SAR HAWK® SURVEYOR

Target Acquisition and Mapping

User Manual

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SAR HAWK

User Manual

Table of Contents

Figures

Tables

Acronyms and Abbreviations

OIC	Oceanic Imaging Consultants
cm	centimeter
ENC	Electronic Navigational Chart
GIS	geographic information system
GUI	graphical user interface
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
SAR	Search and Recovery
SI	Side Imaging
TIFF	Tagged-Image File Format
UTM	Universal Transverse Mercator

1 Welcome to SAR HAWK

SAR HAWK (Target Acquisition and Mapping Software) is Oceanic Imaging Consultants's (OIC) software program for reviewing your Humminbird data. SAR HAWK automatically creates mosaics of your side imaging sonar data over your co-registered charts or imagery. SAR HAWK will show where you've been and what you saw.

This manual documents SAR HAWK's features and functions. Information is presented in the order that you need it for out-of-the-box playback. It discusses each process in the SAR HAWK workflow and how to accomplish it. Selected sections conclude with a table of commands relevant to the workflow process described in that section, which serves as a review of the commands available in SAR HAWK and how to execute them. Selected sections also include an interactive tutorial for demonstrating some of the features. Test data are provided with the software for use with the tutorial instructions. The sections are as follows:

- System Requirements and Setup
- The Graphical User Interface (GUI)
- Configure SAR HAWK
- Load Charts
- Add Data
- Display and Processing Settings
- Work with Contacts
- Additional Features
- End Playback and Close Project.

We use the following typographical rules throughout this manual for emphasis and clarity:

- **Boldface** indicates onscreen buttons, commands, fields, or icons from a toolbar, menu or window.
- `Courier New` indicates user input or SAR HAWK output. This includes all of the text in the SAR HAWK interface that your actions can change.
- Grey shading of text or columns in a table indicates specific tutorial instructions. Follow these directions to check your work against the figures in this manual.
- Key names are written as they appear on the keyboard. Key combinations are indicated with a plus sign between them, e.g., to press Alt+F, press Alt and F simultaneously.
- Click means to press the left mouse button. Double-click means to quickly press the left mouse button twice. Right-click means to press the right mouse button.

For further assistance using the SAR HAWK program, we encourage you to contact us.

       E-mail sarhawk@oicinc.com
       Web: www.oicinc.com

2 System Requirements and Setup

This section describes the sensor and system requirements for computers hosting SAR HAWK, and how to install, launch, and create/open a project in the software.

2.1 SAR HAWK Input Requirements

SAR HAWK is designed to read Humminbird™ Side Imaging sonar data files, and provide the user with an interactive, scrolling waterfall for data review and target detection, and a geo-coded "mosaic" (coverage map) for easy referencing of your data and target detections to features on charts and background imagery. SAR HAWK requires the user to input the name of the Humminbird™ master data file (the one that ends in ".dat") and expects the matching ".IDX" and ".SON" files will be in a folder with the same name as the ".dat" file. SAR HAWK operation is largely automatic, but the user can if they wish specify choices for units (distance, position, etc.) color palettes, location of charts and sensor/antenna offsets. These options are covered below.

2.2 System Requirements

SAR HAWK is a Windows-based application and compatible with Windows Vista through Windows 10. The minimum system requirements and recommended specifications are presented in Table 1.

Table 1. System Requirements

Component	Minimum	Recommended
Processor	Dual core	Quad core
RAM	2 GB	4 GB
Graphics	CPU	OpenGL 3.1+ compatible GPU and up-to-date video driver
Display	1024x758 (32 bit color)	
Disk Space	Install is approximately 300MB, but more space is needed for logging data. Please be aware that some systems may log close to 1 GB/min.	
Ports	USB port for dongle;, Ethernet port for sonar connection and serial port(s) if using NMEA inputs	

The computer that is running SAR HAWK does not require a dedicated graphics processing unit (GPU), but a GPU does provide better performance. SAR HAWK will automatically offload computation-intensive tasks such as mosaicking and high-quality rendering to the GPU when the GPU supports OpenGL 3.1+. In practice, most recent Intel central processing units (CPU) come with an integrated GPU that meets this requirement, as well as most recent mobile/desktop GPUs from AMD/NVIDIA. You must keep your video driver updated, however. To ensure that you have the most updated driver for your system, please go to the manufacturer's Web site:

For AMD/ATI:
http://support.amd.com/en-us/download
For NVIDIA:
 http://www.nvidia.com/Download/index.aspx
For Intel HD 3000/4000/5000 series:

https://downloadcenter.intel.com/

In order to run the SAR HAWK software, a OIC-provided dongle must be attached to the workstation, with up-to-date dongle drivers installed. Dongle drivers are present in the installation media provided by OIC (see Section 0).

2.3 Installing SAR HAWK

SAR HAWK installs by default to a folder in the Program Files(x86) folder on the local drive. The software package comes with a licensing dongle, which looks like a USB stick, and an install dongle, which looks like a credit card. The install dongle includes three folders: demo_data, documentation, and install. The demo_data folder contains charts, a demo project, and demo data files in the native SAR HAWK format. The documentation folder contains the quick start tutorial and this user manual. The install folder contains the installation file.

If you have a limited feature demonstration version, the demo_data folder may contain additional folders for different demo data. The limited feature version only plays the included data files, does not need a dongle to run, and cannot load normal, non-demo data.

To install SAR HAWK:
1. Plug the USB card in your computer and navigate to the install folder.
2. Create a folder on your local (C:) drive named `SAR_HAWK_DEMO`, for continuity with OIC training materials.
3. Copy the demo_data folder to the SAR_HAWK_DEMO folder. SAR HAWK performs better when data are saved locally.
4. Insert the licensing dongle into a USB port.
5. Double-click on SAR HAWK-3.x.xxx.exe (file name is not exact).
6. SAR HAWK will present you with the licensing terms agreement page. To accept the terms and default installation directory, check the "I agree…" statement, and select "ACCEPT". To configure installation directory other than the default location, select the "Options" button. The Setup Options dialog, shown center below, allows you to specify an alternative installation location. Select "OK" when satisfied or "Cancel" to return. On successful installation SAR HAWK will inform you of success and offer to launch the software. Select "Launch" or "Close"

Figure 1. SAR HAWK installation process and dialogs

2.4 Launch SAR HAWK

SAR HAWK launches using standard Window commands. The dongle must be in a USB port or you will receive an error message. After securing the dongle, either:
- double-click on the **SAR HAWK** desktop icon;
- from Windows Explorer, navigate to the install folder in the Program Files folder, and double-click on the SAR HAWK.exe; or
- click on the **Start** Windows icon, locate the SAR HAWK shortcut and click on SAR HAWK.

If SAR HAWK has detected multiple crashes, it may present you with the option of switching to software mode upon launch. You might find it beneficial to test if SAR HAWK performs better in software mode on your system. SAR HAWK also presents you with the option of sending a crash detection report if the software crashes. Please fill out this report if you would like our developers to investigate the cause of your crash.

2.5 Create or Open a Project

A SAR HAWK project is a working directory that stores files for the program such as contacts, cached files, raw data and processed swath and mosaic data. The project folder contains results obtained from mosaicking the project data, including swath files and exported mosaic data (you may choose to save exports elsewhere).

The project folder is stored in the workspace, or working directory. For continuity with OIC training materials, we suggest that you use the SAR_HAWK_DEMO folder that you copied the data to earlier. The default directory is <my documents>\sarhawk_projects, which works just as well. If you do not choose one of these locations, choose another location, but not one in which you have installed SAR HAWK executables (i.e., other than C:\Program Files (x86)\SARHAWK).

Upon launching SAR HAWK, choose between creating a new project and opening an existing project in the select project window (Figure 2).
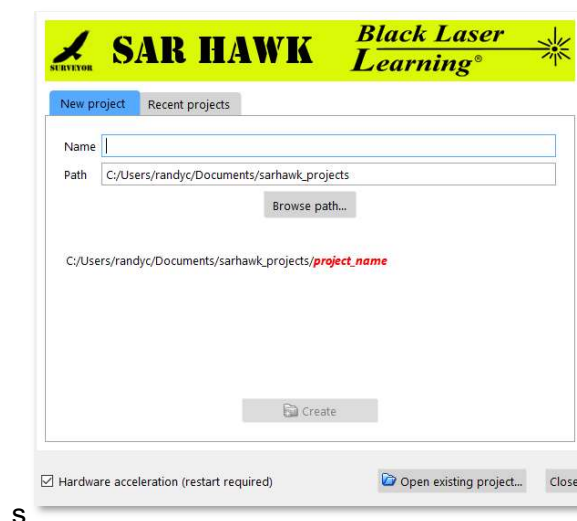
Figure 2. SAR HAWK Project Opening dialog

SAR HAWK   User Manual

Follow the instructions in Table 2 to create a new project or open an existing project.

At the end of this process, you should have the SAM GUI open, ready to load, playback data, or review an existing project.

Table 2. Create or Open Project

To create a new project:	To open an existing project:	To open a recent existing project:
1. Click **New project** tab. 2. Click **Browse path...** to open the Select Folder window. 3. Enter a name in the **Name** field: Test. 4. Change the workspace to C:\SAR_HAWK_DEMO 5. Click **Create**. 6. SAR HAWK's GUI displays.	1. Click **Open existing project...** to open the Open window. 2. Navigate to the location where the project is (C:\SAR_HAWK_DEMO \demo_data\humminbird) 3. Click the geomosaic.xml file to select it. 4. Click **Open**. 5. SAR HAWK's GUI displays.	1. Click **Recent projects tab**. 2. Click the project name. 3. SAR HAWK's GUI displays. OR 1. Enter the name of the project in the **Name** field in the **New Project** tab. 2. Click **click to open**. 3. SAR HAWK's GUI displays.

3 The Graphical User Interface (GUI)

Before viewing or loading data, take a moment to familiarize yourself with the SAR HAWK display (Figure 3). The SAR HAWK interface has a main toolbar, a mosaic window, a status bar, and ancillary windows with controls which will appear in the sidebar. Some elements are specific to playback mode. Each element of the GUI is described in a section below.
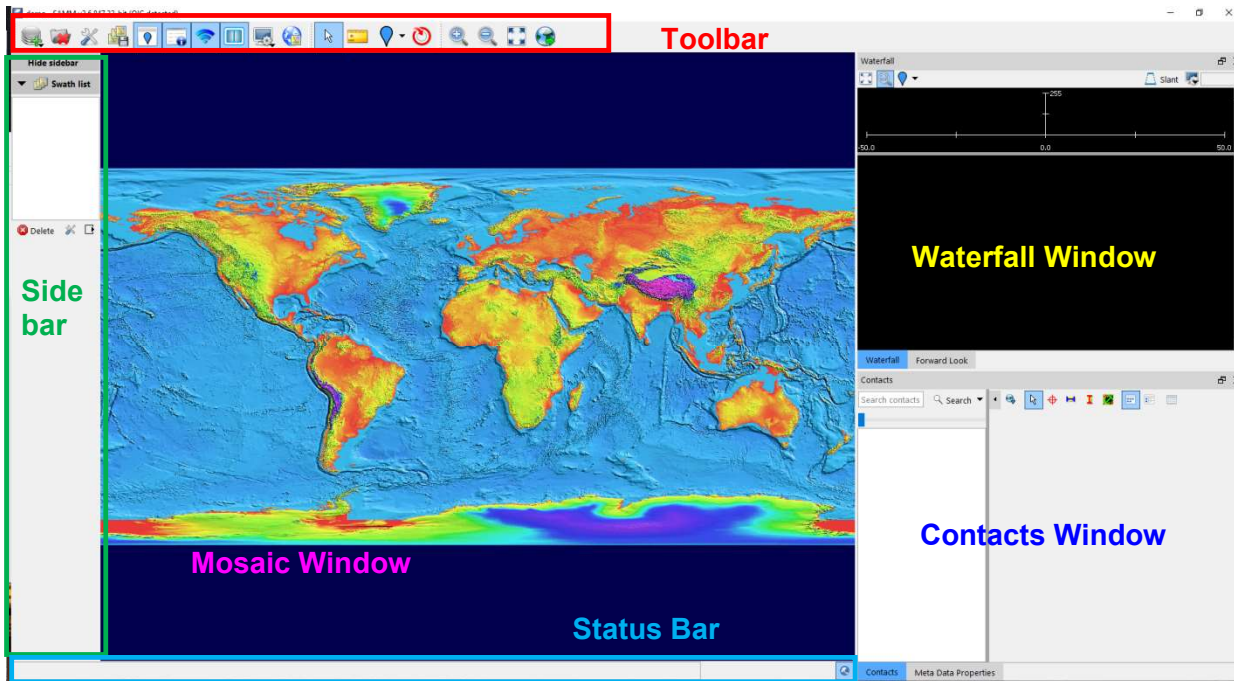
Figure 3. Graphical User Interface

3.1 Mosaic Window

The mosaic window displays charts or satellite imagery with sonar data and contacts. As sonar data are read from the file they are pasted into the mosaic window, using the included GPS position and course. To break the mosaic (coverage map) in to pieces (we call these "swaths") just press the "scissors" icon on the Mosaic Toolbar. You can use this to cut out turns, and make separate layers for each of your passes over a target. SAR HAWK shows you your swaths in the Side Bar, where you can turn them off and on, and re-layer them. Mosaic operations are discussed in detail below in Chapter 7.

SAR HAWK read the GPS position data, and attempts to find the best background chart or image for the data. It first looks in the local folder specified by the user at setup, and then if you are connected to the internet will optionally check for charts on the Web. The user can control the background charts from the Chart Background Options icon, discussed in detail below in Chapter 5.
The green outlined shape represents the vessel. Pink outlined crosshairs represent the positions of the GPS antenna and the sonar transducer. The blue line gives the track of the boat. You can zoom by rolling your mouse wheel toward or backwards, clicking the Zoom icons on the toolbar, pressing the +/- keys on the keyboard, or using a two finger scroll on a laptop track pad.

3.2 Toolbar

The toolbar is a collection of icons that open dialog boxes or directly execute commands when clicked. The toolbar icons are pictured and described in Table 3. Toolbar Icons, in the order in which they appear from left to right on the toolbar.

Table 3. Toolbar Icons

Icon	Icon Name	Function
	Add data	Displays the dropdown Add Data menu
	Close project	Closes the current project
	Configuration	Opens Configuration window
	Export	Opens Export Data window
	Contacts	Opens Contacts window
	Display the waterfall window	Opens the Side Imaging Waterfall window
	Display options	Displays the dropdown swath display options
	Chart background options	Opens the Chart Display Options dialog box
	Record toggle	Begins or ends mosaicking in playback mode
	New swath	Breaks mosaicking without pause in playback mode
	Select tool	Allows user to select swaths or contact markers in the mosaic window
	Measure tool	Activates the measure tool
	Mark contact tool	Activates the mark contact tool
	Zoom in	Zooms in to the center of the mosaic window
	Zoom out	Zooms out from the center of the mosaic window

	Reset the view to the entire survey	Resets the mosaic view to the entire survey
	Auto adjust the display to follow the sensor	Automatically centers the mosaic view on the sensor

3.3 Sidebar

The sidebar appears by default to the left of the SAR HAWK mosaic window. It contains various panels depending on the mode, and can be minimized by clicking the "Hide sidebar" button.

3.3.1 Swath List

The **Swath list** lists the swaths in the project (Figure 4). As the survey or playback progresses, SAR HAWK lists swaths by name in this list and paints them in the mosaic window. The user can make swaths visible or invisible by checking or unchecking. Swaths can be reordered to place the preferred sonar swath on top. Display of bathy and imagery swaths may also be toggled on or off. Section 7.2 describes how to use this list to manage swaths.

- To hide the Swath list, click the **Swath list** title bar.
- To hide bathy or imagery swaths, click the corresponding button to the right of "Display".
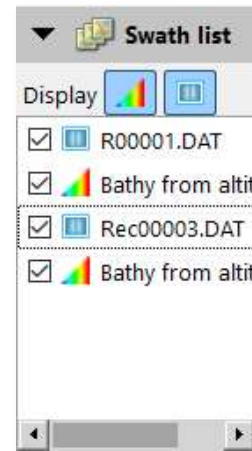
Figure 4. Swath List

3.3.2 Live Info

The **Live info** panel, visible during playback, displays continuously updated values for date, time, position, heading, altitude, sound velocity, and speed (Figure 5). These metadata appear on the sidebar of the mosaic window. SAR HAWK retrieves these metadata feeds from the sonar data file.

- To hide the metadata, click the **Live Info** title bar.
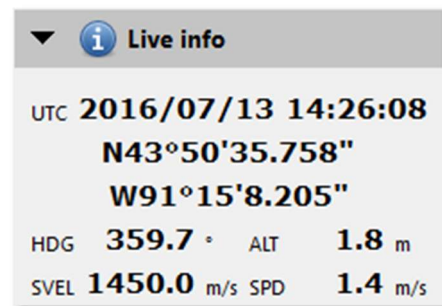
Figure 5. Live Info

3.3.3 Playback Controls

Playback controls appear on the sidebar of the mosaic window when playing back data. The playback controls consist of several buttons a slider bar to speed up or slow down playback and a start/pause button (Figure 6). Table 4 describes the action of each button. To hide the controls, click the **Playback controls** icon.
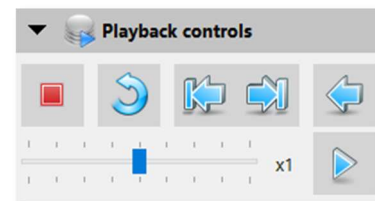
Figure 6. Playback Controls

Table 4. Playback Buttons

Icon	Action
■	End playback and enter post-processing mode.
↺	Restart playback from the first file.
⏮	Playback the previous file.
⏭	Playback the next file.
⬅	Playback from the start of the current file.
⏸	Pause playback.
▷	Start playback.

3.3.4   Processing Controls

Processing controls appear on the sidebar of the mosaic window. These controls enable the user to change how SAR HAWK mosaics the data. See Section 7.4 for details of each setting.
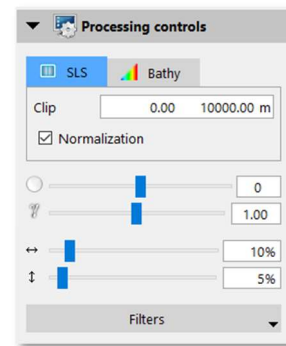
Figure 7. Processing Controls

3.4 Waterfall Window

The waterfall window provides a view of side imaging data. The oscilloscope panel located above the side imaging waterfall displays the sonar return strength versus range with port data on the left in red, and starboard data on the right in green. The oscilloscope panel can be closed when not in use using the Toggle Oscilloscope icon, describe below.
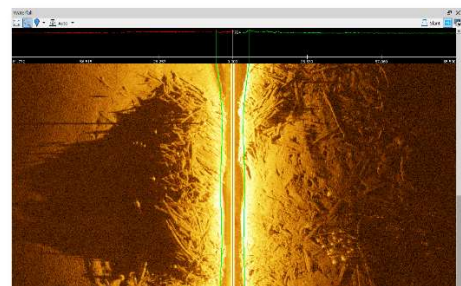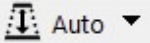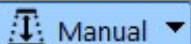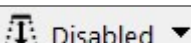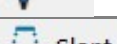
Figure 8. Waterfall Window

3.4.1   Waterfall Toolbar

Waterfall toolbar is located above oscilloscope panel. The toolbar icons are pictured and described in Table 5, in the order that they appear from left to right on the toolbar.
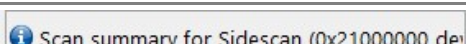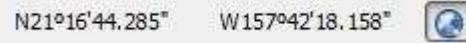
Table 5. Waterfall Toolbar Icons

Icon	Icon Name	Function
	Reset zoom	Resets the waterfall and oscilloscope view to the entire range
	Zoom	Drag a box in waterfall or oscilloscope window to zoom in the section
Auto	Automatic Bottom Track Tool	Bottom tracking is done automatically when automatic bottom tracking is enabled
Manual	Manual Bottom Track Tool	Click within the Oscilloscope window to set manual bottom tracking.
Disabled	Bottom Track Tool Disabled	The bottom track tool is disabled. If altitude meta data exists, it will be used for bottom tracking.
	Contact Marker Tool	Mark contacts and select contact marking options.
Slant	Range Toggle	Toggles slant/ground in the waterfall view
	Toggle Oscilloscope Display	Hide or show the Oscilloscope
	Waterfall Display options	Displays the dropdown waterfall display options

3.5 Status Bar

The status bar is located at the bottom of the main window. It displays operational mode, sensor status, reports errors, displays verbose readout of the position of the mouse cursor in the mosaic window, and hosts several buttons. The definition for each status bar element is supplied in the order that they appear from left to right on the status bar.

Table 6. Status Bar

Icon/Output	Definition	Mode
	New version available	All
	An error occurred	All
Scan summary for Sidescan (0x21000000 de	Scrolling Event Log bar, click to open the Event Log window.	All
5.0cm	Button to cancel file playback/loading, also indicates current mosaic resolution	All
...017-SOLIX_New_Humminbird/Rec00004.DAT	File /playback/loading progress	All
N21º16'44.285" W157º42'18.158"	Position of cursor in mosaic window in GPS coordinates, click toggle button for XY	All
x: 634335.02 m y: 2353571.31 m	Position of cursor in mosaic window in UTM coordinates, click toggle button for Degrees	All

4 Configure SAR HAWK

As stated above, to view data in SAR HAWK, just launch the program, create a new project, and add data using the "Add Data" dialog, from the "Add Data" icon on the far left of the main toolbar. Default settings should be adequate. If you wish to change defaults, use the Configuration dialog, accessed from the **Configuration** icon on the main toolbar (Table 3). The user has the option to specify survey projection and offsets, units of measure, mosaic resolution and logging details, window layout, contact messaging and review of dongle and license properties. All of the options are saved as application settings. This section describes each tab in the Configuration dialog, and provides a tutorial.
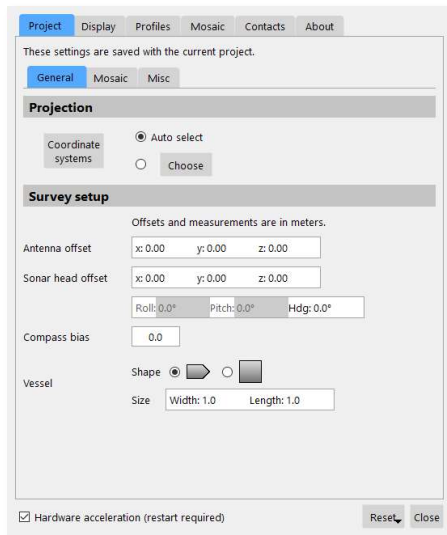
Figure 9. Configuration Dialog
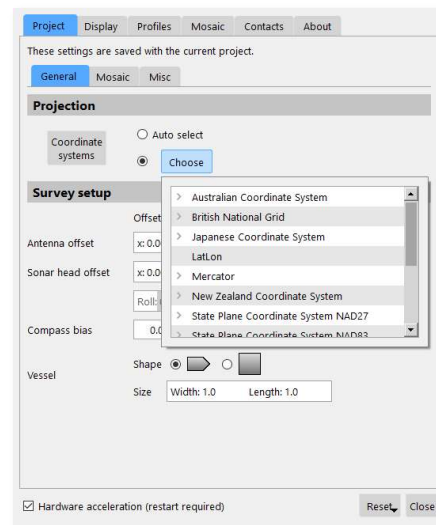
Figure 10. Projection Tab

4.1 Project Tab

The project tab allows the user to configure projected coordinate system and survey settings of the current project.

4.1.1 Projected Coordinate System

Most user will never need to adjust the coordinate system (SAR HAWK uses Universal Transverse Mercator (UTM) based on WGS-84 datum by default). If needed, an advanced user can adjust the projection for the mosaic display. Exported mosaic images projections can be set in the Projection panel in the Project tab of the Configuration window, before data are added to the project through playback or quick look (Figure 10).

Geek Warning! : UTM zones cover six degrees of longitude, run from 80° S to 80° N, are numbered from 1 to 60, and are lettered N or S according to the northern or southern hemisphere. Zone numbering starts at -180 degrees longitude (Midway Island, and the International Dateline) and increase to the east. Hawai'i, for example, is mostly in Zone 4, while the US East Coast is around Zone 18, and the United Kingdom is Zone 30, at Greenwich. The UTM zones are also available on the NAD27 and NAD83 datums.

The following projected coordinate systems are also supported in SAR HAWK: Australian Coordinate System, British National Grid, Japanese Coordinate System, Geodetic (lon/lat WGS 1984), Mercator (Equator), New Zealand Coordinate System, and the U.S. State Plane Coordinate System (NAD27 and NAD83). The list also includes User Defined coordinate system. However, the tool necessary to create user defined coordinate system is not available at the moment. SAR HAWK will support this in the future. If you would like to use a projection which is not supported, please contact OIC

SAR HAWK will project the sonar image and background charts on-the-fly to the coordinate system set in the Configuration window. You may only set the projection *before* data are added. Please keep this in mind when creating projects. To manually change the mosaic display projection from the default UTM WGS84:

> Click the **Configuration** icon.
> Select the Project tab in the Configuration window.
> In the Projection panel, choose the coordinate system by clicking on one in the **Choose** dropdown menu.
> Click outside of the **Choose** menu to hide the menu.
> Click **Close**.

As soon as data playback begins, the projection and UTM zone are locked for that project. If you would like to use a different projection or zone, please create a new project.

4.1.2   Transducer Offsets

By default, SAR HAWK assumes the GPS antenna and the side imaging transducer are at the same XY location on the boat (with the transducer in the water and the antenna in the air, of course). If this was not the case during your survey, you can adjust for the difference in position using an offset. Most users will only move the transducer position to the GPS Antenna.

The Survey setup panel in the Project tab in the Configuration window provides input fields for the vessel dimensions and translational and rotational offsets associated with the sonar, navigation, and heading sensors (Figure 11).

Figure 11. Survey Setup Panel

The fields are defined as follows.
- Antenna offset: the distance of the GPS receiver antenna from a reference point in common with the sonar head offset (usually, center of the boat). The numbering convention is:
  - X = Port / Starboard (positive number = starboard, negative number = port).
  - Y = Fore / Aft (positive number = fore, negative number = aft).

Z = Height (positive number = above reference point, negative number = below reference point).

- Sonar head offset: The transducer, also known as the sonar head - offset from a reference point in common with the antenna offset. The same numbering convention is used as for the antenna offset.
- Sonar heading offset: Humminbird uses course, not heading, so only used if transducer is known to be not mounted perfectly perpendicular to the ships keel.
- Pitch and roll offsets: Not used with Humminbird Data
- Compass bias: Not used with Humminbird Data

4.1.3   Bathymetry Mosaic

A single beam bathymetry mosaic is created from altitude meta-data(Figure 12). The default sampling rate is 2 Hz. Contour lines can be automatically added in real-time during mosaicking. Real-time contour generation settings are explained in section 7.4.3.
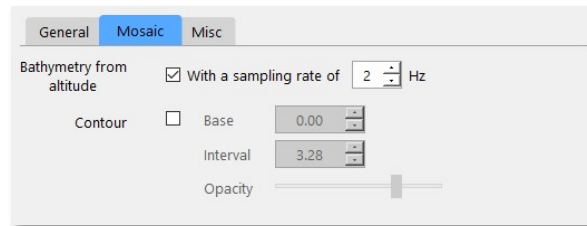
Figure 12. Bathymetry Mosaic Tab

4.2 Display Tab

Display tab contains General, Swath colormap, and Units of measure panels.

4.2.1   General

The General panel in the Display tab in the Configuration window allows the user to change UI appearance between normal and dark UI mode (Figure 13).

Figure 13. General Panel

To change the display appearance:
1. Click the **Configuration** icon.
2. In the General panel in the Display tab, check/uncheck the **Dark UI** box.
3. Click **Close**.

4.2.2   Swath Colormap

The Swath colormap panel in the Display tab in the Configuration window enables the user to change the swath display colors of default and mosaic in progress (Figure 14). During processing, SAR HAWK displays imagery data in the mosaic window and waterfall by matching pixel values to screen colors using the colormap. Changing the colormap may highlight different objects in the subsea environment.
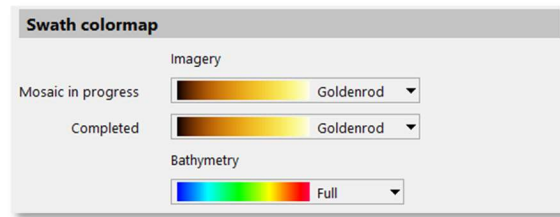
Figure 14. Swath Colormap Panel

The "Mosaic in progress" swath refers to the swath that SAR HAWK is currently mosaicking. The "Completed" swaths are those swaths that are completely mosaicked. "Bathymetry" swaths are swaths derived from altitude. SAR HAWK has nine built-in colormaps for imagery: goldenrod, copper, reverse gray, grayscale, bone, cool, green, hot, and jet (rainbow). Each colormap brings out different features of the data. There are five built-in colormaps for bathymetry: full, step, contour, legacy, and non-linear.

To change the colormap for swaths:
4. Click the **Configuration** icon.
5. In the Swath colormap panel in the Display tab, click the dropdown menu for the swath type and click the desired colormap.
6. Click **Close**.

4.2.3 Units of measure

Display units may be changed from the Units of measure panel in the Display tab in the Configuration window (Figure 15). Table 7 shows the parameter, available units, and affected display area.
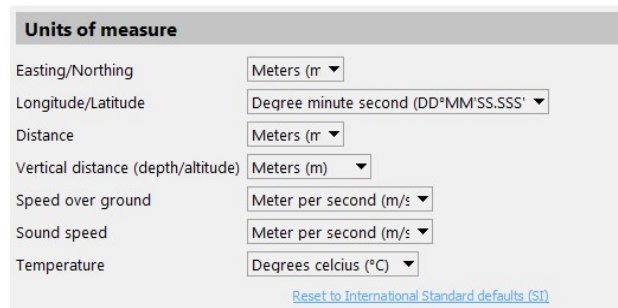
Figure 15. Units of Measure Panel

Table 7. Parameters and Units

Value	Units	Affected Display Area
Easting/Northing	Meters Feet Yards	Status bar
Longitude/Latitude	Degree minute seconds Degree decimal minutes Decimal degrees	Live Info Status bar Contacts
Distance	Meters Feet Yards	Contacts Measure Tool Survey Setup Waterfall Range
Vertical Distance (depth/altitude)	Meters Feet	Live Info Contacts

Value	Units	Affected Display Area
	Yards Fathoms	
Speed over ground	Meters per second Feet per second Knots	Live Info
Speed of sound	Meters per second Feet per second	Live info
Temperature	Degrees Celsius Degrees Fahrenheit	Properties

To change the units of measure:
1. Click the **Configuration** icon.
2. In the Units of measure subpanel in the Display tab, click the dropdown menu for any field and click the desired unit.
3. Click **Close**.

4.3 Profiles Tab

Profiles tab allows management of window size, position and layout profiles (Figure 16). To create a new profile, click **New Profile**. To rename profiles, select a profile then click **Rename** or double-click the profile name. To delete profiles, select the profile then click **Delete**. To edit the window sizes, positions and layouts, simply select a profile and move windows around until they are in the desired positions. Click on the corners of windows to expand or shrink their sizes. The layout is saved to the currently selected profile. Upon subsequent launches of SAR HAWK, the window layout may be restored by loading the corresponding profile. Loading of profiles may be done through the Profile tab or under the Display Options Icon in the main toolbar (Figure 17).
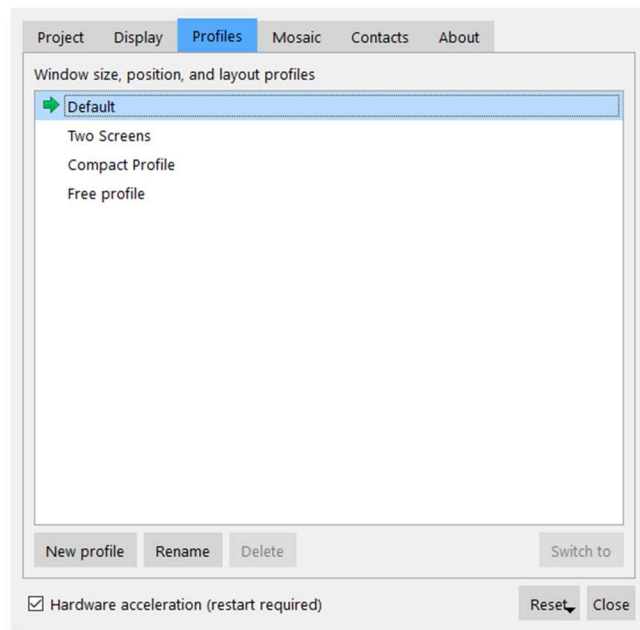
Figure 16. Profile tab
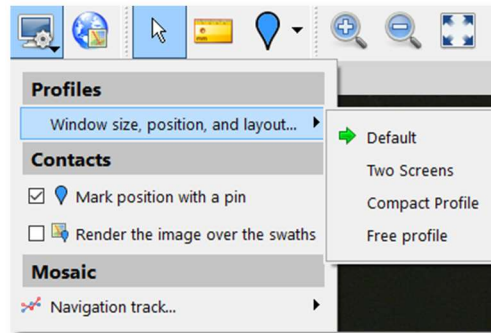
Figure 17. Loading Profiles via Display Options

4.4 Mosaic Tab

Mosaic tab provides options how SAR HAWK creates mosaic and data files.

4.4.1   General

General panel allows the user to change the default resolution of the imagery and bathymetry mosaic and how SAR HAWK starts a new swath (Figure 18). This sets the highest resolution of the imagery and bathymetry mosaics, but does not change the logged data. In this section you can also direct SAR HAWK to generate a new swath automatically if time gap between successive pings is greater than the user specified limit. This can be useful for automatically creating new swaths in file playback or loading.
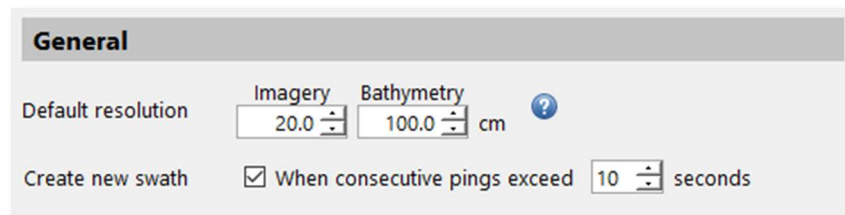
Figure 18. General Panel

4.5 Contacts tab

SAR HAWK can send contacts over the network or a serial connection. Each contact is sent as a proprietary NMEA sentence ($POIT) (Figure 19).
To send contacts:
1. Click the **Configuration** icon.
2. In the Contacts tab, click **Not configured** to configure the connections.
3. Open the Contact Viewer.
4. Select contacts.
5. Right click and select **Add contact(s) to staging table**.
6. In the staged toolbar, click on the **Send contact(s)** button.
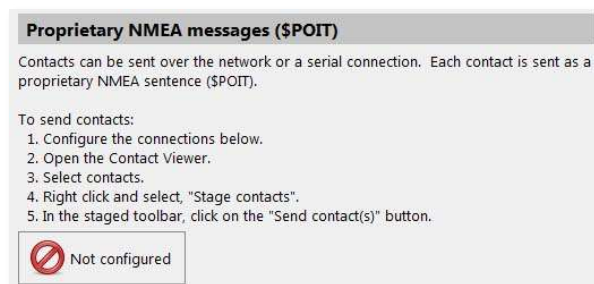
Figure 19. Contacts Tab

4.6 About

The about tab provides dongle license information, SAR HAWK version information and OpenGL information (Figure 20).
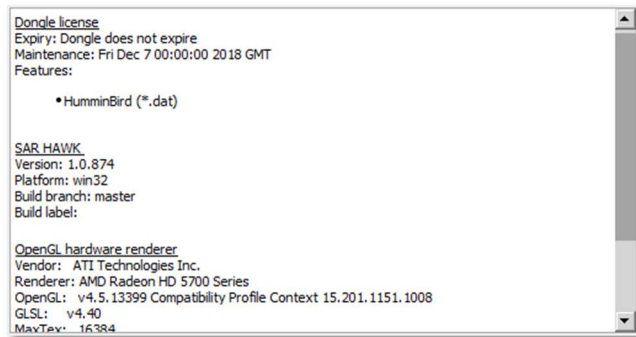
Figure 20. About Panel

If your license supports it, and if a newer version is available, it can be automatically downloaded from OIC's internet server by clicking the **Check for updates** button (Figure 21).
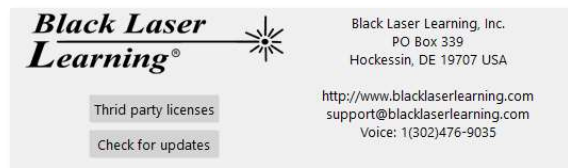
Figure 21. Update Panel

4.7 Rendering Method

Like many graphically oriented programs (Photoshop, Google Earth, etc) SAR HAWK can take advantage of a high-performance graphics card if your computer has one. We refer to this as "hardware rendering", and it just means SAR HAWK will run better, your images will look better, and come out quicker. SAR HAWK will automatically detect the presence of a high end graphics processor, and use that if it can. Regrettably, not all high end cards are stable, and some may from time to time over-heat and crash, If you do not have a GPU, SAR HAWK uses software rendering, meaning all the computations are done in software by the CPU, and SAR HAWK may run a bit slower. If you experience multiple crashes, you should see if software rendering alleviates the crashing.

Table 8 describes the two ways to change between software and hardware rendering, if you desire to override SAR HAWK's detected method.

Table 8. Change the Rendering Method

After launching SAR HAWK:	Upon the launch prompt:
1. Click the **Configuration** icon in the main toolbar. 2. Check/uncheck the **Hardware Acceleration** box. 3. Click **Close**. 4. Click the **Close** icon to close the project. 5. Click the **Close** button on the project selector screen to close SAR HAWK. 6. Relaunch SAR HAWK. 7. Reopen the project.	1. Click **Yes** or **No** to switch to software rendering or keep hardware rendering, respectively.

4.8 Reset Button

The reset button enables you to reset the window locations if somehow you get them scramble to a configuration you don't like (Figure 22). SAR HAWK remembers the last location of its windows between sessions. Click **Window position and sizes** from the **Reset** button dropdown menu to reset the windows. After clicking the button, you must close the project and then exit SAR HAWK. Launch SAR HAWK, and then the windows will be restored to their default location.
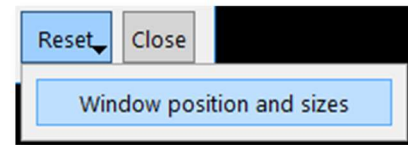
Figure 22. Window Position Reset

4.9 Configuration Tutorial

Table 9 provides instructions for configuring a project using the demo data and for data playback.

Table 9. Configure Project

To configure for playback mode with demo data:

1. Click the **Configuration** icon.
2. Click the Project tab.
3. In the Projection panel, leave the UTM zone set to **Auto select**.
4. In the Survey setup panel:
    • in the **Antenna offset** field, enter x:`0.00`   y: `0.00`   z:`0.00`;
    • in the **Sonar head offset** field, enter x: `-1.50` y: `0.00` z: `0.00`;
    • leave the **HDG** field set at `0.0`;
    • leave the **Compass bias** field set at `0.0`;
    • do not change the boat shape; and
    • in the **Size** field, enter Width: `3.0` and Length: `8.0`.
5. Click the Display tab.
6. In the Swath colormap panel,
    • leave the **Mosaic in progress** field set to Goldenrod; and
    • leave the **Completed** field set to Goldenrod..
7. In the Units of measure panel, visually confirm the **Distance** and **Vertical distance (depth/altitude)** fields are set to **Meters (m)**. Click the Mosaic tab.
8. In the General panel, set the **Default resolution** to 5.0 cm.

5 Charts and Background Images

SAR HAWK automatically adds background satellite images when connected to the internet. If you are an advanced user SAR HAWK allows you to load a wide variety of charts and geospatial data files as background layers in the mosaic window. The Chart Display Options window interfaces to the chart module, which is integrated with Global Mapper™ software.

This section describes the basic and advanced interface in the charts module, the differences between raster and vector data formats, how to retrieve National Oceanic and Atmospheric Administration (NOAA) Electronic Navigational Charts® (ENCs) the elements of the basic Chart Display Options window and the elements of the advanced Chart Display Options window. It concludes with a tutorial on how to load charts to the advanced interface and a table of commands for customizing the chart display.

5.1 Basic vs. Advanced Interface

The Chart Display Options dialog has a standard and advanced interface. In the basic interface, charts are added by file to the project. This manual loading method is also available in the advanced interface. The chart module saves manually loaded files to the project, not to the application. In the advanced interface, users have the additional capability to add charts by folder to the charts database, which are saved to the application. Files added by folder are then available in any SAR HAWK project. Both interfaces have the option of displaying the ArcGIS Web Mapping Service World Imagery basemap underneath locally added files. An Internet connection must be available for this option.

While Global Mapper supports rendering many different types of files, SAR HAWK has only been thoroughly tested with standard navigational chart types, shapefiles, and GeoTIFFs.

5.2 Retrieve NOAA Electronic Navigational Charts

If you do not have any nautical charts and believe they may exist for your work area, follow these instructions to retrieve NOAA charts for your state. Web sites do change, so we cannot guarantee that these instructions are current. Skip to section 5.3 if you already have charts.

1. Go to the NOAA Office of Coast Survey Chart Downloader Web site (http://www.charts.noaa.gov/?Disclaimer=noaa%21nos%40ocs%23mcd&Submit=Proceed+to+Chart+Downloader).
2. Next to the second picture, click on the ENCs link.
3. Click on your state in the **ENCs by State** table.
4. Read the User's Agreement. Click **OK**.
   - The charts automatically download to your browser's default download folder.
5. Open the folder containing the charts.
6. Right-click on the charts folder ([State initials]_ENCs.zip) and select **Extract All**.
7. Click **Browse**.
8. Navigate to a local disk or network drive to save the folder. Be sure to note the location where you save the file so that you can find it in the next step. (This is the location of your chart database that you will point to in SAR HAWK in the next section.)
9. Click **OK**.
10. Click **Extract**.

NOAA updates charts nationwide weekly via a notice to mariners. If you are using your charts for navigational purposes, make sure to get new charts or check for updates.

5.3 Elements of the Basic Chart Display Options Window

The basic chart display options window, launched by clicking the **Chart background options** icon in the toolbar, hosts the chart database list and several buttons. Figure 23 shows an empty chart database list in the basic window. The basic chart loader saves information on a per-project basis.
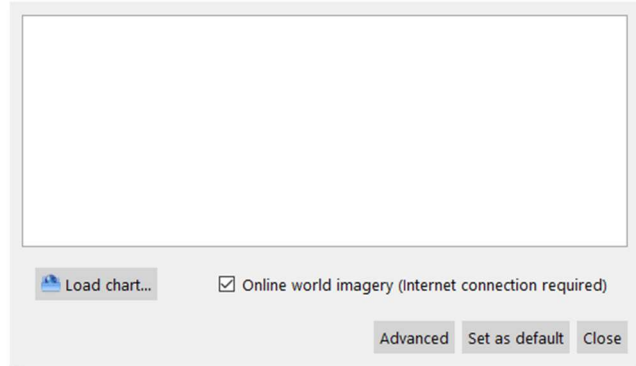
Figure 23. Empty Basic Chart Display Options Window

The basic chart display options window has a **Load chart...** button to load charts to the mosaic window, and provides the option to add the ArcGIS World Imagery basemap with an on/off checkbox. The **Advanced** button changes the chart display to the advanced interface, the **Set as default** button saves the current settings as the automatic chart display options to the application, and the **Close** button closes the Chart Display Options window. The next time the window is called, it will open to the last interface viewed.

To load charts or other geospatial data files to the chart database list:
1. Click the **Load chart...** button.
2. In the Manual Load Chart window, navigate to the file location of your saved charts (C:\SAR HAWK_DEMO\demo_data\charts).
3. Click on a file to select it (you may select multiple files).
4. Click **Open**.

5.3.1 Basic Chart Display Popup Windows

The Manual Load Chart window enables you to select any file type present in the folder you are viewing. This is because Global Mapper supports many different file formats. Geospatial data are often stored in more than one file. If you select a support file, not the file that SAR HAWK renders, you will be prompted to select the file format, as shown in Figure 24. This window appears whenever Global Mapper cannot tell what file type you have attempted to load.
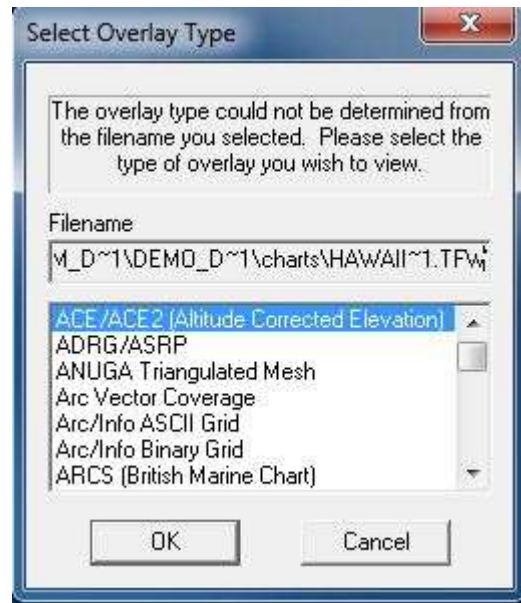
Figure 24. Select Overlay Type Error Message

If this window appears, you likely picked the wrong file type from a family of files sharing the same name, but with different file extensions. If you know you picked the correct file, then you can pick the file type from the list and click OK. If you are not sure,

1. Click **Cancel**.
2. In the chart database list, right-click on the orange Loading... file and click **Unload**.
3. Click the **Load chart...** button again.
4. Select all files of the same name in the family and click **Open**. SAR HAWK will load the correct one, and try to load the incorrect ones.
5. You may get the Select Overlay Type window again for the support files. Click **Cancel.**
6. Give SAR HAWK a moment to load the correct file (watch for one to turn green. The description will match the correct file).
7. Select all of the orange Loading...files (these will be the incorrect files from the family), right-click and click **Unload**.

If you choose to load a text file, you will be presented with the Generic ASCII Text File Import Options window (Figure 25).
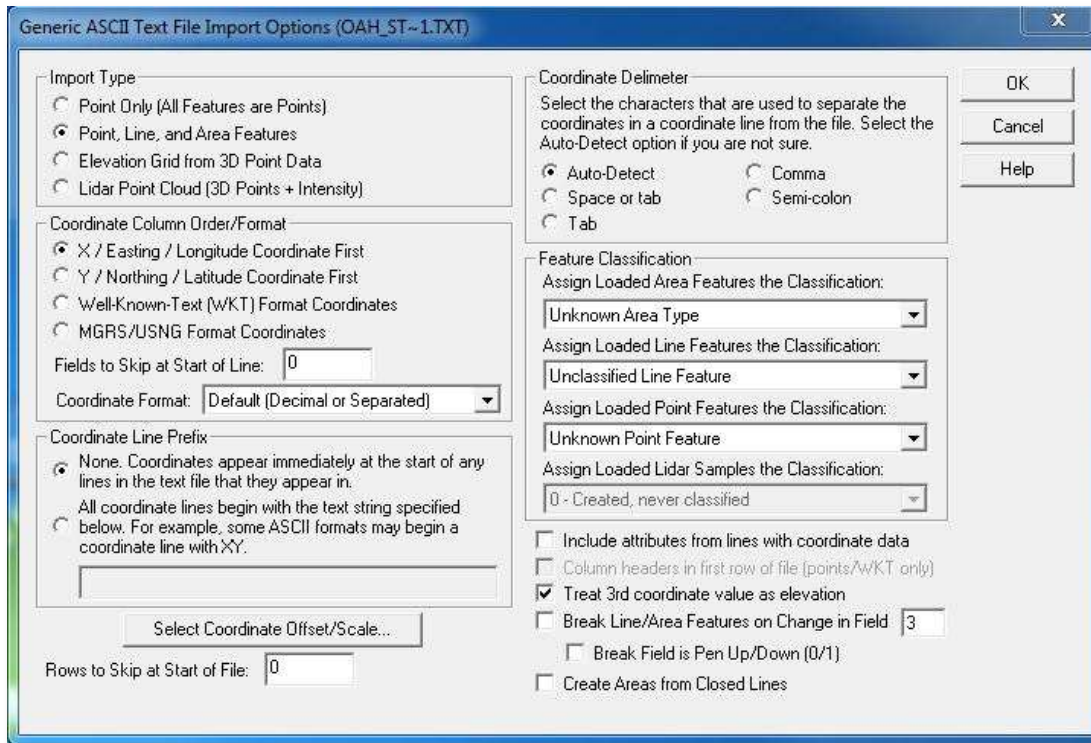
Figure 25. ASCII Text Import Options

If you accidentally loaded the text file, click **Cancel**, then unload the orange **Loading...** file in the chart database. If you intentionally loaded the text file, specify the format of the text file using the fields in the window. SAR HAWK will render two-dimensional point or point, line, and area files.

5.3.2 Using the Basic Chart Loader

Figure 26 shows the sample charts (ENC, RNC, air photo) loaded in the charts database.
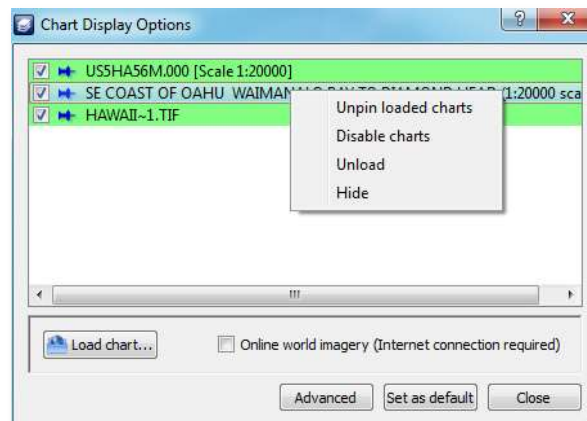
Figure 26. Charts Loaded in Basic Window, with Context Menu

The pin and green color coding are automatically displayed in the database table on any chart added manually, whether in the basic or advanced interface. The pin means that the chart cannot be unloaded by SAR HAWK's auto load function, a feature of the advanced interface. Green highlighting means that the chart is loaded in the mosaic display, whether through manual or automatic loading.

You can control which charts display in the mosaic window from the context menu, accessed by right-clicking on a file. The available commands follow.
- Unpin loaded charts: Allows the auto load function to recognize the chart.
- Disable charts: Prohibits rendering the chart, even if it is loaded.
- Unload: Removes the chart from the loaded list (and the basic interface).
- Hide: Hides the chart from the auto load function, but does not remove it from the database.

The ArcGIS World Imagery provides high-resolution worldwide coverage. It displays under the other layers. This service requires an Internet connection.
- To turn off the Web service, uncheck the box.

5.4 Elements of the Advanced Chart Display Options Window

The advanced Chart Display Options window is accessed by clicking the **Advanced** button in the basic Chart Display Options window. Many users find the Advanced Chart Display Dialog easier to use than the Basic dialog. From the advanced window, you can load a selection of charts and images by scanning folders for supported files; preview the files; and customize your chart display by configuring the auto load function, manually adding files, pinning files in the database, and turning the world imagery on and off. The folders added in the advanced interface are preserved between SAR HAWK projects, so a chart database can be built during first time use and will be available in all following SAR HAWK projects.
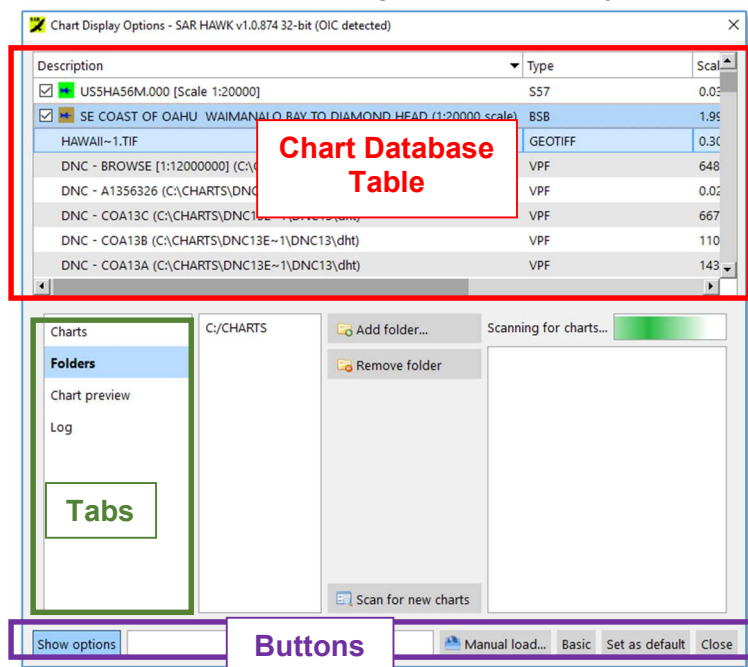
Figure 27. Chart Display Options Window upon Launch

The advanced window includes four tabs: Charts, Folders, Chart Preview, and Log. The chart database table, tab toggles, and buttons appear on every tab (Figure 27). The database table, appearing as the top panel, lists the geospatial data files that are present in the chart database you created as well as manually loaded charts. They are highlighted in every tab according to the legend appearing on the Charts tab. Unlike the basic window, the advanced table includes columns for the description, type, scale or area, and file path of each file. Files added by folder in the advanced window do not appear in the basic interface.

From the table, you can sort the table by column and select, unpin, disable, unload, and hide charts. The context menu features are the same as those available in the basic interface, except that when charts are unloaded, they do not disappear from the list.
- To sort by column, click on the column name.
- To resize the columns, click and drag on the border.
- To access the context menu, right-click on a chart.

5.4.1   Buttons
- The **Show options** button shows or hides the advanced interface tab content.
- The **Manual load...** button opens the manual load window.
- The **Basic** button toggles back to the basic chart display options interface.
- The **Set as default** button saves the current chart auto loading options and world imagery status as the default settings in the application.
- The **Close** button closes the Chart Display Options window. The next time the window is called, it will open to the last interface viewed.

5.4.2   The Folders Tab
The Folders tab enables you to populate the chart database from folders stored on your local hard drive or network. Figure 28 shows the add/scan charts panel of the Folders tab.
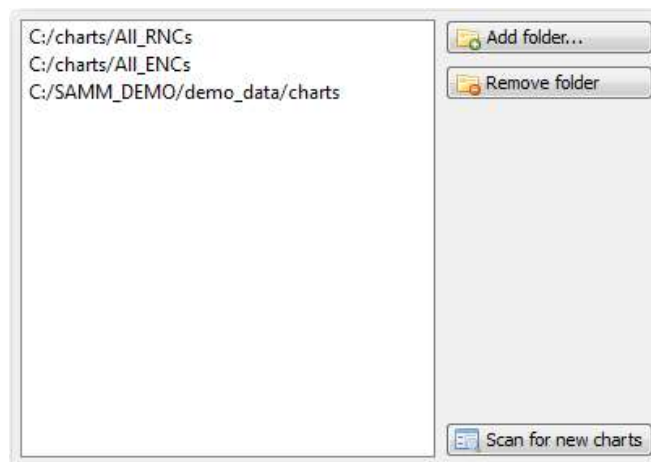
Figure 28. Add/Scan Charts Panel

- The **Add folder... button** allows users to browse to folders containing chart files and add them to the list of folders to be searched for charts.
- The **Remove folder** button removes files/folders from the add/scan charts panel. All charts located within the folder are removed from the database as well.

- The **Scan for new charts** button scans files from the listed folders and adds them to the database (and populates the database table). Press this after you add a folder.

Populating the Charts Database

Adding a chart to the database makes it available for use in future projects without having to manually add it. To do this:

1. Add folders: On the Folders tab, click the **Add folder...** button and navigate to the location holding the folder. Click on the folder to select it and click **Select Folder**. Add as many folders as you have containing relevant geospatial data. The scanning algorithm in the next step will recursively search inside all subfolders. For simplicity, consider saving all of your background layers in one main folder and add that folder to SAR HAWK. Take care to preserve the file structure of any acquired DNC folders, or the scanning algorithm may not recognize the charts. When the scanner finds a folder containing a file named LHT, it stops looking for compatible data because the LHT file means that it has found a DNC. Data that are not DNC data stored inside a folder with a DNC LHT file will be lost.
2. Scan folders: After you have added your main charts folders and your root DNC folders, select a folder in the list and click **Scan for new charts**. This process runs in the background so you may continue working in SAR HAWK, with the exception that adding another folder will stop the scanner (rescan the folder if this happens). The scanning function finds all files in the selected folder that are compatible for display in SAR HAWK.

Once SAR HAWK has scanned the folders, the available files appear in the database table (Figure 29). The auto load function in the advanced interface selects charts from this database to display.
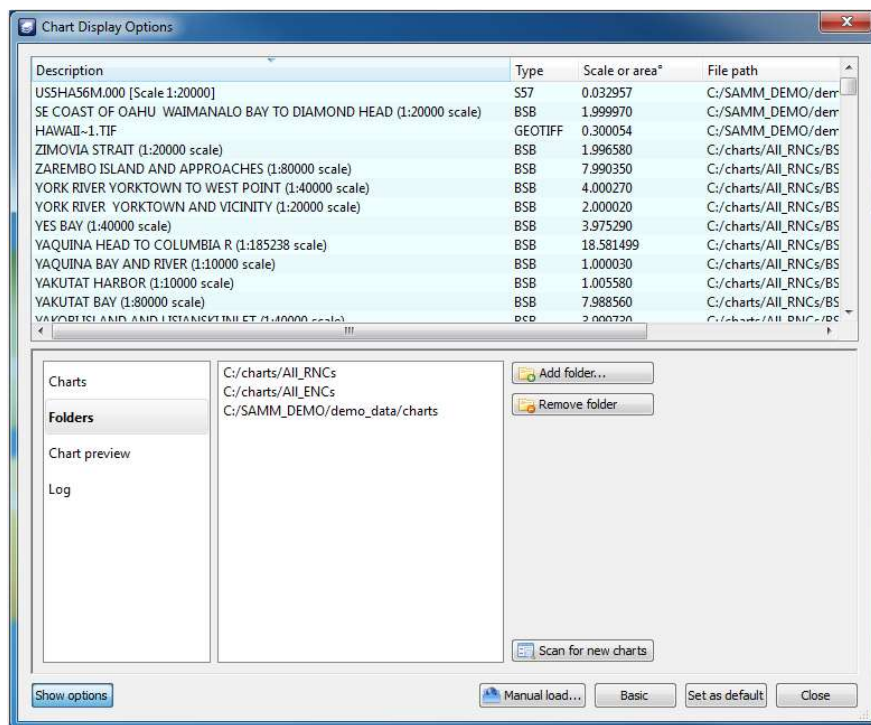
Figure 29. Populated Chart Database

5.4.3   The Chart Preview Tab

The previewing charts tab of the advanced interface enables viewing any chart in the database. This helps you get a feel for each type of chart file, if you are unfamiliar, and also shows you the geographic extent and level of detail present in each file. To preview a chart, click on the chart preview tab. The chart highlighted in the database shows in the viewing window. Click on a chart to highlight it. Resize the chart preview panel with a click and drag on the panel border.

5.4.4   The Charts Tab

The Charts tab is the default tab displayed (Figure 30).
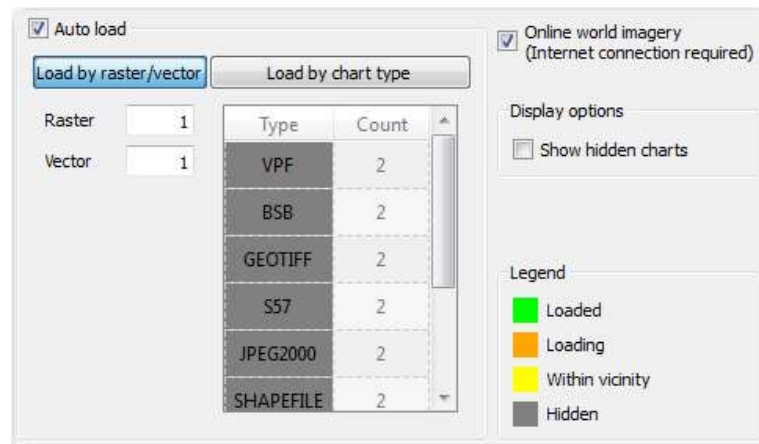
Figure 30. Charts Tab

By default, the **Auto load** and **Online world imagery** checkboxes are checked. The Auto Load option allows you to manually specify what type of locally available charts are loaded. The **Online World Imagery** option can make life very easy, by letting SAR HAWK just search the web for whatever it can find. If you don't like what it finds, or if it is taking too long, uncheck this option If you prefer to just use online imagery, and not have SAR HAWK look on your hard drive for local charts, uncheck **Auto Load**. The auto load feature loads the files from the chart database that most closely match the location of your current Humminbird data. Auto Load constantly looks for charts that satisfy its criteria, set in the **Load by raster/vector** and **Load by chart type** fields.

- The **load by raster/vector** feature loads charts up to the number entered per type of data file (raster or vector). Click in the **Raster** or **Vector** fields and enter a number to change the numbers.
- The **load by chart type** feature loads charts of the specific format up to the number per format (VPF for DNC, S-57 for ENC, BSB for RNC, GeoTIFF, shapefile, etc.). Formats are listed in the Type column as they are loaded to the chart database. *The list doesn't forget any file types loaded in all of SAR HAWK's history, so it may present file types that are not present in the database anymore. This happens when you unload the source folder.* Click in the types fields to enter the number per file type that the auto loader should load.

Toggle between the methods that the auto load algorithm uses to load charts by clicking on the buttons. The auto loader indicates which method is in use by highlighting the button in blue.

The display options and legend refer to the database table.

- The **Show hidden charts** box unhides files hidden from the table. It does not unhide them from the auto load algorithm. To do this, you must right-click on the chart and click **Unhide**.

5.4.4.1 Color Coding

SAR HAWK color codes the charts in the database so that you can see what charts will be rendered and what charts might be available for rendering. The legend is shown on the Charts tab, but the color coding is used on all tabs of the advanced interface. Only the green, loaded charts display in the basic interface.

Green

Charts that are loaded are bright green and will be rendered, unless they are disabled. (You may want to disable a chart, instead of unloading it, to prevent the autoloader from replacing it in the display.) Green charts were either automatically loaded because they meet the auto loader's criteria, or they were manually loaded through either

a. The **Manual load...** button, or
b. The **Load** command available on the right-click menu on a chart in the database.

Unless the database has been sorted, the green loaded charts always appear at the top of the list, in the order of smallest vector first, then higher resolution rasters.

Orange

Orange highlighting is transient. These charts are loading, so the orange indicates that SAR HAWK is actively loading them to the mosaic window. They will turn green when they are loaded.

Yellow

The yellow charts follow; these are yellow because they don't meet the auto-load criteria but intercept the mosaic window extent or they were manually unloaded using the **Unload** command from the database context menu.

The yellow charts are within the vicinity of the project, and are available to the autoloader if the auto load settings are changed. The charts are ordered using the same convention as the green ones, with vectors covering the smallest area first, then rasters of higher resolution. If the database is sorted, they will reorder according to the sort but this does not affect the display.

Gray

Hidden charts are highlighted in grey, when they are shown. They are hidden from the auto loader. You may toggle their display in the chart database on and off from the **Show hidden charts** checkbox under Display options on the Charts tab.

Manually Loaded vs. Folder Added Chart Behavior

SAR HAWK's chart loader determines how to treat a chart based on how it was loaded. You can force the manually loaded or folder added behavior using the context menu commands.

SAR HAWK's auto load algorithm either recognizes a chart in the database as suitable for loading, or it doesn't. If it doesn't recognize the chart, that chart file has either been pinned, so it can be rendered, or it is hidden, and it cannot be rendered. SAR HAWK automatically pins every chart that has been loaded manually, either in the basic interface or using the **Manual load...** button in the advanced interface. You can also pin any chart by right-clicking on it in the

database list and clicking **Pin Loaded Chart** (if the chart is already loaded) or clicking **Load** (to load the chart, which SAR HAWK then automatically pins), or double-clicking on the chart.

You can hide any chart from the auto load algorithm by right-clicking on it and clicking **Hide**. It disappears from the database list, but will display if you click the **Show hidden charts** box on the Charts tab. To reveal these charts to the auto load algorithm, you must right-click on the hidden chart and click **Unhide**. If you click **Load** on a hidden chart, it will load it and then pin it. It will still be hidden from the algorithm, but will then be available for rendering.

Charts added through a folder (and therefore added to the charts database) will not be available in the basic interface, unless you manually pin them or the autoloader has loaded them. The autoloader looks at these charts in order to find charts suitable for rendering.

Every loaded chart has the option to be disabled, or to prevent it from rendering without hiding it. This keeps the chart in the loaded station, which means the autoloader counts it as a loaded chart, but the chart does not render.

5.4.5   The Log Tab

The log tab reports errors in the chart module, including the database, scanner, and renderer.

5.5 Advanced Chart Loader Tutorial

There are three ways to display background content in the mosaic window using the advanced interface. To load background layers in SAR HAWK, follow the steps in Table 10.

Table 10. Load and Display Charts

To auto load files from folders:	To load Web-hosted content:	To load individual files:
1. Click the **Chart background options** icon in SAR HAWK's toolbar. 2. Click the **Advanced** button. 3. Click the **Folders** tab. 4. Click **Add Folder**. 5. Navigate to and click the folder containing charts or geocoded files. 6. Click **Select Folder**. 7. Click **Scan for new charts**. 8. Click the **Charts** tab. 9. Ensure the **Auto load** box is checked. 10. Click **Close** to exit the window.	1. Click the **Chart background options** icon in SAR HAWK's toolbar. 2. Click the **Advanced** button. 3. Stay on the **Charts** tab. 4. Ensure the **Online chart** box is checked. 5. Click on the type of map or imagery you want to select it. 6. Uncheck the **Auto load** box (for the playback tutorial). 7. Click **Close** to exit the window.	1. Click the **Chart background options** icon in SAR HAWK's toolbar. 2. Click the **Advanced** button. 3. Stay on the **Charts** tab. 4. Click the **Manual load...** button on the bottom of the window, next to the **Close** button. 5. Navigate to and click the chart (or other geocoded files). 6. Click **Open**. 7. Click **Close** to exit the window.

5.6 Chart Customization Commands

The features for customizing the chart display are collected in Table 11 with the methods available to execute the commands.

Table 11. Chart Customization Commands

Command	Action
Select chart	• In the chart database table, click or right-click on the chart.
Select multiple adjacent charts	• In the chart database table, click on the first chart, hold Shift, and click on the last chart.
Select multiple non-adjacent charts	• In the chart database table, click on the first chart, hold Ctrl, and click on each subsequent chart.
Hide charts from chart database table	• In the chart database table, right-click on the chart and click **Hide**.
Show hidden charts in chart database table	• In the display options and legend panel of the Charts tab, click the **Show hidden charts** checkbox.
Unhide hidden charts	• After showing the hidden chart, in the chart database table, right-click on the charts and click **Unhide**.
Turn hide/unhide a chart from the auto loader while keeping the chart loaded	• In the chart database table, right-click on the chart and click **Pin loaded chart/Unpin loaded chart**.
Unload manually loaded chart from the chart database table	• In the chart database table, right-click on the chart and click **Unload**.
Enable/Disable forced display of a loaded chart in the mosaic window	• In the chart database table, check/uncheck the box next to the chart. • In the chart database table, right-click on the chart and click on **Disable charts** or **Enable charts**.
Restrict the auto load feature to a certain number of raster/vector charts	• In the auto load panel of the Charts tab, ensure the **Auto load** box is checked, then enter the number of raster charts in the **Raster** field and the number of vector charts in the **Vector** field.
Restrict the auto load feature to a certain number of charts by chart type	• In the auto load panel of the Charts tab, ensure the **Auto load** box is checked, then click the **Load by chart type** button and enter the number of each type of chart in the chart type fields.
Turn the world imagery on/off	• In the online chart panel of the Charts tab, ensure the **Online chart** box is checked and click on the desired service (imagery, topography, weather).
Disable the auto load function	• In the auto load panel of the Charts tab, click the box next to the **Auto load** field to uncheck it.
Set the current settings as default	• In the display options and legend panel of the Charts tab, click the **Set as default** button.
Preview the chart	• In the chart database table of the Chart preview tab, click on the chart.

5.7 Loading a xyz file as background bathymetry

Background bathymetry can be created from xyz files. When manually loading a chart, simply choose a xyz file to bring up the xyz option window (Figure 31).

5.7.1   File path

File path displays the file path to the currently selected xyz file.

5.7.2   Projection

You may use the current projection for the currently loaded mosaic. If there is no projection selected, you may manually select the correct projection using the Select projection button.

Figure 31. Load XYZ Options

5.7.3   Point distance threshold

This slider sets the minimum distance between points with which to create bathy data.

5.7.4   Chart type

Choose to create background bathy comprising of gridded data, contours, or gridded contours. Using gridded data will create a background chart with colored bathy. Contours will create a background chart with contour lines. Gridded contours will create a background chart with both colored bathy and contour lines.

5.7.5   Z-sign convention

Specify the z-sign convention of the xyz file you are loading. You may open the xyz file in a text editor to find out which z-sign convention to use.

5.7.6   Contour line interval

Specify the interval between contour lines.

5.7.7   Smooth lines

Applies smoothing to the generated contour lines.

6 Add Data Files

SAR HAWK can mosaic data in playback or quick look modes. To mosaic data properly, SAR HAWK accesses two classes of data: the sonar data itself and metadata. When in playback or quick look mode, SAR HAWK gets these data from the raw data files

This section describes how to start a project in quick look or playback mode by adding data files to the project. The Add data dropdown menu (Figure 32), accessed by clicking the **Add data** icon, which is found at the left most position of the main tool bar.
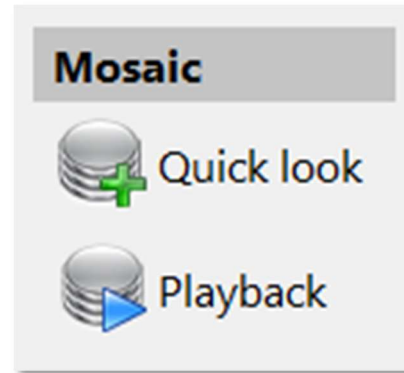
Figure 32. Add Data Dropdown Menu

6.1 Add Files in Playback or Quick Look Mode

Humminbird data files consist of a .DAT file and a folder of the same name as the .DAT file which contains .IDX and .SON files. Table 12 lists the known .IDX and .SON file data types. SAR HAWK only requires B002 and B003 files to properly function. If the .DAT file, B002, or B003 files are missing or corrupt, SAR HAWK will not be able to load the data. Although the data is properly structured, in some cases the user may have to manually create the expected file structure (Figure 33 and Figure 34).

Table 12. Data File Types

Filename	Data Type
B001.IDX, B001.SON	Fathometer data
B002.IDX, B002.SON	Port side imaging data
B003.IDX, B003.SON	Starboard side imaging data
B004.IDX, B004.SON	Downview data
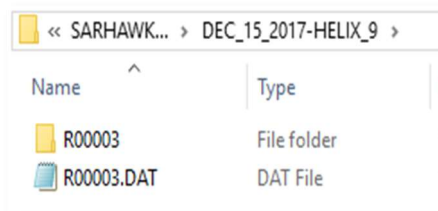
Figure 33. DAT File Folder Structure
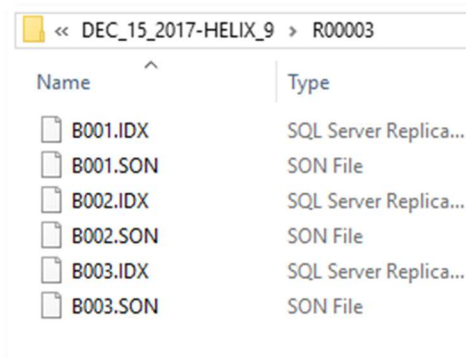
Figure 34. DAT File Folder Contents

6.1.1 Quick Look

Quick Look allows the user to select data files and quickly generate a mosaic without viewing the data. The resulting mosaic can be composed of numerous swaths, each of which is created from raw data files that are continuous in time. Therefore, if the data files were continuously recorded throughout the survey, the mosaic will have only one swath. If the data logging was paused during turns, the mosaic will have the number of swaths equal to the number of survey lines.

To load data files for quick look mode:
1. Click the **Add data** icon.
2. Click **Quick Look**.
3. Navigate to the directory containing the .DAT file.
4. Select .DAT file you wish to load.
5. Click **Open**.
6. Before starting, you may adjust any processing options (Figure 35).
7. Click **Start** and monitor file loading progress in the status bar on the bottom right. The swaths display when all files are loaded.
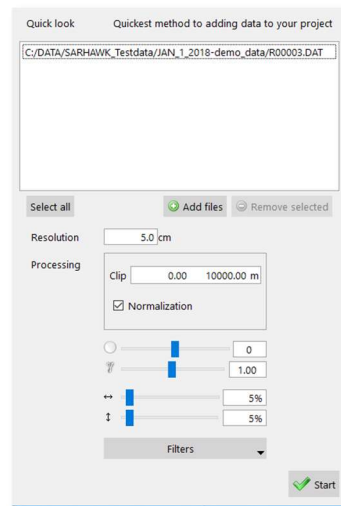
Figure 35. Quick Look Processing Options

6.1.2 Gridded Text Format Quick Look

Gridded text format data in xyz or csv format is also supported.

To load xyz or csv files for quick look mode:

1. Click the **Add data** icon.
2. Click **Quick Look**.
3. Navigate to the directory containing the .xyz or .csv file.
4. Select file you wish to load.
5. Click **Open**.
6. The Easting, Northing, and Altitude fields will be populated with the data from the chosen file.
7. Before starting, you must confirm the Projection, Units of measure, Field separator, and z sign convention. You may also select to skip the first line of the file. (Figure 36).

Click **Start** and monitor file loading progress in the status bar on the bottom right. The swaths display when all files are loaded.
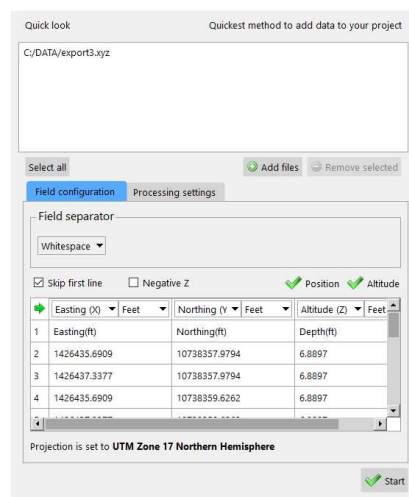
Figure 36. Gridded Text Format Quick Look

6.1.3 Playback Files

Playback files option allows the user to replay the survey and watch mosaic being created with user inputs such as breaking the swath at line turns and marking targets.

To Add data for playback mode:
1. Click the **Add data** icon.
2. Click **Playback**.
3. Navigate to the directory containing the .DAT file.
4. Select .DAT file you wish to load.
5. Click **Open**.
6. Verify or adjust processing controls as needed (Figure 37).
7. Click the **Start** button on the playback controls (Figure 37). The survey playback begins and mosaic starts to build up.
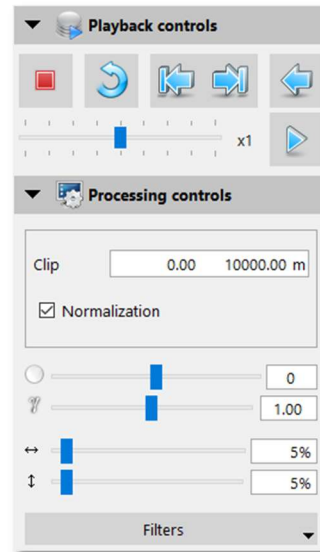
Figure 37. Playback and Processing Controls

7 Display and Processing Settings

SAR HAWK has display options which enable you to control how your sonar display and mosaic appear. These settings control some elements of the GUI, like the mosaic window and the live info feeds, or the data display. In the section, we describe how to:

- adjust the mosaic window display;
- manage swaths using the Swath list;
- control playback;
- toggle the display units;
- adjust the post-processing rendering options.

7.1 Adjust the Mosaic Window Display

By default, the bounds and content of the mosaic window are set by the user providing data, either in playback or load. The GUI allows control of the content and geographic boundaries of the mosaic window. This manual described how to load background content (charts and imagery) into the mosaic window in Section 5. Table 13. Mosaic Window Extent Commands lists available commands to adjust the extent and behavior of this window and how to execute the commands.

Table 13. Mosaic Window Extent Commands

Command	Action

Zoom in	- Zooms in to the cursor position.
	   - Roll the mouse wheel away from you.
	- Zooms in to center.
	   - Press the + key.
	   - Use a two finger scroll toward you on a laptop track pad.
	   - In the toolbar, click the **Zoom in** icon.

Zoom out	- Zooms out from the cursor position.
	   - Roll the mouse wheel toward you.
	- Zooms out from center.
	   - Press the - keys.
	   - Use a two finger scroll away from you.
	   - In the toolbar, click the **Zoom out** icon.

Zoom to the extent of the survey	- In the toolbar, click the **Reset View to the Entire Survey** icon. - Press the spacebar.
Center view on sensor and track it	- In the toolbar, click the **Auto adjust the display to follow the sensor** icon.
Pan	- Click anywhere in the mosaic window and drag your mouse.

7.2 Manage Swaths

SAR HAWK lets you manage swath layers during playback and in post-processing mode. The Swath list controls layering in the mosaic window. The commands that fit into the swath management class are listed in Table 14. Swath Management Commands, with directions for execution. Please keep in mind that these commands do not affect the raw data in any way.

Table 14. Swath Management Commands

Command	Action
Turn off in mosaic window	• Click the box next to the name to uncheck it.
Turn on in mosaic window	• Click the box next to the name to check it.
Rename	• Click the name to select it, then click it again to activate keyboard input. Enter the new name.
Bring forward/Send backward	• Click the name to select it, then drag to the desired layering position in the list.
Delete	• Click the name to select it, then click the **Delete** button.
Change properties	• Click the name to select it, then click **Display selected swath properties** to open the Swath properties window. **Contrast** and **Opacity** in the Rendering controls panel can be modified.
Select multiple consecutive swaths	• Click the first swath to select it, then hold Shift and click the last swath.
Select multiple nonconsecutive swaths	• Click the first swath to select it, then hold Ctrl and click the other swaths.
Display full swath name	• Click Toggle full swath name view to expand the Swath list window

7.2.1   Swath Management and Playback Tutorial

These steps demonstrate most of the swath management and playback features. Follow along using the demo data in playback mode, checking the results on your screen against the bulleted results. Launch SAR HAWK, create a new project, and add data from the demo_data folder in playback mode (the example uses the R00004 demo data.)
1. Click Add Data, and choose Playback.
2. Choose the R00004.dat file and click open.
3. Click Play.
4. In the Swath list, click the checkbox next to R00004.DAT.
   • The swath turns off in the mosaic window.
5. Click the checkbox again.
   • The swath shows in the mosaic window.
6. Using the playback controls, click **Pause**.
   • The vessel, live info feed, and file loading progress freeze.
7. Click **Play**.
   • The vessel starts moving again.
   • The Live info feeds update.
8. Drag the **Speed** slider bar to the left.
   • The vessel slows down.
9. Drag it to the right.

- The vessel speeds up.
10. Drag the speed back to the middle (`x1`).
    - The vessel returns to the normal speed.
11. Wait until the vessel turns. Then, in the toolbar, click the **Manually start a new swath** button. Wait until the vessel turns again, then press **Pause**.
    - `R00004.DAT_2` appears in the Swath list above `R00004.DAT`.
12. Turn the `R00004.DAT` swath on and off. Pay attention to what it looks like.
13. In the swath list, click the `R00004.DAT` swath and then drag it to the top of the list.
    - The first swath is layered over the current swath.
14. Turn off the first swath.
    - The entire current swath is now visible.
15. In the main toolbar, click the **Record** icon then press **Play.**
    - The boat moves without painting a swath underneath it.
16. Click **Record** again.
    - SAR HAWK resumes mosaicking and begins a new swath.
17. Click on the `R00004.DAT` swath and then click **Delete**.
    - The swath disappears from the mosaic display. This does not affect the raw data (the files in the folder that you added), but the swath is gone from this particular project unless you add the source data file again.
18. Click on **Pause**. Click on the `R00004.DAT_2` swath, then press **F2**. Enter `Second Swath`.
    - The name changes to `Second Swath`.

7.3 Toggle Display Units

Display units of parameters may be changed from the Configuration window. Section 4.2.3 described how to set the initial display units. This section provides a tutorial to supplement Section 4.2.3.

7.3.1 Display Units Tutorial

This tutorial shows how to change position units from the Configuration window and toggle position formats in the status bar.
1. Click the **Configuration** icon.
2. Click the Display tab.
3. Select **Degree minute second** from the **Longitude/Latitude** dropdown box.
    - The position fields in the Live Info feed change to degree minute seconds.
    - The cursor position unit correspondingly changes in the bottom right of the status bar.
4. Click the **Reset to International Standard (IS) units** button to reset the default settings.
5. Click the **Toggle between Lon/Lat vs. Easting/Northing** icon to the far right of the status bar (Figure 38).
    - The units toggle between GPS WGS 1984 Longitude and Latitude coordinates in the format set from the Configuration window and Universal Transverse Mercator coordinate meters.

Figure 38. Status Bar Position Units

7.4 Apply Imagery Processing Options

You can process sonar data by clipping the sonar image range or adjusting the rendering options. These features do not affect the raw data in any way. SAR HAWK's processing options are fully available in playback and quick load modes.

7.4.1   Processing Controls

When in playback mode, the imagery processing options are available in the Processing controls panel on the sidebar (**Error! Reference source not found.**). The processing options are as follows.

- Clip: Adjusting these values trims the SI data to the specified minimum and maximum ranges.
- Normalization: Attempts to automatically correct image gain and contrast to make targets easier to see.
- Contrast: The brightness and gamma rendering options change the intensity and emphasis on light or dark tones in the imagery, respectively.
- Feathering: Adjusting the feathering value controls how the imagery is blended together in the coverage map (mosaic) where images overlap. A value of 0% will create a sharp boundary at the overlaps, and increasingly higher values will cause more blending.
- Filters: Navigation, Heading and Altitude data can be smoothed by applying De-spike and Smoothing filters.
- Bathy Beam Width: Adjust the Beam width in degrees on the Bathy tab.(Figure 40)
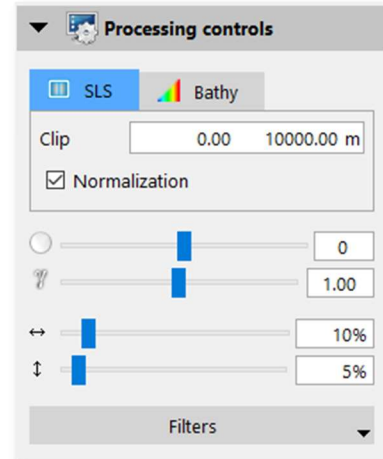
Figure 39. Imagery Processing Options
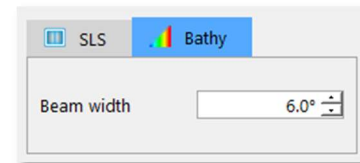
Figure 40. Bathy Processing Options

Note that processing options in the Processing controls on the sidebar are applied to the currently playing swath only.

7.4.2   Swath Properties

Imagery processing and display options are available for the swaths that are already mosaicked from the **Properties** button on the Swath list To open the window, select swath(s) in the Swath list and then click **Properties (the tool icon below the swath list)**. *At this time, contrast and opacity are the only available features.* Save the settings by clicking **OK** before moving to the next swath.
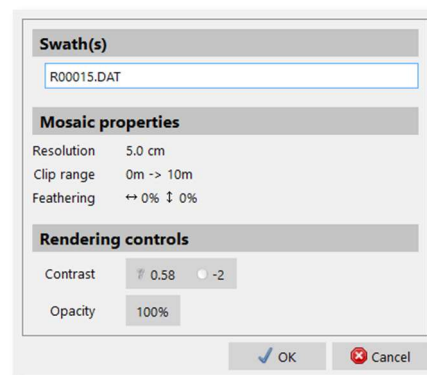
Figure 41. Swath Properties Window

7.4.3   Bathymetry Properties

In the top right corner of the Mosaic View window you will find the bathymetry legend. This legend displays the current bathymetry colormap as well as the minimum and maximum values. The bathymetry inherits the units of measure as specified in the configuration panel under Vertical distance. (Figure 42)

Figure 42. Bathymetry legend

To configure the minimum and maximum values for the bathy legend, simply click on the bathymetry legend to bring up the bathymetry legend options. Using this dialog window, you may set the bathymetry colormap, minimum and maximum values. (Figure 43). To configure real-time contour lines, check the Contour checkbox and adjust the Base, Interval and Opacity settings. Base value refers to the depth where the first contour will be generated. Interval refers to the interval at which additional contour lines are generated. Opacity adjusts the transparency of the contour lines.
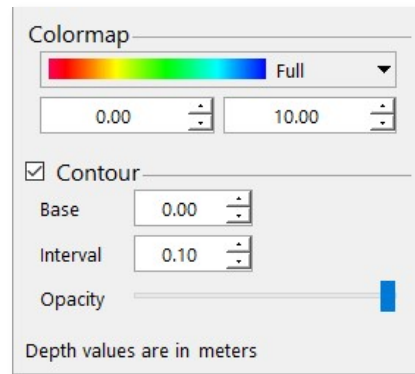
Figure 43. Bathymetry legend options
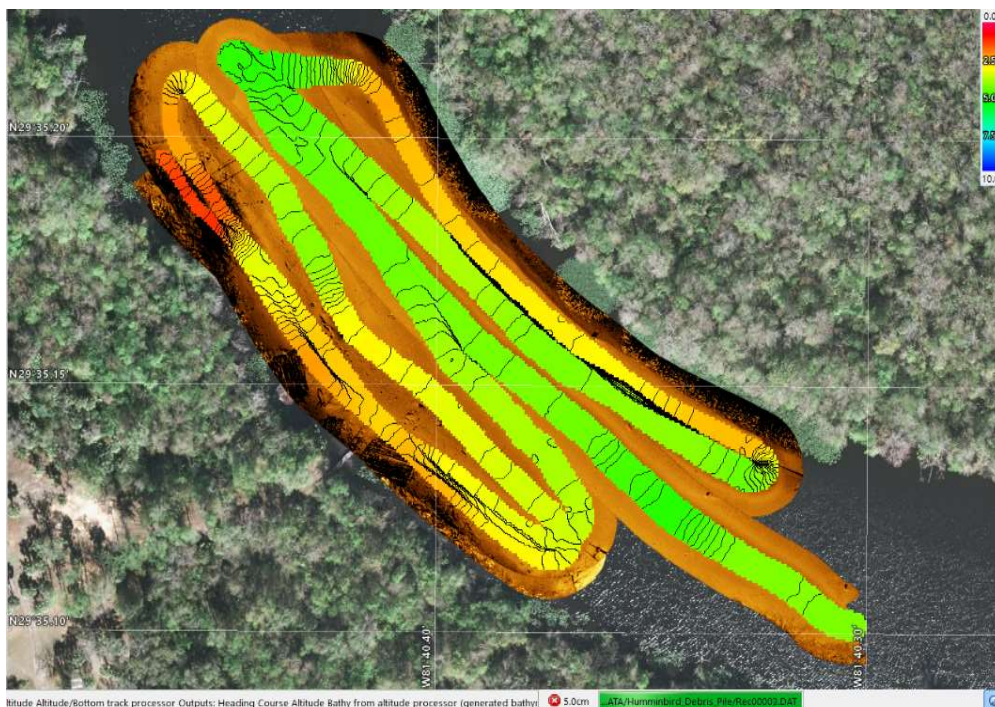
Figure 44. Example: Bathy from existing altitude layered over Side Imaging and real-time contours

7.4.4   Bottom Tracking

For sidescan data processing, bottom tracking is required to remove the water column record from the data in order to produce a seamless sidescan mosaic (a.k.a Slant Range Correction). By default, SAR HAWK uses recorded altitude values for bottom tracking. If the altitude data is noisy, adjust the despike and smoothing filters for altitude in the Processing Controls panel on the sidebar. You can manually override the altitude data using the Bottom Tracking tool in the Waterfall window. Click the Bottom Tracking button to activate the tool and select Prefer recorded, Manual or Auto bottom track.

- **Prefer recorded**: Default mode. The altitude packets from the device or files will be used. Auto bottom track will be turned on if no altitude data was detected during scan.

- **Manual**: Click within the Oscilloscope or Waterfall window to set and override the altitude.

- **Auto bottom track**: SAR HAWK will automatically detect and track the bottom. If the resultant tracking is noisy, adjust the despike and smoothing filters for altitude in the SLS Processing Controls panel on the sidebar.

7.5 Other Display Options
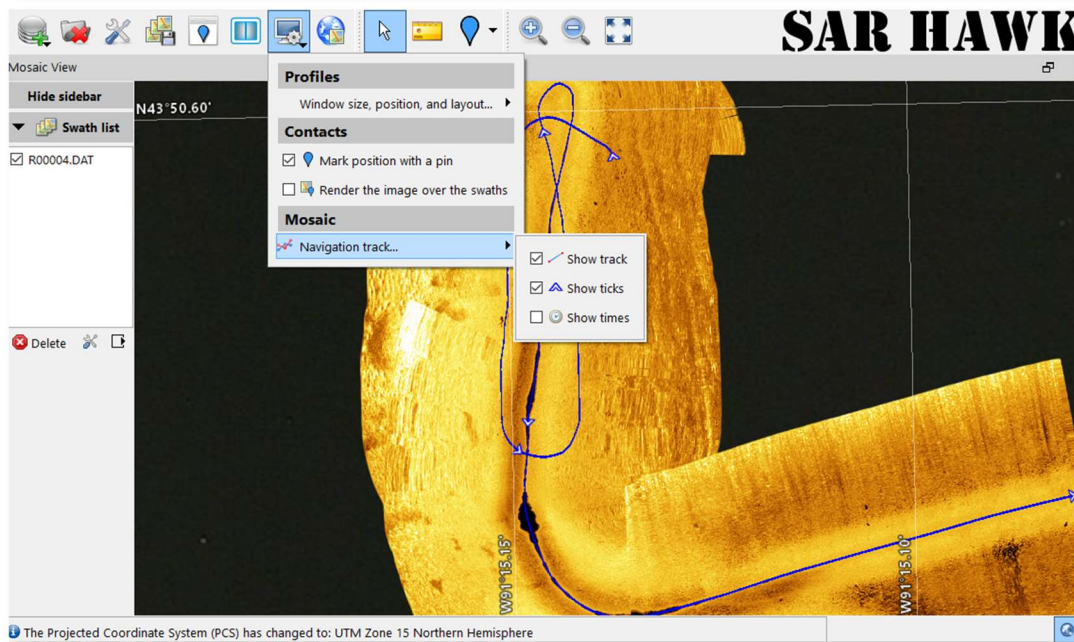
Figure 45. Display Options Dialog with Navigation Track Options

Select the "Display Options" icon on the toolbar to access the Display Options Dialog (Figure 45).

The Display Options Dialog supports options for visual features in the mosaic window. The Contacts section allows you to engage or disable marking of contact marks with a "push-pin" icon, and to turn on or off plotting of the actual target snippets over the mosaic. These options do NOT delete targets; unselecting them just de-clutters the mosaic display.

The Navigation Track options allow you to:
> Toggle on and off the display of the sensor navigation track
> Toggle on or off "Tics" to indicate direction of travel
> Toggle on or off display of time fix associated with navigation positions.

None of these options in any way affect either the mosaic or the raw data, just the display.

7.6 Imagery Processing Tutorials

Trimming Tutorial

This example shows how to apply the trimming filters. The observable effect of each function conveys more information than words, so make sure you are comfortable with how the default view looks before proceeding. If SAR HAWK is not already playing data, as before, launch SAR HAWK, create a new project, and add data from the demo_data folder in playback mode (the example uses the file R00004.DAT) and press "Play". Increase the playback speed to 16x and wait until the end of the file.

1. In the Processing controls panel under Clip enter values of 2m and 15m. Press the "Seek start of file" button. Hide the R00004.DAT swath.
   - The first 2 meters of data on the port and starboard are clipped, as well as anything past 15m.
2. Uncheck Normalization. Press the "Seek start of file" button.
   - Hide and unhide the R00004.DAT_3 swath to see the effect of normalization.

Rendering Tutorial

This tutorial walks you through changing some of the rendering options available in SAR HAWK. The rendering options include changing the colormap, and the contrast, opacity, and feathering values.

1. Click the **Configuration** icon in the toolbar.
2. In the Swath colormap panel in the Display tab, select **Reverse Gray** from the Mosaic in progress dropdown menu.
   - The mosaic in progress swath changes to a greyscale where objects are light and object shadows are dark.
3. Change it back to **Goldenrod** and click **Close.**
4. In the Processing controls on the sidebar, drag the Brightness slider bar to the left and right.
   - Watch the intensity of the waterfall and mosaic change for the entire swath currently being mosaicked (Figure 46).
5. Drag the Gamma slider bar to the left and right.
   - Changing the gamma value enhances light or dark tones (Figure 46).

	Gamma: 1.00	

Brightness: -25	Brightness: 0	Brightness: 25
	Brightness: 0	
Gamma: 0.50	Gamma: 1.00	Gamma: 1.50
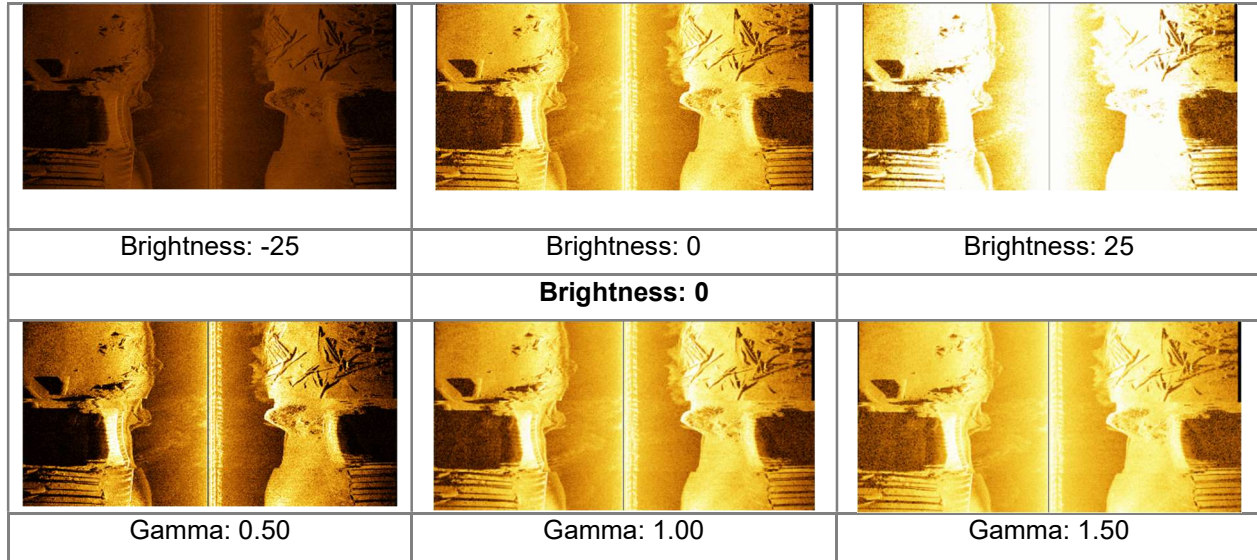
Figure 46. Brightness and Gamma Rendering Effects

6. Drag the Feathering slider bars to the left and right.
   - Adjusting the horizontal feathering varies the sharpness of port and starboard boundaries at overlapping swaths, while adjusting the vertical feathering affects the clarity of the entire image (Figure 47).
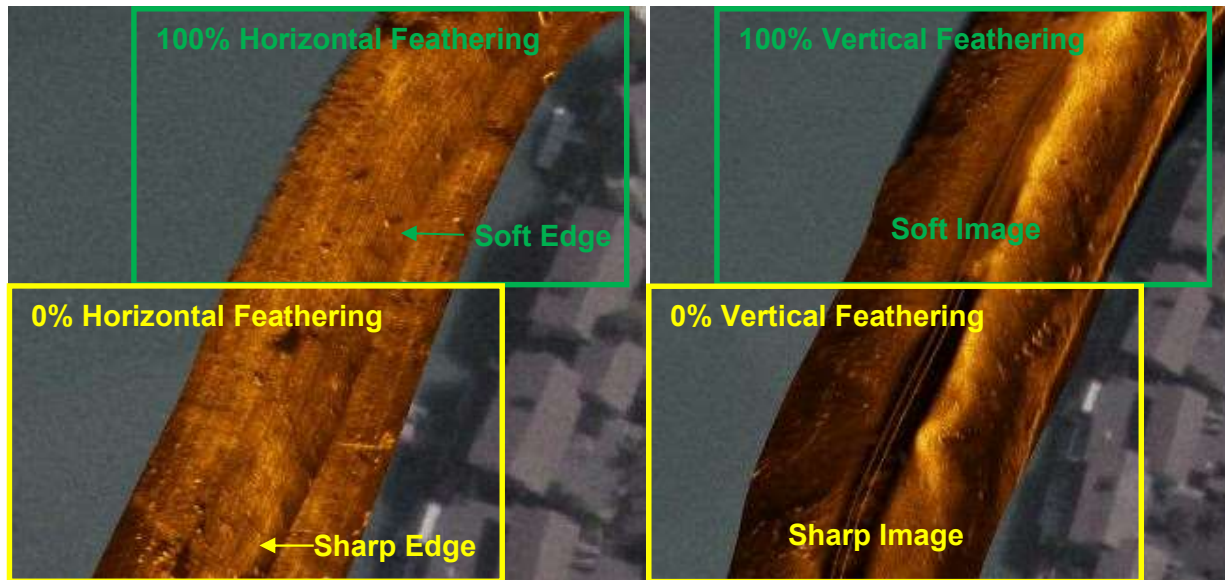
Figure 47. Feathering Effect

7. In the Swath list, select the swath that is currently being mosaicked and click the Display selected swath properties button.
8. Click the **100%** button next to Opacity and drag the slider bar to the left and right.
   - Transparency of the swath in the mosaic window changes with the slider.

8 Working with Contacts

SAR HAWK supports marking "contacts" from the raw data in the waterfall display, as well as from the processed and mosaicked swaths. One benefit of post-processing data is enhancing the imagery sufficiently to maximize detection of contacts. For contacts marked in SAR HAWK, SAR HAWK stores the location, sonar image, and other properties. SAR HAWK enables enlargement, enhancement, measurement, and classification of these contacts in the Contacts window or database. In addition, SAR HAWK can export contact images and associated user-supplied information in an *.html or *.xml report.

This section describes the contact analysis workflow and the elements of the Contacts window as they are used in the process. It concludes with a brief tutorial to guide interaction with SAR HAWK's contact features. The general contact workflow is to:

1. Set contact marking options
2. Mark contacts
3. Adjust the contact display
4. Attribute, or provide data about, the contacts
5. Organize the contacts
6. Export a contact report
7. Optionally, broadcast contacts to a remote NMEA compatible plotter.

8.1 Contact Marking Options

There are several options which will affect the imagery captured for marked contacts (Figure 48 and Figure 49). Table 15 describes each setting.

Figure 48. Waterfall Contact Marking Options

Figure 49. Mosaic Contact Marking Options
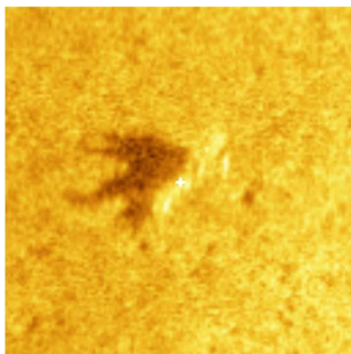
Figure 50. Snapshot Contact
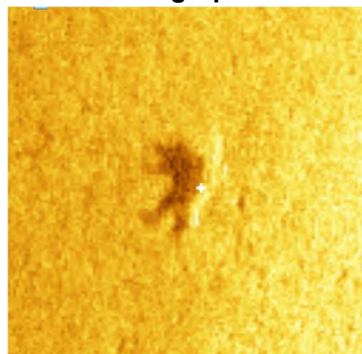
Figure 51. Geocoded Contact
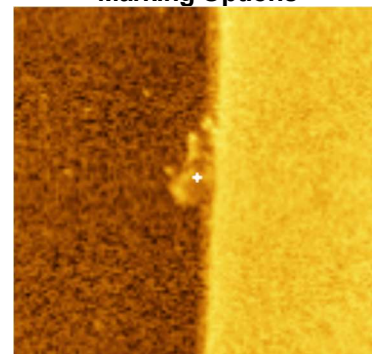
Figure 52. Contact in Water Column

Table 15. Contact Marking Options

Option Name	Definition
Name	Set the name to use for contacts. Setting the name will disable automatic generation of the contact names. The contact name may also be edited in the contact viewer.
Type: Geocoded	Use mosaic imagery as target image. Imagery will have processing applied and may appear different from what is in the waterfall (Figure 51).
Type: Snapshot	Use a snapshot of waterfall imagery as target image. Imagery will be exactly as you see it on the waterfall (Figure 50). Also this is the only way to capture a target that appears in the water column (Figure 52). NOTE: When using snapshot mode, contacts will not be speed corrected and therefore not measurable.
Resolution	Specify what resolution to capture the image at
Size	Sizes values are 64, 128, 256, 512, and 1024 pixels. Note that pixel size is affected by resolution.
Comments	Set the comments for the contact. The comments may also be edited in the contact viewer.

8.2 Mark Contacts

To build your contact database, you must first mark the contacts. You can mark the contacts in the waterfall window during playback mode. You can also mark contacts in the mosaic window in any mode. Marked contacts appear as small blue pins on an image in the mosaic window, as shown in Figure 53. The contact imagery is a square centered on the marked position, from the data of origin. The contact, marked position, and all other associated properties are saved locally in the contact database for later classification, organization and export.
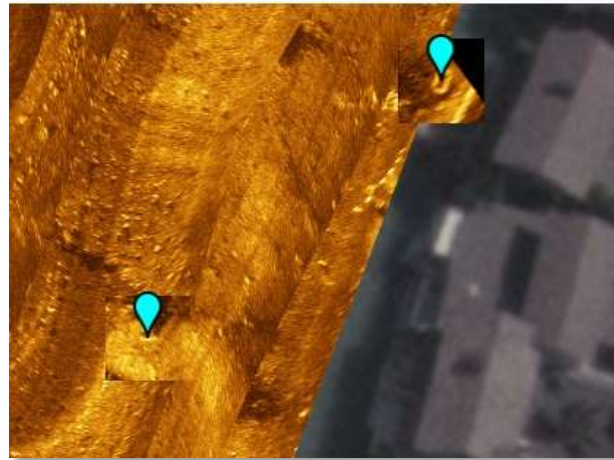
Figure 53. Contacts in Mosaic Window

To mark a contact in the waterfall window in playback mode:
1. Select the contact marker tool at the top of the waterfall window. Click on an object (or anywhere) in the waterfall window.
   - A contact thumbnail is saved in the database.
   - A black and blue dashed diamond appears around the contact area (Figure 54).
   - If the Display Options item "Render the image over the swaths" is checked, the thumbnail appears in the mosaic window.
   - If the Display Options item "Mark position with a pin" is checked, a small blue marker appears over the mosaic, marking the recorded position of the contact.
   - The black and blue diamond marker stays at the contact position and reappears in the waterfall as a black and green dashed square when the waterfall data covers the target location again on consecutive passes (Figure 54).
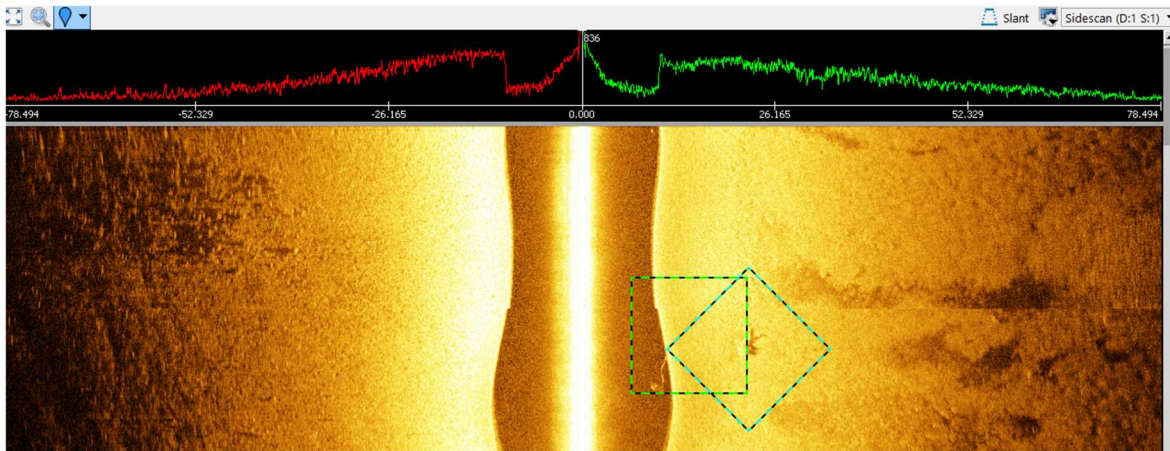
Figure 54. Square and Diamond Markers

To mark a contact in the Mosaic window:
1. Click the **Mark contact tool** icon in the toolbar.
2. A white square frame appears around the mouse cursor in the Mosaic window. Click on the target.
    - A contact thumbnail is saved in the database.
    - The thumbnail appears in the mosaic window.
    - A small blue marker appears over the mosaic, marking the recorded position of the contact.
4. Click the **Select Tool** icon to exit the "Mark contact" mode.

To turn on/off the display of the blue pins or the images:
1. Click the **Display options** icon
2. Check/uncheck the box next to **Mark position with a pin** or **Render the image over the swaths**.

8.3 Elements of the Contacts Window

Click the **Contacts** icon to open the contact database. Elements of the Contacts window are labelled in Figure 55. This section introduces the elements of the contact window and covers the Contacts window display options. Usage of these elements in the contacts workflow will be described in the following sections.
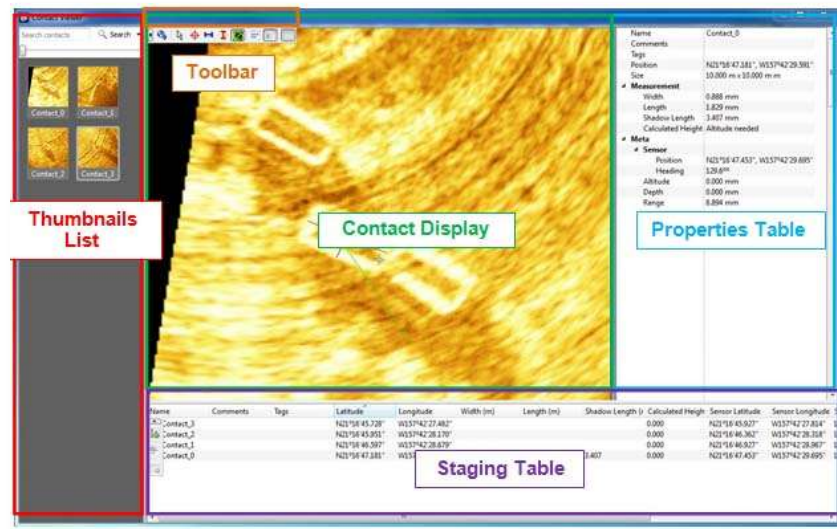
Figure 55. Contacts Window

The Contacts window contains the contact thumbnails list, a toolbar, the contact display with associated properties table, and the staging table. Contacts that you have marked are visible in the contact thumbnails list (unless you have previously set a filter in the search bar), but the contact display, properties table, and staging table do not open by default. Each element of the Contacts window can be resized by hovering over the edge of the panel, and clicking and dragging.

8.3.1 Thumbnails List

Thumbnails are smaller views of the contact, shown in the thumbnails list. To adjust the size of the thumbnail panel, click on the slider bar and drag to the desired size. From the list, you classify contacts and control the display of contacts in other elements of the Contacts window. The context menu includes commands to rename, edit comments, assign new tags, filter by tag, add contacts to the staging table, or delete contacts. Right-click on a thumbnail to access this menu.

When you click or right-click on a thumbnail, this selects the contact and displays it in the contact display. To control which contacts display:
- Select multiple adjacent contacts by clicking on the first thumbnail, holding Shift and clicking on the last thumbnail.
- Select multiple non-adjacent contacts by clicking on a thumbnail, then holding Ctrl and clicking on each thumbnail.
- Select all contacts by clicking on a thumbnail, then pressing Ctrl+A.
- Remove all contacts from the contact display by clicking in the empty space in the thumbnail list.

These standard Windows selection commands also apply to selecting multiple contacts for context menu options.

8.3.2   Contacts Toolbar

The icons in the Contacts toolbar are pictured and described in Table 16.

Table 16. Contacts Toolbar Icons

Icon	Icon Name	Function
	Import contacts	Import contacts from another SAR HAWK project to the current project
	Pan/Zoom cursor	Suppress selection mouse commands and activate navigation commands
	Mark the contact center	Change the recorded position of the contact
	Contact width	Measure the width of the contact and save it as an attribute
	Contact length	Measure the length and save it as an attribute
	Shadow length	Measure the shadow length and save it as an attribute
	Tiles	Show only selected thumbnails in the display
	Properties	Show the properties table for the selected contacts
	Staging Table	Show or hide the staging table

8.3.3   Contact Display

The contact display shows a larger view of selected thumbnails. In the display, you can use the measuring tools to attribute the contact dimensions, and mark the contact center. You can also access the same commands on the display context menu as in the thumbnail context menu and the toolbar.

You may use your keyboard or mouse to navigate within the contact display. To zoom in on an area, either click the **Pan/Zoom** icon in the toolbar or right-click on the tile and click **Pan/Zoom**.Then, click and drag a box around the area. To zoom in/out from the tile center, either:

- roll the mouse wheel away from/toward you;
- press the +/- keys; or
- on a laptop track pad, use a two finger scroll toward/away from you.

To zoom out to show the full tile, press the space bar or Esc key. You may also use the **Pan/Zoom** tool to pan. The area pan and zoom methods work without activating the **Pan/Zoom** tool from the icon or the context menu. Hold shift and click and drag a box around the area to zoom, or hold Ctrl and click and drag to pan in the contact display.

8.3.4   Properties Table

The properties table shows the attributes of each selected contact in a report view, adjacent to the contact display. The **Name**, **Comment**, **Altitude**, and **Depth** fields are directly fillable in the properties table. **Position**, **Size**, **Sensor Position**, **Sensor Heading**, and **Range** are defined by the contact mark. **Position** and **Range** automatically update if the **Mark the contact center** tool is used to move the recorded contact. The **Tag** field is defined from the contact thumbnail list, and the **Width**, **Length**, and **Shadow Length** fields are filled when the user executes the measure tools. The **Calculated Height** field auto fills when the user enters an altitude.

8.3.5   Staging Table

The staging table shows a table view of the properties of each contact sent to it. The contact properties that are shown in the Properties table in report view, from top to bottom, appear by default from left to right as columns in the staging table. Use the staging table to export contacts as a report, or to prepare them for transmission to a NMEA compatible plotter.

To show or hide the staging table, click the **Staging table** icon. Adding contacts to the staging table also automatically displays the staging table. To do this, right-click on a tile or selected thumbnails and click **Add contact(s) to staging table**.

A small toolbar hosts icons for the staging table commands. These commands are also found on the staging table context menu. They are:
- create report
- send contact(s)
- show contact(s)
- remove contact(s) from the staging table
- show only contacts selected in the staging table in the thumbnail list and contact display
- export contacts in a report.

Format the staging table by adjusting column width, hiding/unhiding columns, sorting, and rearranging column order.
- To resize columns, hover over the column break line, click, and drag.
- To hide/unhide columns, right-click on the column name row and click the checkbox next to the field name.
- To sort a column, click on the column name.
- To rearrange the column order, click on a column name and drag it to the desired location.

8.3.6   Contact Display Commands

For quick reference, the display options available in the Contacts utility are listed in Table 17. The methods available to execute the commands are bulleted to clarify when multiple execution methods exist.

Table 17. Contact Display Commands

Contacts Window Element	Command	Action
All	Resize elements	• Hover over the element edges and click and drag.
	Show/hide the properties table	• In the toolbar, click the **Properties/Tiles** icon • In the contact display, right-click on the contact and click **Properties/Tiles**.
	Show/hide the staging table	• In the toolbar, click the **Staging table** icon
	Show/hide toolbars	• Click the arrow icon at the left of the toolbar.

Contacts Window Element	Command	Action
Contact Display	Add contacts to contact display	• In the thumbnail list, click on the thumbnail to select it.
	Add all contacts to the contact display	• In the thumbnail list, click on any thumbnail and press Ctrl+A.
	Add multiple nonadjacent contacts to the contact display	• In the thumbnail list, click on the first thumbnail, hold Ctrl and click on each thumbnail.
	Add multiple adjacent contacts to the contact display	• In the thumbnail list, click on the first thumbnail, hold Shift and click on the last thumbnail.
	Remove all contacts from contact display	• Click in the empty space of the thumbnail list.
Thumbnail List	Resize thumbnails	• In the thumbnail list, click on the slider bar and drag.
Thumbnail List and Contact Display	Show only those contacts in the staging table in the thumbnail list and contact display	• In the staging table, select the contacts to show and click the **Show contact(s)** icon in the toolbar. • In the staging table, select the contacts to show, right-click and click **Show contact(s)**.
Contact Display	Zoom in on area	• In the toolbar, click the **Pan/Zoom** icon, and in the contact display click and drag a box around the area. • In the contact viewer, right-click on the tile and click **Pan/Zoom**, and click and drag a box around the area. • In the contact display, hold Shift and click and drag a box around the area.
	Zoom in to center	• In the contact display, roll the mouse wheel away from you. • In the contact display, press the + key. • In the contact display, use a two finger scroll toward you on a laptop track pad.
	Zoom out from center	• Roll the mouse wheel toward you. • Press the - keys. • Use a two finger scroll away from you.
	Zoom to contact	• In the contact display when zoomed in, press the spacebar.
	Pan	• In the toolbar, click the **Pan/Zoom** icon, and in the contact display click and drag. • In the contact viewer, right-click on the tile and click **Pan/Zoom**, and click and drag. • In the contact display, hold Ctrl and click and drag.

Contacts Window Element	Command	Action
Staging Table	Add contacts to the staging table	• In the contact display, right-click on the tile and click **Add contact(s) to staging table**. • In the thumbnail list, right-click on the selected thumbnails and click **Add contact(s) to staging table**.
	Resize columns	• Hover over the column break line, click, and drag.
	Hide/Unhide Columns	• Right-click on the column name row and click the checkbox next to the field name.
	Rearrange the column order	• Click on a column name and drag it to the desired location.

8.4 Attribute Contacts

SAR HAWK enables the user to make complete contact reports through classification and measurement of the contacts. These processes are used to define contact properties, so that data about the contacts may be transmitted with the images through your workflow.

8.4.1   Classify Contacts

The first step of attributing your contacts is to classify them with comments and tags. These are user-defined properties that give context to the image and enable sorting, filtering, and identification of each contact for later review and export. The comment field is a text field for entering any text description that suits your purpose. Tags are labels used to filter and sort your contact database.

Add Comments

Add a comment two different ways:
- In the thumbnail list, right-click on a thumbnail and click **Edit comments**. Enter the comment and press Enter/click **Okay**.
- In the properties table, click in the **Comments** field. Enter the comment and press Enter.

Add Tags

Recall, for SAR HAWK tags are user-defined labels for contacts to allow grouping and analysis. Before adding tags, think about how you would like to be able to sort your data. Your classification system is only as useful as you make it. For example, you may make tags for unknown, wreck, cinder block, diver, ordnance, etc. to be able to filter and sort contacts by the type of object they represent. Or, define tags using location identifiers or swath number if you have a need to sort by location. If the purpose of your survey was to identify and locate disposed ordnance, for example, you would obviously define tags for as many different ordnance types as are recognizable.

In the interest of good record keeping, you may want to define tags that will be applicable to future surveys. Once tags are defined, you can filter by the tag and send only the contacts with a certain tag to the staging table for reporting. You may assign more than one tag to contacts.

To get started tagging, define the tags in the database. This can be done with or without concurrently assigning the newly defined tag to a selected contact.

- In the thumbnail list, click the **Search** drop down menu and click **Create Tag**. Enter the tag name and click **OK**. This adds the tag to the database.
- Right-click on a thumbnail/tile, hover over **Tags** and click **Assign new tag**. Enter the tag name and click **OK**. This adds the new tag to the contact and the database.

Then, apply the tags to relevant contacts. As you may have gathered, this can be performed with or without concurrently defining a tag in the database.

- Right-click on a thumbnail/contact, hover over **Tags** and click the checkbox next to any tags to check it (Figure 56). Click anywhere outside the context menu to hide the menu.
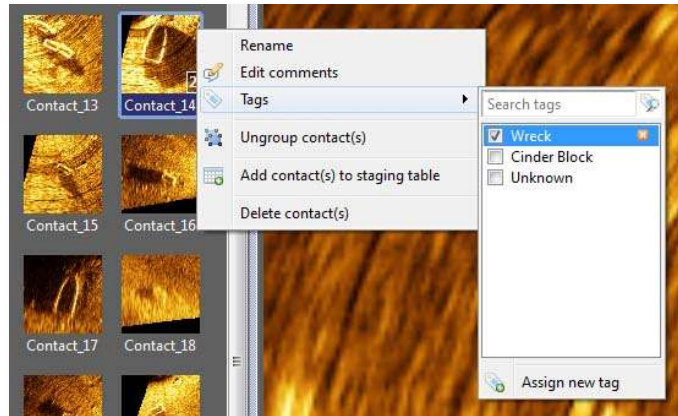
Figure 56. Assigning Tags

8.4.2 Measure Contacts

Three measure tools, accessed from the toolbar, can be used to precisely measure targets in the SAR HAWK contact utility. The measure tool transforms the cursor into a line that you draw over the contact. The three measuring lines have distinct colors to symbolize the width (blue), length (red), and shadow length (green). Match these colors to the object dimensions consistently to ensure the accuracy of your contact measurement properties.

To change the cursor behavior to measuring, either click on one of the measuring icons in the toolbar or right-click on a tile and click one of the measure commands. To measure the contact, click on one edge of the contact then drag the mouse to the opposite edge. SAR HAWK draws a line as you drag the mouse. When measuring shadow length, make sure that you click on the beginning of the shadow, closest to the object, and drag the mouse *in the direction the shadow is cast*. The distances are displayed in the properties table.

8.4.3 Calculate Contact Height

In order to calculate the contact height, the sensor altitude at the contact's position and shadow length must be known. To calculate the height, enter the altitude in the **Altitude** field of the properties table in the unit shown and measure the shadow length. SAR HAWK uses these values to calculate the height. It is displayed in the **Height** field.

8.4.4 Change Position

SAR HAWK fills in the lon/lat position of the contact using the initial contact mark. You may edit this position by using the Mark the contact center tool. To change the cursor behavior to marking the contact center, either click the **Mark the contact center** icon or right-click on the

tile and click **Center**. Then, click the new center on the contact display. The newly marked position updates in the properties table.

8.4.5   Rename Contacts

Naming contacts provides another way to sort the contacts, because the naming column may be sorted alphabetically in the contact staging table. By default, SAR HAWK names each contact `Contact_X` where X is the sequence in which contacts were created. To rename the contact,

- in the thumbnail list, right-click on a thumbnail and click **Rename**. **Enter** the name and press Enter; or
- in the properties table, click in the **Name** field. Enter the name and press Enter.

8.4.6   Contact Attribution Commands

Table 18 provides a quick reference of the attribution commands and methods of executing the commands. The methods available to execute the commands are bulleted to clarify when multiple execution methods exist.

Table 18. Contact Attribution Commands

| Command	Action
Rename	- In the thumbnail list, right-click on a thumbnail and click **Rename**. **Enter** the name and press Enter. - In the properties table, click in the **Name** field. Enter the name and press Enter.
Add comment	- In the thumbnail list, right-click on a thumbnail and click **Edit comments**. Enter the comment and press Enter/click **Okay**. - In the properties table, click in the **Comments** field. Enter the comment and press Enter.
Define tag in database	- In the thumbnail list, click the **Search** drop down menu and click **Create Tag**. Enter the tag name and click **OK.** - Also in the thumbnail list, right-click on a thumbnail, hover over **Tags** and click **Assign new tag**. Enter the tag name and click **OK**. This adds the new tag to the contact and the database.
Assign tag to contact	- In the thumbnail list or the contact display, right-click on a thumbnail/contact, hover over **Tags** and click **Assign new tag**. Enter the tag name and click **OK**. This adds the new tag to the contact and the database. - Also in the thumbnail list or the contact display, right-click on a thumbnail/contact, hover over **Tags** and click the checkbox next to any tags to check it. Click anywhere outside the context menu to hide the menu.

Command	Action
Remove tag from contact	• In the thumbnail list or contact display, right-click on a thumbnail/contact, hover over **Tags** and click the checkbox next to any tags to uncheck it. Click anywhere outside the context menu to hide the menu.
Mark the contact center	• In the toolbar, click the **Mark the contact center** icon. Click the new center on the contact display. • In the contact display, right-click and click on **Center.** Click the new center on the contact display.
Measure width	• In the toolbar, click on the **Measure Width** icon. Click on the extreme edge of the widest part of the object in the contact display, drag the mouse to the opposite edge, and release the mouse button. • In the contact display, right-click on the contact in the display and click **Width**. Click on the extreme edge of the widest part of the object in the contact display, drag the mouse to the opposite edge, and release the mouse button.
Measure length	• In the toolbar, click on the **Measure Length** icon. Click on the extreme edge of the object in the length dimension, drag the mouse to the opposite edge, and release the mouse button. • In the contact display, right-click on the contact in the display and click **Length**. Click on the extreme edge of the object in the length dimension, drag the mouse to the opposite edge, and release the mouse button.
Measure shadow length	• In the toolbar, click on the **Measure Shadow Length** icon. In the contact display, click on the beginning of the shadow, closest to the object, and drag the mouse *in the direction the shadow is cast*. Release the mouse button at the far edge of the shadow. • In the contact display, right-click on the contact and click **Shadow length**. Click on the beginning of the shadow, closest to the object, and drag the mouse *in the direction the shadow is cast*. Release the mouse button at the far edge of the shadow.
Calculate Height	• In the Properties table, enter the altitude of the sensor at the approximate time and position that the contact was marked in the unit shown in the **Altitude** field.

8.5 Group Contacts

Your survey will most likely generate multiple images of the same object. You may have noticed this while you were attributing your contacts. Using SAR HAWK's grouping feature on multiple images of the same object defines a relationship between contacts in the database. To group contacts, click on a thumbnail in the thumbnail list and drag it over another thumbnail, then release the mouse button. The receiving contact becomes the group reference. You can also group contacts by selecting multiple contacts and right-clicking on a thumbnail, then selecting

Group contacts from the context menu. The contact selected first becomes the group reference. No observations are deleted; the other grouped contacts are kept.

The clearest, most accurate contact should be used as the group reference, because it is the contact that holds the attributes for the group. The properties of the other grouped contacts are suppressed in the staging table. To change the group reference, right-click on the tile in the contact display and click **Set as group reference** (Figure 57). You may ungroup contacts by right-clicking on the thumbnail or contact tile and clicking **Ungroup contacts**.
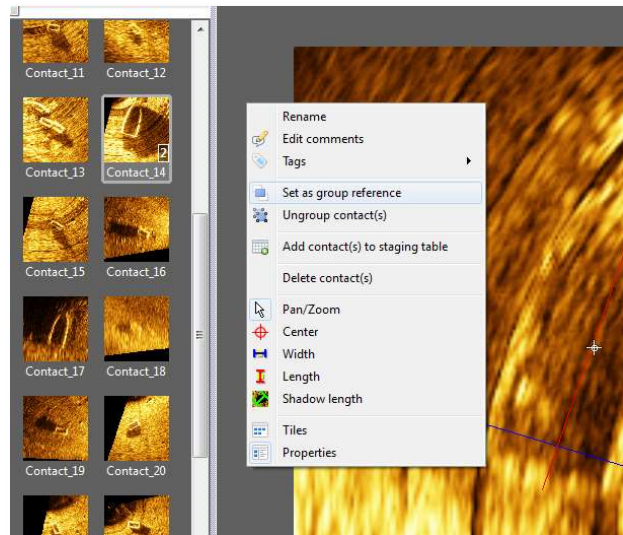
Figure 57. Grouped Contacts and Context Menu

After you have removed redundancies in your dataset by grouping unique objects, you are ready to export the contacts.

8.6 Export Contacts

The staging table, as the name implies, controls which contacts are exported to the *.html and *.xml reports.

8.6.1   Send contacts to the staging table

To efficiently add contacts to the staging table, limit the thumbnail list by searching and filtering, then batch select the contacts. Searching the thumbnail list hides all of the contacts that do not match the search terms. To search by name, enter the name in the **Search** field. You may also search the tags list for tag names. To do this, either click on the **Search** dropdown menu in the thumbnail list, or right-click on a thumbnail/tile and hover over **Tags**. Then, enter the name of the tag in the field. Clear the search using the **Clear search** button.

You may also filter by tag to limit the thumbnails shown in the list. To do this, access the tags window in the same way by either clicking on the **Search** dropdown menu in the thumbnail list, or right-clicking on a thumbnail/tile and hovering over **Tags**. Then, click the checkbox next to the tag whose thumbnails you want to keep in the thumbnail list. Or, enter `tags://` and then the name of the tag in the search bar (Figure 58).

Figure 58. Filtering By Tag

To send contacts to the staging table, right-click on the selected thumbnails/tiles and click **Add contact(s) to staging table**. You can select all, multiple adjacent, or multiple non adjacent thumbnails in the same way as viewing them in the contact display (Section 8.3). The staging table will appear at the bottom of the Contacts interface, with contact and properties displayed in a tabular form.
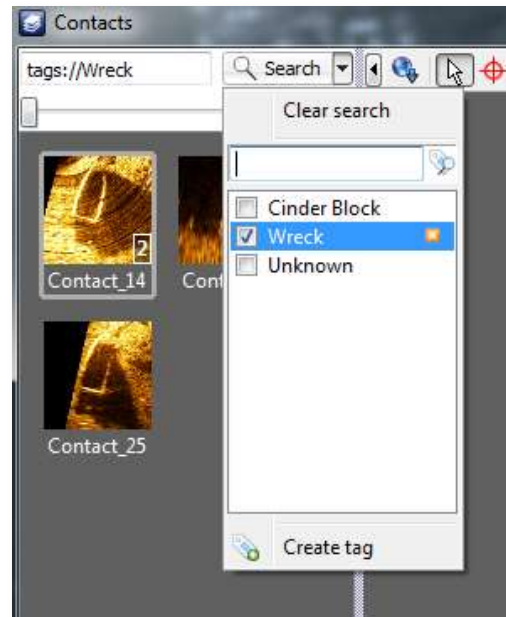
8.6.2   Prep the Staging Table

At this time, most of the formatting functions in the staging table are for display purposes only. The order of the contacts in the table, however, is preserved in the report. Sort the table by clicking on the column name. Text fields sort alphabetically while numeric fields sort sequentially, in ascending or descending order. A small up arrow signifies ascending, while a small down arrow signifies descending.

To remove contact(s) from the staging table, select them in the table and either click the **Remove contact(s) from staging** table icon or click this command on the right-click context menu. You may also choose to limit the display of thumbnails and tiles to those present in the staging table; use the **Show contact(s)** icon or context menu command to perform this action for contacts selected in the staging table. This assists in building your report because it shows you which images will be exported.

8.6.3   Export a Report

You can export reports in *.html and *.xml format from the staging table. To build the report:
1. In the staging table, sort the table to set the report order.
2. Click the **Create report** icon ().
3. In the Create Report window, navigate to the file location to save your report. The default file location is the project folder.
4. Enter a file name.

5. Click **Save**.

When you click Save, a popup window greets you with a successful report notification (Figure 59). Accept the message by clicking **OK** or view the report in a browser by clicking **Open**.

Contact report created successfully at:

D:/Projects/contacts/contact_report.html

OK   Open

Figure 59. Create Report Success Window

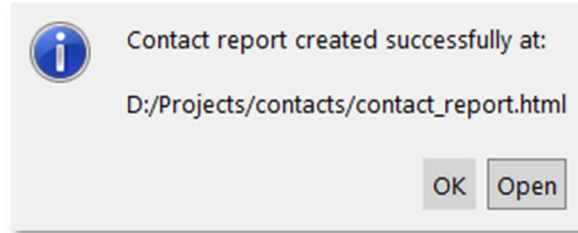The report export function creates a folder and three files in the project folder: one *.html file, one *.xml file of the same name, one targetexport.css file and one folder of the same name with "_images" appended to the name. This folder contains the *.png tiles of each contact. The *.html file contains each contact tile with its attributes displayed on the right in report form. *At this time, the report includes the Name, Time, Lon/Lat, Easting/Northing, Range, Heading, Sonar Altitude, Sonar Depth, Image Resolution, Measured Width, Measured Length, Measured Shadow, Height from Shadow, and Comment fields.*

8.6.4 Delete Contacts

When reviewing the contacts, you may find contacts that are irrelevant to your purpose. If you desire to delete the contacts, select the contact(s), right-click on the selected thumbnails/tiles and click **Delete contact(s)** or press the delete key. Deletion is permanent. As an alternative to deletion, you may choose to export these contacts before deleting them from the project so that they are preserved in report form. A less efficient way of recovering deleted contacts is to remark them in playback mode.

8.6.5 Contact Organization Commands

Table 19 lists the organization commands and the methods to execute them as a quick reference. The multiple methods available to execute the commands are bulleted.

Table 19. Contact Organization Commands

Command	Action
Group contacts	• In the thumbnail list, click and drag the thumbnail over the group reference contact. • In the thumbnail list, select contacts to group, then right-click on one of the thumbnails and click **Group contact(s)**.
Ungroup contacts	• In the thumbnail list or contact display, right-click on the thumbnail/contact and click **Ungroup contact(s)**.

Command	Action
Set group reference	• In the contact display, right-click on the thumbnail/contact and click **Set as group reference**.
Search by name	• In the thumbnail list, enter the search term in the **Search contacts** field.
Search by tag	• In the thumbnail list, click on the **Search** dropdown menu, then enter the tag name in the field. • In the thumbnail list or contact display, right-click on a thumbnail/contact, hover over **Tags** and enter the tag name in the field.
Filter contacts by tag name	• In the thumbnail list, click the **Search** dropdown menu and click the checkbox next to the tag. • In the thumbnail list or contact display, right-click on a thumbnail/contact, hover over **Tags** and click the checkbox next to the tag. • Enter `tags://` and then the name of the tag in the search bar.
Add contacts to staging table	• In the thumbnail list, select contacts (single, multiple adjacent, multiple non adjacent, all) then in the thumbnail list, right-click on the thumbnail/tile and click **Add contact(s) to staging table**. • In the contact display, right-click on a tile and click **Add contact(s) to staging table**.
Sort by column	• In the staging table, click on the column name.
Remove contact(s) from staging table	• In the staging table, click on the contact(s) to select, then click the **Remove contact(s) from staging table** icon • In the staging table, click the contact(s) to select, then right-click and click **Remove contact(s) from staging table**.
Show only those contacts in the staging table in the thumbnail list and contact display	• In the staging table, select the contacts to show and click the **Show contact(s)** icon in the toolbar. • In the staging table, select the contacts to show, right-click and click **Show contact(s)**.
Delete contact(s)	• In the thumbnail list, right-click on selected thumbnails and click **Delete contact(s)**. • In the contact display, right-click on a tile and click **Delete contact(s)**.
Export a report	• In the staging table, sort by column to set the report order, then click the **Create report** icon. Enter a file name, change the file location if desired, click Save, and then click **OK** to return to the Contacts window or **Open** to view the *.html report in a browser.

8.7 Contacts Tutorial

This example demonstrates some of the contact features available in OIC's SAR HAWK. Follow the directions with the sample data to learn to mark contacts, measure them, and create a report. As before, launch SAR HAWK, create a project and select some FLS data for playback. Commence playback, and make sure the PPI window is open.

1. Look for something interesting in your Forward Look window PPI. Double-click on it.
   - A small blue tack appears in the corresponding location in the mosaic window.
2. Mark three more targets in the same manner.
3. Click the **Contact** icon.
   - The Contacts window opens. Not all elements of the Contacts window are visible yet.
4. Click on the **Contact_0** thumbnail.
   - The contact displays in the contact view.
5. Click the **Properties** icon on the toolbar (mouse over the buttons to see the names.)
   - The properties table opens on the right side of the Contacts window.
6. Click the **Measure Width** icon on the toolbar. Click on the extreme edge of the widest part of the target, drag the mouse to the opposite edge, and release the mouse button.
   - A blue line appears, representing the contact width.
   - The width field in the right panel displays the width in meters.
7. Measure the length and shadow length in the same manner. Measure the shadow in the direction the shadow is cast. You can enter the altitude, if known, in the properties table to calculate the height of the target.
8. Right-click on the contact icon and select **Add contact(s) to staging table**.
   - The staging table appears at the bottom of the Contacts window, with attribute information in a tabular view.
9. Click on **Contact_1** to select it. Hold Shift and click on **Contact_3** to select the second, third, and fourth contacts. Right-click and select **Add contact(s) to staging table**.
   - SAR HAWK adds the contacts to the staging table. The Width (m), Length (m), and Shadow Length (m) fields are blank for contacts that you have not measured.
10. Right-click on any of the field names. Uncheck Sensor Latitude and Sensor Longitude.
    - They are no longer displayed in the table. This works for any column.
11. Click on the Latitude column.
    - SAR HAWK sorts the table by ascending latitude. This works for any column.
12. Click the **Create report** button. Enter a file name and set the file location and click **Save**.
    - SAR HAWK exports an .html file with images.
13. Close the Contacts window.

9 Additional Features

SAR HAWK has four additional features present in the toolbars: the Meta data properties window, select tool, measure tool, and export tool.

9.1 Meta data properties

The meta data properties window displays various sonar and navigation/ heading sensor properties, which can be used for informational and troubleshooting purposes.

To view meta data properties:
1. Press Control+M.
2. Expand each items to view detailed information (Figure 60).

Figure 60. Meta Data Properties Window

9.2 Select tool

The select tool allows the user to select swaths or contact markers in the Mosaic window. When a swath is clicked in the mosaic window, the corresponding swath in the Swath list will be highlighted. When a contact marker is clicked, the Contacts window opens and the corresponding contact will be highlighted in the contact list and displayed in the contact view.

9.3 Measure tool

The measure tool can be used to measure any portion of the mosaicked imagery in linear units.

To use the measure tool:
1. Click the **Measure tool** icon in the toolbar.
2. Click two or more points in the mosaic window between which you want to measure distance (Figure 61).
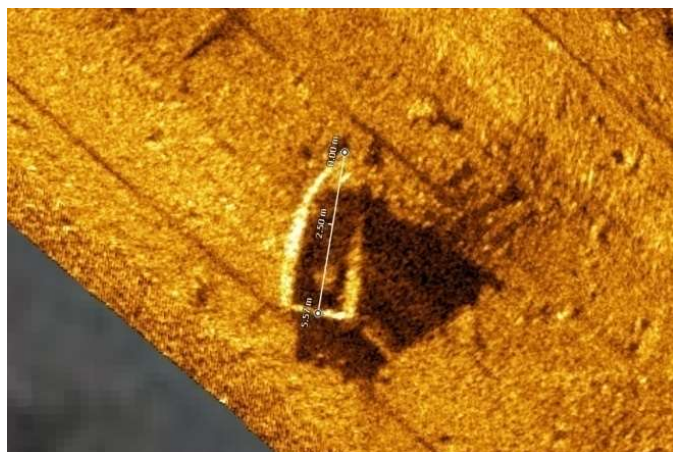3. Click at the point to delete it or drag the point to move it.

Figure 61. Measure Tool

9.4 Export Tool

The export tool integrates SAR HAWK directly into your workflow, no matter which spatial analysis software package you use, by exporting in the widely readable GeoTIFF format or the freely accessible Google Earth format. The tool saves the mosaic as a geocoded image as it appears in the mosaic window, with respect to swath layering and rendering properties. To export your mosaic, access the Export dialog from the **Export** icon (Figure 62). Note that the Export icon is only available in post-processing mode. If you are in playback mode, exit the mode by clicking the Add Data icon with red x on the toolbar. New formats for export are discussed in Appendix A.
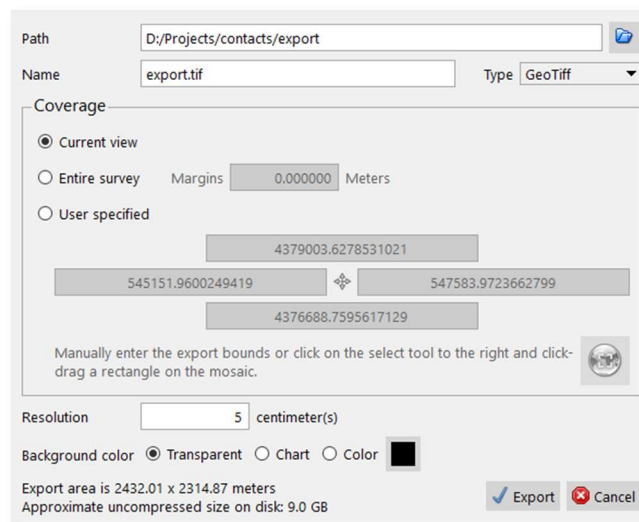

Figure 62. Export Dialog

The default output folder is set to the export folder in the project and the file is named `export`. You may change the output folder by entering the new path into the **Folder** field or clicking the folder button. Change the file name by entering it in the **File** field. Export file format can be selected from the dropdown menu next to the File field. The remaining file export options are available in the Properties subpanel of the export window. These include the extents, resolution, and Background color.

9.4.1   File Type

SAR HAWK supports export to GeoTIFF, Tiled GeoTIFF(s) (*.tif or *.tiff) Google Earth (*.kmz), and XYZ formats. Tagged-Image File Format (TIFF) files are a raster imagery file type. Rasters store data in a grid of pixels. GeoTIFFs are TIFFs with geographic tags embedded in the file, so the data (image that you see) and metadata (location information that allow placing the file on a map) are encoded in the same file. The format is an industry standard, and GeoTIFFs created in SAR HAWK can be read in any program that reads GeoTIFFs as well as regular TIFFs (in most circumstances).

When exporting to Tiled GeoTIFFs, SAR HAWK subdivides exported areas into smaller areas (2,048 x 2,048 pixels), referred to as tiles. Tiles are useful when working with survey data that

will result in excessively large file sizes (due to survey size and/or high resolution exports) when exported to GeoTIFFs. Tiles that do not have any survey data within them will automatically not be exported, which helps to reduce the overall file size associated with the export as well as the time required to process an export. Figure 63 provides an example of the advantage of using tiles.

Figure 63. Single GeoTIFF Export vs Tiled GeoTIFFs Export

Google Earth files are the native file type for Google's mapping program. SAR HAWK's *.kmz export can be added to a Google Earth map for further analysis or creating maps for reports (Figure 64).

Single beam bathy can be exported as a xyz file. The resulting xyz file can then be imported as a background chart or imported into another program which can utilize xyz files.
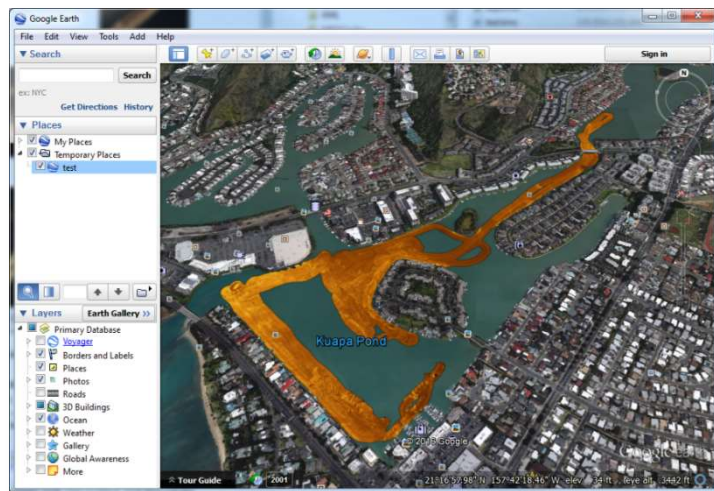

Figure 64. Exported Data Displayed in Google Earth

9.4.2   Extents

The user may elect to export the visible extent of the mosaic, the entire survey or some user specified area. If you would like to limit the exported data to the extent of the mosaic window, set the extent of the mosaic window before opening the export tool.

9.4.3   Resolution

The resolution can be set between 0.1 cm (1 mm) and 1,000 cm (10 m). Because higher resolution images mean larger file sizes, plan on SAR HAWK taking more time to export images of higher resolution.

9.4.4   Background color

SAR HAWK allows the user to set the background color of the exported GeoTIFF image to either transparent or desired color, or to use the background image/chart. Google Earth export always sets the background to transparent.

9.4.5   Export Tutorial

This brief tutorial demonstrates how to export a mosaic file.

1. Be sure that you are in post-processing mode. Click the Add Data icon with red x to exit from playback mode.
2. Arrange the swaths with the clearest images on top (click and drag from the Swath list-see Section 7.2).
3. If you do not want to export the entire mosaic at once, pan and zoom in the mosaic window until the window only shows the extent of the mosaic for export.
4. Click the **Export** icon.
   - The Export Dialog displays.
5. In the **Folder** field, change the path of the file by clicking the **folder** button. In the Export window, navigate to the desired folder and enter the file name. Click **Save**.
6. From the file format dropdown, choose **GeoTIFF, Tiled GeoTIFF(s)** or **Google Earth**.
7. In the **Extents (visible swaths)** field, choose either **Current view** or **Entire survey**.
8. In the **Resolution** field, set the desired resolution.
9. In the Background color field, select either Transparent or Color. If Color is selected, click on the color button to set the background color.
10. Click **Export**.
    - SAR HAWK function is halted while it builds the export file.

9.5 InterNAV Tool

InterNav is a tool used to align swaths using targets or features found in more than one swath (also known as "swath matching"). Errors in navigation during data acquisition result in errors in the data visible when swaths are superimposed; i.e. features don't match, or are offset on screen. By using objects/targets visible on adjacent swaths, and using known locations, InterNav can re-align the swaths, thus improving swath accuracy.

9.5.1   Using InterNAV

In order to begin using InterNAV load sidescan data and identify specific features with mis-matched positions in overlapping swaths. The data must be processed in playback mode and the identified features must be marked to create contacts. In the contact window, group the mis-matched features from overlapping swaths together. And enable InterNAV offsets (figure 65).

Subsequent loadings of the data will be automatically corrected, and the corrected nav tracks will be shown in green instead of blue.
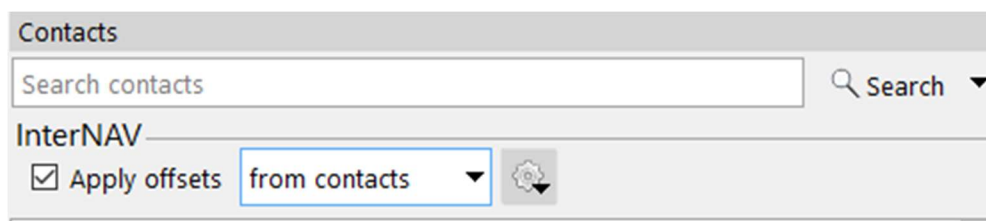

Figure 65. Apply InterNAV offsets

9.5.2   InterNAV Anchor Points

If there is good agreement between swaths, but a systematic offset affecting all or portions of the dataset, then an InterNAV Anchor Point can be assigned. Assigning anchor points is most easily accomplished with a background chart or image being displayed in the Mosaic window. In most cases, using a known feature which is also shown on a background chart will be ideal, such as a buoy, channel marker, or something on the shoreline.

Mark the feature you want to use as an InterNAV anchor as normal. In the contact window, find the feature and right click on it and set it as a InterNAV anchor. On the mosaic view, click the position where the contact should be anchored.

Subsequent loadings of the data will be automatically corrected, and the corrected nav tracks will be shown in green instead of blue.

10   End Playback and Close Project

To stop data playback and close the project:
1. Click the **Add data** icon in the toolbar and click **Yes** in the popup window to end playback.
   - SAR HAWK stops painting swaths.
   - The waterfall stops, vessel icon disappears, and the Live Info, Playback controls, Processing controls also disappear from the sidebar.
2. Click the **Close Project** icon.
   - SAR HAWK saves the project automatically before returning to the opening screen.
3. Click **Close** to exit SAR HAWK.