Environmental Restoration Group, Inc.

USER GUIDE

Setup and Operation of the ERG RadScout

(Model 105G Survey System)

Revision: 4

REVISION LOG			
Revision Number	**Date of Revision**	**Description of Changes**	**Pages Affected**
1	01/02/18	Revised to add new features of RadScout (1.7.0.9) and RadScene (1.4.0.8)	11, 23, 27, 28
2	03/21/22	Revised to add new features of RadScout (3.1.0.2) and RadScene (2.4.0.6)	1 - 35
3	04/20/22	Revised to include new features of RadScene (2.5.0.0)	24
4	03/24/26	Revised to include new features of RadScout (4.4.0.10) and RadScene (3.4.3)	All

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1. PURPOSE

The purpose of this manual is to demonstrate the proper setup and use of the ERG RadScout Model 105G handheld GPS survey system (RadScout) and accompanying software.

2. DISCUSSION

The ERG RadScout is a simple-to-use GPS mapping system for performing outdoor radiological scans. It consists of an interface datalogger containing all necessary software to acquire position correlated radiological scan data from a radiological detector and export the data for processing using a variety of applications, such as Microsoft Excel, or ESRI ArcGIS. The handheld datalogger comes installed with two applications, one for collecting data (RadScout) and one for exporting data to a removable disk drive (RadSync). The RadScout datalogger records radiological survey data every one-second with an associated GPS position for each record while also providing a real-time display of the recorded data. The ERG RadSync software is used to synchronize all field data from the datalogger to a single removable USB thumb drive. Using the ERG RadScene desktop application, the survey data can be viewed, managed, analyzed, merged, and exported.

The RadScout uses Ludlum equipment for radiological detection. A typical RadScout survey setup uses either a Ludlum Model 3000 or Ludlum Model 2221 meter paired with a thallium-doped sodium iodide scintillation detector, a Juniper Systems Mesa handheld datalogger, and a sub-meter Juniper Systems Geode GPS receiver. ERG incorporates Bluetooth in the survey system to allow for a completely wireless interface between the datalogger, meter, and GPS receiver. Users who wish to use their own meters may optionally utilize a serial port on the back of the datalogger for a wired connection. *NOTE: If using a meter that is not provided by ERG, confirm that appropriate firmware that allows for RS-232 data dumping in one-second intervals is used.*

3. PROCEDURE

The following section comprises the steps to set up and operate the RadScout gamma survey system.

3.1 Setting up the Hardware

Power on the Datalogger

Power on the datalogger by pressing the power button, located on the bottom right-hand corner of the Mesa datalogger. A red LED on the front of the device will flash to indicate the system registered the request, and a startup logo will appear on screen.

To unlock the device and reveal the home screen slide a finger upwards on the display and tap the ***Field PC*** sign-in option; do not sign in as the ERG user. Open the RadScout program by tapping the ERG RadScout shortcut on the home screen on Mesa[3] datalogger, or by tapping the ERG RadScout shortcut on the Mesa[4] datalogger Start Menu. After a brief startup, the program will open, as shown in Figure 1.

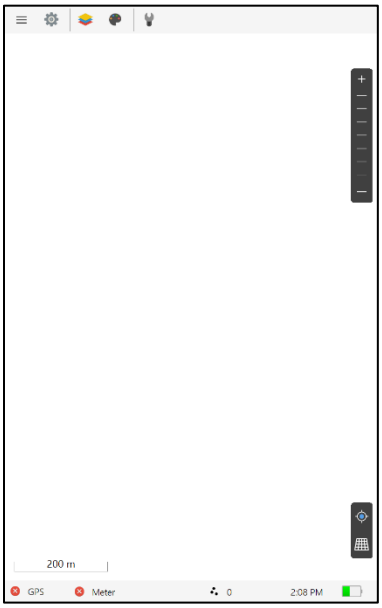


Figure 1. RadScout Startup Window.

Setting Up the Radiation Detector and Meter

The typical radiological instruments used with the system are the Ludlum Model 3000 or Ludlum Model 2221 meter with a gamma detector (typically a Ludlum Model 44-10 or Ludlum Model 44-20); although Ludlum Model 2350 and Ludlum Model 2360 meters are also compatible. Refer to the Ludlum Technical Manuals for information on the use, calibration, and maintenance of this equipment. Equipment calibrations and function checks should be performed in accordance with the site and/or user standard operating procedure (SOP).

Connecting a Meter to the Datalogger

To connect to a specific meter, ensure the meter is powered on and that the Bluetooth LED indicator is flashing. The Bluetooth indicator on the Model 3000 meter will flash blue. The Bluetooth indicator on a Model 2221 will flash red. In the RadScout startup window tap the **File** menu icon , Program Settings, and then select the Meter Type (M3000, M2350, M2360, or M2221).

If the meter has previously been paired with the datalogger then the meter unit number will appear as a selectable Meter Source. Select the meter unit number you wish to connect to. *NOTE: The meter unit*

number can be found on the Bluetooth module of an M2221 or on the side of the meter body of an M3000. To pair a new Bluetooth meter unit to the datalogger, tap on the Meter Source search icon, then tap the ***Discover*** button, as shown in Figure 2. *NOTE: This option is only available when the datalogger is not connected to a meter.* A brief Bluetooth Discovery window will open as the datalogger identifies available Bluetooth-enabled meters. Select the correct unit and tap the ***Connect*** button in the lower left corner of the screen.

When connecting to hardwired devices, ensure the correct meter type is selected in the Hardwired options. Select the meter unit number and tap the ***Connect*** button in the lower left corner of the screen.

Upon successful pairing the meter unit number will display under the Meter Source. Tap on the ***Save*** button in the Program Settings window.

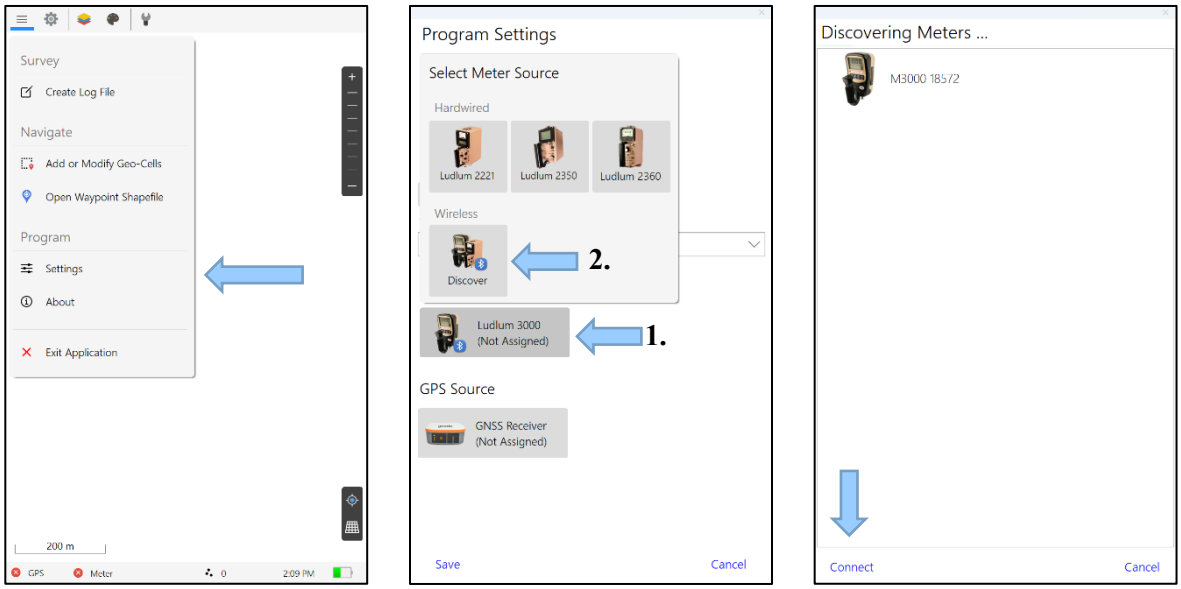


Figure 2. Pairing a Survey Meter to the Datalogger.

Connect to the meter through the **Settings** menu icon  by tapping the ***Connect*** button under the meter image, as shown in Figure 3. If the meter is opened successfully, the values will be displayed next to the trefoil symbol  in the bottom left-hand corner of the screen. A red error icon  indicates there is no connection. *NOTE: If using a M2221 meter make sure the unit is in Dig. Rate mode.* Once the Bluetooth device is paired and selected as the Meter Source, the device will automatically connect on startup of the application.

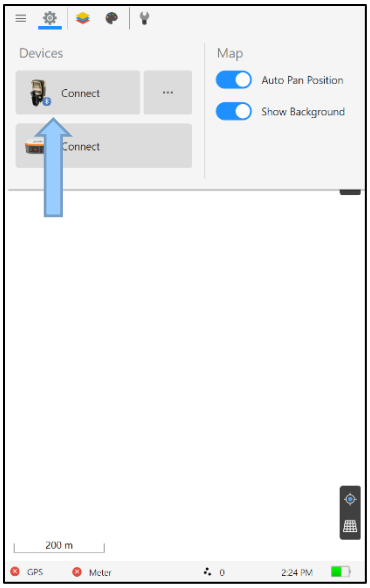


Figure 3. Connecting a Survey Meter Through the Settings Menu.

Connecting to the Geode GPS Receiver

The datalogger's internal GPS receiver may be adequate for surveying needs when sub-meter accuracy is not necessary. If sub-meter accuracy is desired the external Geode GPS receiver should be used. The Geode GPS receiver is connected to the datalogger in a similar manner as the survey meter.

To connect to a specific GPS receiver, ensure the receiver is powered on and identify the serial number located on the bottom of the receiver. From the RadScout startup window tap the **File** menu icon ☰ and tap ***Program Settings***. If the GPS has previously been paired with the datalogger then the receiver serial number will appear as a selectable GPS Source. If you do not see the desired GPS receiver serial number as an option in the GPS Source drop-down box, then the unit has not been paired with the datalogger. To pair the GPS receiver to a new datalogger tap the GPS Source button and tap ***Discover***, as shown in Figure 4. A Bluetooth Discovery search will begin and should identify all available Bluetooth-enabled GPS receivers. When the GPS receiver is identified and visible, select it and tap the ***Connect*** button in the lower left of corner of the window. Tap the ***Save*** button in the Program Settings window. When connected, a satellite icon will appear in the lower left corner of the home screen. *NOTE: A blue satellite indicates that the receiver is receiving DGPS (high accuracy) position readings while a green satellite indicates that it is not.* To connect or disconnect the GPS receiver from the datalogger tap on the ***Connect*** or ***Disconnect*** button, as shown in Figure 5.

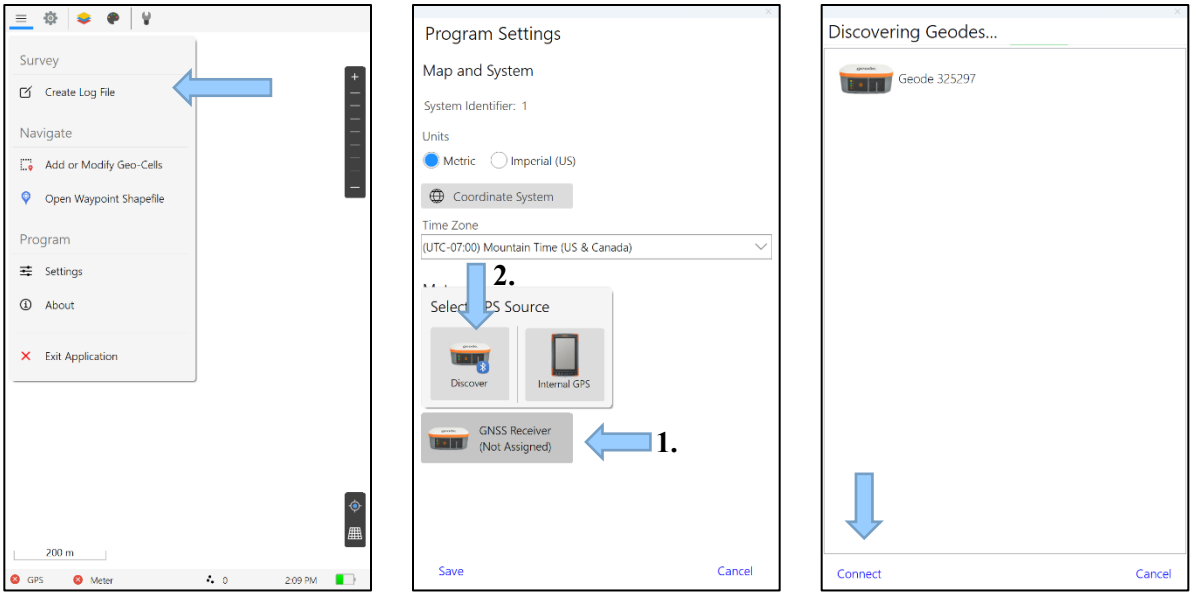


Figure 4. Pairing a Geode GPS Receiver to the Datalogger

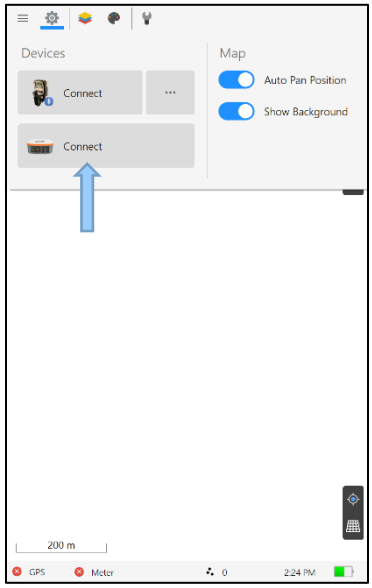


Figure 5. Connecting a Geode GPS Receiver Through the Settings Menu.

The internal datalogger GPS may also be used as the primary GPS receiver to reduce hardware. To select the internal GPS receiver, open the Program Settings window and select Mesa Internal in the GPS Source menu. *NOTE: The GPS receiver must be disconnected for this option to be available.*

Once the Bluetooth device is paired and selected as the GPS Source, the datalogger will automatically attempt to connect on startup of the application.

Charging the Datalogger

The RadScout Mesa datalogger comes with a standard wall charger that plugs into a port on the bottom of the device. A red LED light at the top of the datalogger will pulse while charging and will remain on when fully charged. The device will operate for 8 to 10 hours on a single charge and takes approximately 3 hours to fully recharge.

Charging the Geode

The RadScout Geode receiver uses a standard micro-USB or USB-C cable for charging depending on the specific model. A red LED light located on the Geode will pulse while charging and will remain on when fully charged. The device will operate for 7 to 8 hours on a single charge and takes approximately 3 hours to fully recharge.

3.2 RadScout Interface

Interactive RadScout program interfaces are shown in Figure 6. Non-interactive status interfaces are shown in Figure 7.

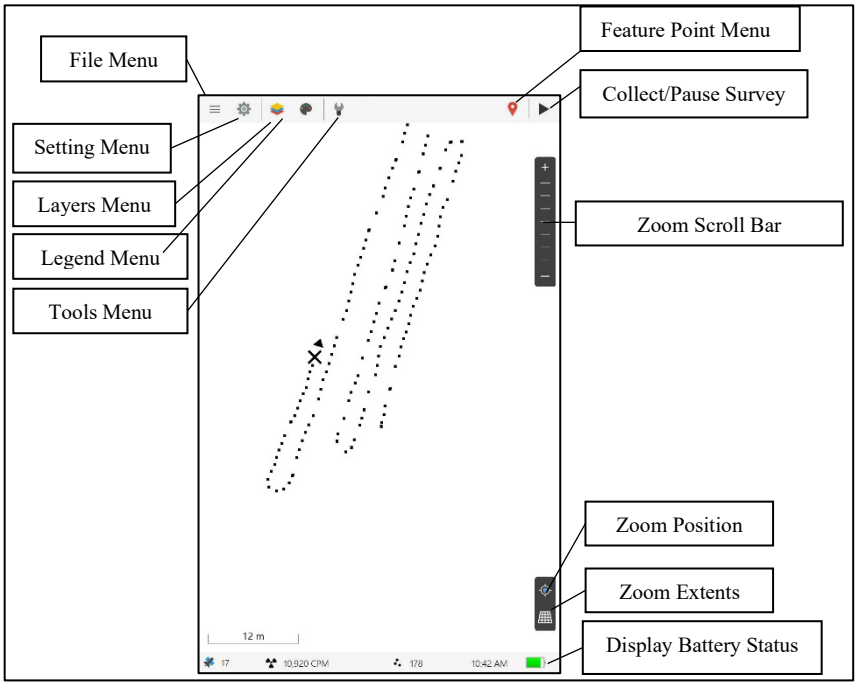


Figure 6. RadScout Interactive Interfaces.

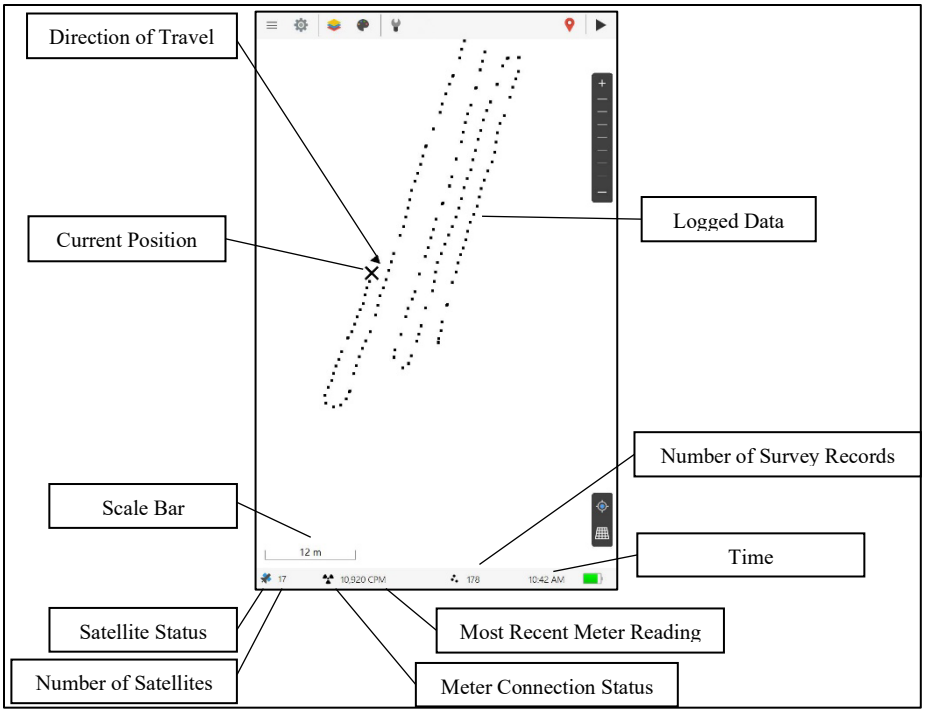


Figure 7. RadScout Non-interactive Status Interfaces.

Map Controls

The Map Controls bar is used to navigate the real-time position and data and is displayed on the right side of the survey window, as shown in Figure 7. The items in the map controls are explained below.

The Zoom Bar allows the user to zoom in and out by sliding their finger along the bar.

Zoom Position will zoom to the current location of the array position.

Zoom Extents will zoom to the bounds of the survey data and background data.

In addition to the visible buttons, using two fingers to pinch the screen allows the user to zoom in and out, while double-tapping and dragging on the screen allows the user to draw a rectangle that the window will zoom to.

The **Settings** menu  contains an ***Auto Pan Position*** toggle that will automatically scroll the user's position to the center of the map whenever they walk off screen. Tap the toggle button to turn this feature on or off.

Status Bar

The Status Bar is used to display the status of the system and survey and is displayed at the bottom of the survey window, as shown in Figure 7. The items in the status bar are explained below.

The satellite icon shows the status of the GPS receiver. A flashing satellite will indicate that the receiver is connected, but that there are insufficient satellites to obtain a valid position. Once solid, the number of GPS satellites will be displayed next to the satellite icon. A solid green satellite indicates that position is being tracked, but DGPS status (high accuracy) has not been obtained. The satellite color will change to blue when DGPS status is acquired.

The trefoil icon indicates that a meter is connected to the datalogger. The real-time meter values will be displayed next to the trefoil. These values will be in units of counts per minute (cpm) unless otherwise stated.

The three-point icon will indicate the total number of records collected in the open log file. This value will reset to zero when a file is closed.

The battery indicator will show the battery status of both the datalogger and GPS receiver. Tap on the battery to open a window showing the percentage and remaining time of the battery. Tap the battery icon or anywhere on the battery indicator to close the battery window.

3.3 Performing a Survey

The RadScout software is used to view, collect, and analyze spatially correlated radiological data with superior accuracy and data quality. Using the position of the GPS receiver, collected radiological data with associated positions are viewed in real-time. In addition, the program provides the ability to apply a color

legend with gamma ranges to current and previously collected background survey data to provide real-time mapping of the gamma count rate data.

Defining a Coordinate System

By default, the RadScout application will use the WGS84 longitude latitude geographical coordinate system for all mapping and log file collection. There are times when it is necessary or practical to define a projected coordinate system. For instance, when adding a georeferenced aerial image file, it is necessary to set the coordinate system of the RadScout to the same coordinate system defined in the aerial image. The coordinate system will also be beneficial when collecting point features, which will be discussed in more detail below. To define a coordinate system, tap the File menu icon and tap Program Settings. Tap ***Coordinate System***, as shown in Figure 8. Select the desired Coordinate System and Zone from the drop-down box and tap the ***Save*** button. Once the coordinate system is saved, it will automatically apply every time the application is opened until changed again.

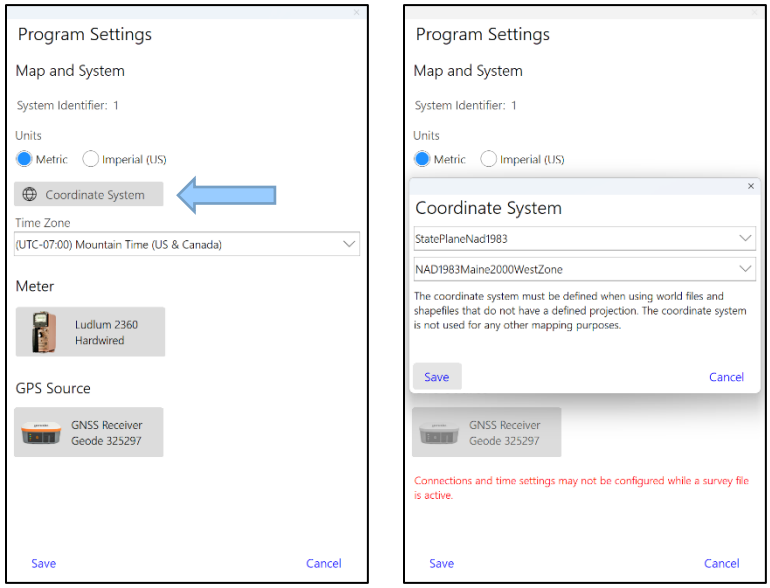


Figure 8. Defining a Coordinate System.

Defining a Legend

The legend menu can be used to define specific colors to ranges of gamma count rate data. Although the M2221 records both ratemeter and one-second scalar data, only the ratemeter data will be evaluated and displayed using the legend. If a M3000 is being utilized, the legend will be applied to the one-second scaler multiplied by 60. To edit the legend, tap the ***Legend*** menu icon . The legend editor will appear, as shown

in Figure 9. To add a new legend range or "break", tap the ***Add*** icon [+]. A new legend break will be added each time at 10,000 cpm increments. Tap on a break's color to change color, tap on a break's point size to change point size, and tap on a break's range to change the gamma threshold. *NOTE: The threshold is defined as the count rate at which the data will be colored if it is equal to or exceeded. For example, in the legend defined in Figure 9 all data with values between 30,000 cpm and 39,999 cpm will be colored orange. Data that are equal to or exceed 40,000 cpm will be colored red.* To remove a legend break, tap on the delete icon [×] next to the corresponding break.

In addition to manual legend edits, automatic color ramps and legend breaks can be applied by tapping the [...] icon on the upper right corner of the legend editor. A dropdown menu will open that will allow you to select a color ramp for the current legend breaks or to classify new legend breaks using collected data.

When all changes to a legend are complete, tap ***Update*** to save the legend and exit the menu or ***Cancel*** to discard changes and exit the menu.

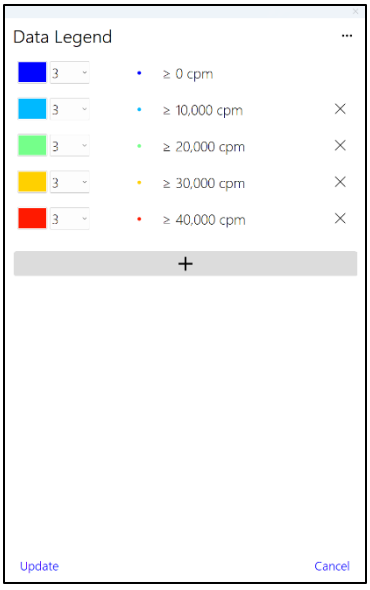


Figure 9. Legend Editor Menu.

The legend will be applied to both background geographical survey file (.gsf) layers and gamma data collected on active .gsf files. When multiple survey points exist at approximately the same location on a map, the highest gamma count rate value will appear on top of the lower gamma values. This allows for the typically more important gamma count rates to be visible when viewing data that are located spatially near to each other.

Creating a Survey File and Collecting Data

Prior to collecting survey data, a file must be created. To create a file, tap the **File** menu icon and then tap ***Create Log File***. A Create New Log File window will be displayed, as shown in Figure 10.

The filename will be automatically created using the current date, time, and the RadScout system ID. *NOTE: The system ID is provided as an integer to distinguish files easily when multiple dataloggers are used together. The system ID for each datalogger is predefined and may not be modified.* If desired, additional information may be added to the beginning or end of the filename string. It is highly recommended that the numerical fields are not modified. If necessary, enter additional information in the User, Survey Unit, or Comments text boxes. Tap on the ***Create*** button to create the file.

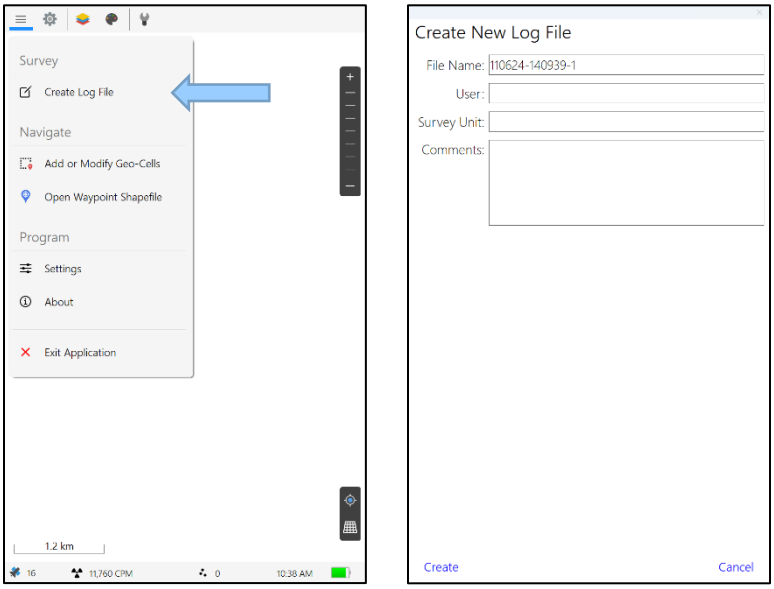


Figure 10. Create a survey file.

Once a survey file has been created, survey data may be collected. Tap the ***Collect*** icon to start collecting data. Logged data will appear on the map in real time as individual points and the datalogger will produce an audible beep as every new data point is logged. The datalogger volume can be adjusted using the P1 and P2 hardware buttons on the front of the datalogger. To pause the data collection, tap the ***Pause*** icon. When surveying is complete, tap the **File** menu icon and close the file by tapping either the ***Exit Application*** button in the lower left corner of the window or ***Close Log*** in the upper left corner of the window. A new popup window will display to confirm closing the survey file. Tap ***Yes*** to confirm or ***cancel*** to return to the survey. *NOTE: Once a file is closed, it may not be reopened to append data, however, all previously collected files may be opened as background layers and displayed while collecting new data.*

Adding Background Layers

The ability to add background files is an important feature that may be used to specify a survey transect (grid and survey spacing) file or to view previous survey data. The RadScout application allows previous geographical survey files (.gsf), geographical survey file merged (.gsfm), ESRI shapefile (.shp), or geotagged images (.jpg and associated .jpw) files to be loaded as background layers. As discussed in previous sections, the same legend that is active on the map will be applied to the. gsf and .gsfm files that are loaded as background layers. This simplifies the process of navigating back to elevated gamma "hotspots" or areas of interest based on survey data alone.

A shapefile may be a point, line, or polygon feature set. *NOTE: When gamma survey data are in a .shp point feature file the loaded map legend will not be applied to the shapefile data; a legend can only be applied to a .gsf or .gsfm file.*

To add or remove background layers, tap the **Background Layers** menu icon  . A list of accessible files will be displayed, as shown in Figure 11. *NOTE: To make a custom file accessible in the list, the file should be placed in the "RadScout" folder on a USB thumb drive and transferred using the RadSync application.* These files can include .gsf, .gsfm, .shp, and world files (.jpg with corresponding .jgw). Filter and sort these files by tapping the ***Filter*** icon  on the top right corner of the window. To select a desired file, tap the check box next to the file name. All coordinate systems will be re-projected into the active coordinate system if they differ. In the **Settings** menu icon  a ***Show Background*** toggle button can be toggled to show or hide the selected background files.

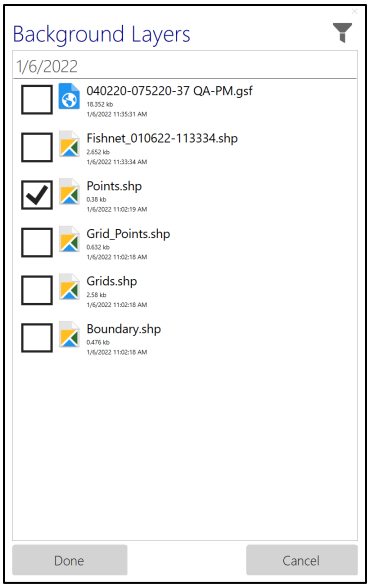


Figure 11. Loading Background Layers onto the Map.

Waypoints

The waypoint function is useful for displaying a point feature shapefile for navigational or informational purposes. For instance, it might be necessary to navigate to a predetermined sample location. To open a waypoint file, tap the **File** menu icon ☰ and then tap ***Open Waypoint File***. A list of available shapefiles will appear, as shown in Figure 12. *NOTE: To add custom shapefiles to the Open Waypoint File menu, the point feature shapefile must be added to the datalogger using the RadSync application.* Select the desired shapefile, then tap the ***Open*** button. The points will be displayed on the map, as shown in Figure 13. Unlike the background files, waypoint features allow user interaction through the map interface.

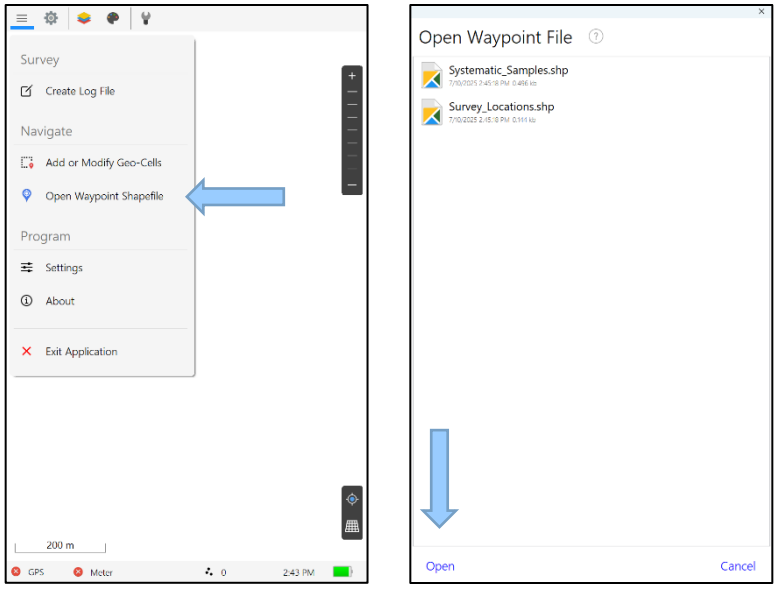


Figure 12. Adding a Waypoint File to the Map.

Opening point features as a waypoint file will make several new map control options visible, as shown in Figure 13. To reveal map options, tap on a feature point to reveal the waypoint menu and then select the option from the menu.

Navigate will pull up a compass needle to navigate towards the selected feature.

Visibility is used to turn individual samples on and off. This feature is useful to determine when tasks at specific locations have been completed.

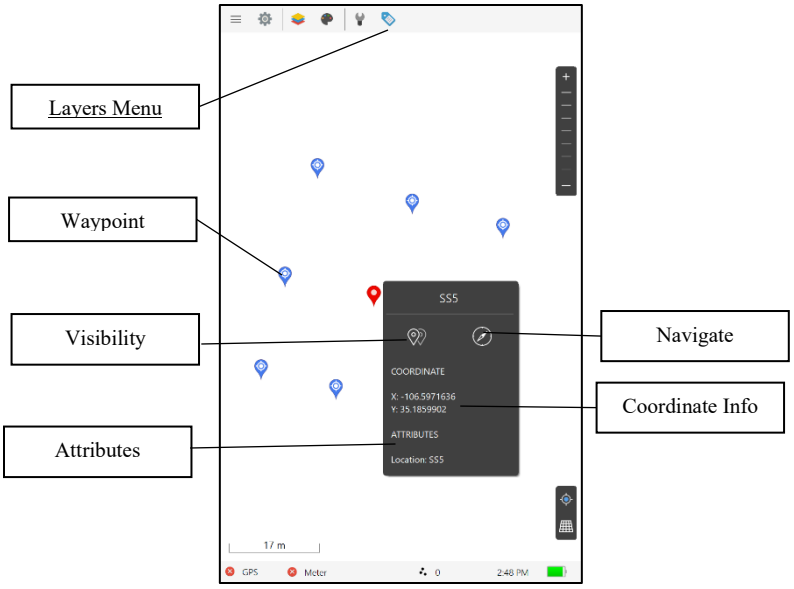


Figure 13. Waypoint Functions.

A **Labels** menu icon will appear next to the **Tools** menu icon when a waypoint file is open. Tap on the **Labels** menu icon to bring up labeling options, as shown in Figure 14. Labels will depend on column headers and values present in the point feature shapefile.

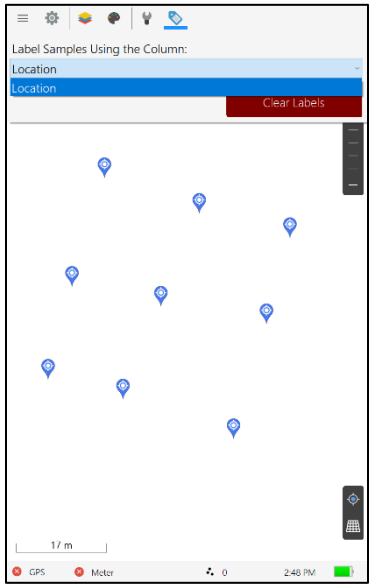


Figure 14. Waypoint Labels Menu.

Adding Features

It may also be necessary to add new data features to the map while performing tasks, for instance if an existing data feature point falls in an inaccessible location and a new location must be noted. The RadScout

application provides the ability to add point and line features to a map. Tap on the **Add Feature** menu icon to access the point and line feature options, as shown in Figure 15. *NOTE: A log file must be open to access this menu.*

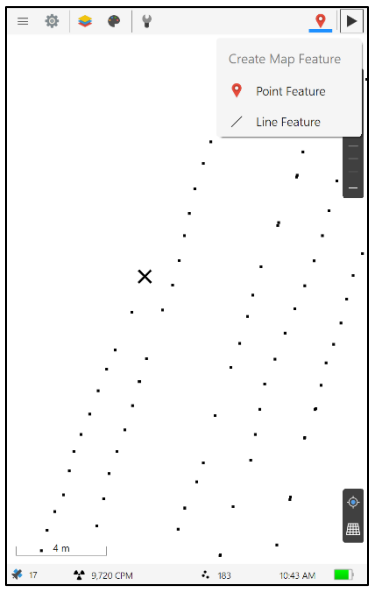


Figure 15. Add Feature Menu.

To collect a point feature, ensure that the GPS receiver is located over the desired location and tap the Point Feature option to begin collecting a point feature on the map. A new window will appear and the datalogger will begin collecting and averaging GPS positional data, as shown in Figure 16. *NOTE: It is important to remain in one location during this process to maintain high accuracy.* The number of averaged points, position, horizontal dilution, collection date information will be displayed. A comments box allows the user to record notes that may be displayed on the map or exported for later reference. If the datalogger is connected to a meter, there will also be an option to collect static gamma data at the location. When adequate precision is achieved and comments are complete, tap ***Save*** to save the point feature to the survey file.

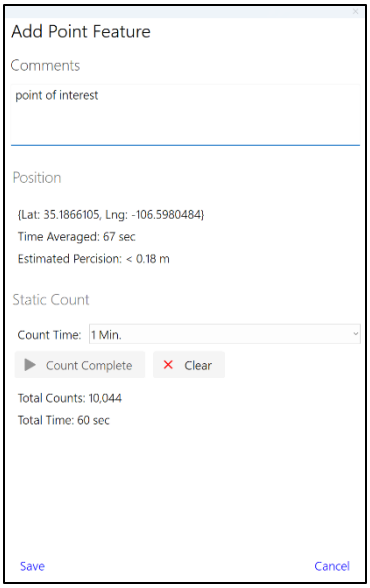


Figure 16. Add Point Feature Window.

To collect a line feature, tap the Line Feature option to begin collecting a line feature on the map, demonstrated in Figure 17. A comments box window where a description of the line feature may be added. When finished leaving comments, tap ***Start Log***. A new menu will appear at the top of the screen. Ensure that the GPS receiver is located at the desired start location and then tap the **Collect** icon ▶. The RadScout will record a position every one-second as you walk the length of the line and connect all positions to form the line feature. The line feature collection may be paused at any time by tapping the **Pause** icon ⏸. To end feature collection, tap **End Segment**. A dialogue box will appear with the option to save the line feature. Tap ***Yes*** to save the line feature to the survey file and close the line feature collection menu or tap ***No*** to discard the line feature and close the menu.

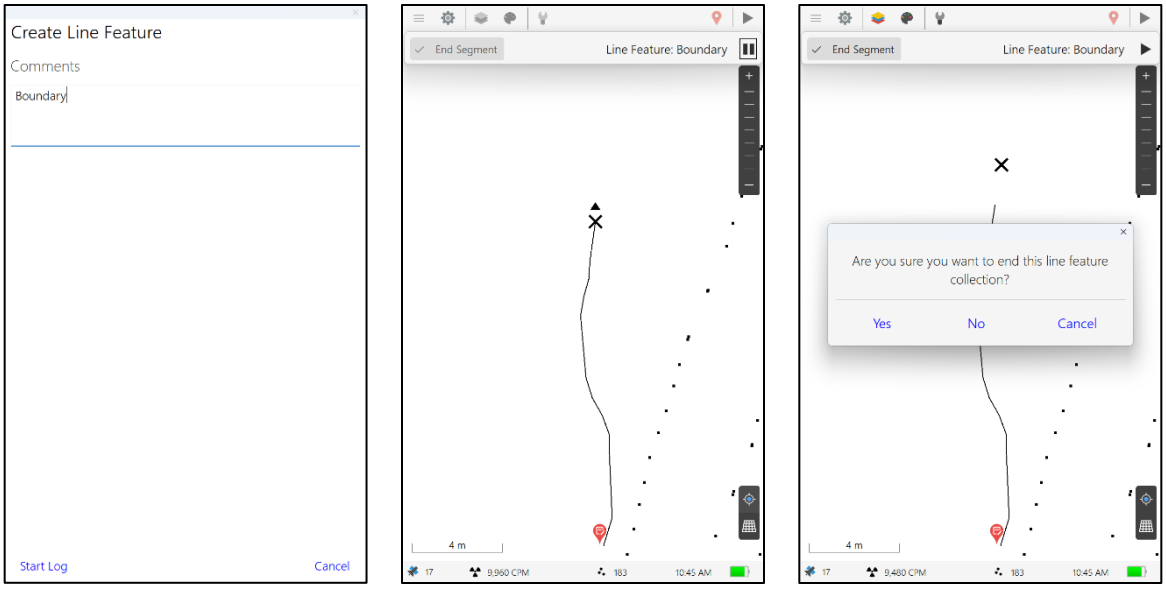


Figure 17. Create line feature menus.

Add or Modify

Additional Tools

The **Tools** menu icon brings up several tools to provide the user additional information on their map or features, as described below:

The Measure tool will provide distances between locations tapped on the map.

The Coordinate tool displays X and Y coordinate data for any location tapped on the map.

The Create Transects tool is used to create and overlay a user-defined grid on the map which may then be followed as a survey guide, transect lines, or to show sample interval spacing.

The Log File Statistics tool is used to display basic statistics on previously collected .gsf files.

The Locate Min/Max tool is used to identify the record that has either the minimum or maximum value of that log file. This tool can be used with current or background .gsf files.

To use the Measure tool, tap on the icon to bring up a new window. Tap on the map at the start location, and then again at the end location you would like to measure the distance between. Successive taps will

provide the distance of the total line segment, as well as the distance of the final two points that were tapped, as shown in Figure 18. Tap ***Close*** to close the tool, ***Clear*** to start a new measurement, or ***Undo*** to remove the previous segment.

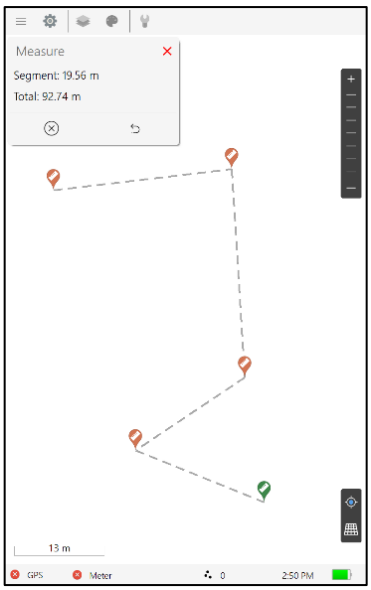


Figure 18. Using the Measure Tool.

The Coordinate tool will open a new window. Tap anywhere in the map window to display the coordinates of the tapped location, as shown in Figure 19. Tap a new location to move the marker or tap ***Close*** option to close the tool.

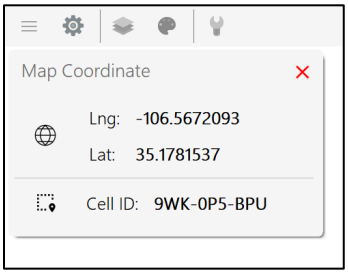


Figure 19. Using the Coordinate Tool.

The Create Transects tool opens a new window for drawing a fishnet polygon, as shown in Figure 20. The transect spacing (distance between parallel lines) can be modified by tapping the ***Spacing*** icon 10 and inputting a distance, and the ***Units*** icon Meters allows units of meters or feet to be selected. The ***Angles*** icon 0 allows the user to adjust the angle of the generated transects. To draw the perimeter polygon to create a fishnet polygon within, tap the map window to add vertices (points that make up the polygon perimeter).

Once three vertices are defined a perimeter polygon will appear. The perimeter polygon will adjust itself as more vertices are added. Tap ***Clear*** to start over, or **Undo** to delete the last vertex. To change the orientation of the transects, tap the ***angle*** icon and enter the desired degrees of rotation. When the perimeter polygon is complete and the desired angle is set, tap ***Generate*** to overlay a grid within the perimeter polygon. If generated transects require adjustment, changes can be made by adjusting settings and tapping ***Generate*** to overwrite the existing transects. Tap ***Save*** to save the transects to the datalogger. Tapping ***Close*** will bring up a dialogue box with the message "Would you like to save the fishnet as a background shapefile?". Tap ***Yes*** to automatically close the tool, save the fishnet with a default name, and load the fishnet as a background file. Tap ***No*** to close the tool without saving the fishnet. Tap the ***Cancel*** button to go back to the Create Fishnet tool.

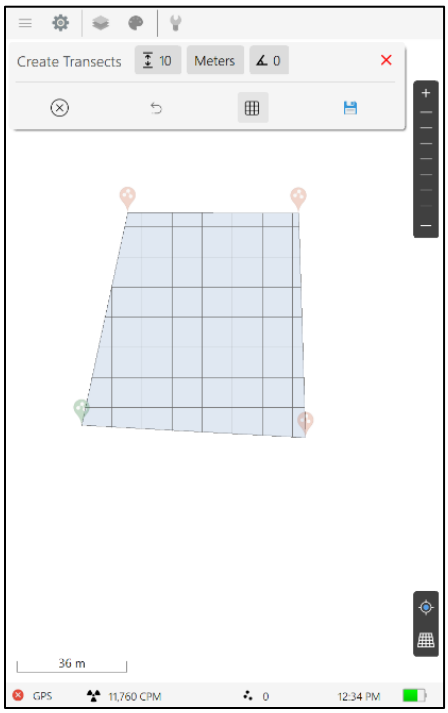


Figure 20. Using the Create Fishnet Tool.

The Log File Statistics tool will open a list of .gsf files on the device. Selecting a .gsf file will then display a histogram of the ratemeter data along with summary statistics of the number of records, the mean, and the standard deviation, as shown in Figure 21. *NOTE: The Log File Statistics tool may not be used on files that are currently being used as log files.*

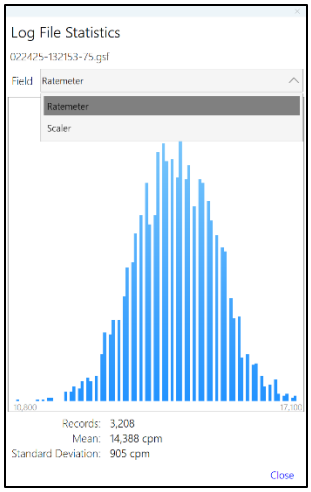


Figure 21. Using the Log File Statistics Tool.

The Locate Min/Max tool will open a window that can be used to identify the minimum or maximum reading in the active survey file or in the loaded background files, as shown in Figure 22. Tap either ***Survey File*** or ***Background Files*** to switch between the two options. Tapping the ***Min*** button place a marker on the map where the minimum reading was recorded. Tapping the ***Max*** button will place a marker where the maximum reading was recorded. Use the < or > icons to pan through the data in numerical order.

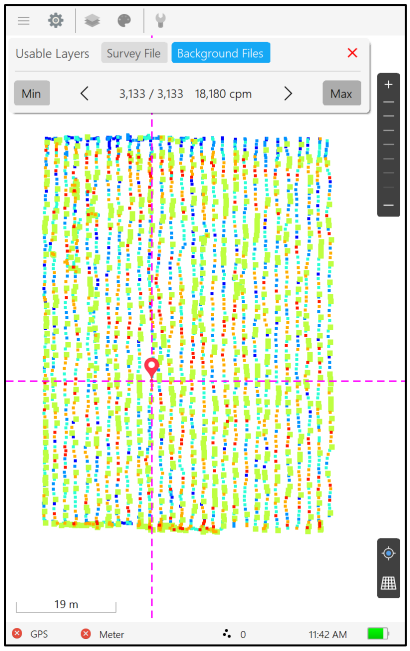


Figure 22. Using the Locate Min/Max Tool

4. SURVEY DATA EXPORT

Following the collection of data, it is often necessary to transfer field data to a central computer used for processing and reporting. This section discusses the process for transferring field data from one or multiple dataloggers to a single removable USB thumb drive.

Synchronizing Data

The Mesa datalogger includes the ERG RadSync application to simplify data transfer and ensure no survey data files are overwritten or deleted. *NOTE: ERG recommends always using RadSync for file transfer (Do not use Windows Explorer to transfer files). RadSync cannot be used while the RadScout application is open.*

To transfer field survey data from the datalogger to another computer, place a removable USB thumb drive into the USB slot on the bottom of the datalogger and open the RadSync application. The RadSync application will display .gsf survey files and data feature shapefiles that will be transferred to the removable USB thumb drive, as shown in Figure 23. Tap the ***Synchronize*** button to transfer the displayed files between the datalogger and USB thumb drive. *NOTE: The RadSync application will only display and attempt to transfer files that do not already exist on both the USB thumb drive and datalogger. If the data feature shapefiles on the datalogger are determined to be larger than the files on the disk (for instance, if features were added since the last transfer) then the shapefiles will be replaced with the newer file.* All original files will always be maintained on both the datalogger and the USB thumb drive.

If multiple dataloggers are being used to collect data, the same USB thumb drive should be used to export all data by following the same steps for each datalogger.

The application also provides an easy method of transferring background files and/or aerial image files to the datalogger. To synchronize and import data onto the datalogger, place the desired files (.gsf, .jpg, or .shp) onto the USB thumb drive in the directory <Drive>:\RadScout\. *NOTE: Files must be placed into the folder names "RadScout".* The software will copy these files to the datalogger if they do not already exist. *NOTE: That when this approach is used for synchronizing world image files (.jgw) with associated .jpg files, only the name will be used to determine if the file already exists.*

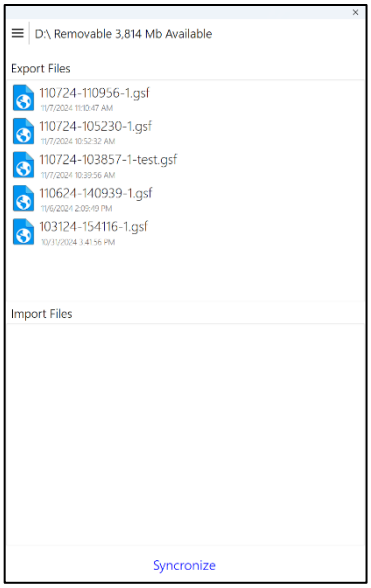


Figure 23. RadSync Software for Importing and Exporting Files.

Transferring Background Layers between RadScout Units

The RadSync application allows users to transfer background files, including transects created using RadScout, between Mesa units. *NOTE: This function is for transferring between Mesa units only. Users cannot export RadScout generated transects onto their desktop.* From the RadSync window, Tap the **File** menu ☰ and tap ***Export Background File***. This will open a window that allows you to select local files to export to USB drive. Tapping the ***Show Transect Files Only*** toggle will only display Transect files created on the Mesa using the RadScout application, as shown in Figure 24. Once the desired files are selected, tap Export to USB to transfer the files.

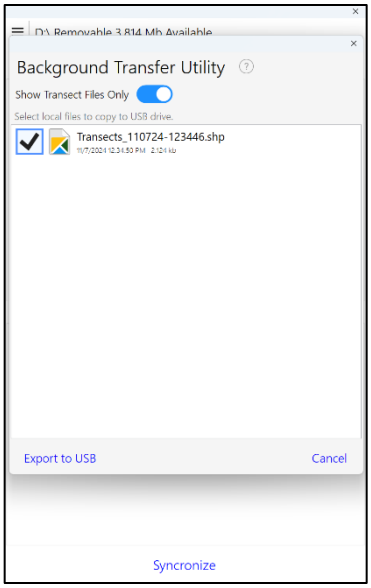


Figure 24. RadSync Background Transfer Utility.

5. DATA ANALYSIS

This section discusses the process for managing field data using the ERG RadScene application on a single desktop or laptop processing computer. The RadScene application provides the ability to create projects specific to the survey work being performed and makes it easy to import field data directly from the USB thumb drive.

5.1 Installing the RadScene Software

RadScene is available for download from the Microsoft Store via the ERG website. Install the software on a computer that will be used as the primary processing computer. The RadScene application is compatible with Windows 8.1, 10, and 11.

5.2 Projects

The RadScene software utilizes projects which will keep files organized and retain project settings, such as coordinate systems.

Project Controls

The **Project** menu allows the user to create new projects, open and modify projects. A description of each of the Project options are outlined below

Current Project – The **Current Project** tab allows the user to view and modify the settings for the project that is open in the RadScout application.

Open – The **Open** tab allows the user to open an existing RadScene project, or to continue to RadScene without a Project association.

New- The **New** tab allows the user to create a new project, or link to an existing project saved on a shared drive.

Settings- The **Settings** tab allows users to save and restore project-link files when uninstalling and reinstalling RadScene.

About- The **About** tab contains RadScene version information and patch notes from the most recent RadScene update.

Creating a New Project

To create a new project, go to the **New** tab from the **Project** menu. Under **New Project** enter a new project name and directory, as shown in Figure 25, and click the ***Create*** button. The software will create a folder in the directory matching the project folder along with all subfolders used to store RadScout survey data.

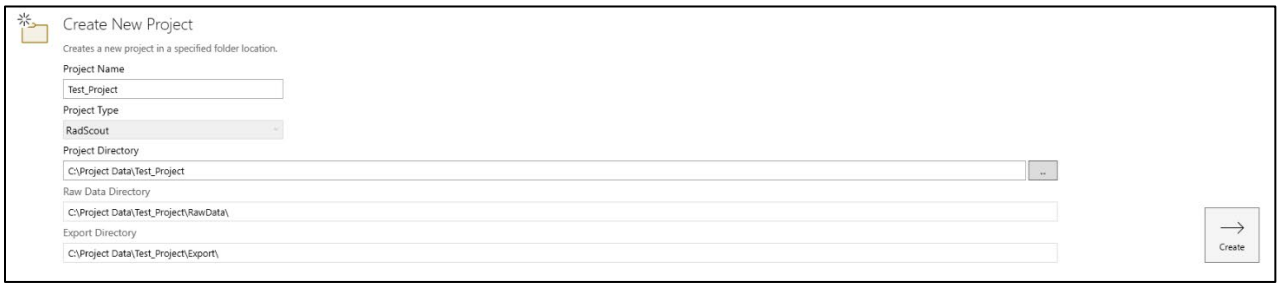


Figure 25. Creating a new project.

To create a new project link to an existing project located in a shared folder or drive, go to the **New** tab from the Project window. Under **Create New Project Link** enter a new project name and directory, as shown in Figure 26, and click the ***Create*** button.

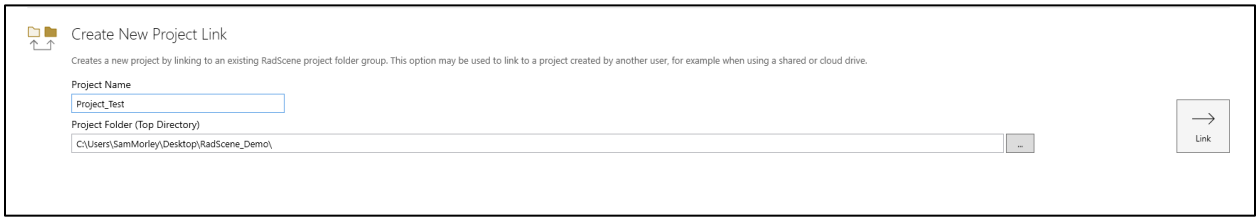


Figure 26. Creating a New Project Link

Opening and Modifying Existing Projects

To open or delete an existing project click the **Open** button in the **Project** menu (see Figure 27). To open an existing project, select the desired project. To delete an existing project, hover the mouse over the desired

project then select the ×. *NOTE: When a project is deleted, the project is removed from the project list, but all folders and survey data are retained in the original file path.* If a project has been deleted but it becomes necessary to reopen the project, create a new project link using the steps in the previous section. Selecting the ***Continue Without a Project*** button allows the user to use RadScene without an associated project directory.

Figure 27. Open or Delete an Existing Project.

Defining a Coordinate System

To define a coordinate system, select ***Project Setting*** from the **Current Project** tab. Uncheck the box that says *Use Latitude/longitude (WGS 1984)* then select the ***System*** and ***Zone*** for the desired coordinate projection. Once the system and zone are selected, use the ***Datum Transformation*** dropdown to select the correct datum transformation for the project, see Figure 28. The RadScene application uses the National Oceanic and Atmospheric Administration's (NOAA) Horizontal Time-Dependent Positioning (HTDP) algorithm and grid-shift files for datum transformations and accounts for time elapsed since reference frames were established. Therefore, results may differ when comparing transformed to other GIS applications that may not consider HTDP. The default datum transformation uses the most recent grid-shift files. If the project is created using older survey data, a different transformation may be warranted.

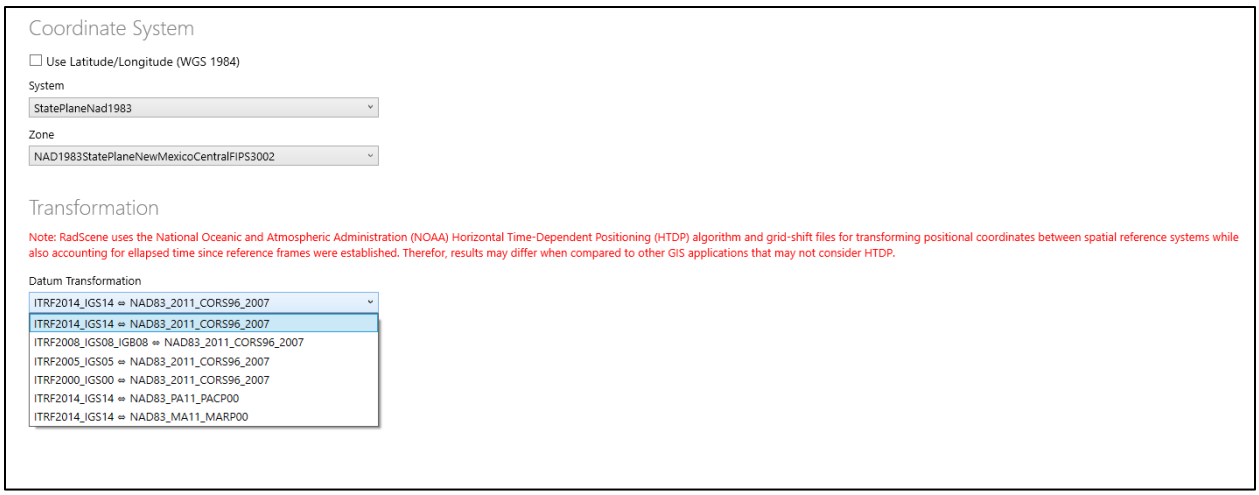


Figure 28. Defining a Coordinate System

5.3 RadScene Interface

The RadScene application map window, layers window, and other associated tools are all accessible from the main window, as shown in Figure 29.

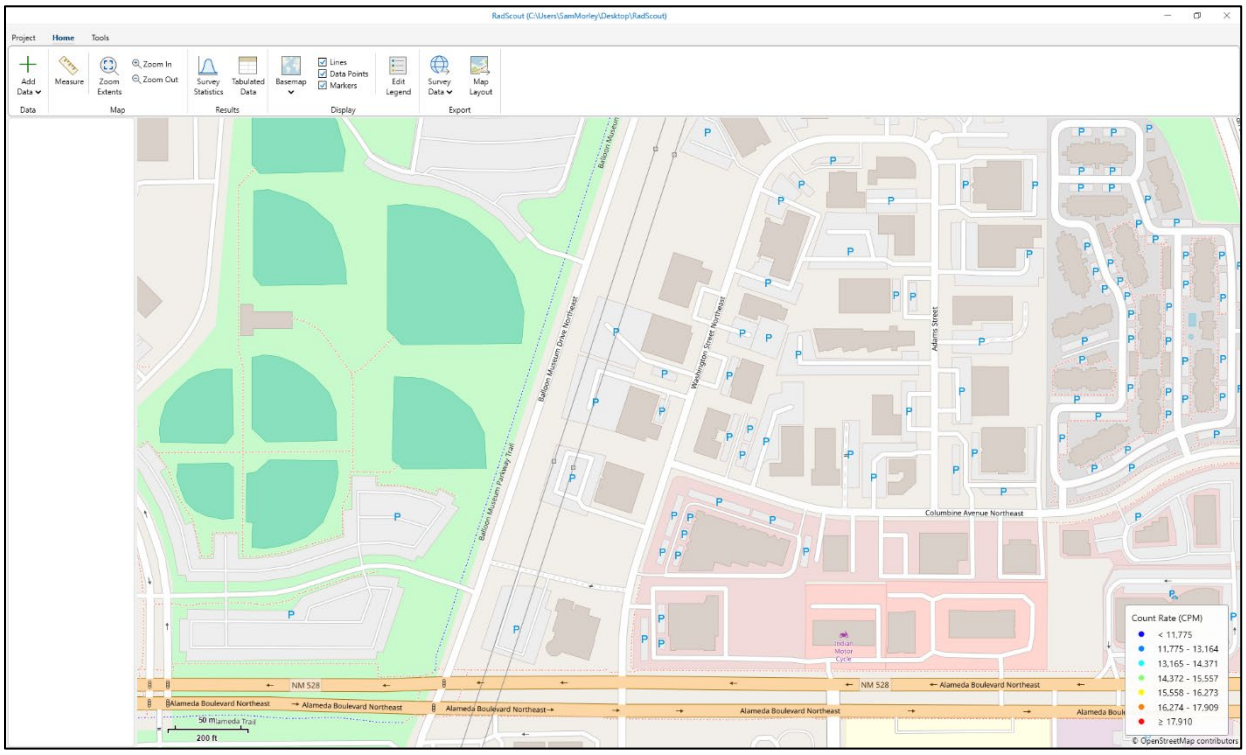
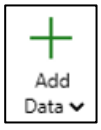


Figure 29. RadScene Interface.

Toolbar Controls

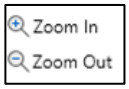
The toolbar controls are located on the **Home** ribbon. A description of each RadScout tool is outlined below.



The Add Data button is used to add survey and background files to the map. The add file dropdown allows the user to select different files based on attributes such as file type.

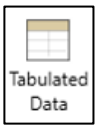
The Measure tool is used to measure distance on the map.

The Zoom Extents tool is used to zoom out to the bounds of open survey and background data.



The Zoom In and Zoom Out tools are used to zoom in and out of the center of the map.

The Survey Statistics tool opens a histogram and summary statistics of all the survey files loaded onto the map. This tool is only available when survey files are added to the map.



The Tabulated Data tool displays an attribute table that includes all of data from the survey files loaded into RadScene.

The Basemap dropdown allows the user to select their preferred basemap from five options: Open Street Maps, ESRI Topo maps, Bing Arieal Imagery, Bing Hybrid Imagery, and a plain white background.

The Lines, Data Points, and Markers checkboxes allow the user to toggle line features, radiological data points, and marker features on or off.

The Edit Legend tool opens the legend editor.

The Survey Data export tool is used to export all data loaded into the map to a usable data format such as a shapefile (.shp), or a comma separated file (.csv).

The Map Layout export tool is used to save the current map as a PNG image (.png) or JPEG image (.jpeg).

Layers Window

The **Layers** window, as shown in Figure 30, will display all files currently loaded into the map window. Unchecking the box next to a layer will remove the layer from the display. Double click on individual layers to display the survey file information. Right click on the survey files to show a context menu with additional options, including Zoom to Layer, Remove Layer, Layer Properties, Layer Attributes, and Layer Statistics. Right clicking a background files will only display Remove Layer and Layer Properties. To remove all survey files or background layers, right click on the main layer header Background Layers or Survey Files and select ***Remove All***.

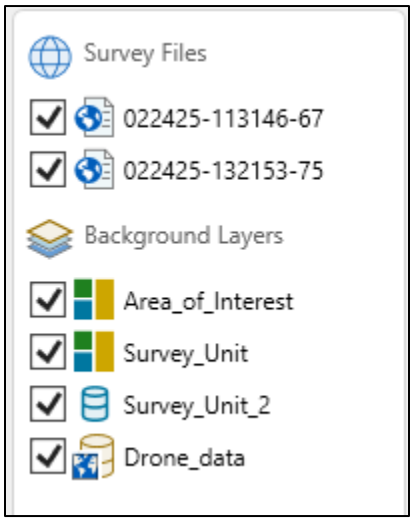


Figure 30. Layers window within RadScene.

Defining a Legend

A legend can be used to define specific colors to ranges of count rate data. To apply a legend, click the Edit Legend tool to open the legend editor or to view the currently applied legend. Double clicking the legend on the map will also open this menu. The thresholds and associated colors will be shown, as demonstrated in Figure 31. The threshold is defined as the count rate at which the data will be colored if it is equal to or greater than the threshold. To add a new legend break, increase the number of classes using the classes dropdown. A new legend break will be added and the current legend will reclassify using a Jenks Natural Breaks method. Legend colors, sizes, and threshold values can all be modified by clicking the relevant icon or value as indicated in Figure 31. Up to 10 breaks may be added to a legend.

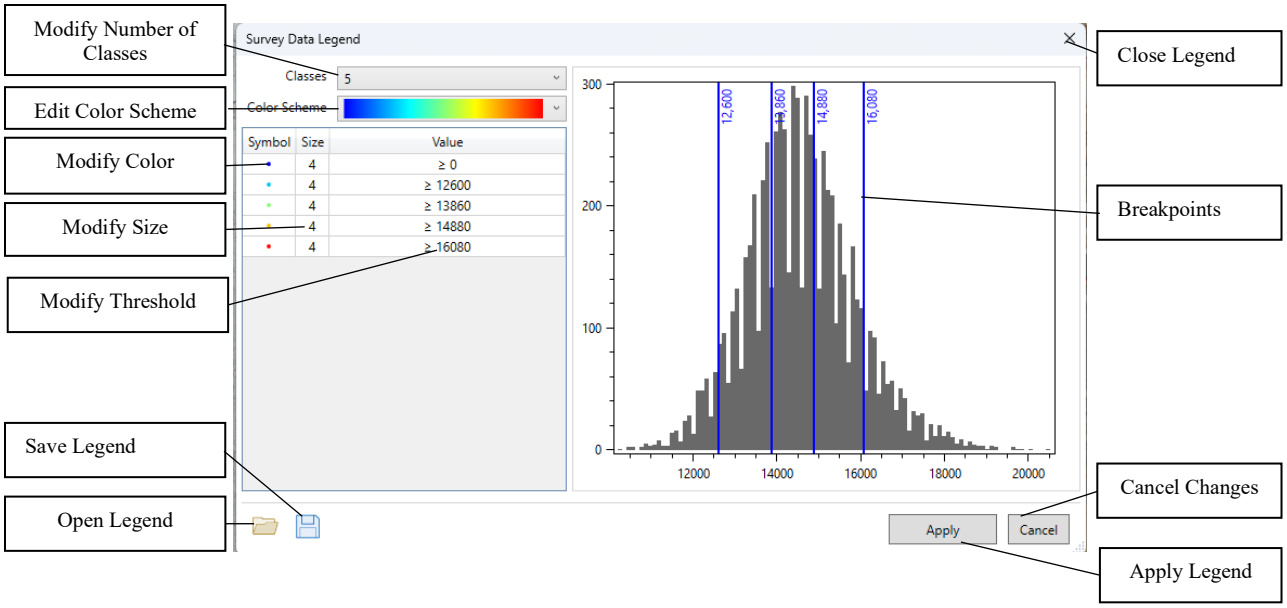


Figure 31. Defining a Map Legend..

Legend break points can also be adjusted by clicking and holding the mouse button while dragging the breaklines that are displaced on the data histogram.

The ***Color Scheme*** drop-down allows the user to automatically color all legend breaks based on a defined color ramp from low-to-high. *NOTE: Selecting a color ramp will overwrite any user-specified legend colors.*

When finished editing the legend, click ***Apply*** button to save changes and exit the editor. Click the ***Cancel*** button or close the window and exit without saving changes.

The legend will be applied to all layers loaded in the map window and will be displayed showing higher gamma count rate values on top of the lower gamma values when drawn on the map, even when using background layers. This allows for the typically more important gamma count rates to be more visible when viewing the data that are located very near to each other, and possibly displayed on top of each other, spatially.

The ***Save Legend*** button will save the legend as an IDX (.Idx) file. This file can be opened using the ***Open Saved Legend*** button. This allows the user to switch through various saved legends when working on a project.

Importing Data

Once a project is defined, field data may be imported. Insert the USB thumb drive used to store field data from the RadSync software and click the ***Import Data*** button found in the **Current Project** tab of the Project menu, as shown in Figure 32. *NOTE: The application will only copy files that do not already exist in the project directory. If the Data Features on the USB thumb drive already exist in the project directory the* ***Import Data*** *button will be disabled.*

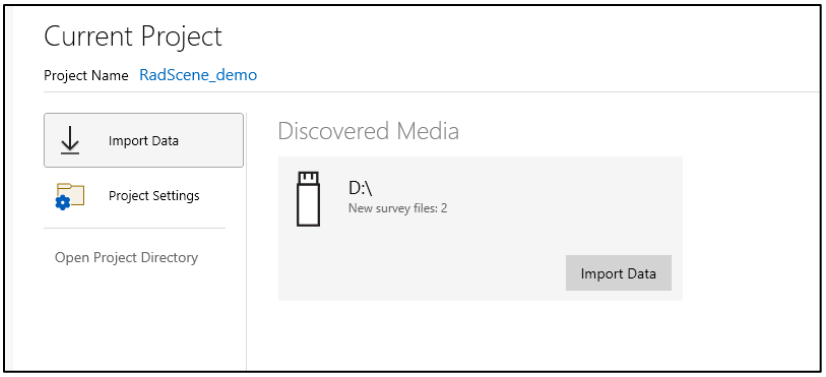


Figure 32. Import Data from USB thumb drive.

5.4 Data Analysis

Once data has been imported, it will become available to be added to the map. Click the Add File 

tool to add survey data to the map. Refer to the RadScene Interface above for information on viewing survey file details, tables, and defining legends.

Click on the Survey Statistics tool  to open a histogram and summary statistics window for all data displayed in the map window, as shown in Figure 33. Click and hold on the vertical bar to drag in either direction. The corresponding gamma count rate value will be displayed above the cursor.

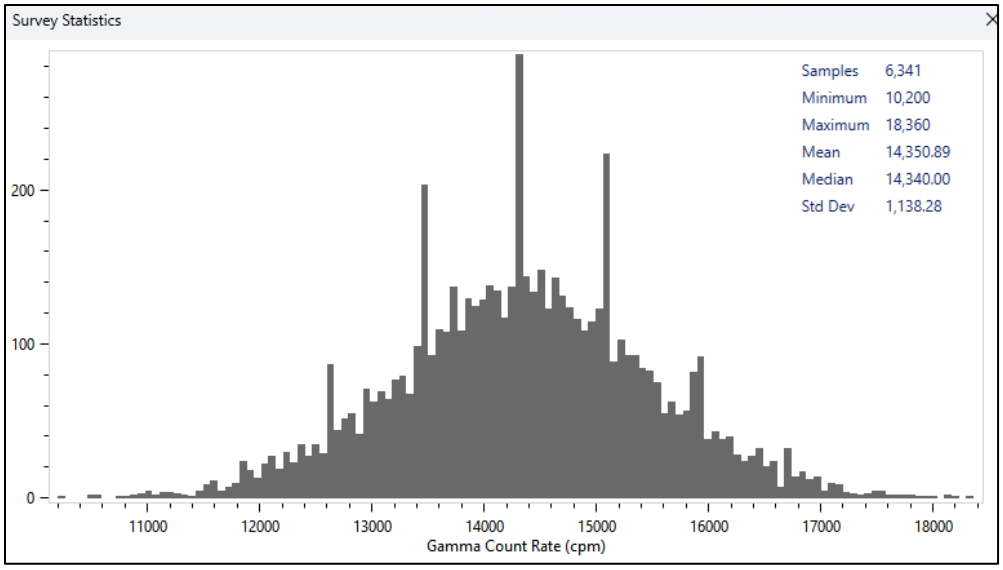


Figure 33. Data Histogram and Statistics

5.5 Exporting Data

Click the Survey Data  tool from the Export options to export all survey files currently loaded in RadScene into either a shapefile (.shp), comma separated file (.csv), bulk shapefile export, or as a merged survey file (.gsfm), as shown in Figure 34.

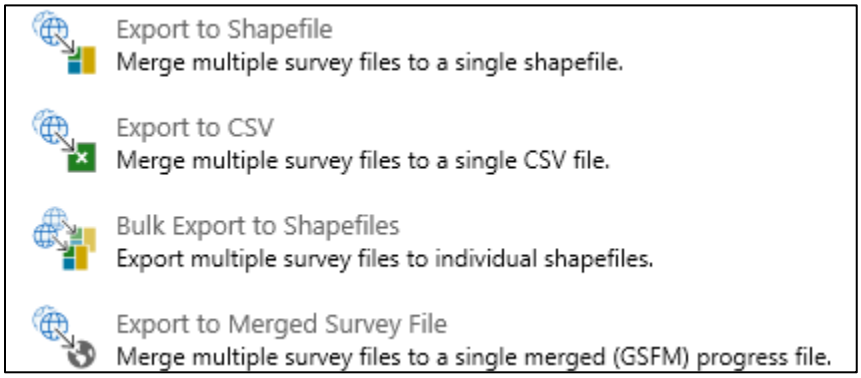


Figure 34. RadScene Export Options

Export to Shapefile

The Export to Shapefile option allows the user to export multiple survey files (.gsf) into one shapefile (.shp), see Figure 35. The export window allows users to choose to export all survey files loaded in the RadScene application, or just the files that have been checked. Click the appropriate radio button to indicate using the WGS Long/Lat or the defined project projection coordinate system. Select the time zone that the survey was performed in to correctly offset the time of each file record. The "Export records using UTC time" check box can also be used if it is preferable to keep data in UTC GPS time.

If a GSF file that is being exported includes point and line features, the file will be split into three files upon export. One file contains all the radiological survey points, one contains all point feature data, and one contains all line feature data. Deselect the checkbox next to each file to remove them from the export. *NOTE: By default, the exported file will be named using a date string, but the name may be changed by clicking the Select Directory*  *icon next to the current directory.* When all parameters have been selected, click the ***Export*** button to export all survey files.

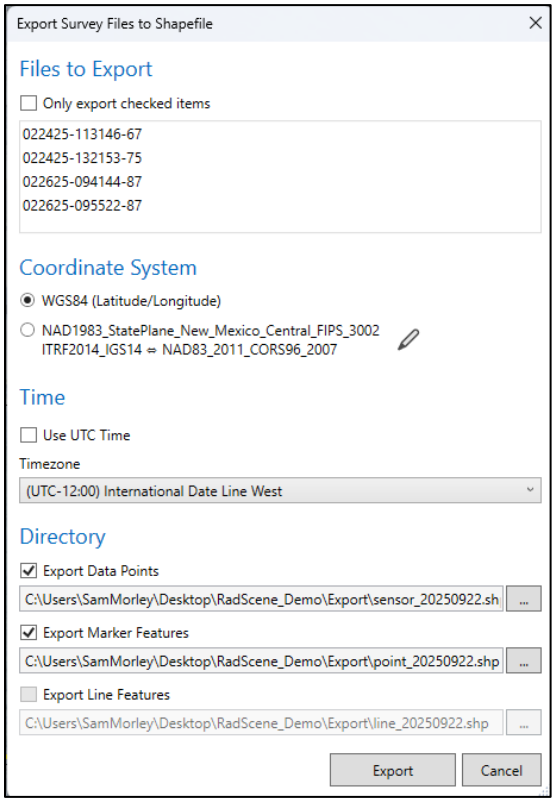


Figure 35. Export to Shapefile

Export to CSV

The Export to CSV option allows the user to export multiple survey files (.gsf) into one comma separated file (.csv), as shown in Figure 36. As with the Export to Shapefile option, the export window allows users to choose to export all survey files loaded in the RadScene application, or just the files that have been checked. Click the appropriate radio button to indicate using the WGS Long/Lat or the defined project projection coordinate system. Select the time zone that the survey was performed in to correctly offset the

time of each file record. The "Export records using UTC time" check box can also be used if it is preferable to keep data in UTC GPS time.

If a GSF file that is being exported includes point features, the file will be split into two files upon export. One file contains all the radiological survey points and one contains all point feature data. Line features are not exported using the Export to CSV tool. Deselect the checkbox next to each file to remove them from the export. *NOTE: By default, the exported file will be named using a date string, but the name may be changed by clicking the Select Directory*  *icon next to the current directory.* When all parameters have been selected, click the ***Export*** button to export all survey files.

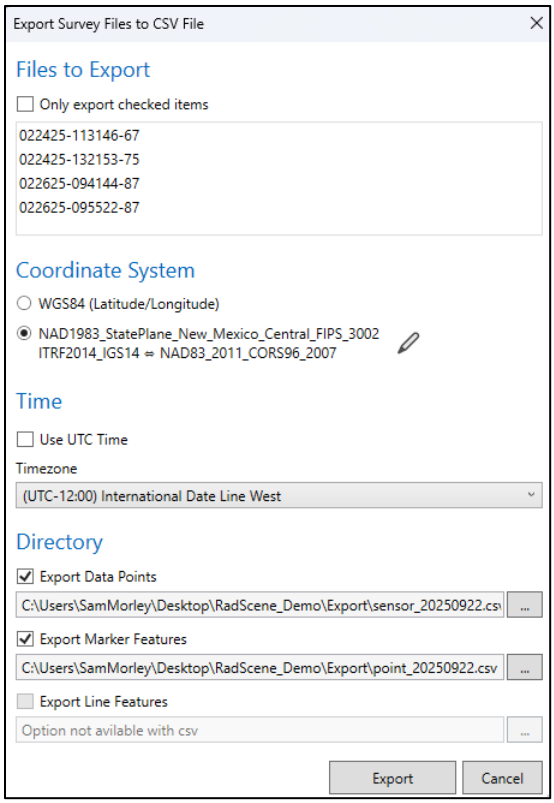


Figure 36. Export to CSV

Bulk Export to Shapefile

The Bulk Export to Shapefile tool allows the user to export multiple survey files (.gsf) into separate shapefiles (.shp), as shown in Figure 37. As with the Export to Shapefile option, the export window allows users to choose to export all survey files loaded in the RadScene application, or just the files that have been checked. Click the appropriate radio button to indicate using the WGS Long/Lat or the defined

Project Projection coordinate system. Select the time zone that the survey was performed in to correctly offset the time of each file record. The "Export records using UTC time" check box can also be used if it is preferable to keep data in UTC GPS time. *NOTE: The exported files will retain the original survey file name when bulk exporting.* When all parameters have been selected, click the ***Export*** button to export all survey files.

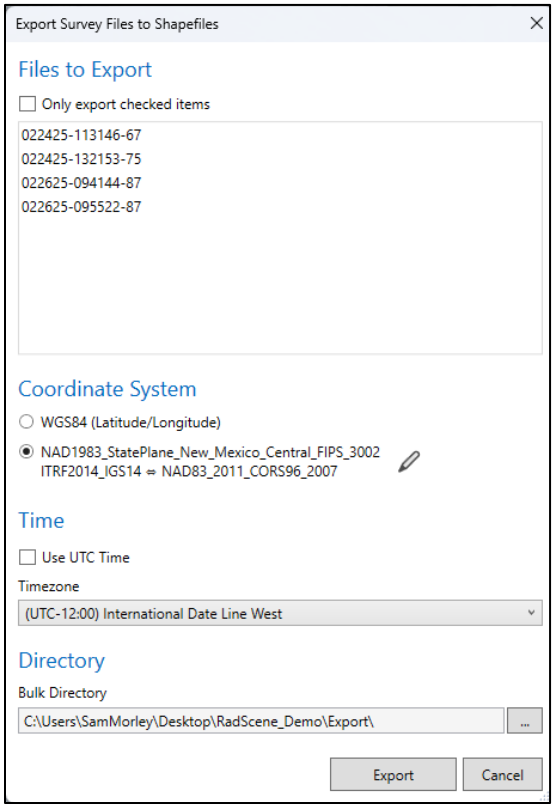


Figure 37. Bulk Export to Shapefile

Export to Merged Shapefile

The Export to Merged Shapefile tool allows multiple survey files from different users to be merged into a single file and exported to each datalogger. *NOTE: A merged .gsfm file may only be used as a background file for viewing data progress within RadScout.* Users can choose to export merged survey files directly to a USB drive (default), or select a custom directory location, see Figure 35. When all parameters have been set, click the ***Export*** button to export the merged survey file.

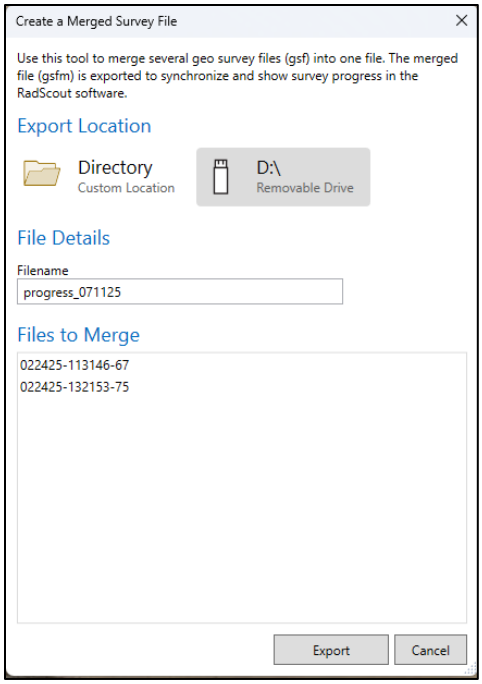


Figure 38. Creating and Exporting a Merged GSFM.

5.6 Data Tools

Additional File Tools

Additional tools not specifically related to RadScene operation, but found useful, are located at the top of the RadScene application window on the **Tools** ribbon. A description of each tool is outlined below.

The Repair File tool is used under rare circumstances when a .gsf file becomes corrupted. This may occur when power loss or damage unexpectedly occurs during active surveying.

The CSV to Shapefile tool is used to generate a shapefile using a .csv file that contains coordinate information.

The Transform Shapefile tool is used to project a shapefile between an ITRF and NAD83 datum. The conversion accounts for Horizontal Time Dependent Positioning (HTDP) using the National Oceanic and Atmospheric Administration's (NOAA) grid-shift files.

The Nearest Neighbor Averaging tool performs a spatial nearest neighbor averaging of a shapefile using the selected fields. The results of the averaged fields will be added to the selected shapefiles as a new attribute column.

The Create Transects tool is used to create gridded transects either by using a polygon shapefile or creating a boundary on the RadScene Map.

Repairing a Corrupt File

In very rare scenarios, a .gsf survey log file may become corrupt, preventing it from being exported as a shapefile. This may occur if the datalogger shuts down unexpectedly or freezes while a record is being written to the file. When loading survey files onto RadScene, corrupted files will be identified by a red exclamation circle  . To repair a corrupted file, select the **Tools** menu at the top of the RadScene application window, and then click the Repair File tool. Select the file from the open file dialog. Click the ***Repair*** button from the ***Confirm Repair*** window, as shown in Figure 39, to repair the file. The tool will create a backup of the original file, which will have the suffix 'backup', and will then be copied to the same folder location as the original file.

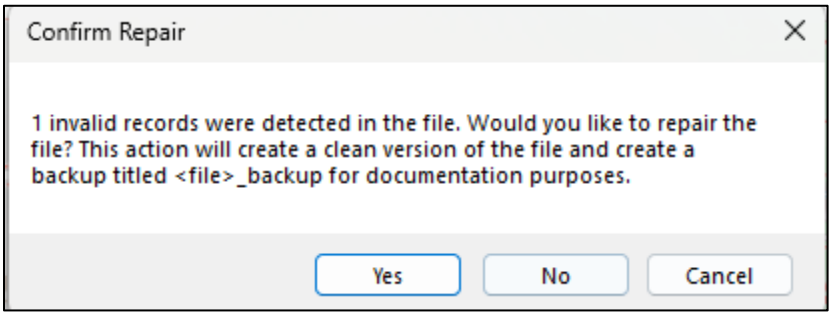


Figure 39. Repair Corrupted GSF tool.

CSV to Shapefile.

Occasionally, point data stored in a csv file needs to be converted to shapefile form to be imported on the RadScout or opened in a GIS application. The CSV to Shapefile tool allows the user to convert csv files that include coordinate data into a shapefile that can be used as a waypoint file in RadScout as shown in Figure 40. After selecting the desired CSV file, select the columns from the file that corresponds to X and Y coordinates using the dropdowns under ***Coordinate Definitions***. Users can set the coordinate projection of the shapefile by clicking on ***Edit*** button  then, using the ***System***, ***Zone***, and ***Datum Transformation*** dropdowns, defining the desired projection. Once all parameters have been set, select the ***Export*** button.

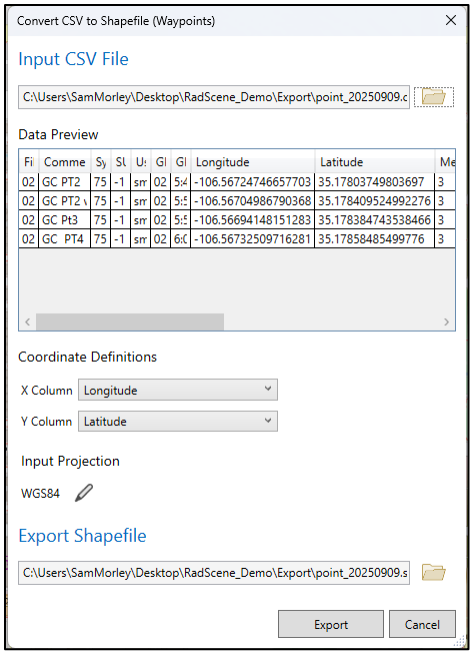


Figure 40. Convert CSV to Shapefile

Transform Shapefile

The Transform Shapefile (Figure 41) tool projects shapefiles between an ITRF and NAD83 datum realization using the National Oceanic and Atmospheric Administration's (NOAA) Horizontal Time-Dependent Positioning (HTDP) algorithm and grid-shift files. Transformations using this method account for change in positioning due to crustal movement over time, allowing the users to correct for location shifts that may occur when comparing data collected over an extended period of time.

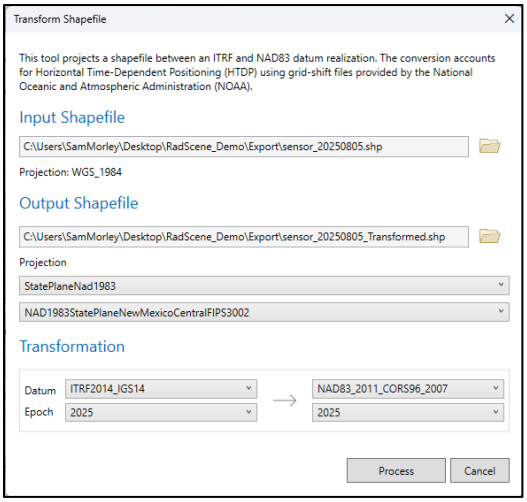


Figure 41. Transform Shapefile

Nearest Neighbor Averaging

RadScene allows for basic spatial analysis of datasets by enabling the user to perform nearest neighbor averaging on one or more fields in a shapefile, as shown in Figure 42. Nearest neighbor averaging of survey data can improve spatial resolution and assist in the identification of hot spots. The resulting averaged fields will be added to the selected shapefiles as new attribute columns.

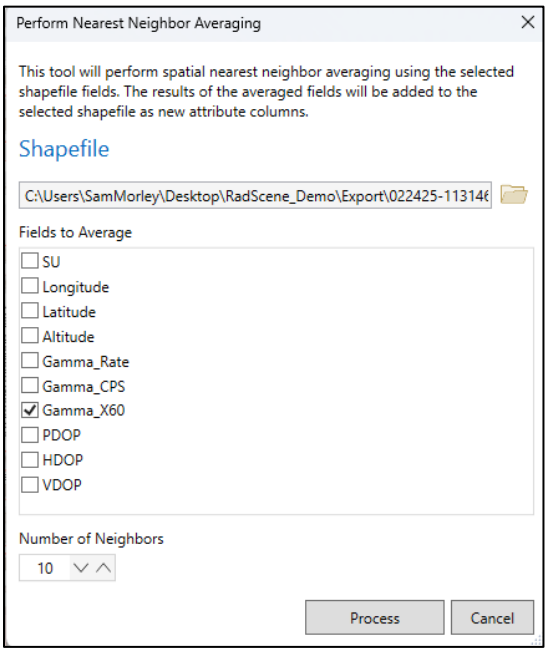


Figure 42. Nearest Neighbor Averaging

Create Survey Transects

During survey planning, defining survey boundaries and survey transect spacing is often required. The RadScene application allows for gridded transects to be created using an existing polygon shapefile as a boundary. To create survey transects, select the **Tools** menu at the top of the RadScene application window, and then click the Create Transects tool. Selecting this tool will bring up a separate window, as shown in Figure 43. From this window, a polygon shapefile can be loaded by clicking the ***Open Shapefile*** button and transect spacing (distance between parallel lines) can be defined in the *Spacing:* box. The angle of the transects can be defined in the *Angle* box. Select *Generate Transects* to create a grid within the polygon boundary. Select the *Export Shapefile* option to bring up a Windows directory to specify the location to save the shapefile created. If a USB thumb drive is detected, the export location will default to the RadScout folder so that the transects can be easily loaded onto a datalogger using the RadSync application.

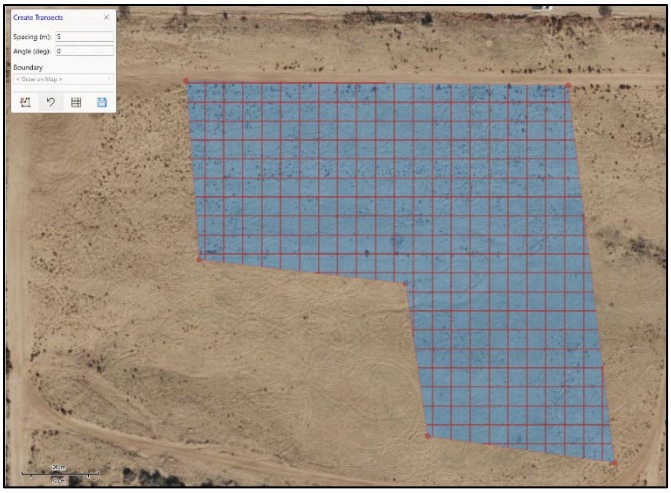


Figure 43: RadScene Create Transects Tool.