BearboatXL Manual

Introduction

BearboatXL is the successor of *BearboatSP*. It is a complete rewrite, but it is modeled on *BearboatSP* so it will be familiar to users of that earlier program. XL, among other things, is the Roman numeral for 40, which is roughly the number of years the program has been evolving. It is available only on Macintosh computers. There is no fundamental reason that I could not produce a PC version, but the proliferation of malware over the last couple of decades has made producing free software for distribution increasingly difficult. Both operating systems have created a complicated way of notarizing software to try and ensure that users will not have their computers attacked by software downloaded from the Internet. I do not have the resources to go through this process for the PC.

Currently (1/1/26), *BearboatXL* is incomplete in that there is functionality present in *BearboatSP* that is not present in *BearboatXL*. This will be rectified over time; I would assume by the end of the year. *PrintBearboatXL* is a separate application whose sole purpose is to take designs created in *BearboatXL* and introduce them into the real world either by printouts onto paper or via various formats that can be opened in a variety of 3D-CAD programs.

BearboatXL cannot open a *BearboatSP* design. There is enough similarity between how the two programs create the parameters that define a design that a user can manually go through a process of migrating a design from one format to the other - approximately - without too much difficulty.

BearboatSP was an update of an earlier program called *Bearboat Pro*. The differences between *BearboatSP* and *Bearboat Pro* are relatively minor; much of the code base is the same.

Bearboat Pro was developed in 2002 for both PC and Macintosh. It was the successor to what is now called *Bearboat Classic*, which was available only for Windows.

This program is shareware. It may be freely distributed. There is no charge for this program. If you ever actually build a kayak, I would ask that you send me a picture.

I encourage people to send their comments and suggestions for *BearboatXL*. It is an excellent time, while the code is still fresh in my head, to consider improvements. If you find features of the program confusing, drop me a line. ANY feedback is appreciated.

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History

I bought my first sea kayak in 1962, the Gulf Islander As a kid, it was the first major purchase of my life. My interest in kayak design and the actual building of kayaks started in 1967 when a teacher at my high school, Dwight Gibb, cajoled me into helping him make me a fiberglass boat for river kayaking. Once the boat was complete, he taught me the basic kayak skills. Many years passed before I built another kayak, but the seed had been planted.

The original versions of the program that became *Bearboat* were written in 1980 on the first HP personal computer, the HP-85, using HP Basic. That original machine had 32K of memory and a built in printer that output on 3" rolls of thermal paper. It required approximately two weeks for the computer to calculate the data for an entire kayak. I could not produce full-scale drawings, so for my early designs I spent days in the Anchorage library plotting on graph paper the numeric data that was produced.

HP – 85 Note the small built in screen and the roll of thermal paper used to output data

The program has been rewritten several times since then, often on a different OS platform with a different language, leading up to *BearboatXL*. *BearboatSP* was not a complete rewrite but merely an updating of *Bearboat Pro*.

1. 1980 *Bearboat* (personal use) - HP Basic on HP-85
2. 1998 *Bearboat Classic* – Virtual Basic on WindowsNT
3. 2002 *Bearboat Pro* – REALbasic on Mac OSX: Mac OS9 & Windows versions available
4. 2009 *BearboatSP* – REALbasic on Mac OSX: Windows version available
5. 2026 *BearboatXL* — Xojo on macOS. No Windows version available.

Synopsis

A kayak builder wrote *BearboatXL*. In this documentation, "your kayak" is treated as synonymous with "your design". However, this software is equally suited to designing a canoe. An open canoe would be designed simply by ignoring the deck. A closed canoe is essentially the same thing as a kayak as far as this software is concerned. It is quite possible to design a rowboat using this software; I hope some day to do just that.

The primary output of this program is a bunch of drawings of the cross-sections of the boat you have designed. The output can be on simple 8.5 by 11 paper or US legal paper, which is 8.5 by 14 inches. Other paper sizes are possible. The program accommodates to the fact that many of the cross-sections will require more than one piece of paper to draw. For these larger cross-sections, you tape a few pieces of paper together. The actual printing process is done by a separate utility program called PrintBearboatXL that is freely available.

The program determines the shape of the underwater section of any cross- section of the boat by determining the minimum wetted surface that will enclose the area specified by the user and constrained by the waterline width and depth of the boat at that position. With these three values, (waterline width, submerged cross-sectional area and depth) there is a uniquely determined curve that will be drawn for that cross-section. There is logic to minimizing the wetted surface as this helps minimize the resistance of the boat moving through the water.

Optionally, the program provides the possibility of additional constraints on the individual cross-sections beyond the basic three of underwater cross- sectional area, waterline width and depth. The designer can specify that the bottom of the cross-section cannot be completely flat by providing a minimum angle at the keel line. Similarly, it is possible to constrain the sides of the underwater area to an angle less than vertical.

Overtime, I have become more interested in the character of the hull and deck above the water. Once you get to a “reasonable” point in terms of wetted surface, there are other things that are of interest in terms a designing a boat that meets other needs (comfort, stability, storage capacity, surfing performance etc.) Despite this “maturation” of my thinking, the minimum wetted surface curves remain valuable, and this program still rigidly allows only the underwater curve that is the minimum wetted surface (subject to a few "constraints" that can optionally be applied - see below). This is not, in practical terms, that much of a straightjacket. You can easily modify the cross-sections that this program provides. The program can get you into the ballpark and you can go on from here. For example, it would not be hard to design a chine boat from the cross-sections that this program provides.

The cross-section profile curve of the deck and the cross-section profile curve of the above water sides of the kayak are decided by the user choosing from one of a number of “families” of possible curves.

This methodology assures that your design will be truly smooth. There will not be any subtle "wows" in the contour of your boat as might occur with other software programs, for example ones that make use primary use of NURB surfaces. It also allows you to design the underwater hull almost separately from the above water kayak. You can optimize your below water shapes and then design the upper parts of the kayak and let the software deal with melding them into one smooth whole. The waterline and the seamline are designed, to some degree, independently.

There are many ways and materials that are used to make kayaks. In the past, I have made fiberglass boats and have used the predecessors of this program to make the plug. My own construction technique has been to cut out of foam the cross-sections of the boat at every 10 cm. I place these cross- sections, appropriately spaced apart, on a straight stick the length of the boat and plank the result.

It should be obvious that there are many other techniques and modifications that can be used. Cedar strip building techniques can result in incredibly beautiful and light kayaks. *BearboatXL* is quite suited to designing kayaks and canoes of this sort.

The program is also capable of making reduced size models of the boat that you are designing. You can specify, for example, that you want cross-sections that are 1/5 life-size to allow you to make such a model that can be helpful in the design process.

A second type output is a computer file of numbers describing the cross-sections of the boat that you have designed. (width, height etc). These files are created as comma or tab delimited files that can be "read" by other programs (spreadsheets or word processors). The ability to document your design in this great detail is particularly useful for people who might have the opportunity to design more than one boat in their career. This enables you to compare your early designs (with whose behavior you have now become familiar) with later designs. This also enables you to compare your design with existing kayaks that have features you either like or dislike.

A final type of output is a computer file that can be read by a plethora of 3D-CAD programs (examples include *Rhino* & *SolidWorks*). Such programs, for users that master them, can specify the design of a kayak to the finest detail of hatches and cockpits. The output of *BearboatXL* can act as a starting point. 3D milling machines are capable of carving out a life-size 3D copy of the boat the user has specified. I have been able to export the data to these machines and successfully produced a plugs for several of my designs: Ursa 350, Ursa 430, and Ursa 432.

Individual designs are stored on the computer as rather small files. You can create and modify many different kayak designs. The smallness of these files makes it convenient to collaborate or share with others who have the program. It is easy to e-mail them.

Bugs

All programs have bugs. Therefore, I am sure that this one does. The user should take the initiative to make sure that the output of this program makes sense before actually trying to build a boat. Make sure that the output fits your concepts of the boat you are trying to build. If the boat is supposed to be 21” wide, make sure that it is, etc. It should be obvious that I cannot guarantee the accuracy of the output of this program. Let the user beware.

Having said this, I am interested in squashing any significant bugs. If you see any anomalous (incorrect) results or strange behaviors when you are doing things that seem rational, please notify me so I can correct or clarify the situation.

Installation

The *BearboatXL* and *PrintBearboatXL* are downloaded as a zip files. Expand them to get the working applications. Technically, these files can be placed almost anywhere, but it is most appropriate to place them in your Applications folder.

Terminology: Computer Interface

This manual strives to be consistent in how it refers to the various widgets that are used to specify the user's intents. These elements of the computer interface are commonly called controls and include such things as labels, sliders, checkboxes and radio buttons. The terms that are frequently used in the manual are defined below.

Window or Environment

The program basically consists of many different windows (environments) that provide the controls that let the user design or view various aspects of the kayak. Choosing items in the main menus usually specify the different windows.

For example, there is a *Profile* window that allows specification of the parameters that determine the side profile of the kayak.

Text Entry

Data entry boxes allow the user to type in values for the program to use. An example would be the data entry box that accepts the name of the kayak being designed in the *Enter/Exit* window. They are used fairly infrequently in *BearboatXL*.

Up/Down Arrow

Up/Down arrows are paired buttons that allow you to increase or decrease a value by a discrete amount. A single click will increase or decrease a value by one unit. To increase the flexibility of this control, *BearboatXL* modifies the behavior of *Up/Down Arrows* when the *Shift* or *Option* key is held down. This results in the increment value being greater when the *Shift* key is held down and lesser when the *Option* key is held down.

Slider

Sliders are commonly used to select a value from a spectrum of values. *BearboatXL*, for example, uses *Sliders* to specify the placement of location lines on graphics. These placements can range between the bow and the stern of the boat. *Sliders* allow the user to choose values in a range between a high and a low value.

Radio Button

Radio Buttons seen on the window as a group. They allow the selection of a single choice among many.

Checkbox

Checkboxes allow an option to be either selected or not.

Canvas

Canvases are the areas in the window that show the graphics and pictures.

BearboatXL occasionally allows clicking on the canvas itself to accomplish certain tasks, for example, moving the dots around in the *Profile* window that specify the shape of the deck profile. For the most part, *Canvases* function purely to show the state of the design being specified by other controls.

Group Box

Group Boxes are labeled rectangles on the window that group various controls to help organize the use of the window.

Pop Up Menu

Pop-up Menus provide a list of options that “pop-up” (actually usually down) when you click on the control. Only one of the options on the list can be selected at any given time.

Curve Shapers

A set of 4 controls are used to shape a curve. This functionality is seen in multiple locations in *BearboatXL*. These controls determine 4 integers, the values of which together specify the shape of a smooth curve starting at nothing at the bow, rising to the middle of the boat, and then declining to nothing at the stern. By convention, the leftmost value primarily affects the fullness of the curve at the bow. The rightmost integer primarily affects the fullness of the curve at the stern. The middle two values primarily influence the shape of the mid-position of the curve.

In Application Help

Much of the application's functionality is explained in the program via help windows containing explanatory text. Clicking on certain elements brings up a window in the upper right-hand corner of the screen that contains textual information about the topic at hand. The information presented here is often more complete than what is presented in this manual. The help elements are:

1. A ? button on each window. These provide an overview of the purpose of the window itself.

2. ⓘ buttons commonly adjacent to push buttons that explain the result of clicking on said button.

3. Special *Labels* that, when clicked on, bring up a help window referencing the topic that the label refers to. These labels can be identified because they turn blue when the cursor hovers over them.

Units of Measurements

Metric units are used throughout, primarily centimeters. Make sure that if you want to design a boat that is 21 inches wide, you do not end up with a boat that is 21 centimeters wide. As an option, imperial measurements are commonly shown next to their metric equivalents for those who are more comfortable with feet and inches.

The bow of the boat is considered to be at position 0 (zero). The stern of the boat is at position x, where x is the length of the boat in centimeters. All the measurements of where things are on the boat are based on this framework.

The surface of the water is considered the zero point of the vertical plane.

Entities, such as the height of the deck or the seam, are measured from the surface of the water NOT from the lowest point (bottom) of the boat.

Terminology: Kayak Descriptors

Deck Line

The line running the length of the boat in the midline connecting the highest point of every cross-section. The profile of the dek as seen from the side

Keel Line

The line running the length of the boat in the midline connecting the lowest point of every cross-section

Seamline

The line running along each side of the boat that connects the widest point of every cross-section

Design Weight

The user designs a kayak specifying a particular weight that determines where the waterline of that boat will be.

Waterline

This is the line running along each side of the boat where the surface of the water is when the kayak is at its design weight. Used in some contexts as synonymous with the greatest depth of the boat.

Waterline Width

This is the distance between the waterlines on each side of the boat, i.e. the width of the boat at the waterline. With a boat constructed using this program, the waterline width at any point is less than (or rarely equal to) the seam width at that point.

Deck Height

The distance from the highest point of the deck to the surface of the water is considered the deck height. Deck heights vary along the length of the boat.

Draft

The distance from the bottom of the boat to the surface of the water at the deepest point of the hull is considered the draft. The deepest point of an individual cross-section is often referred to as its draft (or depth). The drafts are expressed as positive numbers for the submerged part of the boat. Where the keel line is above the waterline, (at the bow and stern) the draft is expressed as a minus number.

Depth

Depth is synonymous with draft in this manual.

Seam Width

The distance between the two seam lines at any given point, which is the same thing as the width of the boat at that point.

Seam Height

Distance of the seam line above the surface of the water.

Bow Seam Height

Distance of the bow of the boat above the surface of the water

Stern Seam Height

Distance of the stern of the boat above the surface of the water

Position

Distance, in centimeters, from the bow of the boat.

Entry (Enter)

Position near the bow where the keel line enters the water

Exit (Leave)

Position near the stern where the keel line leaves the water

Waterline Length

Length of the part of the boat that is in the water (Exit - Entry)

Wetted Surface

As applied to a boat, this is the area of the boat that is in contact with the water. It would be expressed in centimeters squared. I also apply this term to an individual cross-section. In this context, it is the length of the line of that cross-section which is in contact with the water and would be expressed in cm.

Minimum Keel Width

This is a minimum width that the boat hull can attain. This assures that keel-like structures are thicker than the specified minimum.

Minimum Seam Width

This is a minimum width that the boat can attain at the seam line. This assures that the ends of the boat are not knife-edges. For many methods of construction this is not particularly important as "real-life" will prevent knife-edges.

Files in BearboatXL and PrintBearboatXL

The most important file is the one that stores a particular design. At the conclusion of a design session, the user is invited to save the design in its current state. A default location where these files are stored is a folder in the **Documents** folder named **BearboatXL_Designs**. This file is somewhat human readable, it contains all the parameters that the user has specified. These files are very small, no more than a KB or two, so they occupy an insignificant amount of space on the computer.

To minimize the potential of data loss due to encountering a bug or some computer failure, the application automatically saves, at intervals of time, the current state of design, snapshots as it were. These are saved in a folder within the **BearboatXL_Designs** folder that is named **PriorVersions**. That folder contains folders named after the month: 2603 would be the folder for March 2026. The files themselves are titled with the name of the design and a suffix that indicates the date and time that they were created. If the name of your kayak were Octopus, a typical file name would be something like **Octopus_260701_1502**. The trailing digits are indicative of YYMMDD_HHMM. 260701_1502 would signify July 7 at 03:02 PM.

The automatic creation of snapshot files in **PriorVersions** partially addresses a problem that I have occasionally encountered. I have a design, and I confidently make a change. For example, I might make the kayak 2 cm narrower. I work on the design for a long-time, making all the adjustments in the other parameters. I get deeper and deeper and then I realize that I really do not like the consequences of the original change. Now I should have saved my old design with a different name, so I could go back to it. But I didn't.

What the files in **PriorVersions** allow is a way to go back in time. It is a breadcrumb trail of where you have been. These files are small enough that they are not going to occupy significant space on your hard drive. You can find them and throw them away anytime that you want. They are just there to supplement any system that you may have to backup your old work.

Other files are produced by *PrintBearboatXL*. That program can take a design file and export cross-sections of the boat as a grid of numbers, best examined by a spreadsheet. Alternatively, it exports files in formats usable by a host of 3D visualization software. These files can be stored wherever the user prefers. All these files are prefaced by a date/time stamp YYMMDD_HHSS, so it is clear when they were created.

Menu Bar

The functions of the program are available through the menu bar. The *Design Menu* offers access to the various windows where the boat is created.

Design Windows

Curve of Areas

Profile

Seamline

Waterline

Cross-Section

Angle

Design: Curve of Areas

As the kayak is designed, the user can go back and forth between *Curve of Areas*, *Profile*, *Seamline*, *Waterline*,*Cross-Section* and *Angle*. It makes the most sense to start with the *Curve of Areas,* although some may find this a little abstract. This is a curve created by drawing a graph of the underwater area of the boat (y axis) vs. the position from the bow to the stern (x axis). The smoothness of this graph assures that the boat will have a smooth shape as it starts thin and small at the bow, expands to a point somewhere near the center of the boat, and then tapers toward the stern. This curve determines a host of parameters that characterize your design, such as the displacement, center of buoyancy, and the prismatic coefficient.

There are a number of parameters that determine the shape of the curve of areas. Entry and Leave define the waterline length and determine where the keel line enters and leaves the water. The Maximum Area is the size of the largest cross-sectional area. The Location of Max Area is the position of the largest cross-sectional area. The Length is just the overall length of the boat and is less important here, as the curve of areas is primarily concerned with the underwater length.

There are 4 arbitrary parameters that can be adjusted to affect the shape of the curve. Many of the curves in this program use this technique. The first parameter affects primarily the first quarter of the curve while the second the second quarter etc. As the number increases, that part of the curve becomes “fuller”. The left side of the graphic is the bow and the right the stern.

There is an upper limit of underwater cross-sectional area that can be accommodated by a kayak of any given waterline width and depth. This is not that complex to understand. Let's say there is a point along the length of the boat that has a waterline width of 50 cm and a depth of 10 cm. It is not going to be able to accommodate a cross-sectional area of greater than 500 cm2 (10 cm * 50 cm). That would be a rectangular underwater cross-section. If you "ask" for more than this in the curve of areas module, then later you are going to have to change other parameters in other modules (primarily the width and or depth of the boat) You cannot expect to specify a boat 16 feet long, 21 inches wide with a draft of 2 inches and expect it to carry 900 lbs. The *Curve of Areas* window does not prevent you from creating whatever curve of areas you want, but you can specify parameters that result in underwater cross-sections that are "impossible". You will see this when you visualize the cross-sections in the *Cross-Section* Window.

Design: Profile

The profile of the deck and the profile of the hull are both determined in this window.

The hull profile is determined by a curve at the bow and a curve at the stern separated by a flat section extending a variable length along the bottom of the boat. Most kayaks do, in fact, have a substantial length of the hull which is actually flat. This length can be made arbitrarily short, so it is possible to design a kayak with the hull contour bowed along its entire length. Some surf kayak designs or river kayak designs can approach this in their attempts to create boats which are extremely maneuverable accepting that they will track poorly.

The draft (depth) of the boat is determined in this window. This is a critical value. Slight changes in the draft will greatly affect the cross-sections along the length of the boat.

For reference, a Position line can be superimposed on the graphic. The values of various parameters at that position are displayed for the user. This line is designed to fade away when not being actively used. It can be brought back into view by clicking on the vertical crimson line to the left of the Position control

It is possible to tweak the bow curve, by placing and moving about, a dot that forces the curve to pass through it. This dot (yellow) appears if the user interacts with the *Bow Tweak* control.

In the real world, the actual curve in the bow area tends to be customized by the builder during construction. Its appearance strongly influences the overall "look" of the design.

The deck profile is created by positioning red dots along the length of the boat, determining where the profile must pass. The program does its best to create a smooth line that connects these points. Clicking on a particular dot allows the user to move it around with the mouse. In the left upper corner, there is an inexhaustible source of red dots to more rigidly specify the side profile of the deck. In general, it is best to minimize the number of dots used, which will result in a "smoother" overall contour. It is possible to select dots to be removed if they have become excessive.

Design: Seamline

The *Seamline* window shows the seamline from above and from the side. By definition, the seamline connects the widest parts of the boat at any location.

In the overhead view, the waterline is shown for reference as a faint blue line. the waterline curve cannot be altered in the *Seamline* window.

In the side view, the profile of the boat is shown for reference as a faint gray outline. It cannot be modified here. Additionally, a faint gray straight line extends from the point of the seamline at the bow to the point of the seamline at the stern and a faint blue line shows the waterline.

Working with the overhead view, the user can specify the maximal width of the seamline and the position of the maximal width. The curve shapers allow modifications to the curve of the seamline as seen from above. It is not permitted to have a seamline that is narrower than the waterline.

For reasons of aesthetics and ease of construction, *BearboatXL* forces the seamline to live in a single plane. Therefore, a piece of wood forced to conform to the seamline is not tortured, it is bent in the confines of a single plane. This constraint was not present in *BearboatSP* and the other earlier versions. One can imagine this plane as being hinged on a straight line between the intersection of the seam with the bow and with the stern of the boat. This line is dimly visible in the side view. The plane is angled at this hinge; the number of degrees is controlled by the *Seam Angle*. Classically, the seam angle is some negative number of degrees, the plane is angled downwards from the hinge. The seamline, as visualized from the side, will bow down slightly. If the angle is zero, then the seamline will be seen as a straight line. It is possible to specify a positive seam angle. Under that circumstance, the seamline will bow upwards slightly, a so-called reverse sheer that can be seen on some modern boats.

Design: Cross-Section

The *Cross-Section* window is activated under the Design menu, but this environment is equally important as a tool to simply visualize your kayak. The only part of this window that actually changes the design of the boat, is contained in the *Side* and the *Deck* group boxes. Here you can change the family of shapes that are applied to the sides and a deck of the kayak.

The program minimizes the wetted surface which determines the underwater cross-section, but it is arbitrary how the waterline is to be connected to the seamline and the seamline to the top of the deck. For this purpose, the user chooses from the families of curves that are available to determine the shape, as seen in cross-section, of the sides and deck of the boat. You choose one family for the side and one family for the deck and that is applied to the entire boat. This gives an aesthetic unity to the craft.

Popup controls present the various options. The result of these choices is displayed on the canvas, showing the cross-section.

For the deck, I have always used *Semi-Ellipse*, which has worked well for me. Others like a more peaked deck, and other options allow for this.

For the side, the default is *Bezier*. If *Bezier* is selected, a slider appears that allows modification of the *Bezier* curve of the side of the boat. Moving the slider to the right tends to make the curve "fuller" while moving them to the left makes the curve "flatter". You might think that the *Straight* option would produce an angular-looking craft, but this is not really the case. Many commercial kayaks, in fact, have flat sides, but because of the curves in the third dimension and changes in angulation, this is not easily perceived.

One will run across cross-sections where the underwater portion is displayed with orange lines. This indicates that the specified cross-sectional area cannot be accommodated by the waterline width and draft at this location. Most commonly, this is seen at the bow entry area and where the boat exits the water at the stern. When only seen in these locations, it is generally safe to simply ignore this. Minor issues of this sort in these locations can be simply "sanded out"; they are not important.

When orange lines are seen on more central cross-sections, then this is a more significant issue. It is possible to have made incompatible choices in the other design windows. It is possible to ask for a cross-sectional area at a given point that is larger than can be achieved with the depth and waterline width chosen for that same point. The program will indicate this by drawing the underwater cross-section in orange and appending a triangle shape to reach the requested underwater area. These conflicts can be resolved by making the cross-sectional underwater area smaller here in the *Curve of Areas* window or by increasing the depth in the Profile window or increasing the waterline width in the *Waterline* window or some combination of the above.

The *Show Hex* checkbox, results in cross-sections that are simply straight lines between the deck peak and the seamline, the seamline and the waterline, and the waterline and midline draft. Hex refers to the fact that this is a hexagonal shape. I have found it useful for me in visualizing in my mind how the various curves have been specified.

Design: Angle

The maximal underwater cross-section will often result in totally vertical sides and a totally horizontal bottom for many cross-sections. Some designers do not like this and prefer to constrain the algorithm so there is always at least a slight angle. For the bottom of the boat, a slight V makes the bottom stiffer. Avoiding a totally vertical underwater side may make the design more "forgiving" when waves or currents push the kayak from the side.

This window allows specifying angles that constrain the proposed underwater cross-sections to avoid purely vertical or horizontal. The effects of these constraints can be visualized here.

As larger and larger angles are specified, you may start to see the orange lines appear, indicating that the cross-sectional area cannot be accommodated with these increasingly confining constraints. Modifications may be required in other windows (increased draft and the like)

Design: Enter Exit

When the application starts, you will find yourself in this window. Three basic choices are provided.

Practice: Play with a design called Tutor Kayak to familiarize yourself with the program. No irrevocable changes will be made. You always start in the same place.

New: Start with a new boat design. The first task is to provide a name for the design.

Open: Choose a previously saved design to visualize or to make additional refinements.

On finishing a session, you should return to this window to decide whether to save your work and where to save it.

PrintBearboatXL

This application serves a basic purpose: taking a design created in *BearboatXL* and create cross-sections that can be used in actually building the boat. Additionally, the *BearboatXL* data can be exported in formats that can be accepted by CAD programs where the design can be further refined or fed to tools capable of outputting 3D objects.

When the program starts, the user is directed to choose a *BearboatXL* design to work with. To create cross-sections on paper, the user is tasked with specifying just which cross-sections are wanted. There is a canvas that displays the length of the boat. A red line indicates the position of the currently chosen location. Click on the canvas or use the *Location Specifier* to move that red line to the desired position. Then use the *Start* or *End* buttons to assign that location to the start or end of the cross-sections to be printed. An interval control determines just how many cross-sections are going to be printed over the span that has been specified.

If the construction technique involves placing something like cedar strips over the cross-sections, it is possible to request that the drawings accommodate the thickness of the strips. If the strips are 8 mm thick, choose a skin thickness of 8 mm, and the cross-sections will draw the appropriate lines.

Once the positions have been determined, click on the *Print Cross-Sections* button to create the output. To test how things are set up or to move the designs to a commercial printer, it can be useful to print to PDF format. It is possible to print out the cross-sections on letter paper using a home printer. Multiple sheets of paper are used to reconstitute a single cross-section when necessary. If you are using a very large printer, it is possible with the *Change Printer Parameters* to specify large paper sheets capable of printing the whole cross-section on a single sheet.

The *Export 3D: CAD* area in the upper right of the window allows specifying various formats that can be used in various programs. A slider allows making these drawings more or less detailed. Choosing more detailed output results in larger files that might be big enough to be inconvenient or overwhelm the hosting software.

The *Grid Text Files* produce an output that is, under most circumstances, not very useful. This is more of a legacy option. The points that determine the circumference of the chosen cross-section are provided as numbers on an XY plane. The XYZ refers to a convention of referring to a given point on the kayak. The surface of the kayak is described as points in space specified by their X, Y, Z coordinates. The Z coordinate identifies where along the length of the boat the cross-section lies. A point with a Z coordinate of 50 is on the cross- section that is 50 cm from the bow. The X coordinate describes how far from the midline of the kayak a point is. The midline of the boat has an X value of 0. The point that is at the widest place on the boat will have an X value of half the boat's width. The Y value is the distance of the point from the waterline. Negative values refer to points that lie underwater. Positive values refer to points that are above water.

The data is provided for "half" the boat. Since kayaks are bilaterally symmetric, this essentially describes the entire boat. The text file that is produced is best examined in a spreadsheet that is capable of conveniently displaying large columns of numbers. Decades ago, I used such numerical output as a means to draw by hand the cross-sections on large sheets of paper. With modern software and printers, this approach is mostly outdated.

Final Comments

This manual covers most of the highlights, but to learn the program you have to use it. Use the in app help to learn more about various controls. Feel free to push buttons and try anything that you want. The *Practice* button in the Enter Exit window is there so you can play with a design with no permanent consequences. This is the way to come to a better understanding of the program. There is nothing in this program that is particularly difficult.

Remember to save some time for paddling.

Keep an eye on the Web site: http://bearboat.net/BearboatXL.html for updates of the program and possibly this manual, which could stand to be expanded. It is pretty barebones.

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