

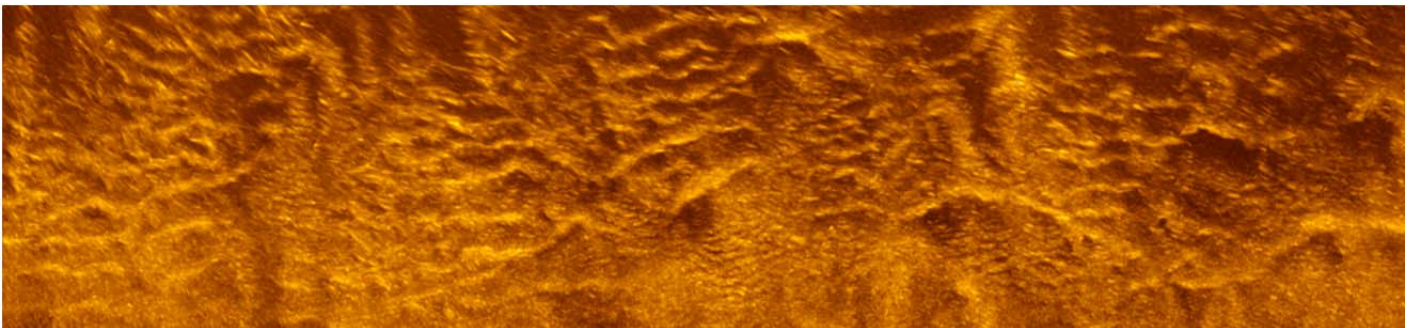
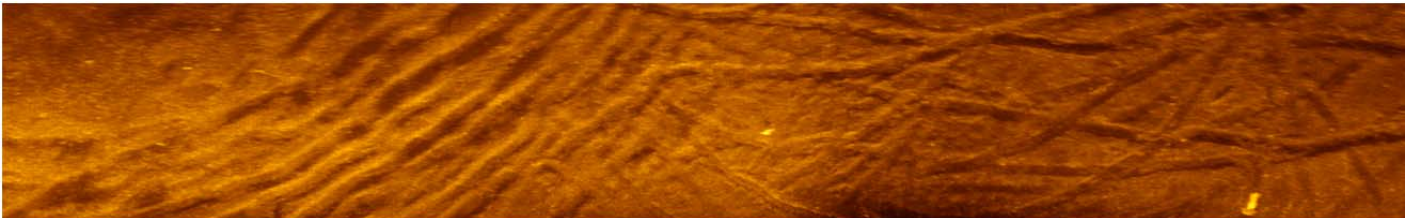
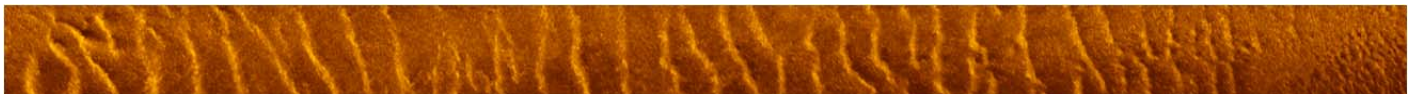
Quick start guide



KONGSBERG

M3 Sonar

Creating an image mosaic
using Photoshop and Geographic Imager



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M3 Sonar Quick start guide

***Creating an image mosaic
using Photoshop and Geographic Imager***

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About this document

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Document history

Version 1.0 First Release

1 ABOUT THIS MANUAL

Purpose of manual

This manual is written to provide instructions on how to collect image data that will be combined into a mosaic of multiple overlapping geo-referenced images.

Target audience

The reader is expected to be familiar with the basic setup and operation of the M3 Sonar with position and heading sensor inputs.

Software version

M3 Software v1.40

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- Adobe® Photoshop®
- Avenza® Geographic Imager®
- Google Earth Pro®

2 M3 SONAR

The Kongsberg Mesotech Ltd. M3 Sonar is a 2D multibeam system with imaging and profiling capabilities. The M3 Sonar provides high-resolution and easy to interpret images by combining the rapid refresh rate of a conventional multibeam sonar with image quality comparable to a single-beam sonar.

Detection of small objects out to 150 meters combined with a 120° to 140° field of view allows the operator to see the complete underwater picture in real-time.

2.1 System Description

The M3 system consists of 3 main units:

- Computer
- Operations Cable and Power Supply
- Sonar Head
- External sensors

Computer

The Computer runs the M3 software that manages communication with the Sonar Head, performs all beamforming and image processing and presents the sonar imagery for the operator.

Operations Cable and Power Supply

The Sonar Head requires a DC power supply to run. A small DC switching supply can be used with the run the system on a surface vessel. The power may also be supplied locally when installed on a Remotely Operated Vehicle.

Sonar Head

The Sonar Head is installed underwater and transmits and receives an acoustic pulse. The Sonar Head requires DC power from a power supply located near the Sonar Head.

Sensors

Position and heading sensors are required to create GeoTiff images. The sensor accuracy will determine how well the images are overlaid in the mosaic. It is up to the user to determine the sensor accuracy requirements.

Note

NMEA 0183 sensor format is required (GGA, GLL, GGK, HDT, HDM).

Accessories

The M3 system accessories can be supplied by Kongsberg, the system integrator or the end user. Typical system accessories include:

- Equipment case
- Telemetry extension kits
- Displays
- Mounting brackets
- Rotators
- Accessory kit

2.2 System Diagram

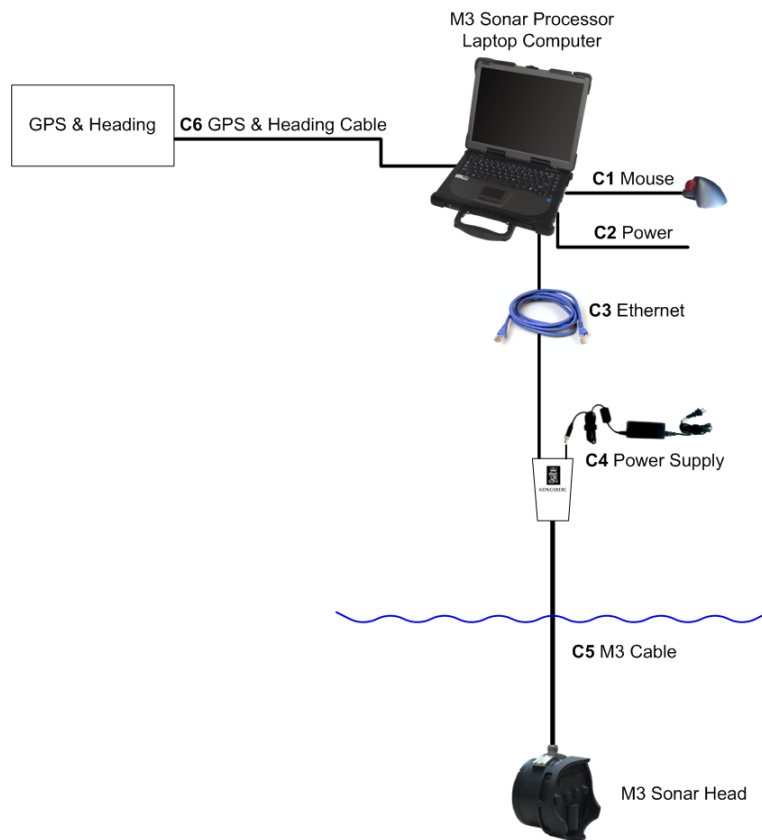


Figure 1. Basic M3 system connections

2.3 Support Information

If you require assistance with your M3 Sonar, please contact:

Kongsberg Mesotech Ltd. Phone: +1 604 464 8144

Email: km.sales.vancouver@kongsberg.com

3 GETTING STARTED

The basic M3 Sonar system consists of:

- Sonar Head
- Operations Cable and Power Supply
- Software
- Position and heading sensors

In addition to the basic components, a power supply is required to power the Sonar Head. Figure 2 shows the components required for operating the M3 System.

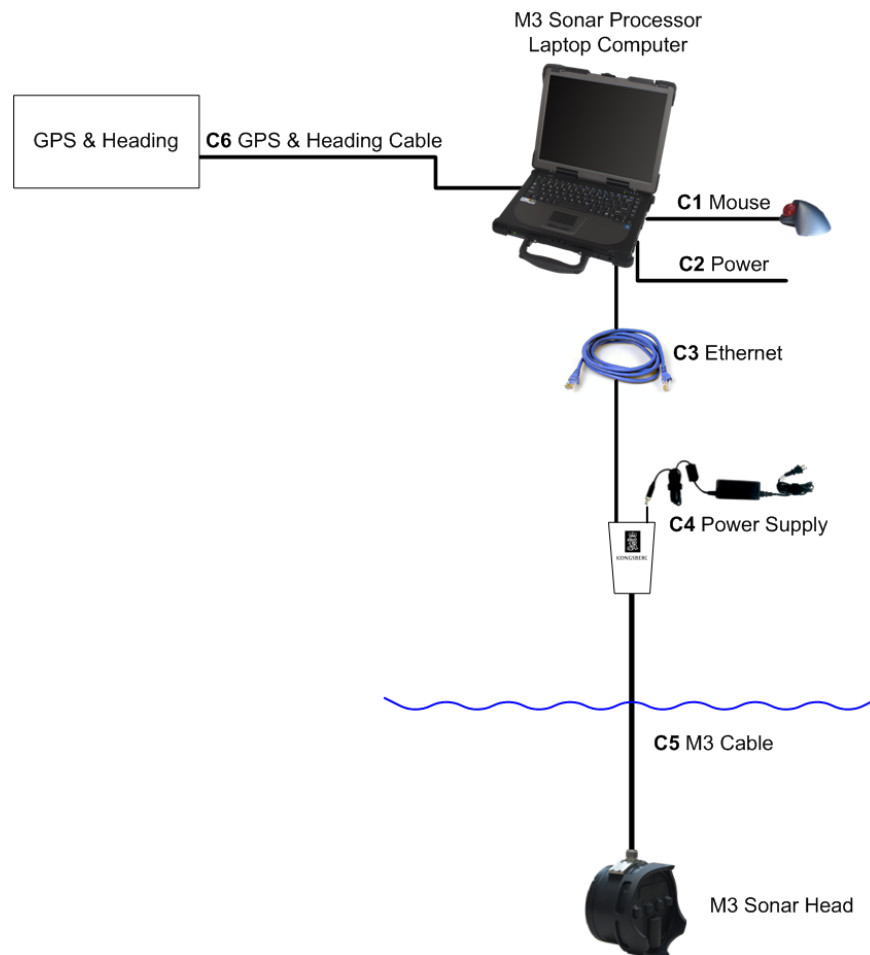


Figure 2. Basic M3 system components required system check

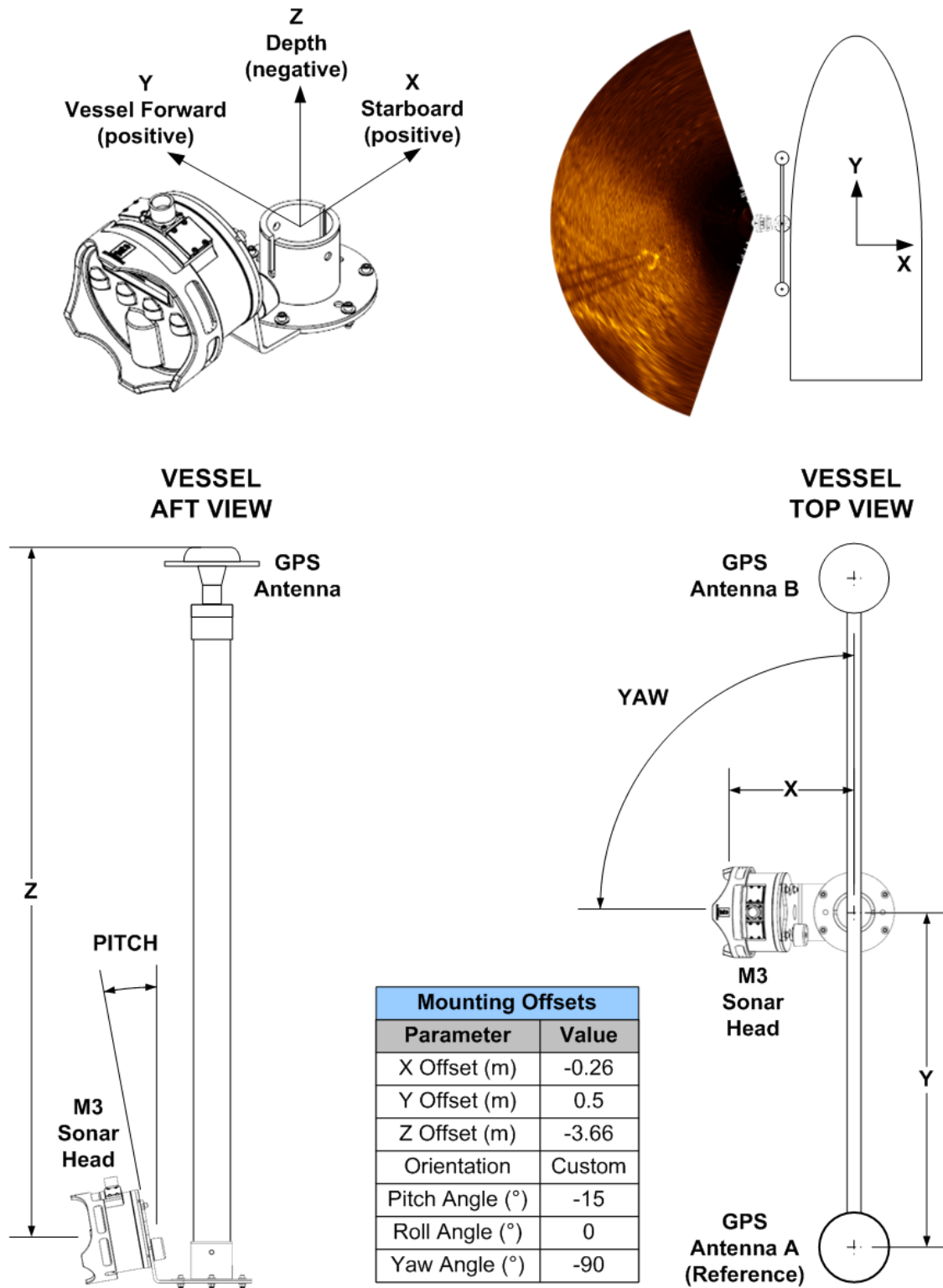


Figure 3. Example: Port side looking mount tilted down 15°

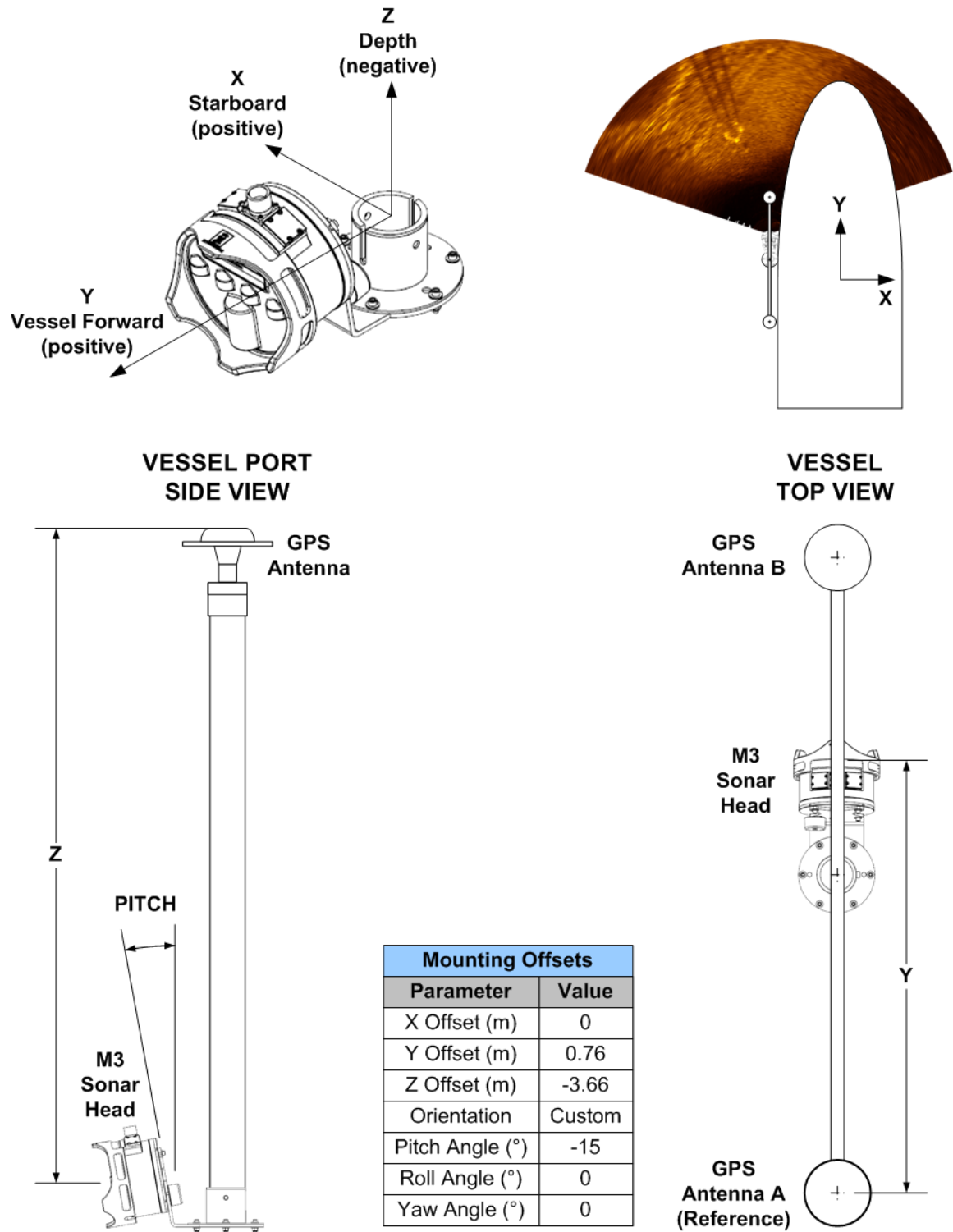


Figure 4. Example: Forward looking mount tilted down 15°

3.1 Quick-start

To perform a system check on the M3 components please follow the instructions below.

Install software

1. Insert the M3 software installation CD into the computer.
2. Run **Setup** and apply the default settings during installation

Configure the network settings

3. Open the **Local Area Connection** window and click on **Properties**
4. Select **Internet Protocol (TCP/IPv4)** and click **Properties**
5. Set the computer to **Use the following IP address: 192.168.1.233**
6. Set the **Subnet Mask** to: **255.255.255.0**
7. Leave the **Default Gateway** field blank
8. Click **OK** to apply changes

Start-up and testing the sonar

9. Connect the M3 system components shown in Figure 2 on page 10.
10. Apply AC power to the M3 power supply
11. Run the M3 software
12. Click the **Connect Head** located in the **Setup** menu and the sonar will start pinging automatically once the connection is complete.

Shutdown

13. Before turning off or removing power to the sonar, click on the disconnect button
14. Close the M3 application

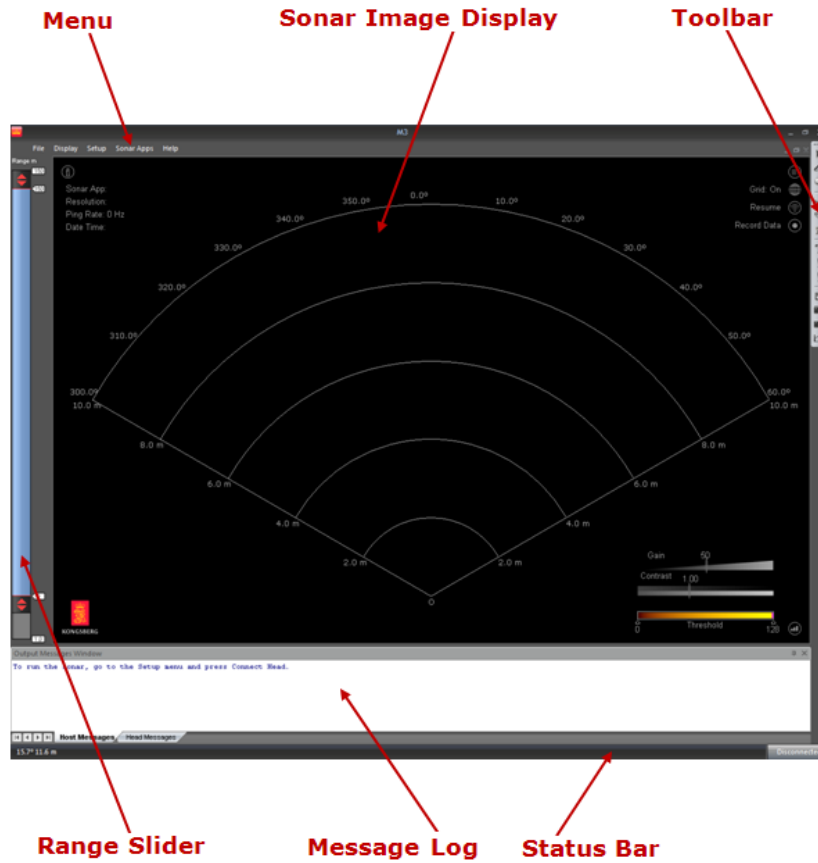


Figure 5. M3 Software Interface Modules

4 OPERATIONAL PROCEDURES

This section describes how to configure the M3 Software, collect data, and process the recorded data into a mosaic image.

The workflow is structured as follows:

1. Master reference and sensor configuration
2. Collect data to mosaic
3. Process the data into an image mosaic

4.1 Master Reference and Sensor Configuration

Purpose

This procedure shows how to configure the M3 Software to use position and heading sensors and set the Master Reference point offsets.

Description

The Master Reference is the location of the position sensors relative to the Sonar Head. It is critical to have the mounting offsets entered as accurately as possible. Significant errors in the mounting offsets will result in an image mosaic that appears blurred, or severely distorted.

Prerequisites

1. A surface vessel or UUV with the M3 Sonar attached looking to forward, port or starboard.
2. Position and Heading sensors connected to the M3 Software.

Related topics

- Collecting image data to mosaic

Procedure

1. Run the M3 Software.
2. Setup heading sensor
 - a. Click **Setup** menu > **System Configuration**

- b. Select the **Devices > Sensor Setup** tab
 - c. Click **Add Device**
 - d. Set the Protocol to **HDT** (Heading True)
 - e. Configure the serial port settings for the sensor
 - f. Add a **Name** for the sensor (e.g. Hemisphere VS330)
 - g. Click **Test Device** and ensure the NMEA sensor string is displayed in the Port Monitor.
3. Setup Position sensor
 - a. Click **Setup** menu > **System Configuration**
 - b. Select the **Devices > Sensor Setup** tab
 - c. Click **Add Device**
 - d. Set the Protocol to **GGA** (or other supported position format)
 - e. Configure the serial port settings for the sensor
 - f. Add a **Name** for the sensor (e.g. Hemisphere VS330)
 - g. Click **Test Device** and ensure the NMEA sensor string is displayed in the Port Monitor.
4. Measure the mounting offsets
 - a. Measure and record the position of the M3 Sonar Head transducer (center of the face) relative to the position and Master Reference (position sensor reference):
 - i. X Offset (m): _____
 - ii. Y Offset (m): _____
 - iii. Z Offset (m): _____
 - iv. Pitch Angle (°): _____
 - v. Roll Angle (°): _____
 - vi. Yaw Angle (°): _____

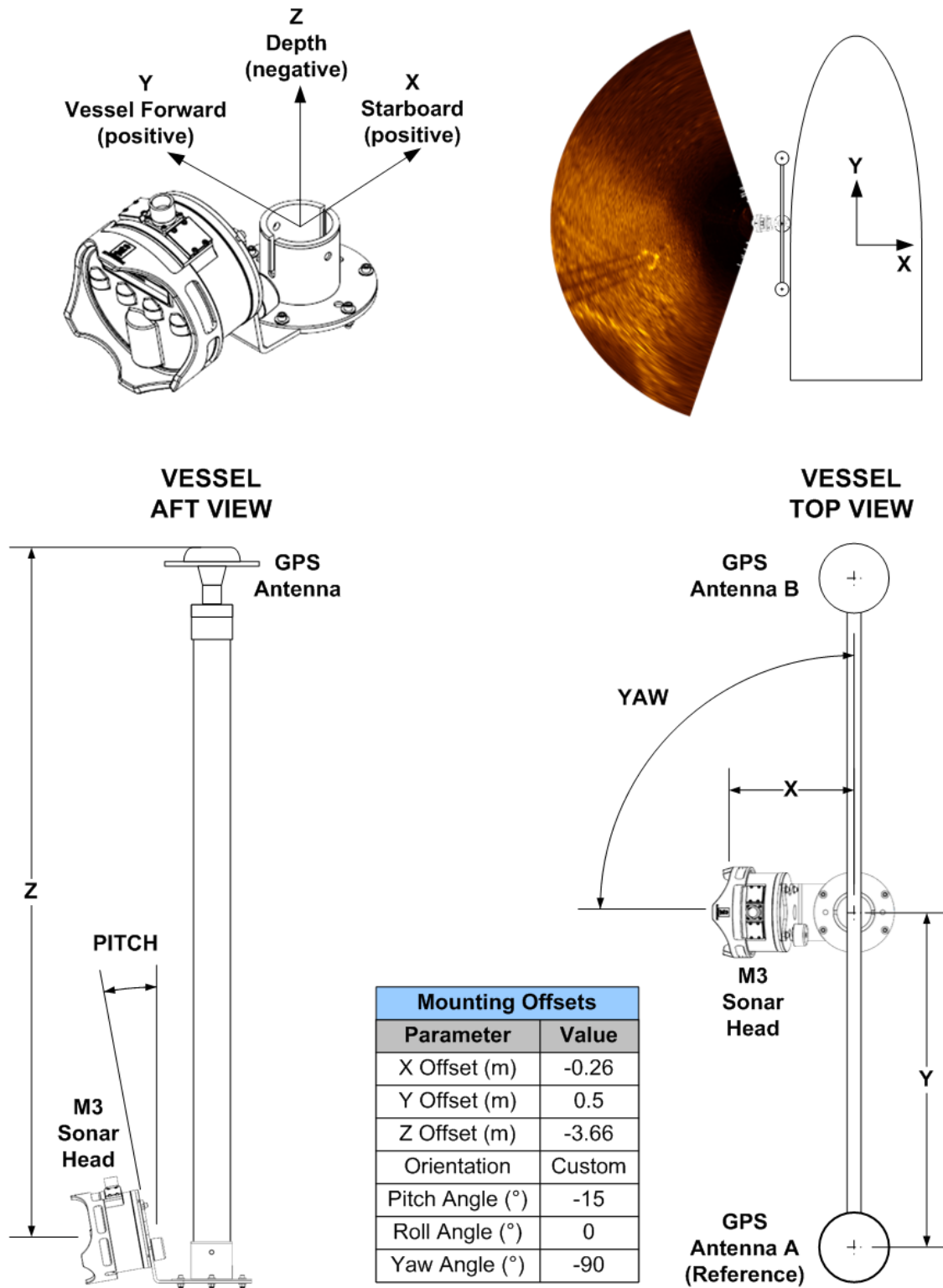


Figure 6. Example: Port side looking mount tilted down 15°

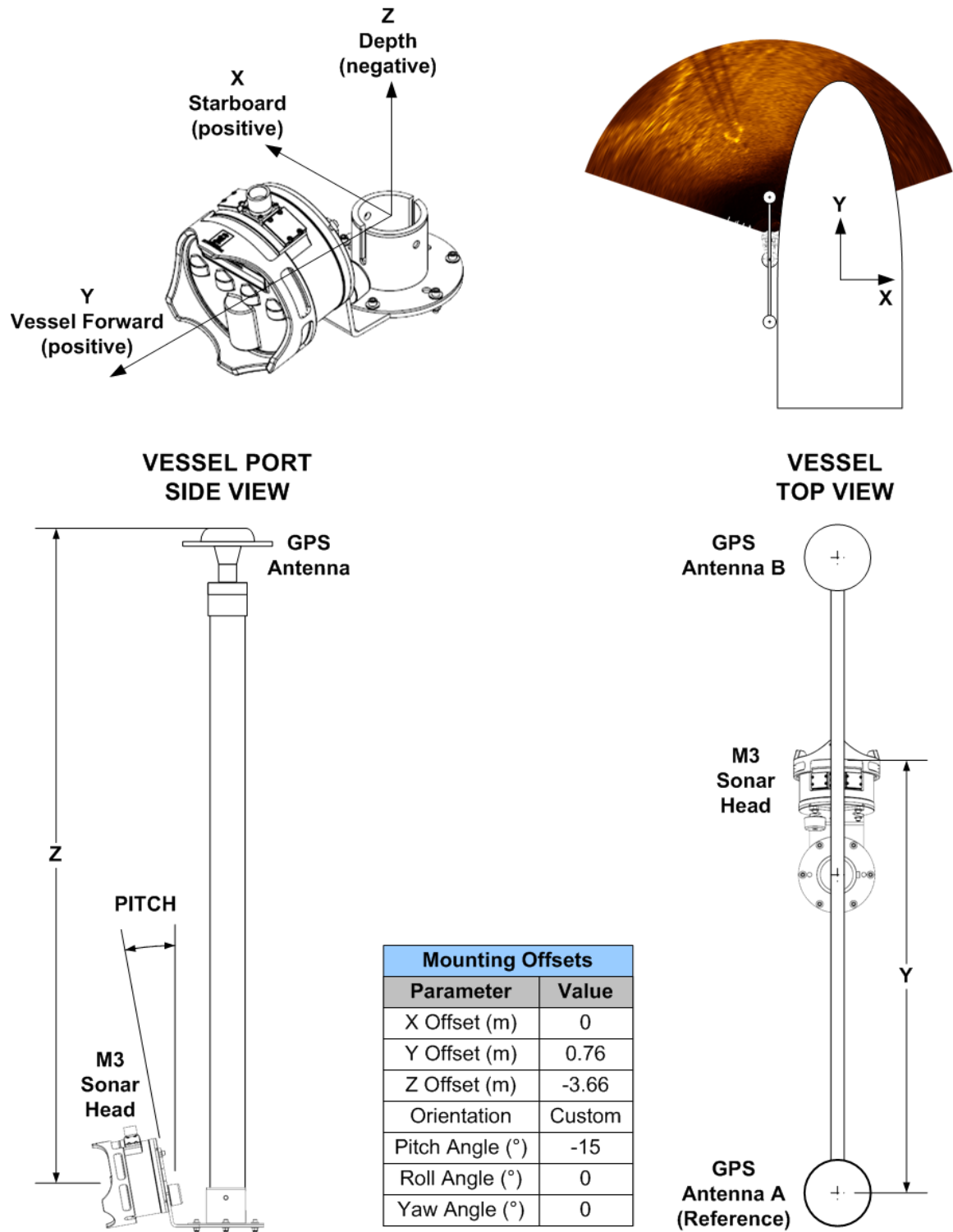


Figure 7. Example: Forward looking mount tilted down 15°

5. Configure the mounting offsets
 - a. Click **Setup** menu > **System Configuration**
 - b. Select the **Deployment > Mounting Offsets** tab
 - c. Enter the X, Y, Z offsets and the Pitch, Roll, Yaw angles
6. Configure the Master Reference
 - a. Click **Setup** menu > **System Configuration**
 - b. Select the **Deployment > Master Reference** tab
 - c. Select the Position sensor that was setup in the previous step. (e.g. Hemisphere VS330)
 - d. Select the Heading sensor that was setup in the previous step (e.g. Hemisphere VS330)
 - e. The Depth and Pitch/Roll can be left as Fixed.
7. Save deployment configuration
 - a. Click **Save As**
 - b. Enter a new configuration name and click **OK**. (e.g. Port side looking with -15° tilt)

Note

Changing values in the Master Reference or Mounting Offsets tabs, change the values for the current configuration. If you want to create a new configuration, first click Save As or New, then modify the parameters.

4.2 Collecting image data to mosaic

Purpose

This procedure shows some ways to collect image data with the M3 Sonar to combine in an image mosaic.

Description

To create a large area mosaic, position and heading are required to geo-reference the image data so that it can be placed correctly by post processing software. There are 2 basic mounting configurations for the Sonar: Forward Looking and Side Looking. Some example applications include:

- Survey of an area – square / rectangle
(multiple parallel lines) – FORWARD OR SIDE
- Survey of pier
(one or two lines parallel to the pier) - SIDE
- Survey of shoreline or around a structure
(one pass around a structure at some distance) - SIDE
- Forward looking navigation and survey
(one or more survey lines) – FORWARD

All but the last item in the list above can be done with the M3 Sonar Head facing port or starboard. The side looking configuration has the advantage achieving higher resolution images. Multibeam sonars have the narrowest beam in the center of the array. By reducing the width of the sonar image, we can keep the best resolution data and discard the rest. Good results can still be achieved with the forward looking configuration. The advantage of the forward looking configuration is that the coverage is almost twice as wide. We can also trim the forward looking image vertically instead of horizontally if needed.



Figure 8. M3 Sonar Mosaic with Side-Looking mounting



Figure 9. M3 Sonar Mosaic with Forward-Looking mounting

Some downward tilt can improve the bottom coverage by reducing the first point of contact with the sonar beam and the seabottom.

If a surface vessel is used, then a 15° downward tilt bracket is recommended. A rotator is also a good choice to select the optimal bottom coverage by adjusting the tilt.

Prerequisites

1. A surface vessel or UUV with the M3 Sonar attached looking to forward, port or starboard.
2. Position and Heading sensors connected to the M3 Software.
3. Master references and sensor configuration complete

Related topics

- Master Reference and Sensor Configuration
- Creating an image mosaic

Procedure

1. Connect to the Sonar Head using the M3 Software.
 - a. Power ON the Sonar Head and the position and heading sensors.
 - b. Click **Setup** menu > **Connect**

- c. Confirm the status bar shows the system is **Active** in the lower right corner of the screen.
2. Confirm the M3 Software is running with Position and Heading sensor data displayed in the Information Widget at the top left corner of the screen.




3. Select the operating range to use and a Sonar App mode

The table below indicates the maximum vessel speed that should be used for each mode.

Table: Maximum Vessel Survey Speed

Fine EIQ	EIQ	Imaging 30°
1.5 knots	2 knots	5 knots

4. Begin the survey run and start recording the sonar data
 - a. Press **Record Data** button in the top right “On Screen Menu Widget”.
5. Enable GeoTiff Autosnap by pressing **F11**. The Autosnap status is shown in the bottom right corner of the screen. 
6. Run the survey lines desired.
7. Stop recording when complete (disable Autosnap by pressing F11).

Note

Lower performing computers may results in a slower than expected image update rate. For slower computers, the data should be recorded in MMB format with the GeoTiff Autosnap turned OFF. The data should then later be played back and Autosnap enabled by pressing F11.

4.3 Creating an image mosaic

Purpose

This procedure shows how to export GeoTiff files and use them to create a large area sonar image mosaic that is geo-referenced.

Description

The M3 Software can be used to generate GeoTiff files. These are raster images that include position and heading information embedded in the file. The GeoTiff can be imported into many GIS programs. By exporting a number of overlapping GeoTiff images, you can create a mosaic of a much larger area of coverage.

Prerequisites

1. Adobe Photoshop CS5 or higher
2. Avenza Geographic Imager Plugin
3. Sample dataset of image data configured for side looking deployment (port or starboard). The data can be recording using most Sonar App modes. The EIQ, Fine EIQ and Imaging 30° are typically selected.
4. M3 Software

Note *The time to generate GeoTiff files and then mosaic will depend on the processing power of the computer used. It is recommended the computer used meets the same recommended requirements as the M3 Sonar Processor.*

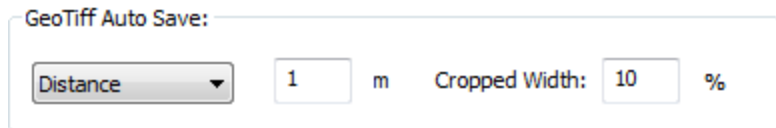
Note *A trial version of Adobe Photoshop and Avenza Geographic Imager can be downloaded from each company's website.*



Related topics


- Collecting image data to mosaic





Procedure

1. Run the M3 Software
2. Generate GeoTiff files from the MMB dataset.
 - a. Select the **Copper** colour palette. Click **Display** menu > **Palatte** > ✓ **Copper**.
 - b. Set the Sector Orientation to 0. Click **Display** menu > **Sector Orientation** > ✓ **0**.
 - c. Open the Preferences window by clicking **Setup (menu)** > **Preferences**. Enable the GeoTiff Autosnap to save at 1m position increments, crop to 10%. Click **OK** to apply changes.



- d. Press **F11** to enable GeoTiff Autosnap. The GeoTiff status on the lower right of the screen will change from grey to green when Autosnap is active.
 - e. Press **File (menu)** > **Playback**. Select the file to playback in the M3 Software (e.g. “Bedforms Example Data.mmb”).
 - f. Once playback has ended, press **F11** again to disable GeoTiff Autosnap.
3. Use the Geographic Imager function **Autorectify** to convert all GeoTiff files from head-up to north-up.
 - a. Create an action to automate the Autorectify and save file functions for use in a batch process.
 - i. Run Photoshop.
 - ii. Open a GeoTiff file created with the M3 Software (e.g. C:\KML\M3_V0140\Images\...). Press **CTRL + O**.
 - iii. Open the Actions tab **Windows (menu)** > **Actions**
 - iv. Click on  **Create new set** and label as **Sonar Mosaic**.
 - v. Click  **Create new action** and label the Name **AutoRectify** and select the Set **Sonar Mosaic**, then press the **Record** button.

- vi. Click **File (menu) > Automate > Geographic Imager: Autorectify...**
 - vii. Click **Save As**. Rename the file to include the description "... (North Up).tif". Select a folder to copy the north up file (e.g. C:\KML\M3_V0140\Images\North Up) to and press **OK**. Check **Save Transparency** and press **OK**. The target folder path will be overridden when doing a batch conversion.
 - viii. Click  **Stop** recording the current action.
 - ix. Close the GeoTiff file that was opened to create this Action.
 - b. Batch convert all GeoTiff files so they are north up oriented.
 - i. Click **File (menu) > Automate > Batch**
 - ii. Select the Set: **Sonar Mosaic**
 - iii. Select Action: **AutoRectify**
 - iv. Select the source folder
(e.g. C:\KML\M3_V0140\Images)
 - v. Select the target folder
(e.g. C:\KML\M3_V0140\Images\North Up)
 - vi. Check the box to ☒ **Override Action "Save As" Commands**.
 - vii. Add (North Up) to the Filenaming
(e.g. Document Name + (North Up) + extension)
 - viii. Press **OK** to begin the batch conversion.
- 4. Copy the GeoTiff files into separate folders containing 100 sequential images. You can process more or less than 100 images. However, the maximum number of images Photoshop can have open at once is 200. Creating a mosaic with much more than 100 images at a time tends to slow down processing.
- 5. Mosaic 100 files from one of the folders in Photoshop
 - a. Select **File > Open** and select all 100 files in the folder
 - b. Once all the files are loaded, select **File > Automate > Geographic Imager: Mosaic**
 - c. Click **Select All** of the available documents list
 - d. Press >> to move them to the Mosaic Documents list

- e. Check the box that says ☒ **Keep source data on separate layers**
 - f. Click **OK** to begin the mosaic process.
6. Create a Photoshop action to automate blending for all 100 layers.
 - a. Open the Actions panel under **Windows (menu) > Actions**.
 - b. Create a new action by clicking on the  **Create new action** button in the Actions panel and save the action as name as **“Lighten 100 Layers”** under the set **Sonar Mosaic** the press **Record**.
 - c. Press (**SHIFT + ALT + G**) to set the current layer blending mode to “Lighten”.
 - d. Press (**ALT + [**) to move to the layer below the current selection.
 - e. Repeat step c. and step d. until you are back at the first layer (200 times). Yes this is tedious; however you will only need to create the action once.
 - f. Once all layer blending has been set to “Lighten”, press  **Stop** to end recording the action.
7. Select the action **“Lighten 100 Layers”** then press  **Run** to apply “Lighten” to all layers.
8. Merge all layers by pressing (**Ctrl + SHIFT + E**).
9. Delete the black background
 - a. Select the  **Magic Wand Tool** in the Tools window
 - b. Set the Tolerance to **1**
 - c. Click on black background areas and delete.
10. Save the GeoTiff file
 - a. Click **File > Save as**
 - b. Select a new filename (e.g. Mosaic 1-100.tif) and click **Save**.
 - c. Use the default TIFF Options and also check the box to ☒ **Save Transparency**.
 - d. Click **OK** to apply changes and save the GeoTiff file.
11. Convert the rest of the GeoTiff files by repeating steps 4, 6, 7, 8 and 9 for each folder.

12. Merge all of the 100 image mosaic files together

- a. Open all mosaic files in Photoshop (e.g. Mosaic 1-100.tif, Mosaic 101-200.tif, Mosaic 201-300.tif, etc...)
- b. Once the files have finished loading, select **File > Automate > Geographic Imager: Mosaic**
- c. Click **Select All** of the available documents list
- d. Press >> to move them to the mosaic documents list
- e. Check the box that says ☒ **Keep source data on separate layers**.
- f. Click **OK** to begin the mosaic process.

13. Set all layers to “Lighten”


- a. Press (**SHIFT + ALT + G**) to set the current layer blending mode to “Lighten”.
- b. Press (**ALT + [**) to select the layer below the current selection.
- c. Repeat step a. and step b. until you are back at the first layer.

14. Save the GeoTiff file

- a. Click **File > Save as**
- b. Select a new filename (e.g. Mosaic all.tif)
- c. Use the default TIFF Options and also check the box to ☒ **Save Transparency**.
- d. Click **OK** to apply changes and save the GeoTiff file.

15. The GeoTiff mosaic is now complete. This can be imported into GIS software.

Note

*The file size limitation for TIFF is 2GB. Large format TIFF can be up to 4GB. For large mosaic images the GeoTiff files can be “Tiled” using the tool  GeoGraphic Imager panel or under **File (menu) > Automate > Geographic Imager: Tile...***

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