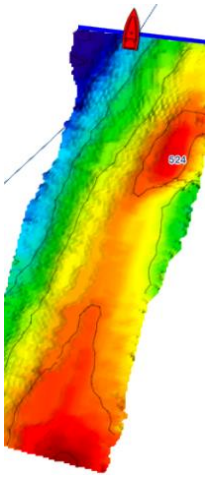
Let's Start!

In order to start recording high resolution bottom maps, edge swipe at the right side of the screen and select [**PBG Recording**].



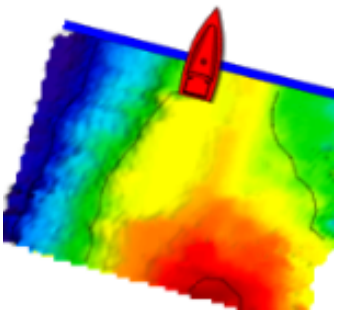
Monitor PBG on Chart

On the Plotter screen, a varying blue bar across the vessel icon intuitively indicates the bottom mapped area.



The bar length changes depending on the water depth: Narrower in shallow water and wider in deep water.

E.g. Blue bar for mapping width

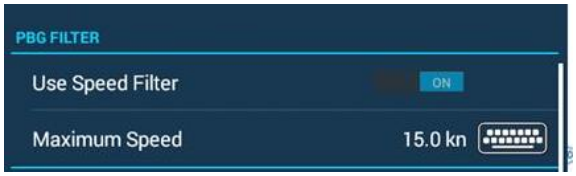


After the boat runs for a while, you can see that the bottom map is created over the area that you just passed over.

E.g. PBG has been on for a few minutes

2.2. Speed Filter – PBG Can Automatically stop recording while running

When the vessel is running, the PGB recording speed filter can be set to automatically pause recording until the vessel slows down. Depending on the DFF3D transducer location and hull design, this filter can prevent PBG from recording marginal PBG data due to aerated water: [Home] – [Settings] – [Chart Plotter] – [**PBG FILTER**] – [**Use Speed Filter**], set to [**ON**] and enter the required speed. It is set to 15.0 knots by default, so that the bottom mapping will stop at a speed over 15 knots.



2.3. Notes while Recording

When running over the same area multiple times

When the boat runs over the same location several times, the previously recorded PBG data will be overwritten. The accuracy of mapped depth will not change because the mapping data recorded at the same location is not smoothed. If the data is recorded during rough sea conditions, the previously recorded area will also be overwritten. In such cases, make sure to stop recording.

Data recording

Data is recorded to the microSD card at the rear side slot on the display when PBG is set to on. The data is not shared

with other displays on the network. In order to have the PBG data on all the displays onboard, turn on the PBG Recording on the other displays, or import the data from another display via USB.

Low capacity

When the remaining capacity of microSD card in the TZT3 MFD reaches 9**5% of available capacity**, a warning message will appear, and the recording will stop. Make sure to leave room for bottom mapping or additional room by removing unnecessary mapping data. MFDs sold by Furuno USA have a 256GB card in them with over 75GB of free memory for PBG recording. This provides every user with over 10 continuous years of recording capability. PBG files can also be exported via USB.

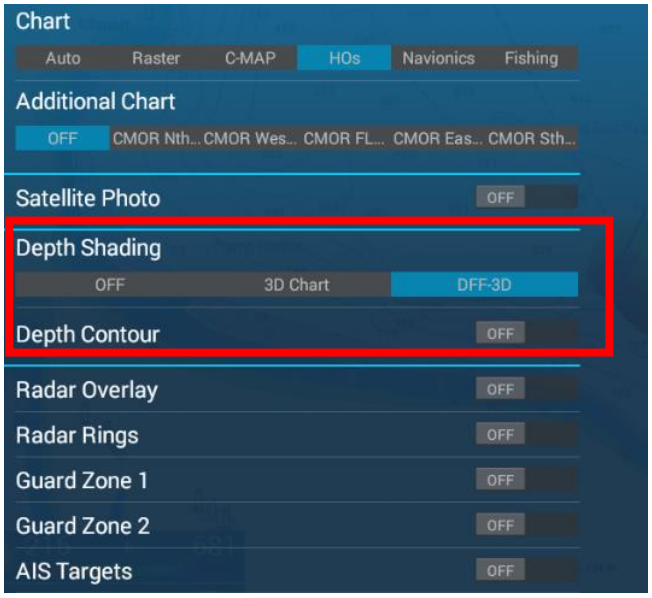
2.4. PBG Recording with Demo File

If a demo file contains DFF3D echo data, PBG recording is available while playing the demo file. The PBG data will be drawn at the location where the DFF3D echo was recorded. With the built-in demo files recorded in Seattle, PBG recording is available. Some screenshots in this document were taken while playing these demo files. Actual recorded PBG data can be easily replayed in the TZT3 MFD's Demo Mode.

3. Displaying PBG

3.1. Displaying PBG Data

The recorded mapping data can be displayed on the Plotter screen via the Layers Menu: Edge swipe at the bottom of Plotter screen and set [**Depth Contour**] – [**ON**] (default) and [**Depth Shading**] – [**ON**]. A variety of presentation options are available as described in **Section 3.2**, **3.3**, and **3.4**.

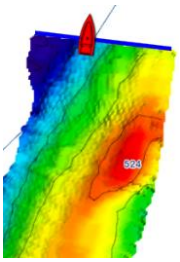
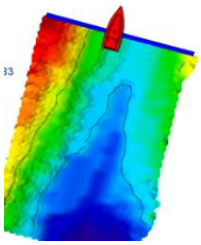
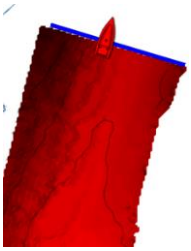
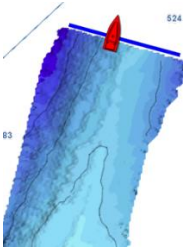
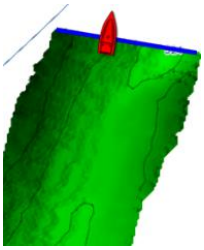
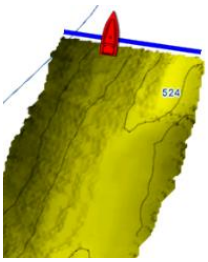


Note:
Depth Shading selection has been available since launching NavNet TZtouch. PBG function added to TZtouch3 with v2 software.

Depth Shading Option	Descriptions
DFF-3D	The recorded PBG data is displayed in variable colors by depth.
3D Chart	This has been conventionally available, same as conventional Depth Shading ON setting.
Off	No depth shading is displayed.

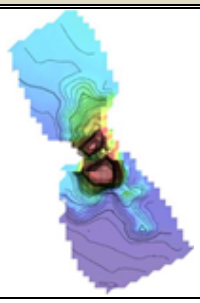
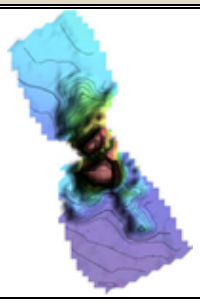
3.2. Color Pallet Options

A total of six (6) options of depth color pallets are available: Access [Home] – [Settings] – [Chart Plotter] – [**DEPTHSHADING VALUES**] – [**Depth Color Shade**] and select one of the following items from your preference.

Classic Hue	Inverted Classic Hue	Red Hue	Blue Hue	Green Hue	Yellow Hue
					

3.3. Shaded Relief Settings

PBG can be shown with Shaded Relief for more detail: Access [Home] – [Settings] – [Chart Plotter] – [DEPTH SHADING VALUES] – [**PBG Terrain Shading**] – [**Light**], [**Medium**], or [**Strong**]. (Default: **OFF**). The Light or Medium setting is recommended to enhance the PBG details.

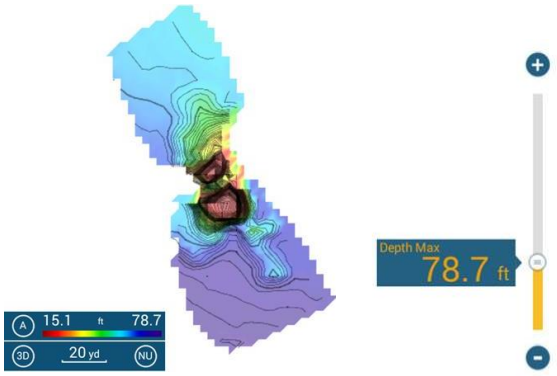
Off	Light	Medium	Strong
			

3.4. Displaying Depth Contour Only

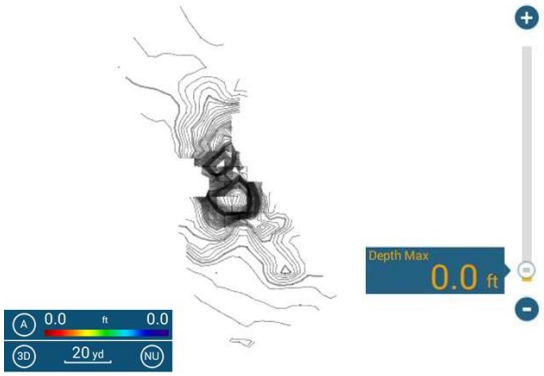
While the PBG color pallet and Shaded Relief settings are extremely intuitively to identify shallow and deep areas at a glance, there are cases where it may be beneficial to show contour lines only.

One case is where the points on the chart are not clearly visible due to shading colors. To display contour lines only:

(1) By default, the PBG data is shown automatically in variable colors. Tap the [A] (Auto) to change to manual adjustment.

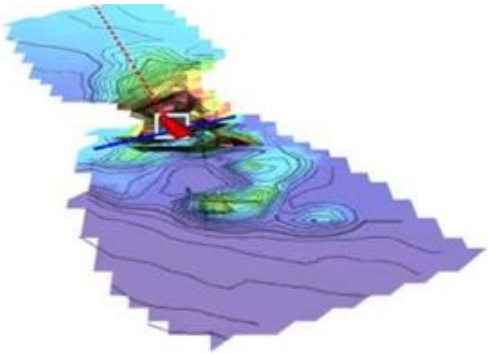


(2) Change the depth value to [**0.0**], so that no color will be shown, leaving the depth contour only.



3.5. Note – PBG in 3D View on Plotter

When the plotter orientation is changed to the 3D view, the bottom mapping will just tilt in perspective, it will not be shown in actual 3D with the initial PBG software release.



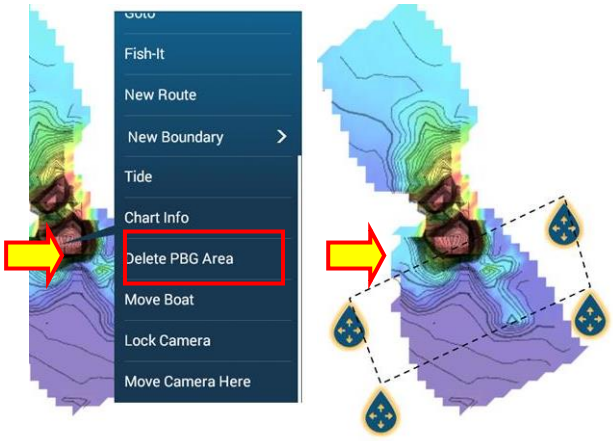
4. Deleting Unnecessary Data

The PBG data can be deleted by selecting an area to be removed. For example, if the recorded data was not very accurate or unnecessary areas were recorded, select the target area and delete it.

4.1. Delete Partial or all PBG Data

(1) Tap on a PBG to be deleted and select [**Delete PBG Area**] from the bottom of the contextual menu.

(2) Tap the display in places to create a polygon. Adjust the polygon to encompass the area to be deleted, tap [**Done**].



Note:

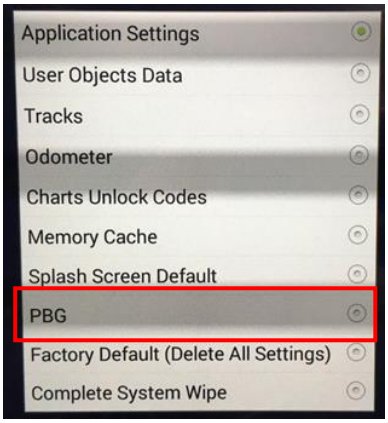
To cancel the deleting action in this screen mode, press the [CANCEL] key on the MCU-002/004/005 and TZT9F/12 or move to another page such as Home. If a PBG area is deleted accidentally, tap the UNDO button to recover the deleted area.

4.2. Delete All

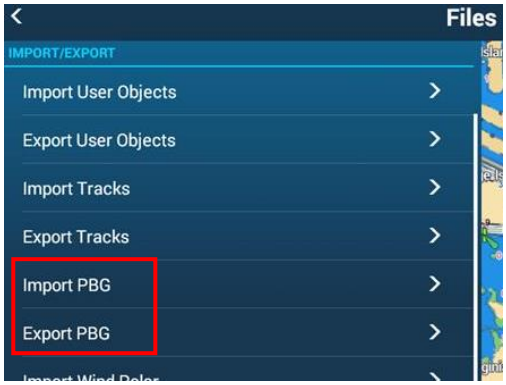
In order to delete all the PBG data, delete the [**PBG**] folder from the microSD card or delete it from the Reset menu (accessible via the Service Menu – Utility – Factory Default).

Note:

Performing [Delete All User Objects] in [Points] – [Delete All User Objects] will **NOT** delete the bottom mapping data.



5. Exporting and Importing PBG Data



PBG data recorded on one display can be exported and imported to another display via USB memory.

To Export/Import: [Home] – [Settings] – [Files] –[IMPORT/EXPORT] – [**Export PBG**] for export and [**Import PBG**] for import.

Note:

When the data is exported to a USB jump drive, the file named [**PBGExport_xxx(date).navnetpbg**] will be generated. Just inserting the USB to the other display will not show the mapping data on the plotter. Make sure to import it to the microSD card at the rear side in [Home] – [Settings] – [Files] – [IMPORT/EXPORT] – [**Import PBG**].

6. Settings and Adjustments

PBG recording is influenced by operational conditions such as water temperature and salinity, as well as installation conditions of DFF3D transducer and sensors. Refer to the following table for settings and adjustments.

6.1. Sensor Position

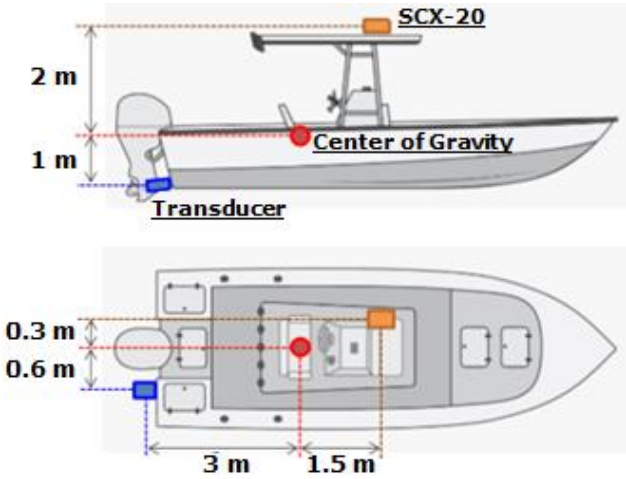
For the highest PBG accuracy, a compatible motion sensor with heave correction is recommended. A Furuno SCX20 or SC33 SATELLITE COMPASS™ is recommended over the DFF3D's internal built-in transducer motion sensor. The following table content is based on the condition that a SATELLITE COMPASS™ such as SCX-20 and SC-30/33 is used as the source of position, heading, and motion sensor. Use of a Satellite Compass to improve PBG accuracy requires setting the correct transducer and satellite compass installed position offset values.

[Home] – [Settings] – [Multi Beam Sonar] – [Initial Settings] – [**Transducer Setup**]:

Sensor	Menu Item	Setting
Transducer	Transducer Position Bow/Stern	Set the distance from the transducer to the ship's center of gravity in the bow/stern direction. If the center of gravity is located at the AFT side from the transducer, enter a positive [+] value. In general, the center of gravity is at the center of the boat, enter a negative [-] value because the transducer is AFT from the center.
	Transducer Position Up/Down	Set the distance from the transducer to the ship's center of gravity in the up/down (vertical) direction. For upward location, set a positive [+] value. Generally, the center of gravity is located up from the transducer, enter [+].

Sensor	Menu Item	Setting
	Transducer Position Port/Starboard	Set the distance from the transducer to the ship's center of gravity in the port/starboard direction. For port location, set a positive value. Generally, the center of gravity is located at the keel line (center). With the transducer at the starboard side, enter [+]. With the transducer at the port side, enter [-].
Motion Sensor	Motion Sensor Source	Select [**SC**] when using a SATELLITE COMPASS™
	Motion Sensor Pos. Bow/Stern	Set the distance from the transducer to the motion sensor in the bow-stern direction. If the sensor is at the AFT side from the transducer location, enter a positive [+] value. If the transducer is located at the AFT side, so that the motion sensor is located at the FORE side, enter a negative [-] value.
	Motion Sensor Pos. Up/Down	Set the distance from the transducer to the motion sensor in the up/down (vertical) direction. Enter a positive [+] value for upward direction because a SATELLITE COMPASS™ is generally located at the top of the mast.
	Motion Sensor Pos. Port/Starboard	Set the distance from the transducer to the motion sensor in the port-starboard direction. For port location, set a positive [+] value. E.g. A SATELLITE COMPASS™ is located over the keel line (center) of the boat: With the transducer located at the starboard, enter [+]. With the transducer at the port, enter [-].
	Roll Sensor Offset Pitch Sensor Offset	This menu is set when using the built-in motion sensor. No setting is required when selecting [SC].
	Motion Sensor Time Lag (in ms)	This setting is not required when using a SATELLITE COMPASS connected to NMEA2000.
GPS Antenna Position	Bow/Stern	When using a SATELLITE COMPASS™ as the GPS antenna, enter the same values as Motion Sensor setting items.
	Up/Down	
	Port/Starboard	

Example of installation and settings



Items		Settings
Transducer Position	Bow – Stern	-3.0 m
	Up – Down	+1.0 m
	Port - Starboard	+0.6 m
Motion Sensor Position	Bow – Stern	-4.5 m
	Up – Down	+3.0 m
	Port - Starboard	+0.9 m
GPS Antenna Position		Same as motion sensor settings

Note:

When the center of gravity is not well known, refer to the following guidance to determine the approx. location of center of gravity.

- **1/3 of distance from the stern** of the boat (e.g. 3 m from the stern on a 9 m boat)
- **1/2 of height** between the hull bottom and the top such as a roof
- **Keel line (center)**

6.2. SATELLITE COMPASS™ - Roll and Pitch Offset

The SATELLITE COMPASS™ itself should be calibrated to offset the roll and pitch for PBG.

Step 1:

At the calm area such as inside the harbor, where is not affected by wave, etc., check the reclining condition of transducer in the following menu, as well as seeing how the bottom is reclined in the cross section mode.

[Home] – [Settings] – [Multi Beam Sonar] – [Initial Setup] – [**DFF3D Monitoring**]

Step 2:

Offset the roll and pitch of SATELLITE COMPASS™ and see that the bottom is properly shown as being offset.

For **SC-30** : [Home] – [Settings] – [Initial Setup] – [SC-30 SETUP]

For **SC-33 and SCX-21** : [Home] – [Settings] – [Initial Setup] – [NETWORK SENSOR SETUP]

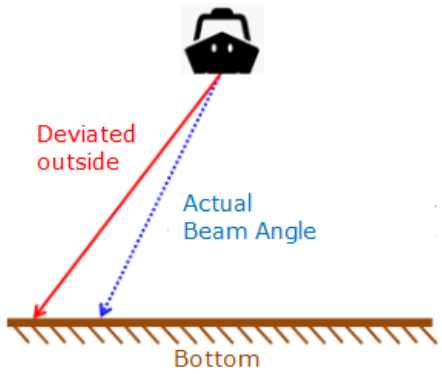
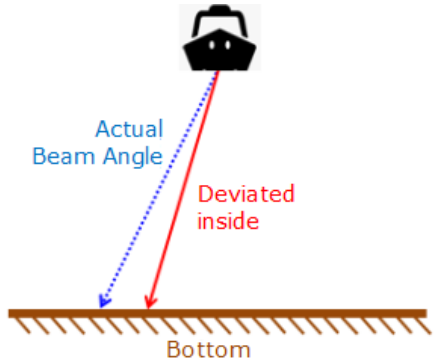
Note and Limitation:

As an example, when the SATELLITE COMPASS™ is installed on a mounting plate, which is flat to the bridge, and the transducer is reclined at 2° , you can offset the roll and pitch by 2° for PBG purposes. However, the indication on the roll and pitch window on the Instrument page and Data Box will show the value after being offset by 2° . There is no option to indicate it as 0° .

6.3. Speed of Sound Correction

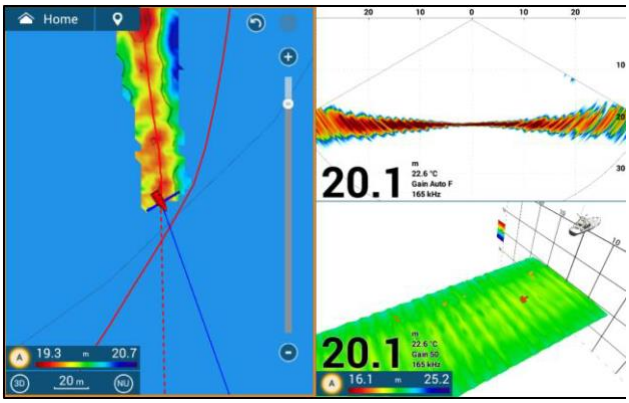
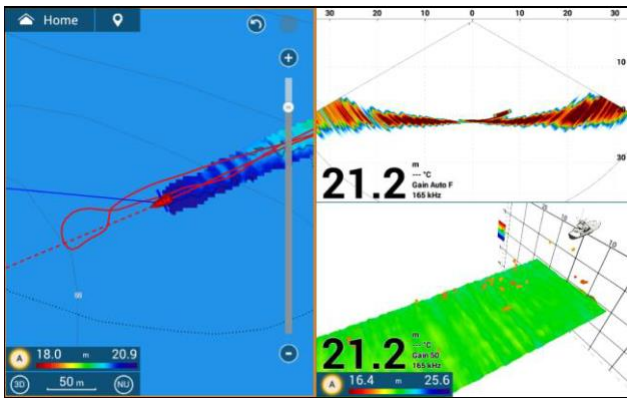
Acoustic propagation speed changes depending on water temperature and salinity. While the DFF3D transmits multiple beams up to 120° in angle, the actual angle can be wider or narrower if the acoustic speed changes. The DFF3D will automatically offset such a deviation automatically as set in [Settings] – [Multi Beam Sonar] – [Cross Section] – [**Sound Speed Correction**] – [**-200**] to [**+200**] m.

The bottom shape may be shown with bump or dent when the acoustic speed exceeds the preset sound speed correction value. Sound Speed Correction should be performed while over a flat bottom referring to the following diagrams.

Beam vs. Deviation	How the bottom will show	Required Action
	The center of the bottom will show as a bump. 	Enter a **minus (-) value** for the sound speed correction until the bottom image on the 3D History or PBG becomes flat.
	The center of the bottom will show as a dent. 	Enter a **plus (+) value** for the sound speed correction until the bottom image on the 3D History or PBG becomes flat.

The following screenshots from the 3D History mode compare the appearance of bottom before and after adjustment performed at the flat bottom.

Before Offset	After Offset

	
The bottom color varies from green (edges) to yellow (inside/center). The bottom color varies from green (edges) to red (inside/center). As a result, the depth contour is drawn in parallel to the track line.	Both 3D History screen and PBG are shown in constant color, i.e. no variation between the edge and inside/center. (The SC-50 was used. The time lag setting was not perfect, and the bottom had partially waving/bumping indication.)

Notes:

(1) The images above were taken at the end of October at sea surface temperature of 22 to 23° . The [Sound Speed Correction] was set to [**-80 m/sec**].

(2) Temperature and salinity changes by season and can cause the PBG to become curved. It is recommended that the bottom image be regularly checked while over a flat bottom area and adjusted if necessary.

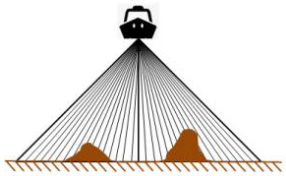
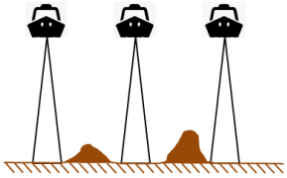
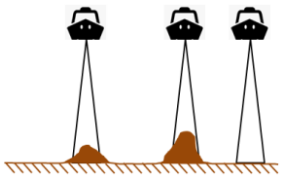
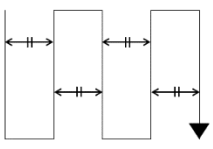
7. Multi-Beam vs. Single-Beam

While the TZT9F/12F/16F/19F draws bottom maps with the DFF3D Multi-Beam System, other competitors use single beam technology for mapping. This section describes the difference between multi-beam and single-beam.

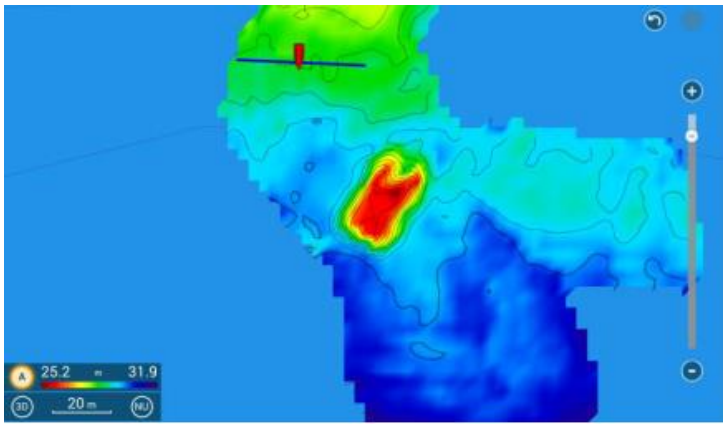
7.1. Multi-Beam and Single-Beam Bottom Mapping Explanation

In the following example, a boat records PBG with some bottom structure using the DFF3D and a single beam Fish Finder. With a single beam Fish Finder, the boat runs several times for mapping in wide area. The PBG (cross section) shows how the mapping data is drawn.

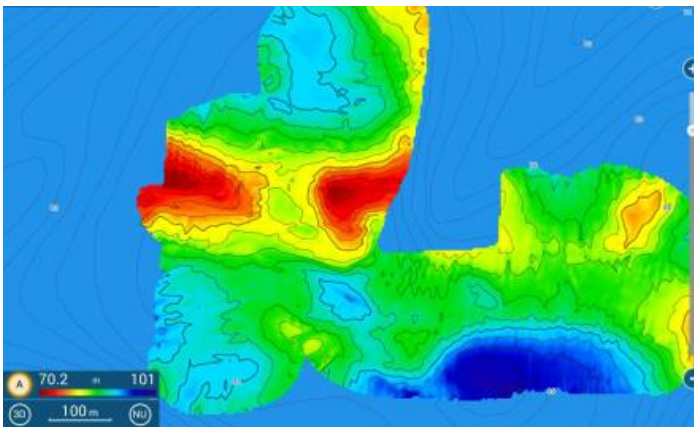
The DFF-3D's unique multi-beam technology records with a width of twice the depth and has no coverage gaps: Deeper depths show wider PBG and individual beams provide high resolution. On the other hand, single-beam recording ONLY maps directly below the transducer regardless of depth. Multi-Beam PBG efficiency increases as the depth increases while single beam efficiency and resolution is reduced as the depth increases.

<table>
<tr><th></th><th>DFF-3D (Multi Beam)</th><th>Single Beam – Case 1</th><th>Single Beam – Case 2</th></tr>
<tr><td>Running for Mapping</td><td>  </td><td> 
Run 1 2 3</td><td> 
Run 1 2 3</td></tr>
<tr><td>PBG (Cross Section)</td><td>  </td><td></td><td>  </td></tr>
<tr><td>Descriptions</td><td>In a Single Pass, the DFF-3D transmits multiple beams and detects varying structure. The drawn image is up to 5000% more accurate than a single beam system.
Note:
Depending on the height of each bump and distance between bumps, the PBG may be recorded as one bump but, this is very rare.</td><td colspan="2">Single beam recording only shows the depth right below the transducer. If the data close to the currently mapped area is available, the gap between these two data points is drawn by falsely bridging the data and structure fails to appear.
With the Single Beam – Case 1, the boat runs three times where no bump is detected: The bottom mapping will show a flat map.
With the Single Beam – Case 2, the bumps are detected in two of three runs. The depth in each run is smoothed to show the slightly reclined bottom. In addition, the peak depth from the bump at the left (Run 1) is applied to the others.
 
If the boat makes many passes over the same area, the accuracy may increase. However, the DFF3D still provides higher resolution in one pass requiring 1/50th of the time, fuel and "Wear & Tear" on your boat!</td></tr>
</table>

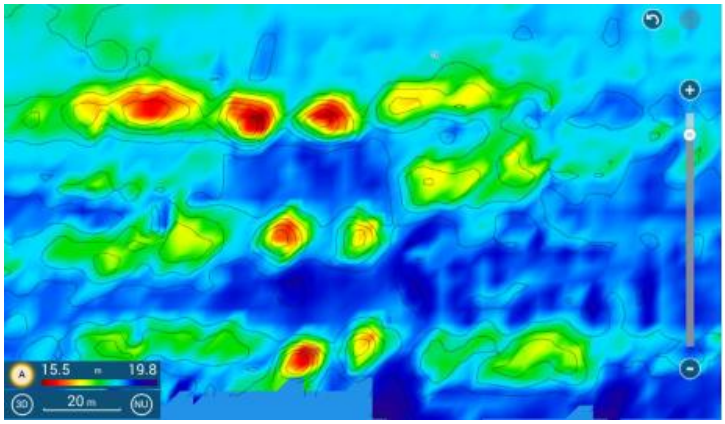
8. PBG Sample Images



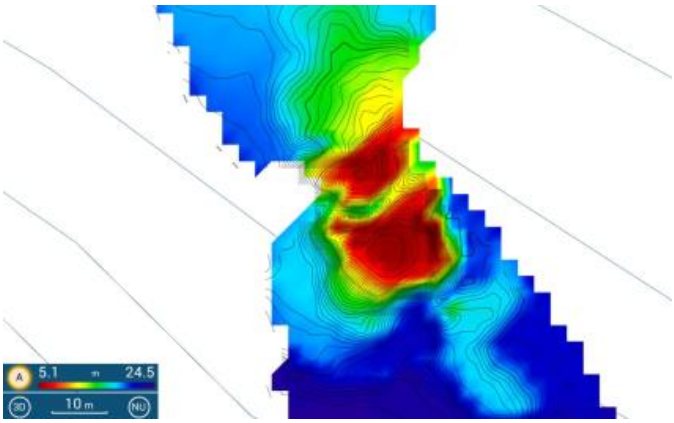
Sunken vessel / Depth: 30 m



Depth: 80 m

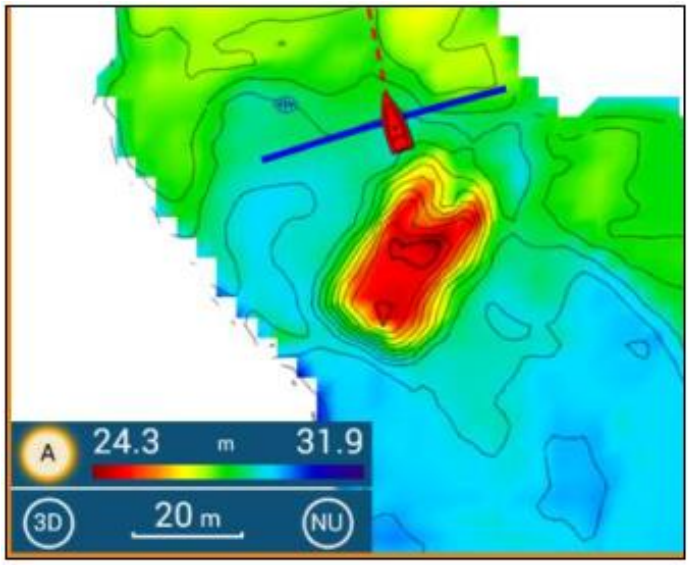


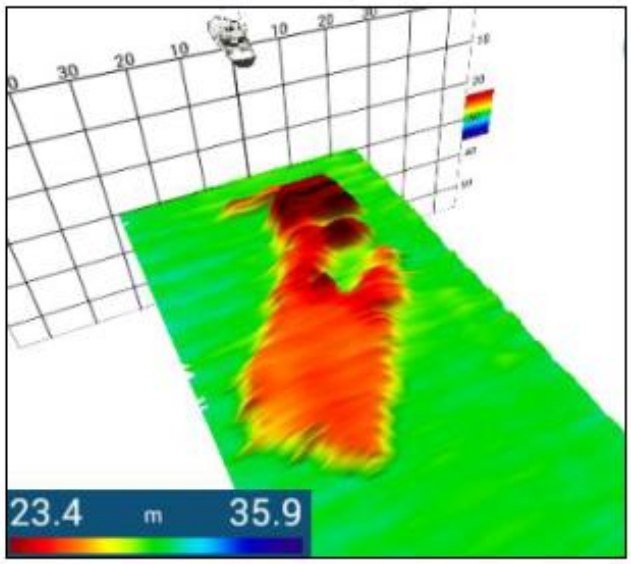
Artificial Fish Reefs / Depth: 20 m



Seattle – Puget Sound

8.1. Sunken Vessel 30 m

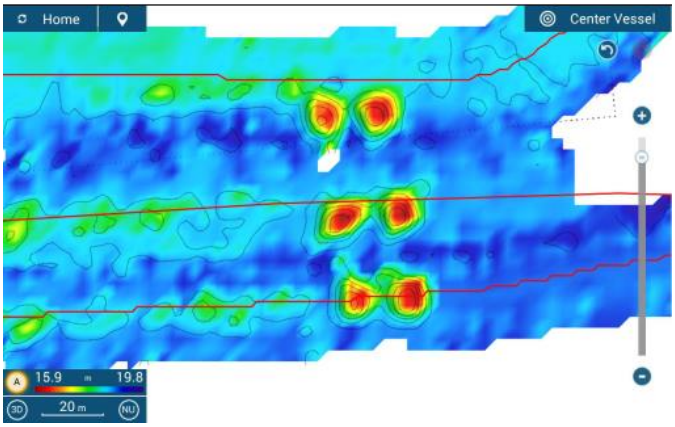
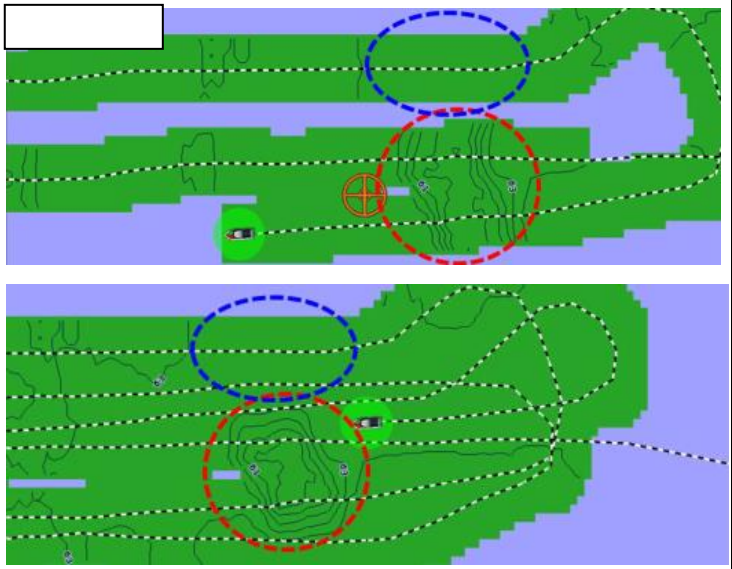




9. On the Water Test Comparison

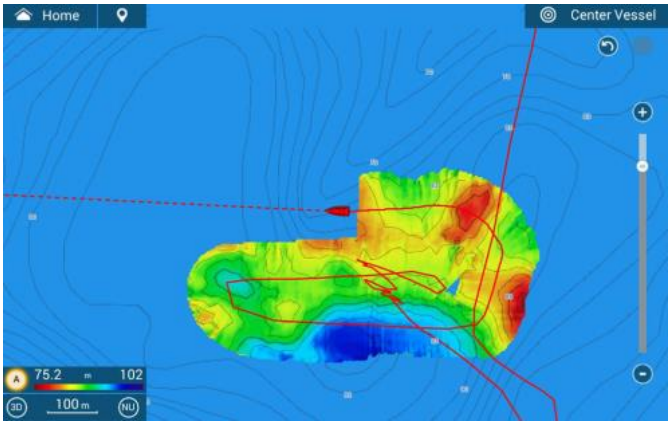
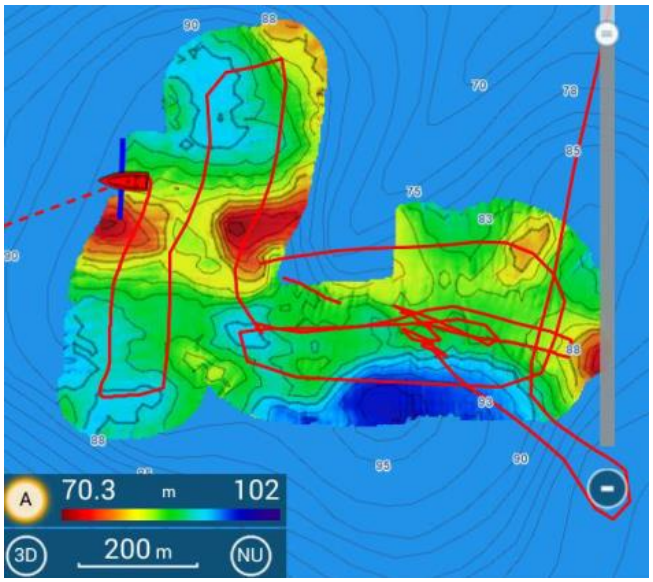
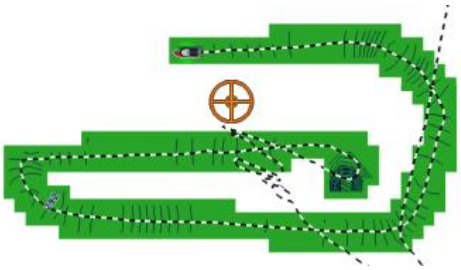
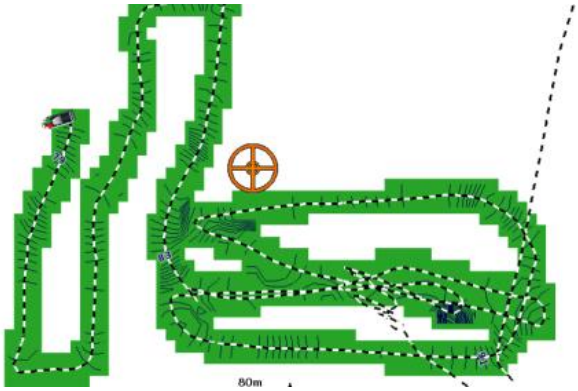
The performance of Multi-Beam PBG recording was compared with single beam from a competitor's product

9.1 Fish Reef – Depth: 20 m Artificial reefs on a flat bottom (sand).

TZT12F with DFF-3D	Single Beam (Competitor A)
	
The TZT12F with DFF-3D PBG clearly shows six (6) reefs in only three (3) passes. The tops of the reef structures are highlighted in red. The location and structure arrangement of each reef is easily identified at a glance.	The boat did not pass directly over the structure inside the blue ovals. Observe how the reef structure was not detected and the area is falsely recorded as having a flat bottom. The area in red is recorded with structure but, the two (2) reefs are merged as one. Also, automatic color shading is not possible. Because manual color shading adjustment is tedious and requires time, all mapping is drawn in green making the low-resolution information even more difficult to interpret. The screenshot at the bottom shows the mapping data after six (6) runs. The area in blue is recorded as the flat bottom and the area in red as one big bump.

9.2 Sloping Bottom with Structure – Depth: 80 m

This test was performed over a sloping bottom (deepest area at 80 m).

TZT12F with DFF-3D	Single Beam (Competitor A)
 	 
The bottom mapping with the TZT12F and DFF-3D mostly corresponds to the content of fishing chart and offered more precise mapping data.	Only the depth below the boat is recorded with very little understanding of the bottom compared to the DFF-3D. The distance between each pass was also too wide to link the contour information in a meaningful way. It is almost impossible to visualize the sloping bottom trend or where the bottom is getting deeper, shallower, or flat.

--- END ---

Rev; March 5, 2021