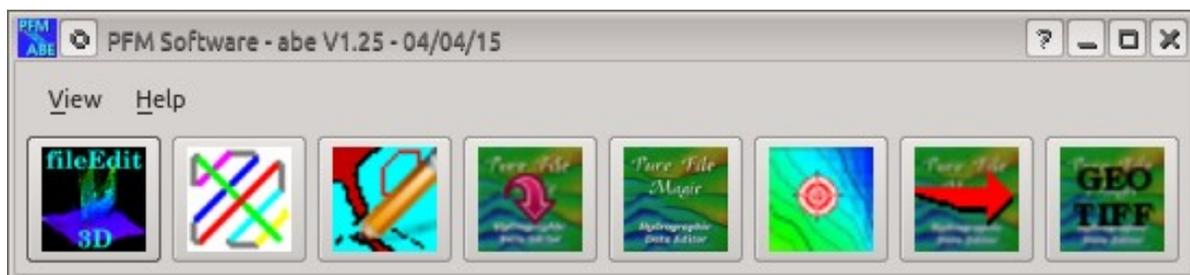


Quick Start Guide for the ABE Program

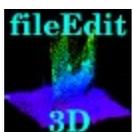
Welcome to the Quick Start guide for the PFMABE software suite. From humble beginnings as an idea on the road to Nashville, this suite of programs has grown to fill your needs to bring sonar/lidar data from collection to mapping. Collecting the data is where you spend all of the time and money. The final chart or GIS product that you deliver is the goal. In between, there's a whole lot of cleaning, shifting, and quality control that needs to happen to create that dataset. That's where PFMABE can help. Funded by your tax dollars, the software is free and always will be. How would you like to learn how to best utilize the tools? It's your software, we believe you should be able to use it.

The abe program was originally written to allow Windows users to run the main programs of the Area-Based Editor (ABE) suite of programs without having to use the command line. Drag and drop capability has been built in to each of the buttons in the abe GUI.



The order of the buttons from left to right is, generally speaking, the order in which you want to run the programs.

fileEdit3D





The first button launches the fileEdit3D program. This program is an along-track, 3D point cloud editor for single data files. The program supports Generic Sensor Format (GSF), Compact Hydrographic Airborne Rapid Total Survey (CHARTS) Hydrographic Output Format (HOF), CHARTS Topographic Output Format (TOF), Coastal Zone Mapping and Imaging LiDAR (CZMIL) Point Format (CPF), and ASPRS LAS data files. Because this program requires random, direct read and/or write of single records, LAZ format is not supported. Please note that, throughout ABE, LAS and LAZ files must be either geographic or UTM. Data points from UTM LAS/LAZ files will be converted to geographic positions when they are loaded into a Pure File Magic (PFM) structure. Since unloading edits from PFM only modifies the status information (the killed flag in LAS/LAZ) the conversion of the X/Y positions to latitude/longitude is not an issue.

In the late 1980's single line swath editors were the tools of choice for the Naval Oceanographic Office since most of the data that was collected was deep ocean data with little or no overlap. Once the emphasis moved from deep water to hydrographic, near-shore data the data volume and overlap of tracks forced the creation of PFM and ABE.

So, why do we keep fileEdit3D around and why is it first in the chain? Suppose you receive some data, either from a repository or from a survey platform. The first thing you want to do is to take a quick look at the data and see if it is any good. The fileEdit3D program allows you to do this without having to know the location of the data. For CHARTS, CZMIL, and LAS v1.3 or v1.4 data you can also use fileEdit3D to view the associated waveform data for points in the point cloud. Using this program to edit data is not recommended for a couple of reasons. First, you can't see any overlapping or nearby data from other files to help in your evaluation of the data. Second, fileEdit3D is not designed to do the majority of data editing in ABE so it doesn't have all of the tools available in pfmEdit3D.

trackLine



Once you have verified that the data in your files is good you probably need to find out where the data is located. You may already know the area and have a generic area file or ESRI Shape file defining the geographic polygon or rectangle that contains the data. In that case you don't really need to run the trackLine program although you may want to so that you can overlay the tracks in pfmView.



If you don't know the area then you will need to define one. The simplest way to do that is to run the trackLine program to create a decimated track file (.trk) and/or a generic area file (.are) for the data files. The trackLine program supports GSF, Smoothed Best Estimate of Trajectory (SBET), POS, CZMIL SBET Format (CSF), LAS, and LAZ data. This program uses heading and speed thresholds to determine when a vertex for a track line segment needs to be output to the track file. The assumption is that GSF files come from boats or ships, thus having lower heading and speed thresholds, and SBET, POS, and CSF files come from aircraft which requires larger heading and speed changes. For fixed wing aircraft the heading and speed values can generally be left at the default values.

For LAS and LAZ data a track file will not be created. The minimum bounding rectangles (MBR) defined in the LAS/LAZ headers will be combined to make an overall MBR for the data. You may note that, even though it is not supported in fileEdit3D, LAZ format is supported in trackLine and other ABE programs. The reason for this is that LAZ can be loaded into the PFM structure. Edits made to LAZ data in a PFM structure can't be unloaded to the input files but the data can be extracted to a new LAS or LAZ file using pfmExtract (more on this later).

areaCheck



The areaCheck program started out as a simple little GUI to allow the user to view, edit, or define areas using ISS60 area files (.ARE) or generic area files (.are). Of course, as a friend of mine once said, "Never do anything useful, it will come back to haunt you". The areaCheck program has evolved over the years to include the ability to display all kinds of data. Duck tape, chewing gum, bailing wire, and super glue have been used to tack on things as they became needed. Thus, this program tends to die if you try to do too many things at once. For the purpose of this quick start work flow you should only need it to view or create an area file to be used by pfmLoad. If you created a track file (.trk) with trackLine you can open it in areaCheck and then define an MBR or polygon to cover the area of the tracks. The file created can be output in generic area file format (.are), Army Corps area file format (.afs), ISS60 area file format (.ARE), or ESRI Shape file format (.shp with associated .dbf and .prj). If you created a generic area file (.are) from LAS or LAZ files with trackLine you can view or edit it in areaCheck.

Please note the capitalization of the extension (.ARE) for ISS60 area files. If you are on Windows and you create a generic area file then make the extension uppercase, none of the ABE programs will work with it.

pfmLoad



The pfmLoad program creates one or more new PFM structures or appends data to one or more existing PFM structures. Now that you have an area file of some sort (.are, .shp, .ARE, or .afs) that covers the data for which you want to build a PFM you can run pfmLoad. Since this is a simple quick start guide I won't cover parameter files (either .prm or .upr) but will instead focus on the simplest use – creating a single PFM structure. You should only create multiple (up to 31) PFM structures if your data files contain data in ALL of the areas to be created. This will save I/O time in that you only have to read the files once for all of the areas instead of once each for each area.

The first page of pfmLoad has a single modifiable field. This field allows the user to set the amount of cache memory used when loading the PFM. On most systems today you can set this value to the maximum of 2GB. If you create multiple PFMs this much memory will be used as cache for each PFM created, so be careful if you want to create 31 PFMs. The second page is where you define the location and name of the PFM you want to create and also enter the area file (that you probably created with areaCheck or trackLine).

One of the most important things that has to be set for each PFM is the bin size. The general rule of thumb for bin size is to use twice the average sonar footprint for the area you are defining or twice the LiDAR spot spacing. This will, hopefully, give you enough points in each bin to make statistical filtering possible. Of course, you don't want to define an area the size of the Gulf of Mexico and then ask for a 2 meter bin size so you have to use some common sense when selecting the bin size. There are two options for setting bin size. The first is in meters and is usually used for near-shore or topographic data. The second is in minutes of latitude and longitude. This is usually only used for deep water sonar data. When you set the bin size using one of these fields, the other field will become a zero.

Next to the bin size fields are the minimum and maximum depth. The reason that these fields are here is to try to save space in the PFM structure. This is done by creating a range and storing the depth values as scaled/offset integers in packed bit fields in the PFM. Since ABE was written for the Naval Oceanographic Office we use depths instead of elevations. When you look at data in ABE remember that the sign on the points should be inverted if you want to read it as an elevation. Everything still appears right side up but the values are depths. In practice, saving space is not really



all that useful anymore since the size of the PFM structure is so much smaller than the size of the input files. So, setting the minimum depth to -10,000.0 (Mount Everest) and setting the maximum depth to 12,000.0 (Marianas Trench) is probably not an issue. Please note that, if you do set these values to more real world values, any data that is outside of these bounds will be automatically marked invalid and will have to be unloaded after editing. This is not a good way to filter data.

The next field is the depth precision. This is set by default to one centimeter. Again, this was a space saving device since this defines the scaling value for the depth values. Since we don't unload the values, any round off here is irrelevant. You can use the context sensitive help to get information on the other fields on this page.

When you have finished setting the values for the first PFM you can press the **Next** button and define a second PFM. You can continue to do this for up to 31 PFMs. For just a single PFM you should leave the fields blank on the third page and press the **Finish** button. This will advance you to the **Global Load Options** page.

There are too many options to cover on the **Global Load Options** page so I will try to make it simple. You can define data flags, data types, and options for loading CZMIL, GSF, HOF, and TOF data. You can also define data specific attributes to be loaded for one or more data types (up to ten attributes) for GSF, HOF, TOF, CZMIL, LAS, and Bathymetric Attributed Grid (BAG) data. You can also define default horizontal and vertical error values for data types that do not have them defined internally (CZMIL and LAS). Context sensitive help is available on all fields on the **Global Load Options** page. Pressing the **Next** button will move you to the **Input Data Files** page.

On the **Input Data Files** page you can specify which files you want to load into your PFM. There are three different ways to do this.

First, you can use the **Files->Browse** button to select one or more input files. This is the simplest method.

Second, and most powerful, you can change the **Directories->Directory file mask** for the data type you want and then use the **Directories->Browse** button to select a directory (and all of its sub-directories) from which you want to include all files of the selected type. This is handy if you have a few hundred input files scattered in a number of directories under a single directory (like a survey directory). Where it really makes a difference is when you are actively surveying and you want to append files to PFMs that have been previously defined. For example, the first day on survey you create one or more PFMs with the data collected that day. On the second day you use pfmLoad to open the previously created PFMs. This will set all of the defined fields as they were set the first day. If you move through to the **Input Data Files** page and use the **Directories->Browse** button to select the same top-level directory, pfmLoad will check the PFM(s) to see which files have already been loaded and then insert just the new files that you added on the second day. This can be continued throughout the



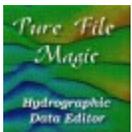
survey to append data to the existing PFM(s).

Third, you can select an existing PFM to get all of the input files that were used to create it. This is useful if you want to create a new PFM with the same data but a different bin size or different attributes.

The **Input file list** is editable so you can remove files from it. And, yes Virginia, you can combine different data types although it is probably better to build two or more PFMs with different data types since pfmView can view, and pfmEdit3D can edit, multiple PFMs at the same time. When you are finished defining the input files you can press **Next** to move to the **Build PFM Structure(s)** page.

On the **Build PFM Structure(s)** page you can save the parameters you have set to a parameter file to be used on the command line of pfmLoad or pfmLoader. You can save in either .prm or .upr format. The uses of these files is beyond the scope of this document. For more information use the **Help** button to get context sensitive help for the **Save** button. Normally you would just press the **Load** button to start the load process. When you press the **Load** button pfmLoad shells the pfmLoader program to actually load the PFM(s). Status information is displayed in the **Process status** box. When the load is finished, the **Finish** button will be enabled and you will be instructed to press it to exit the program.

pfmView



The pfmView program is the driver for the editing process in ABE. It displays one of the PFM surfaces (minimum edited, maximum edited, average edited, minimum unedited, maximum unedited, average unedited, standard deviation, or point count). You can drag and drop a .pfm file on the pfmView button in abe or click the pfmView button in abe and then use the file open dialog to select the PFM(s) to be edited. The surface view is used to determine areas that need to be edited. There are too many options and tools in pfmView to cover them here. Context sensitive help is available on almost every button, menu item, or GUI feature in pfmView.

Here is a generic work flow using pfmView. First, drag and drop a .pfm file on the pfmView button in abe then, using the mouse, select a rectangle of the data in the **Coverage** map in the upper left of the pfmView window. If you make the area so large that there are more bins than available pixels



you will be warned that you are not seeing all of the surface. Select the minimum edited surface and look for anomalies (you can use the different coloring options to help find them). When you see one or more anomalies you then use one of the point cloud editor modes (rectangle edit or polygon edit with or without invalid data) to select an area to edit in the point cloud editor (pfmEdit3D). When pfmEdit3D pops up you use the tools in it to edit the point cloud. You can also use some of the ancillary programs, like the waveform monitors or down-looking image viewer, to help make decisions about the data you are editing. Once you have cleaned the data of outliers you then exit and save the data. The PFM surfaces will be recomputed and the area of the PFM surface that you were editing will be redrawn. When you have finished with all of the minimum surface anomalies you then switch to the maximum edited surface and look for and edit anomalies in that surface. You may want to look at the standard deviation surface as well. When you are done with the section you were viewing you can set the viewed area to **checked** (look for the check button in the toolbars), unload the edits for the displayed area (the button next to the check button), and then press one of the arrow keys to move to an adjacent area (with 5% overlap). When you set the area to checked the coverage map data in that area will turn gray so you can see what you've edited. Wash, rinse, repeat until you are done with the entire PFM then get someone else to go through the PFM using the same technique but setting the surface to verified (use the check button, coverage turns green). It should be intuitively obvious to the most casual observer that multiple people can work on the same PFM at the same time. Just coordinate which area you are working on.

One of the most productive things you can do is to open a PFM in pfmView and then use context sensitive help on every button, menu, or GUI feature in both pfmView and pfmEdit3D. This will give you an idea of what tools are available in both programs.

Important note: When you are finished editing the entire PFM, if you think you might have forgotten to unload the edits for one or more areas, you can unload the edits for the entire PFM using the **Unload edits** menu in the toolbar. Conversely, you can run the pfm_unload program from the command line to do the same thing.

pfmFeature



The pfmFeature program is used to select IHO special order or order 1 features from a cleaned PFM structure. It will allow you to select the PFM structure, an output feature file, an optional input



area file to delimit the area in which features will be selected, and an optional input exclusion area in which features will not be selected. For a description of how the selection algorithm works just click the **Help** button and then click on the text at the top of the **Introduction** page. A number of options are available on the **Feature selection options** page. Again, context sensitive help is your friend. On the **Process** page just click **Run** to select the features. The features can be viewed in both pfmView, pfmEdit3D, and in pfm3D (3D PFM surface viewer).

pfmExtract



The pfmExtract program allows you to extract discrete points or surface values for a selected PFM. The data can be output in ASCII, ESRI Shape, LAS, LAZ, LLZ, or RDP format. The last two, LLZ and RDP, are used mostly by the Naval Oceanographic Office although they might be useful.

pfmGeotiff



The pfmGeotiff program builds a GeoTIFF from PFM surfaces. Either the minimum, maximum, or average edited surfaces is used to create the GeoTIFF. You can select a number of output options and set the colors.

This concludes the Quick Start guide. We sincerely hope this helps you to begin exploring the tools and software in the PFMABE suite. Further training and support is available at sales@pfmabe.software

Please direct any feedback to support@pfmabe.software

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