WINGS 32

Professional User Manual

WINGS 32 Contents

Notice to Non United States Users – Numerical Errors

"WINGS 32" requires that the regional setting for a DECIMAL POINT be set to a PERIOD (.) and not a COMMA

(,) Setting the decimal point definition to a COMMA causes WINGS to read data files incorrectly. For example the number 1234,567 is read as 1234 and 567 as integers not 1234 POINT 567. Therefore WINGS requires 1234.567.

To make the correction click Start, Settings, Control Panel, (Date,Time, Language and Regional Options) choose Change the Format of Numbers and under NUMBER type 123,456,789.00 with a PERIOD before the last two zeros. No need to change Currency.

Technical Support

Technical Support Limitations

Free Software Updates

TECHNICAL SUPPORT

Before you contact Vacanti Yacht Design for Technical Support you MUST first:

1) READ THE USER MANUAL

2) Verify that your computer is <u>free of Viruses</u>

3) <u>CHECK our Home Page</u> on the INTERNET for a Revised Version of WINGS 32 The address is **http://www.vacantisw.com**

3) Verify that you know the exact steps that lead to the problem.

4 You MUST first REGISTER your copy by sending us:
A) Your name and address
B) A 24-Hour FAX Number - we will not make attempts to call at specific hours of the day -
OR E-MAIL Address. <u>E-MAIL is MUCH PREFERED</u>.

5) **All Users must provide at least ONE of the following**:
A) **24 Hour FAX number**. The fax must be available AT ALL TIMES. We cannot call WORLDWIDE from the WEST COAST of the USA to accommodate your schedule. We will try to reply to your fax ONCE. If it is not operational, we will not retry. **Include your FAX number on your FAX to us! Our Fax Number**: 425 413 2815

B) **E-MAIL Address**: This is the **BEST possible solution**. Using e-mail we can respond at anytime, we can accept WINGS 32 design files that you create as attachments to you letters. We can return these files to you with recommendations and file corrections. Contact Vacanti Software at **cad@vacantisw.com**

REPORTING A BUG / ERROR

PLEASE - Verify that the error can be repeated. Clearly and in as much detail as possible describe what steps were followed and how the error occurred. Include your 24-Hour Fax number, your E-mail address or your 24 Hour Phone Number ON ALL CORRESPONDANCE.

TECHNICAL SUPPORT LIMITATIONS:

Vacanti Software currently provides Free Technical Support. This free support is only possible if we are allowed to reply to you at our convenience. Because we provide this support worldwide, your call or fax or e-mail to us may arrive at any hour of the day or night. Therefore it may not be possible for us to reply to you on a schedule you supply.

If your FAX or phone is not operational 24 HOURS a day, it may be very difficult for us to reply. Please try to consider contacting us via email if at all possible so that we may provide detailed information as rapidly as possible.

We cannot provide "online Teaching"

Unfortunately, our low prices do not allow us to provide the ability to call you and coach you in the use of WINGS 32. If you are a new computer owner, we suggest that you read our manual and make an effort to carefully work through a design yourself. New computer users should expect to spend several hours getting used to the conventions of Windows, Computer Aided Drawing (CAD) programs and other information.

We are constantly adding information to our user manual and updates of on-line help will be made as often as possible. Please check our INTERNET HOME PAGE www.vacantisw.com for updates or check new updates.

"WINGS 32" has been in use around the world for several years. It has been used to create everything from simple rudders to bulbed keels for major racing yachts. WINGS 32 is based on the HULL design program PROLINES. Therefore WINGS will be familiar in operation to those who use PROLINES.

FREE SOFTWARE UPDATES:

Free software updates are available on-line at our web site or you can request a copy of our latest WINGS 32 release by mail, phone, fax or e-mail.

      1) Download new software at: http://www.vacantisw.com
      2) e-mail a request for updates to: dcv@vacantisw.com
      3) Fax a request for updates to: 425 413 2815 (Dial International long distance for the USA)

Just Starting Out

Introduction to WINGS 32

Register WINGS 32

Introduction to WINGS 32

WINGS was first created as a DOS based program several years ago. It has been completely replaced by a new version that has full 3D NURB Surface capability based on PROLINES 7 Code. Therefore operation of WINGS 32 is very similar to PROLINES for editing functions, calculations etc.

"WINGS 32" represents a major change in the numerical structure of the original DOS version of WINGS. This new version has a completely new "NURB Engine" that is used to compute true Non-Uniform Rational B-Splines (NURBS) surface. This new engine is faster and more efficient but is not compatible with the old DOS version of WINGS. The old DOS version used a very simple set of 2D offsets and a simple spline to define the outer shape of the keel or rudder. Another spline defined thickness. In this new version the Keel or Rudder is defined as a vertical collection of foil shapes and is a true 3D structure from the beginning. As a result any design in WINGS 32 can be output as an IGS NURB file that is compatible with Computer Numerically Controlled Machining (CNC) and Structural Finite Element Analysis (FEA). "WINGS 32" also provides normal 3D DXF and 2D DXF files for other applications. WINGS 32 can also print basic views of any keel and rudder design.

WINGS 32 uses foil shapes that we created in our program FOIL. These shapes are not the standard table of offsets from the NACA or other databases – they are NURB offsets that create a spline that passes through the NACA or other database values. That permits WINGS 32 to be a full 3D NURB surface. We have provided the most common foils used worldwide with WINGS 32, but should a designer require access to a new foil that is not found in WINGS 32 values the new shape can either be created in FOIL (purchase of the program is required) or we can create the foil at no cost in foil and provide that to the designer. We will provide reasonable support but if a number of new foils is required we suggest the design office to purchase FOIL as well.

"WINGS 32" was created specifically to be easy to use. Therefore one of its most important features is the ability to use Parametric Keel and Rudder Design. Parametric design simply means that the user creates an object by specifying the object type (Bulbed Keel or Straight), and the dimensions of that object such as its span overall, root and tip chord lengths. The designer is not required to build each shape "stick by stick" as is the case in many CAD programs.

When creating a keel or rudder design, the design must not only be fair, it must also meet the design objectives for ballast amount, center of gravity, wetted surface and a host of other factors. Therefore, WINGS 32 hydrostatics, lift and drag computations are built in. These features can be accessed at any time during the design process.

We encourage you to open one of the sample designs provided with WINGS 32 (File, OPEN.. Select a file name that ends in .w32) and then to explore the program by looking at each of menu lists. Take some time to look at each menu and try to get an idea of the functions WINGS 32 provides. With this simple knowledge, attempt to modify the keel or rudder. Try Calculate Hydrostatics in the CALC menu. During this exploration take note that WINGS 32 provides pop up help just as the mouse is moved around the screen. Position the mouse over an icon or speed button and within 2 seconds a button name will appear in yellow at the cursor. At the same time, in the lower left corner of the screen, a single line of text explains how to use the button.

Have Fun Exploring!

WINGS 32 System Requirements

"WINGS 32" is a full 32 bit program designed to operate under Windows XP or later. It requires at least 16 Megabytes of memory, 10 MB of free hard disk space, a mouse or other Windows pointing device, a graphics card capable of at least 16 bits per pixel color. WINGS 32 must be used on a display of at least 800X600 pixels but at least 1024 x 768 pixels will yield far better performance. Best performance in rendering keel or rudder shapes in WINGS 32 will result with graphics cards that provide full 24 bits of color per pixel (millions of colors).

European Users - SPECIAL NOTE: WINGS 32 Will Not Start Errors

WINGS 32 requires that the regional setting for a DECIMAL POINT be set to a PERIOD (.) and not a COMMA (,). Setting the decimal point definition to a COMMA causes WINGS 32 to read data files incorrectly. For example the number 1234,567 is read as 1234 and 567 as integers not 1234 POINT 567. Therefore WINGS 32 requires 1234.567. To make the correction click Start, Settings, Control Panel, (Date, Time, Language and Regional Options) choose Change the Format of Numbers and under NUMBER type 123,456,789.00 with a PERIOD before the last two zeros. No need to change Currency.

WINGS 32 makes use of the OpenGL professional rendering software provided on all new computers. Therefore more rapid graphics performance is made possible when using 3D graphics accelerators that support OpenGL. Older computers will require substantial time to render the keel or rudders to high definition without a 3D accelerated graphics card.

Register WINGS 32

PRINTER MUST BE TURNED ON.

"WINGS 32" is protected from pirating by Software Copy Protection. Each copy of WINGS 32 will be "locked" to the computer it is run on. When WINGS 32 is installed and run for the first time the message window shown below will be displayed after a series of simple error messages. Please accept each notice and proceed to the registration dialog. There are two buttons on the bottom of this form – one labeled "Close Dialog and Contact Vacanti Yacht Design", the other button labeled "Unlock WINGS 32" is used after you have received a computer Key Word from Vacanti Yacht Design.

Press the "Close Dialog…" button the first time you run WINGS 32. A special registration form will be printed that contains a computer number that is unique to your computer. WINGS 32 will then close. Send this number along with your name and address to Vacanti Yacht Design by e-mail or fax using the information printed on the form or on the dialog box.

Vacanti Yacht Design will send back to you a computer "Key Number". Run WINGS 32 again and enter this key number in the space provided for it on the Registration Dialog. Then press Unlock WINGS 32. SAVE the Key Number in a safe place.

The key number will be saved in a WINGS 32.ini file that must not be disturbed. If the file is erased or corrupted, the registration form will be displayed and you may re-enter the key number.

UPGRADING COMPUTER HARDWARE
If the computer hardware that is used to run WINGS 32 is substantially changed it may fail to run and present the registration form. Should this happen, please contact Vacanti Yacht Design and describe the upgrades that have been made. If you purchase a new computer please completely install WINGS 32 on the new PC and remove it from the old computer. Then follow the registration procedure described above.

Using WINGS 32 on More than One Computer

If you wish to use WINGS 32 on more than one computer at different times, you must contact Vacanti Yacht Design LLC. Special arrangements may be made for a second key number.

If you wish to operate WINGS 32 on two computers *at the same time,* for example a design office with more than one designer, a second copy of WINGS 32 may be purchased at a discount.

QUICK START

Keel and Rudder Design Process in WINGS 32

To begin new design in WINGS 32, select FILE, NEW…

1) Choose Meter / Kg or Inch / Pound dimensions

2) Enter the dimensions of the Keel or Rudder in the New Design Dialog

3) Choose the tip type by clicking on the Radio Button near the desired type

4) Choose to add a bulb or flange (top mounting) to a keel

5) Click OK to see the new keel or rudder designed

6) Click OK on the Display Mode Dialog Box

7) The new design will be displayed in all four views

The keel or rudder displayed typically has 4 foil chords displayed. They are shown as a vertex box (small open square) on the leading edge and the trailing edge. All editing in WINGS 32 is accomplished by dragging or numerically editing the leading or trailing edge vertex controls for each foil defined on the keel or rudder. Change the overall dimensions of the keel or rudder by selecting EDIT, Parameter Design Editor.

Choose CALC, Hydrostatics to view the weight, frontal area and many more characteristics. Choose CALC, Lift & Drag to see the projected LIFT (Side Force) and Drag (Slows the boat down) forces for the keel or rudder, not including the effects of the Bulb.

To make detailed changes to the planform add foil shapes to the span of the keel or rudder by selecting EDIT, ADD FOIL, With Mouse or By Index. Placing two foils very near each other along the span creates a local sharp break in the planform.

Move the foils by dragging them with the LEFT mouse button or numerically by RIGHT clicking on a vertex. A dialog box showing all data for the selected foil pops up and all data can be edited in order to insure a design meets exact criteria.

Using WINGS 32 Tool Bar

WINGS 32 Main Screen

Using WINGS 32 Tool Bar

Front | Profile   Sta.Tension=2   x=-0.69   Flange.pfd
Top | Persp   y=-75.00
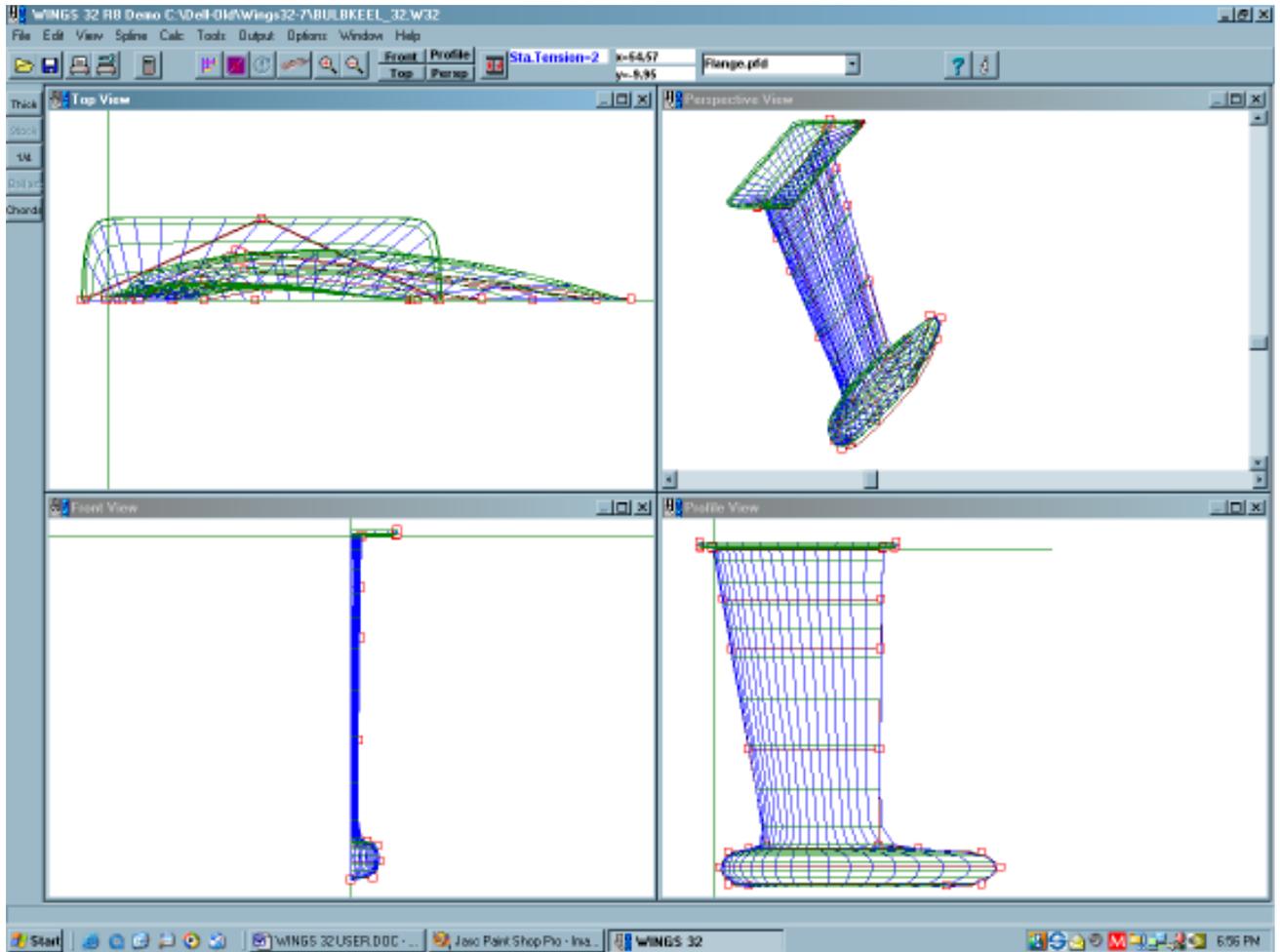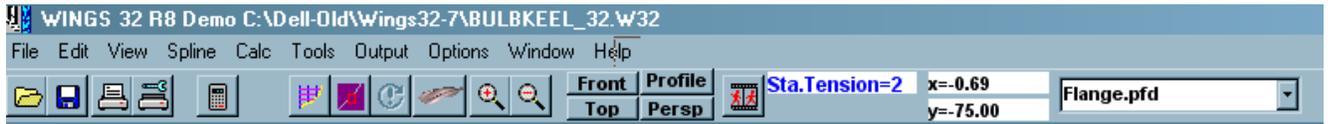
The tool bar shown above gives the designer access to the most often used functions within WINGS 32. The basic name of each function is available by simply resting the mouse cursor over one of the buttons and after a few seconds a small yellow help balloon will appear with the button name written inside. Additional information about each button is also available in a short sentence written in the status line at the bottom of the screen.

More extensive descriptions of each button are presented below. Each button is described in order from left or right. For example the first button is the open folder, used to open an existing file.

Open A File

Clicking this button will bring up a standard Windows dialog box with all WINGS 32 designs found in the current directory. This button cannot be used to read CAD files or other file formats. It is only used to open an existing WINGS 32 design file (extension .w32).

Save This File

The floppy disk image on this button indicates that the current WINGS 32 design that is on screen will be saved. Other files such as reference files or CAD files are not saved with this button.

Print

Select this function to print one or all of the 4 views shown on screen. A dialog box will appear that allows the selection of one or all of the views and the maximum scale that the drawing can be created. The scale is a fraction computed as: Paper Inches / Keel Size Inches or Paper mm / keel mm. Therefore if the maximum paper dimension is 11 inches vertically and the maximum keel span is 44 inches, the greatest possible scale is 11/44 = 0.25. Changing the direction of the paper to match the greatest paper dimension to the greatest keel or rudder dimension will produce a drawing of the greatest possible scale. The greatest possible scale is the closest possible to a scale of 1 or full size.

Printer Setup

Select this button to choose a printer that is installed in Windows, print quality, paper size, paper orientation (portrait or landscape) and other printer functions. Be sure that the correct printer driver is installed in Windows before attempting to print.

Calculate Hydrostatics

The hand held calculator symbol on this button indicates that clicking the button will cause WINGS 32 to compute a complete set of Hydrostatics information, such as displacement, centers of gravity and various shape coefficients.

Change Lines Drawing

The crossed lines on this button image correspond to the stations, waterline and buttocks traditionally found in drawings. Selecting this button allows the designer to turn various lines on or off and toggle between showing NURB splines and traditional stations etc.

Vertex Net ON or Off

Clicking on this button causes the program to either display or hide the vertex control points that define the keel or rudder shape. The vertex markers must be turned on to use any of the mouse editing tools. The vertex markers are the small square boxes located at the end of each foil chord.

UNDO

The circular arrow symbol will become active after you have changed anything that alters the design from its initial state. You may sequentially UNDO up to 90 steps.

Render Keel or rudder

This button is seen as a rendered image. Click this button to open the OpenGL rendering dialog.

Zoom In

The magnifying glass with a plus (+) sign indicates that you can enlarge a desired section of a view. Click on the button and the cursor will become an UP Arrow symbol. Move the cursor to the upper left of the area you wish to enlarge. Click and hold the left mouse button down. As you drag the mouse a zoom window box will be drawn. Release the mouse button when the area you wish to enlarge is enclosed within the zoom window box.

Zoom Out

The magnifying glass with a (-) sign indicates that the *active view* will be returned to normal view. Therefore, to cause a zoomed view to be returned to its normal size, first select the

desired view by clicking the left mouse button in the title bar. When the desired view title bar is highlighted, click on the Zoom Out button.

If for any reason the views are not drawn properly, select View – Fit All Views to Windows.

Front | Profile
Top | Persp *View Buttons*

The view buttons cause the view given by the title of the button to be drawn. For example, the button labeled BODY will cause the Body View to be drawn.

Animate

The Animate button allows the designer to see a "movie" of the keel or rudder played for him in the perspective window. WINGS 32 will display a dialog that asks how long to delay before drawing the next view. The animation sequence will show several views from above and below the keel or rudder. The animation control dialog will remain open so that you may stop, restart or change the speed of the animation.

Set Animation Delay Between Drawings
0.2 Seconds   2 Seconds
✓ Start Animation   ✗ Stop
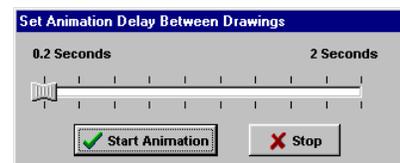
x=12.88
y=20.26 *X and Y Coordinates*

These are display windows that cannot be edited. They indicate the current position of the mouse in inches or millimeters depending on which units are being used in the drawing.

Flange.pfd ▼ *Foil Design List*

This is a pull down list of all of the foils used to design the keel or rudder. Click on the right pull down arrow and display the complete list of foils. The top most foil in the list is the root chord and the bottom most foil is the tip chord. Click on any foil in the pull down list to show all of the data related to that foil. You may type new dimensions for the foil or change the foil type by selecting a new one from a list.

Chord Editor

Chord Length	34
Chord Leading Edge	1.88
Distance of Leading Edge Aft of Root	
Chord Depth on Keel	-10.67
Distance of Chord Below the Root	
Chord Thickness %	11.3
Chord Foil	C:\Wings32\Foils\644015.pfd
Click Foil Name To Change Foil	
Chord Index Number	8

OK   Cancel
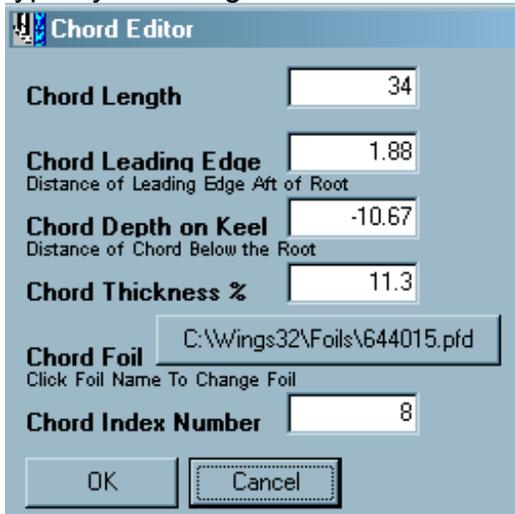
About

The button displays WINGS 32 Copyright and Version information.

Information – Help

"WINGS 32" provides extensive on-line Help. Clicking this button will provide information on how to use WINGS 32. A great deal of the information that is found in this manual is available on-line. (OnlIne Help is under development as of this writing – but will provide a copy of this manual)

Design

Beginning a New Design

    Parametric Keel or Rudder Design

Editing a Design

    Adding New Foil Shapes

    Deleting Foil Shapes

    Changing Spline Tension

Fairing the Keel or rudder

Begin A New Design

"WINGS 32" allows a designer to create a new design with Parametric Keel or rudder Design methods.

Parametric Keel or rudder Design creates a new keel or rudder by asking for just the basic keel or rudder parameters such as span, draft, sweep angle, and foil types. WINGS 32 uses the dimensions to create a keel or rudder shape that is already fair or very nearly fair. The designer should then modify the keel or rudder to suit his specific design task by moving vertex points and adding, subtracting foil shapes or vertex points.

To create a new design using parametric data, select FILE, NEW..., . Now select the keel or rudder type that is the closest to the type you wish to design. Be sure to specify the measurement units that will be used to specify your design. If units of meters are chosen, WINGS 32 will convert that data into millimeters after it creates the design on screen. If Units of FEET are chosen, the data will be converted to INCHES after the keel or rudder has been created. Change the dimensions of the keel or rudder according to the planned design. Carefully check to see that all of the choices and dimensions have been properly selected and click OK. The keel or rudder will be drawn in all views. Modify the default keel or rudder shape to meet your design needs. Use the editing tools found in the EDIT, SPLINE and TOOLS menus.

Import 3D DXF Files to create a keel or rudder shape within WINGS 32 based on data that has been digitized or created in a 3D CAD program such as AutoCAD, CADKEY, DesignCAD 3D or others. "WINGS 32" is expecting elements in the DXF file that are LINES or POLYLINES, not Splines or ARCS or other elements. The data must be 3D and contain Beam, Height and Length. The axes in WINGS 32 are defined as follows: X=BEAM, Y=Length Along The Keel or rudder, and Z=Height above or below Root Chord or other reference line.

The data in a 3D DXF file may be read as offsets for vertex control points to create a keel or rudder directly from the DXF file IF the file meets the following criteria:
1) The data is station oriented no waterlines or other data.
2) The number of line elements or the number of vertex points per polyline is the same on each station and there are less than 30 points per station or vertex column.
3) The number of "stations" is 30 or less.

If the file does not meet these criteria, then it can be read in as a simple drawing and displayed for reference on the screen. This makes it possible to modify a keel or rudder created by WINGS 32 Parametric Keel or rudder Design so that it overlays the reference keel or rudder by using WINGS 32 editing tools.

Editing the Design

Keel or Rudder Design Principals

PLANFORM CHANGES:

"WINGS 32" was developed around the concept of applying fixed foil shapes at specific locations vertically along the keel or rudder. In order to preserve the specific foil shape chosen by the designer, only the first leading edge and last trailing edge vertex control points of each foil is displayed. The rest are hidden from view and protected from being changed during the editing process. The planform shape of the keel or rudder is then adjusted by moving the leading or trailing edges fore and aft and vertically.

THICKNESS CHANGES

In the FRONT view of a keel or rudder only the THICKNESS CONTROL vertex for each foil is displayed. This is typically the maximum thickness of the chosen foil. Moving this vertex in the FRONT view moved the foil vertically or changes its thickness. This function can therefore be used to define the shape of a bulb at the bottom of the keel or the shape of a flange at the top or any other detailed thickness feature of the keel or rudder.

SHARP BREAKS

It is frequently very important to provide a very sharp change in thickness, such as the transition from the top of a bulb to a main keel strut. To make the changes abrupt or sharp, locate TWO or THREE foils of the same type vertically very close to one another. This will cause a very tight radius or sharp bend to develop at the combined foil locations. To insert an extra foil where a tight bend is desired, select the EDIT menu, choose INSERT a New Foil… by Mouse Click or index. If the design has many foils (up to 50 are permitted) it may be easier to choose the index method. Before making this choice use the OPTIONS menu to LABEL FOIL CHORDS, then choose the correct index location based on those numbers.

It is also very important to recall that the FRONT view can be used to adjust rapid changes in thickness once a collection of 2 or 3 foils have been located together. The thickness of each foil can now be adjusted to provide the needed bulb shape.

BULB TRAILING EDGE SHAPES

The trailing edge shape of a bulb designed with a normal NACA or other standard foil shape will result in a vertical bulb tail that is "fish like". To make the trailing edge into a flat or square "Beaver tail" shape or any other shape requires using foils that have the desired shape at the trailing edge. Recently we have added a SQUARE TAIL shape that may be used on the bulb to achieve the proven low drag qualities of a bulb with a tail that is horizontally flat or nearly flat. The designer is therefore encouraged to use the new SQUARE-tail shape we have provided in combination with other foils or design another shape in our program FOIL to achieve the desired trailing edge.

Changing Foils on a Keel or Rudder

Flange.pfd ▾ All of the foils used on any keel or rudder can be listed by clicking the pull down menu of foils located at the right side of the main tool bar. The foils are listed as they appear in order from top to bottom. For example the foil listed at the top of the list is the foil at the top or root chord of the keel or rudder. The foil shown at the bottom of the list corresponds to the tip chord furthest away from the keel or rudder. Change any of these foils by opening the list and click on a foil name. The Chord Editor Dialog (see below) will open. Click on the Chord Foil file name to choose a new foil shape. Click OK on the Chord Editor Dialog to see the new foil drawn within the keel or rudder. The new foil will be listed in the pull down menu.

Editing Tool Buttons

"WINGS 32" offers several means to alter the shape of a Keel or Rudder. They include editing with the mouse or changing vertex control points numerically with a spreadsheet or keyboard. If you are working towards a design that has very specific dimensions required at a specific location on the keel or rudder, it may be most efficient to adjust the design numerically.

Edit FOIL Dimensions Numerically.

Right click on a single vertex in any planar view (Body, Plan, and Profile) and bring up a dialog box that contains the 3D dimensions of that vertex point.

Move A vertex Point with the mouse
"WINGS 32" allows "Instant Editing" of the keel or rudder. You will notice that the mouse cursor is a + sign as it is moved over the Body, Plan or Profile windows. Position the + symbol in the middle of a red square vertex marker. Now Click the left button and hold it down as you move the mouse. Lines connecting the vertex to its neighbors will follow the mouse. The Options menu allows you to select the keel to be updated as you move the vertex or to move just the vertex lines and update the keel or rudder after the move is complete.

When the vertex is in a new position release the left

mouse button to drop it in place. The cursor shape will remain a + sign, allowing the repeated movement of other vertices.

RIGHT Click on a Foil
Chord Vertex Control
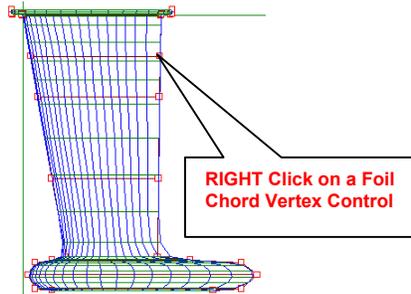
"WINGS 32" has a completely new B-Spline computational engine. This new capability allows the designer huge new flexibility in keel or rudder design. Simply right click one foil chord vertex control you wish to adjust. "WINGS 32" will show the new numerical offset editing dialog shown above.

TOOL Menu

The TOOL menu contains several powerful functions that are very useful to the designer. The tool functions are shown in this image.
The first TOOLS function group includes the ability to Stretch or Shrink the keel or rudder to any overall dimension, Shift the keel or rudder up, down or right or left or Trim and heel the keel or rudder.

STRETCH / SHRINK Keel or Rudder

This function allows the designer to change any one overall dimension, such as length or all overall dimensions (Chord, Draft) all at the same time. These changes may be in the form of a percentage or in the form of an exact new dimension. Changing the overall keel or rudder changes all dimensions proportionately.

Click on the radio button that corresponds to the changes you would like to make in the keel or rudder. For example, if the beam is to be changed from 80 inches to 85 inches(this is the half beam measured from center line to max beam at the deck) then Click the button beside
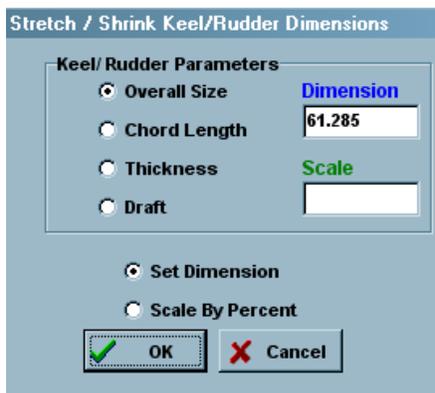
"Half Beam". Now click on "Set Dimension" and enter 85 in the edit field labeled "Dimension".

To increase the overall beam of the keel or rudder 10% then select "Half Beam" and "Scale By Percent". Enter 10 in the edit field labeled "Percent". Using the previous example, the overall beam of the keel or rudder would be scaled from 80 inches to 88 inches for an increase of 10%. Similarly, the beam could be scaled down to 72 inches if the user had selected "Half Beam", "Scale by Percent" and entered –10% in the "scale" field. (80-0.1*8=72)

SHIFT Keel / Rudder

This function is used to translate the keel or rudder with respect to the coordinate system that WINGS 32 maintains. For example, the dialog shown here indicates that the user wishes to shift it forward or aft along its chord length relative to the leading edge. If the user enters 34.6 the keel or rudder will move aft 34.6 inches (or millimeters). Therefore if the keel previously touched the vertical "0" reference in the profile or plan views, it will now rest 34.6 inches aft (further away from 0). If the user enters –34.6 the rudder be moved 34.6 inches forward and will now likely project in front of the 0 reference. Similarly, the user can choose to move the keel up or down to decrease or increase draft. Select "Shift Keel to Zero" to automatically adjust the forward most point on the keel such that it corresponds to "0". With this adjustment made, the user can readily select station spacing relative to the leading edge at even increments.

Keel Parameter and Ballast Editor

Selecting EDIT, Keel Parameter and Ballast Editor, accesses the overall keel and rudder design editor.

Ballast & Parameter Editor

Parameters

Leading Edge Angle	5.72	Degrees
Average Chord	33.14	In/mm
Span	73.45	In/mm

Main Keel Material

Material	Lead	
Mat. Density Lbs/Kg	710.00	Cuft/CuM
Top of Ballast	.00	In/mm
Angle of Ballast Top	.00	Degrees
Bottom	66.43	In/mm

Keel Bulb Material

Material		
Bulb Density Lbs/Kg	.00	CuFt/CuM
Bulb Length	58.49	In/mm
Bulb Thickness	11.72	In/mm
Bulb Height	7.02	In/mm

Total Keel Weight	3343.41	Lbs / Kg
Vertical Ctr of Gravity	-40.60	In/mm
Vertical Ctr Bouyancy	-40.60	In/mm
Main Keel Weight	.00	Lbs / Kg
Bulb Weight	.00	Lbs / Kg

Re-Calculate & Redraw

Save & Close   **Cancel**

The Parameter Editor was created to allow a designer to adjust an overall parameter of the keel or rudder. For example, the ballast material can be changed in the main keel or the bulb section independently. The height of the bulb ballast can also be adjusted and the overall length, width, thickness, leading edge sweep can all be changed by entering one new value in the editor and then clicking "Re-calculate & Redraw".

All of the parameters of the bulb may be changed by editing the parameters shown under the KEEL BULB MATERIAL heading.

A complete set of resulting calculations is shown in the bottom left of the Parameter Editor. Here the designer will find the total weight of the keel or rudder, all centers of effort and the detailed values for the keel and bulb. These computed values cannot be edited by the designer – but will change as the various parameters of the editor are changed and Re-Calculated.

Saving All Changes or Cancel any changes

To accept the changes that have been made in the Parameter Editor, click SAVE & CLOSE, to return to the values before the editor was opened choose CANCEL.

Leaving The Parameter Editor

Select SAVE & CLOSE or Cancel. If you choose SAVE & CLOSE, all of the changes that have been made will be saved and the keel or rudder shape will be redrawn with the new parameters included. To make a permanent copy of the changes you MUST select FILE - SAVE, or click on the Save File Button on the tool bar.

If you choose Cancel, then all changes made will be erased and the original keel or rudder will be redrawn.

WINGS 32 Foil Chord Numbering System
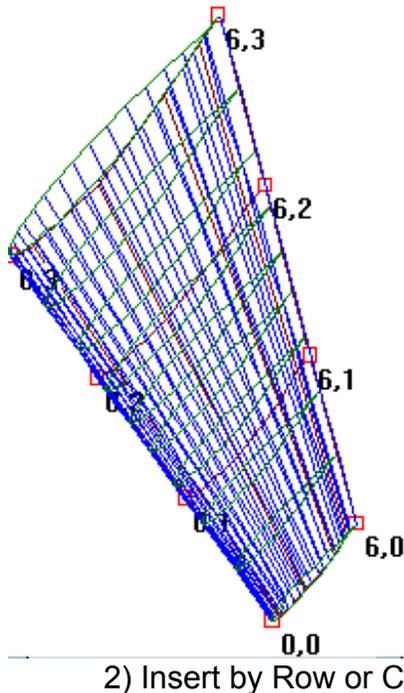
"WINGS 32" identifies each foil chord by a number. The image shows four foils numbered by WINGS 32. It can be seen that the leading edge is number 0, N and the trailing edge is 6,N where N is 0,1,2,3 along the leading or trailing edges. Show the numbering system by selecting Options, Label Vertex Rows and Columns. It is easy to show just a single row or column by selecting Options, Draw Single Vertex Net Line.

Adding Foil Chords

A Foil chord set of control points may be added to allow additional control over the shape of the keel or rudder. The addition of foil chords is frequently done to define bulb shapes or curved leading and trailing edges.

There are two means to add new foil chords. They are:
  1) Positioning With Mouse
2) Insert by Row or Column Number

Positioning With Mouse

Select the EDIT menu and Select "*Insert New Foil*…". Select *Insert by Mouse Click*. A Foil Selection dialog will appear. Choose the foil type that you wish to insert and click ok. Now click at the location where you wish the foil to be added. WINGS 32 allows the user to indicate where he wishes to place a new foil chord by simply clicking the pointer on any planar view, such as Body, Plan or Profile. The chord will be placed at the location of the mouse and will not disturb the leading and trailing edge shapes.

Insert by Foil Index

Select the EDIT menu and Select "*Insert New Foil*…". Select *Insert by Foil Index*. A Foil Selection dialog will appear. Choose the foil type that you wish to insert and click ok. A Foil Index by dialog box will appear. Foils are numbered from Zero at the tip to N at the root (where n is the last foil. Enter a 1 to locate the new chord half way between the current chord number 1 and chord number 2.

Deleting Foil Chords

Foil Chords may be deleted if they have been placed in error or simply are not required.

There are two means to delete foil chords. They are:
  1) Select With Mouse

2) Delete by Row or Column Number

Select With Mouse

WINGS 32 allows the user to indicate which row or column of vertex control points to remove by simply clicking the pointer on any planar view, such as Body, Plan or Profile.

To Delete a Foil Chord:

1) Vertex control points must be drawn - Select the Vertex Net ON/Off Button on the tool bar if vertices are not shown.
2) Select EDIT, DELETE Foil . Then *With Mouse Click*
3) Locate the + Cursor over one of the square vertex control point markers (Default red box)
4) Click the <u>left</u> mouse button.
The foil chord will be removed and the keel will be redrawn.

Delete By FOIL Number

Rows and columns can be removed by specifying the number of the row or column to be deleted.

To Delete a Foil Chord:

1) Vertex control points must be drawn - Select the Vertex Net ON/Off Button on the tool bar if vertices are not shown.
2) Select EDIT, DELETE FOIL.. Then *By Foil Index*
3) Enter the number of Foil Chord to be removed and click OK
The foil chord will be removed and the keel or rudder will be redrawn.

Changing Spline Tension

Keels or rudder designs created within WINGS 32 are based on a special surface that is known as a NURB (Non-Uniform Rational B-Spline) or B-spline surface. NURB Surface types were created by mathematicians to allow the design of virtually any shape. One of the features of B-Spline surfaces is the ability to change the tension or stiffness of the curves.
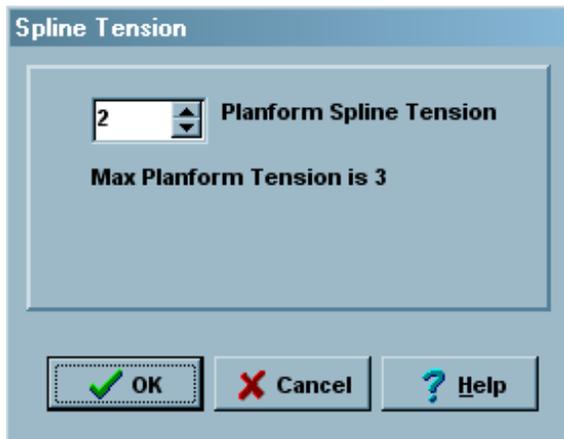
"WINGS 32" allows the designer to change the stiffness of the splines in the lengthwise (Span or draft direction). Tension in the direction of the foil shapes is fixed to preserve the chosen foil shapes along the chord direction. Tension in the spline is the same as using stiff or very pliable battens. By setting tension to its lowest level of 1, the splines act as if they are made of limp string, and will lay in straight lines between the vertex control points, and forming chine breaks at each vertex point. This makes it possible to create sharp vertical breaks in the keel or rudder by simply selecting a tension of 1 in the planform direction.

MAXIMUM POSSIBLE SPLINE TENSION

The highest tension available in either direction is not automatically a level 4. The number of vertex control points along the spline limits the maximum tension. For example, a Tension of 1 requires 3 vertices, Tension 2 requires 4, Tension 3 requires 5 and Tension 4 requires a minimum of 6 vertex control points. WINGS 32 will automatically limit the highest tension you are allowed to select according to this rule.

To change the tension of the splines along the span or draft of the keel or rudder:
1: Select SPLINE, The Spline Tension Dialog Box appears (Shown Above)
2: The Spline Tension Dialog Displays the Current Spline Tension Settings (Planform Tension =1 in the example above)
3: Click on the up or down arrows to adjust the tension
4: Click OK and the keel or rudder will be redrawn with the new spline tension.

Fairing the Keel or Rudder

This feature has not yet been implemented at the time of this writing.

WINGS 32 Design Tools

"WINGS 32" provides special design aids that are intended to make your design process easier. These design aids are found in the **Options** Menu. This menu allows the designer to simplify the sometimes-confusing display of vertex control points and connecting lines on the keel or rudder. For example, when working on the stern of a power boat keel or rudder in the body view, all of the vertex control points are frequently overlaid, in particular in the stern section of the keel or rudder, shown to the left side of the body view.

It is possible to display just one vertex column or row in all views. To use this technique select the Options menu, then click "Draw Single Vertex Net Line…". WINGS 32 will then display a floating dialog box that may remain open as you continue your design work. This new dialog box allows the designer to select one single vertex row or column. As the designer makes a choice on the dialog box, just the selected row or column will be displayed. WINGS 32 will show each vertex row or column as it is selected on the dialog box. Therefore the designer can edit with the dialog open, select a new column or row on the dialog and return to editing. This process can be repeated as often as needed.

When the designer wishes to redraw all of the lines on the screen, he should select "draw All Net Lines" and press OK to close the dialog box.

The following screen illustrates the body view of a sailboat keel or rudder with one vertex column drawn using the Single Vertex Line Selector Dialog Box.

WINGS 32 also allows additional vertex net drawing features that may also help in the design process. Once again select the Options menu and notice that there are Check marks beside the lines "Vertex Net Row Lines Drawn" and "Vertex Net Column Lines Drawn" . The check mark indicates that both of these options are currently active. To draw just vertex column lines as shown in the image below, click the "Vertex Net Row Lines Drawn". This will instruct WINGS 32 to disable the net lines that horizontally connect the vertex control points. Alternately, click on the "Vertex Net Column Lines Drawn" and WINGS 32 will only draw vertex net lines that connect vertex control points horizontally as shown here. If the design clicks on both options then WINGS 32 will only draw the vertex control points themselves with no connecting net lines. The designer may redraw any connecting net lines by clicking the options a second time and the lines will once more be drawn.

IMPORTING EXISTING CAD FILES

Importing a DXF File as a Reference Drawing

Removing the Reference Drawing File

Importing a DXF File as Vertex Control Points

Importing DXF Reference Files

WINGS 32 can import 3D (3 Dimensions: X, Y, Z) DXF (Drawing eXchange Files) created by a CAD program using AutoCAD V14 Format. Database versions of DXF files created by later versions of AutoCAD or other CAD programs are not acceptable. Please choose the older file type when exporting files from any CAD program. The restrictions on these files are as follows:

   1) The files must only contain LINE or POLYLINE elements.

   2) The files should align data as Keel or Rudder THICKNESS on the X-axis, Fore and Aft Chord Length along the Y-axis and height (or span or draft) along the Z-axis, with the root or top of the keel or rudder at Z=0 and the tip chord at Z= -N where N can be any _negative_ value. We have chosen these standards because they exactly match the definitions found in Rhino 3D and others, and when requesting views of FRONT, Right or Left Side even in programs such as CADKEY, the expected view is properly presented.

If the X,Y,Z definitions within your CAD file do not match the X-beam, Y-length, Z-height definitions, then use a rotate axes command to orient the keel or rudder so that WINGS 32 will display it properly. WINGS 32 also offers the chance to exchange axes when the files is imported.

REFERENCE and VERTEX Data

A DXF file can be used in two ways within WINGS 32. A DXF file can be displayed as a Reference Drawing that will be traced over by a WINGS 32 design. A referenced drawing cannot be changed or edited in PROLINES. A DXF file may also be converted into vertex control point locations, WINGS 32 native format of NURB data.

REFERENCE DRAWING DATA

Any number of line or polyline elements that represent the stations, waterlines, buttocks, or outline may be used when a DXF file is read as a reference. This reference image must be traced over by a WINGS 32 NURB surface using vertex control points.

In order to scale the screen and data files within WINGS 32, you must first display a WINGS 32 keel or rudder. This can be done by opening an existing design or by creating a new design by filing out a Parametric Keel / Rudder Design (_File – New…)_ with a keel or rudder that is the same basic type, draft, thickness and chord lengths of the desired reference drawing. It is also possible to create a new file by typing in a table of offsets using _File - New - Type a Table Of Vertices._

With the WINGS 32 keel or rudder on screen, select _File-Import DXF File-Reference._ Select the desired DXF file from the file list and it will be drawn beneath the existing WINGS 32 design. Adjust the station, waterline and buttock spacing such that they overlap the reference keel or rudder file exactly. Add any special stations or waterlines with the _View- Special Stations_... menu item. The color of the reference keel or rudder can be changed within the _TOOLS - Change Lines Colors menu item_.

VERTEX Data File

There are additional restrictions on a DXF file that will be used to create a vertex control points for a WINGS 32 NURB surface. The mathematics of NURB surfaces requires that the same number of vertex control points must be used at every vertex column or row. WINGS 32 assumes that the data provided by the DXF file ONLY contains stations or vertical line or polyline elements. There must NOT be any waterline, sheer, chine or fairbody data included, because WINGS 32 will convert each line or polyline segment into a vertex COLUMN that is station oriented.

WINGS 32 is limited to using no more than 30 vertex control points per vertex column and no more than 30 vertex columns. Therefore, the number of line or polyline segments must not exceed 30. If more than 30 items are contained within the DXF file, the items beyond the 30th item are ignored.

Finally, WINGS 32 numbers its vertex control points by starting at the centerline tip chord (bottom of the keel or rudder) with vertex point 0 and increase to the root chord at the top next to the keel or rudder with vertex point N where N is 30 or less. Therefore if you digitize an existing Keel or Rudder file with a CAD program, be sure to begin at the tip chord and move to the root chord at the keel or rudder joint with the keel.

Removing A Reference File

To turn a reference file off and retain the new drawing, select the FILE menu and click on "Close Reference Keel/Rudder File".

Calculations

Hydrostatic Calculations

Lift and Drag Calculations

Thickness Vs Span (Vertical Position)

Chord Length Vs Span (Vertical Position)

Displacement + Hydrostatics

Displacement
Saltwater	302.341 Lbs
Fresh Water	293.838 Lbs
Weight	3354.10 Lbs
Volume	4.724 CuFt

Length / Width / Height
Span	72.000 In
Draft	72.000 In
Leading Edge Angle	25.000Deg
Trailing Edge Angle	6.202Deg
m	6.000Deg

Planform Data
Aspect Ratio	1.714
Taper Ratio	0.406
Root Chord	60.000
Tip Chord	24.359
Average Chord	42.000 In
Bulb Length	0.000
Bulb Height	0.000
Bulb Width	0.000

Areas
Keel Projected Area	21.000 SqFt
Total Wetted Area	42.485 SqFt
Frontal Area	2.011 SqFt

Centers
Vert Center Gravity	-2.149 ft Below LWL
Lon Center Gravity	2.596 ft Aft "0"
Long Ctr Bouyancy	2.596 ft Aft "0"
Vert Ctr Bouyancy	-2.149 ft Below Lwl

Centers of Action
	0.000 Ft aft "0"
Vertical CLP	3.429 Ft Below LWL
Longitudinal CLP	3.056 Ft aft "0"

Print   OK

Hydrostatics Calculations

To access this feature click the Calculator symbol on the toolbar or from the CALC menu select the Hydrostatics item from the menu list.

Hydrostatics calculations are computed for the current setting of the keel below waterline. The keel MUST have some portion below the waterline (horizontal reference line shown in Body and Profile views) or no calculations will take place. To shift the keel to a desired waterline position select TOOLS, SHIFT Keel Rudder and enter an amount to shift the keel or rudder either up or down. Entering a negative value will move the keel or rudder down and a positive value raises the keel or rudder out of the "water".

LIFT and Drag Calculations

o use this feature, select the CALC menu from the main window. Select LIFT& Drag from the menu list.
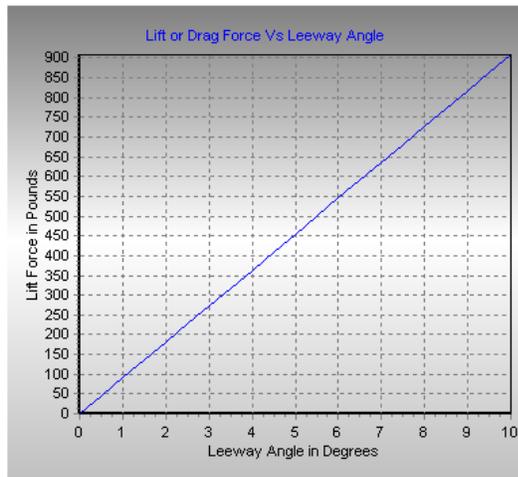
WINGS 32 includes a LIFT and Drag computation that is based on a common linear model found in texts. The model assumes a standard lifting surface with approximately straight leading and trailing edges. WINGS will be enhanced over time to include the effects of bulbs on lift and drag. As of this writing the program assumes an overall span and aspect ratio that will be influenced by the bulb – but may not correctly estimate its drag effects. The user is encouraged to pay close attention to wetted surface and frontal surface areas projected in the Hydrostatics Calculations. Minimum drag will typically occur when the wetted surface and frontal area are minimized. The user is cautioned however that very thin sections less than 8% thick may have a tendency to stall (dramatic loss of lift and increase in drag) at relatively low angles of attack (leeway).

LIFT CURVE SLOPE Calculation

To use this feature, select the CALC menu list from the main menu. Select Lift and Drag. To view the computation of the "lift curve slope" select the "LIFT CURE SLOPE" check box from the "Calculations to Plot" dialog area. The lift curve slope is a measure of the rate at which a planform (keel or rudder) produces lift per degree of leeway or rudder angle. The higher the lift curve slope – the more efficient the planform design becomes.
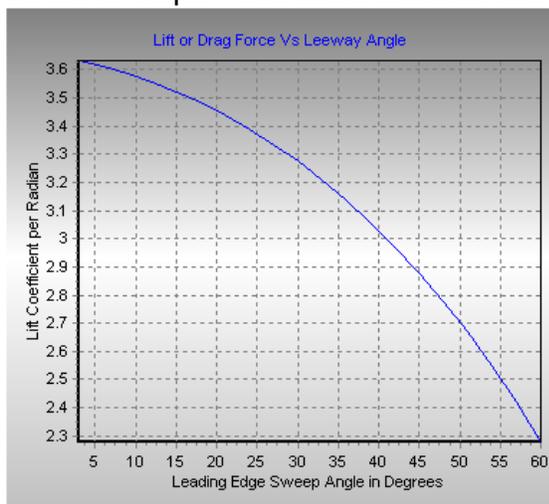
Lift Curve Slope is plotted as a function of the leading edge sweep back angle. Typically a planform develops a lower lift curve slope as the leading edge angle is swept back. Therefore the designer should attempt to optimize performance by choosing a leading edge sweep angle that is equal to the peak of the Lift Curve Slope curve. In the case shown at left the peak occurs near 5 degrees. Depending on the taper ratio (tip chord Vs Root chord) the optimum sweep back angle may be a value larger than the minimum sweep angle. This peak value is the desired optimum.

Selecting the Print button on the right of the form will print the plots. The plot may also be saved as a bitmap for use in a report that you may right by selecting the Save as Bitmap button. Finally, it is possible to print just the actual numerical data by selecting Print Data on the form.

Keel Thickness Vs Span

Another tool to verify the design meets its desired goals and is a fair design (smooth) is to plot planform thickness as a function of span. Choose this option from the CALC menu. Once the dialog box and plot appear the choice is available to show the thickness as a function of actual thickness in inches or millimeters or as a percentage of the chord length where it is measured.
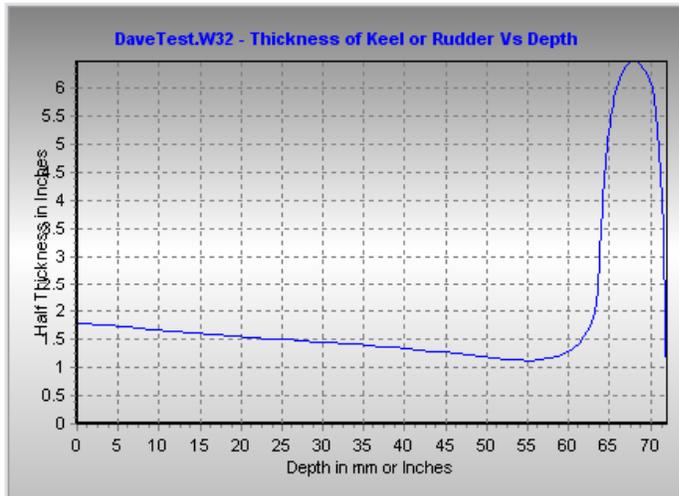
Plotting chord-thickness as a percentage of chord length is a very strong indication of design fairness. Fairness refers to how smoothly the design moves from region to region.

The details of the thickness variation can be displayed more precisely by using the built in zoom function of the graph. Zoom in on an area of interest by clicking in the upper left region of the area and dragging to the lower right. The plot can be returned to normal by clicking in the lower right and dragging to the upper left.

Correct thickness problems by looking carefully at the FRONT view and verifying that the thickness is distributed evenly. Use the WINGS zoom function to look carefully at any particular region. See the WINGS ToolBar Menu for information on using the windows zoom function.

Keel Chord Length Vs Span

One of the more powerful tools that can be used to make sure a keel or rudder design is fair and is drawn with a smooth transition along the span of the planform is to plot Chord Length Vs Span by selecting this item from the CALC Menu.

The dialog box shows a plot similar to the one shown at left for a bulb keel. This plot is a very good indication that the design smoothly transitions from along the span. Any unintended odd changes in chord lengths will be shown here.

This plot is also very useful to get an overall idea of the overall dimensions of the planform design to be sure they meet the design goals.

All plots shown within the calculations menu provide the ability to zoom in and view plotted data in great detail. Zoom by clicking and dragging the mouse from upper left to lower right. Remove zoom effects by clicking and dragging on the plot from the lower right to the upper left anywhere within the plot.
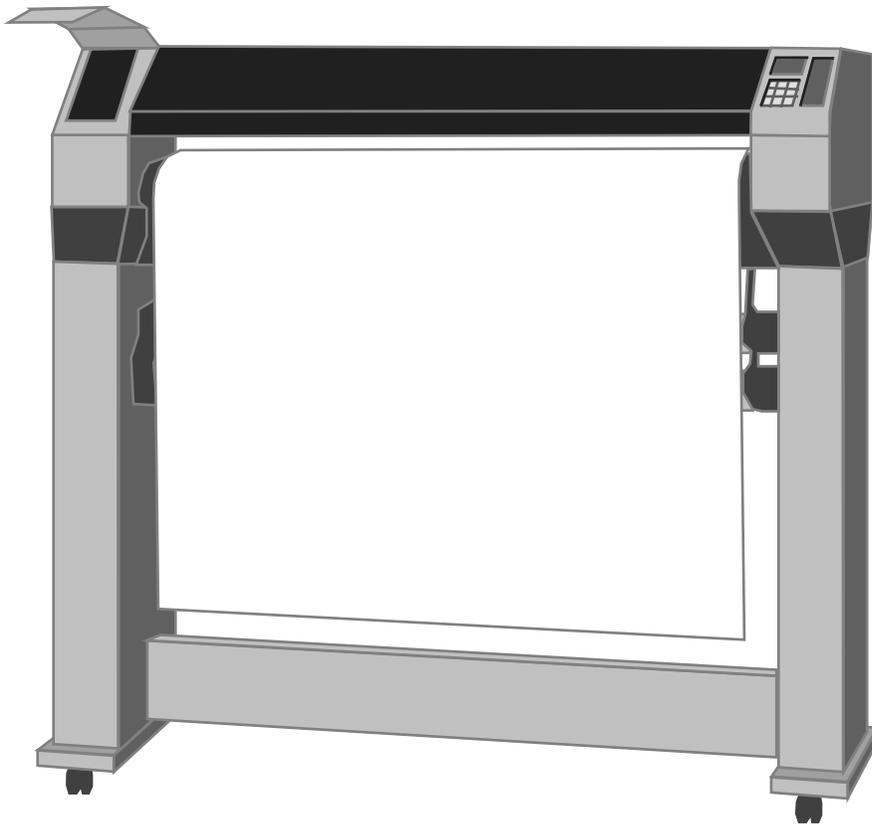
Creating CAD Files

DXF Files

2D DXF

3D DXF

CADKEY Files

IGES NURB Files

Computer Numerical Controlled Machining

Special Stations, Waterlines, Buttocks

Exporting DXF CAD Files

WINGS 32 PROFESSIONAL generates 2D and 3D DXF Files. The Basic version of WINGS 32 generates ONLY 2D DXF Files. The full professional version generates 3D DXF files and several other files types as well. Click the Output Menu and select a CAD file type. A common CAD File dialog box will open. That dialog box allows the user to specify 2D or 3D CAD files. In a 2D CAD file, the current active view on the screen is copied to the file. The file will contain only x and y data just as if it were a normal paper drawing. A 3D CAD file contains all of the data required to show position along the length of the keel or rudder, beam and height. The 3D file can be used by another CAD program to integrate internal structures and finish joiner work. Individual sections of the keel or rudder can be highlighted and zoomed for greater internal detail.
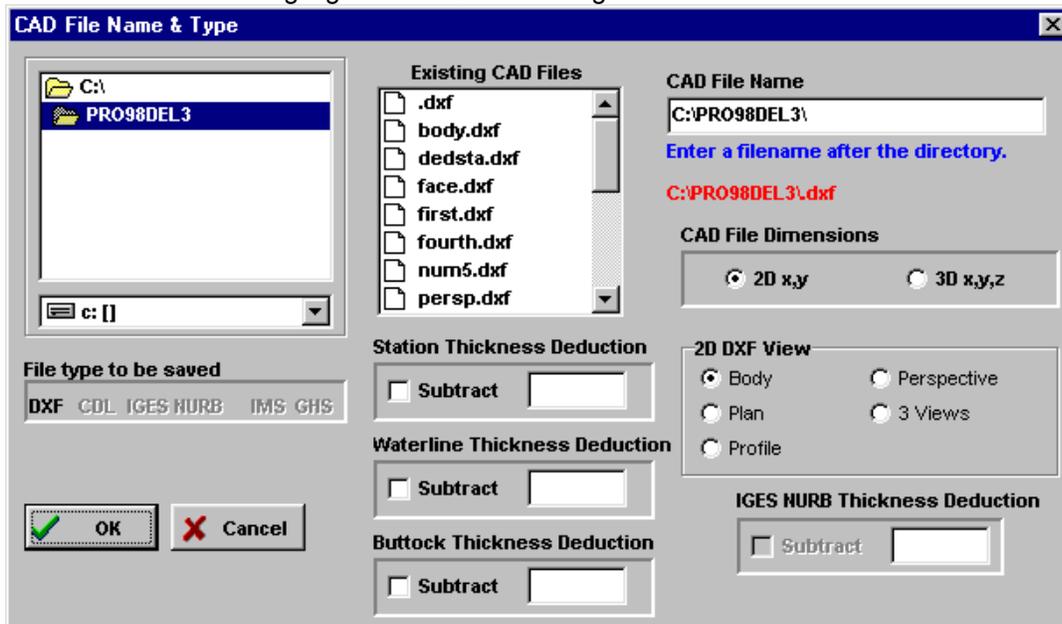
In both 2D and 3D files, WINGS 32 assigns a separate "layer" name and number to each line. For example, the first station is named STA 01, the second is STA 02. Similarly waterlines and buttock lines are also named and numbered. Some smaller CAD programs are not compatible with layer NAMES, but will include layer numbers. Layers can be thought of as separate sheets of paper that are transparent. When they are all laid down together all of the keel or rudder lines are present. When just one piece of paper is present then just one keel or rudder line, such as a station is seen. CAD programs will use the layer names and numbers provided by WINGS 32 to allow the designer to view only those lines that are of interest.

WINGS 32 will only incorporate those lines that are currently drawn on the screen in the DXF file. For example, if stations and buttocks are drawn, then only station and buttock lines are included in the DXF file. This makes it easy to generate files that have just one type of line or all types at the same time depending on what is needed for a task.

All of the DXF files created by WINGS 32 that contain LINES are output in the cad file using an element known as a **POLYLINE**. Each point that WINGS 32 computed on each station for example will appear as a point on single station polyline. If WINGS 32 has been set for 15 points per station, then there will be 15 points on each station polyline. A polyline was chosen because it acts within a CAD program as a single element rather than as separate line pieces. This makes it possible to select a station or waterline within a CAD program by clicking on it.

The **smoothness of the lines** output by WINGS 32 will depend upon the number of points per curve line. For example, the mid ship station of a sailboat would appear to be drawn from a few straight lines if just 5 points per station line is chosen. However, if 50 points per station line is used then the station line will appear as a very smooth curve. This effect may be lost however, if the station is drawn at very large scale, say near full size. To make the station curve appear smooth again, the number of points per station curve must be increased to 100 or perhaps 200. While this will make the drawings very smooth an fair, it will also make the exported CAD files VERY large in size, easily reaching several megabytes in some cases. To adjust the number of points per curve select EDIT, STA/WLS/BUTT Settings.

Skin Thickness Deduction in CAD Files

WINGS 32 provides the ability to deduct a uniform skin thickness along a line that is normal or perpendicular to the keel or rudder. By using this feature a designer can create a mold that has already been adjusted for the keel or rudder thickness, or a designer can generate the shapes that correspond to the inside of the keel or rudder for interior components such as bulkheads, stringers or frames. The option to deduct a skin thickness is made available in the common CAD file dialog box that appears whenever an appropriate CAD file is exported. For example, it does not make sense to specify a skin thickness deduction when exporting an IGES NURB file. Nor is it possible to deduct skin thickness from a 3D DXF Patch file, where no lines are exported.
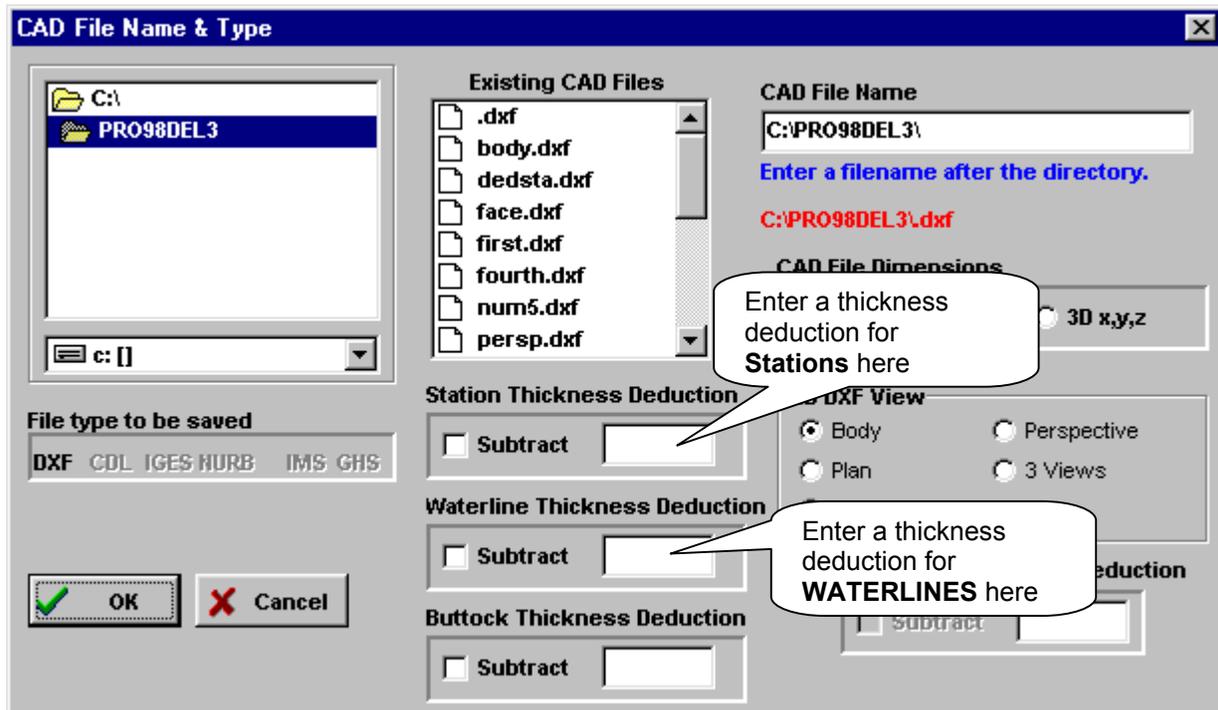
Tips for Viewing and Exporting Keel or rudder Designs

Note - To Adjust the number of Points Per Curve select the *EDIT Edit Station, Waterline Buttock Settings* menu item.
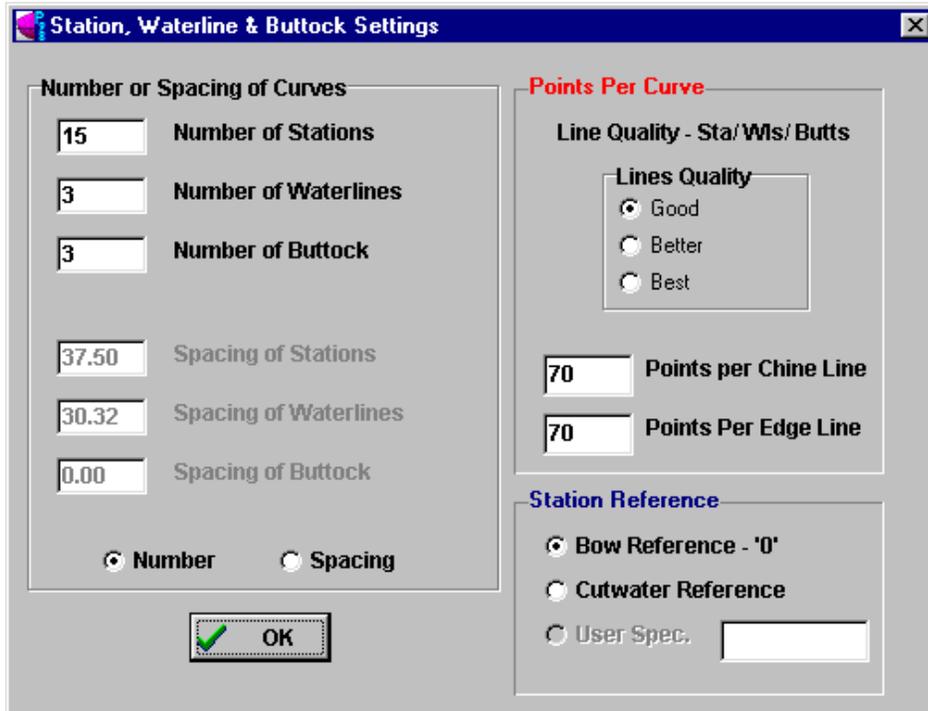
WINGS 32 draws each keel or rudder on the screen using Non-uniform B-Spline (NURB) mathematics. However, because Windows does not support NURBS directly, we must draw each curve in a keel or rudder using small connected straight line sections. WINGS 32 uses about 30 points each connected by line sections for each curve by default. This is sufficient for many applications but it may be necessary to increase the number of points in each line to draw truly smooth curves or to see the exact detail of a keel or rudder shape at chine locations.

In particular, if too few points are used in chined keel or rudders, the chines may appear to have multiple chines that do not fall on the desired vertex location. In this case or in any case of a smooth keel or rudder that shows chined or broken sections rather than smooth curves, the number of point should be increased substantially. WINGS 32 will allow up to 500 points on each curve, so it is common to request 100 or 200 points per curve.

This factor becomes especially important when exporting finished CAD files as a final design output. If these files will be plotted at full scale or at large size, it is important to select a large number of points per curve to avoid the chined appearance that can occur when the drawings are greatly enlarged. The number of points per curve to be included in a CAD file is the same as the number selected for drawing.

The disadvantage of using large numbers of points per curve is that it will slow the operation of WINGS 32 considerably. With this in mind, leave the number of points per curve to a low setting during initial design when large numbers of changes are made that will require redrawing the keel or rudder numerous times. Later when making check plots or when extra smoothing is needed to verify section shape, increase the number of points per curve.

CADKEY Files

CADKEY is a major CAD program development company based in Connecticut USA. WINGS 32 has the ability to generate what are known as CADL files that can be read only by CADKEY. CADKEY can also read 2D and 3D DXF files as well as IGES NURB Files, if a CADKEY user also has the full version of FASTSURF for CADKEY. To generate files for CADKEY, select OUTPUT, CADKEY STA/WLS/BUTTS. Because CADKEY uses only 3D files, this feature is not available on the BASIC version of WINGS 32.

IGES NURB Files

IGES NURB files are a high-level industry standard file. When WINGS 32 creates an IGES NURB file, it does not export any stations, waterlines, patches or any other typical line element. Instead it exports a mathematical definition of the b-spline or NURB surface that defines the keel or rudder shape completely. WINGS 32 exports just the vertex control points and the definition of the spline tension vertically (Stations) and horizontally (Waterlines). With this data a separate CAD program can generate any planar cuts desired, render the keel or rudder in detailed color, intersect the keel or rudder with bow thrusters and propeller tubes or rudder shafts. Keel or rudders can be combined with decks and super structures.

IGES NURB files are also critical to the technology of Computer Numerically Controlled Machining (CNC Machining). CNC machining is now frequently used to create full size precision molds for an entire boat keel or rudder via a large gantry supported 5 axis-milling machine. As of this writing, keel or rudders of up to 45 feet can be machined in place from a very large block of high-density foam created from laminated pieces, just as a half keel or rudder modeler would build.

The IGES NURB file provides the exact definition of every possible point on a keel or rudder. Traditional Stations and Waterlines only define the keel or rudder at specific locations along the lines themselves. It is up to the builder to stretch battens between the stations to determine the shape of the keel or rudder everywhere in between. Clearly a milling machine does not have access to a batten, but rather a mathematical formula that describes each point on a boat keel or rudder precisely.

Computer Numerically Controlled Machining

The IGES NURB file is perfect for use with multiaxis CNC routing machines. The file can be read directly by virtually all commercial systems and converted into commands to directly machine virtually any size keel or rudder from foam or other materials.

Special Stations, Waterlines & Buttocks

WINGS 32 provides the ability to generate stations, waterlines and buttocks at locations other than standard or regular spacing. These "special" sections can be used to show keel or rudder shape at bulkheads, stringer or engine bed locations. WINGS 32 allows up to 30 of each type of special section to be exported as a cad file at any one time. Once the first set of 30 is exported, another set can be generated in their place.

Each section is located by specifying its location relative to the bow, load waterline, and keel or rudder centerline. In the case of the bow reference WINGS 32 actually measures from Zero length - the position of the vertical line in profile and plan views.

When the Special Stations Waterlines & Buttocks menu item is selected from the VIEW menu, a table dialog appears as shown below.

Data that specifies the location of each specially located station, waterline etc, is entered by clicking the left mouse button on the upper most empty location in the data table. After clicking a table cell location, a simple data entry dialog box will appear. The data for each of the sections can be typed in at one time, but for clarity only those lines you wish to display will be shown. Lines to be displayed must be enabled by placing a check mark beside the line type at the right of the dialog. To place a check mark simply click with the left mouse button on the check box and to remove the check click once more. Those lines that are disabled are not erased but simply held in memory and not displayed. The data will not be lost unless a new keel or rudder design file is opened or you select to erase all data by clicking on one of the CLEAR buttons to the lower right of the dialog. You may remove an individual section line by entering a 0 (zero) in place of the original line location.

When all of the locations are entered, click the OK button to display the special sections. The data in the table may be edited, deleted or added to at any time. To edit the data in any way simply reselect the Special Stations... menu item from the VIEW menu. The data will appear ready to be edited, lines enabled or disabled.

Once data has been entered into the special sections table, it can be exported into CAD files by selecting the Special or Single section menu items in the OUTPUT menu. WINGS 32

Basic users are reminded that only 2 D files are possible, and the section that is exported will correspond to the view that is currently active (Title bar is highlighted). Therefore, if you desire a station section as normally seen from the body view, be sure the body view is the active view before selecting the CAD output option.

Rendering WINGS 32 Keel or rudder Designs

"WINGS 32" is currently being modified to provide a much improved rendering capability as of the writing of this document. Contact Vacanti Yacht Design LLC for updated information.

3D CAD Rendering Files

Many 3D CAD programs have the ability to RENDER or paint a 3D shape such that it appears to be real. WINGS 32 exports two file types that can be used to produce rendered images of the keel or rudder. First, a 3D DXF file type containing elements known as 3D Face elements can be read by many CAD rendering programs. Selecting OUTPUT, 3D DXF Patch Surface can create this type of file.

Another file type that can also be exported for use with a rendering CAD program is an IGES NURB file. This file format is usually supported by large an complex CAD programs such as Microstation, PRO ENGINEER, and some extended versions of AutoCAD that support full b-spline or NURB capabilities.

The image shown below is an example of a WINGS 32 keel or rudder design that has been rendered in a commercial CAD package. This file can be created by exporting IGES NURB or 3D FACE entities from WINGS 32.

Importing Keels and Rudders

Importing 3D DXF Keel and Rudder Files

Importing Keel and Rudder Files

WINGS 32 has the ability to import 3D DXF files that were created by the Vacanti Software program **WINGS** or any other CAD program that adheres to the following definitions.

      1) X Axis is Beam

      2) Y Axis is Distance Fore and Aft, with positive position aft the leading edge.

      3) Z Axis is Height Above (+) or Below (-) the Load Waterline (LWL)

File Data Definition

The keel may contain a number of vertical or horizontal cuts, an outer edge or profile outline and a modest number of points per cut. Each "cut" may be thought of as a station or foil section or may be a centerline of the keel or rudder. WINGS 32 expects just the left side of the keel or rudder, and will mirror the second half in any calculations or IMS file exports. This mirroring will only occur if the keel or rudder is located on a monokeel or rudder centerline. Therefore if, for example, dual rudders are placed outboard of centerline, then both the right and left halves must be included.

If the keel or rudder data will be used with keel or rudder data to create an IMS ".off" file, then it is critical to note that the IMS VPP data file allows a maximum of 65 points per station. Because WINGS 32 provides 31 data points per station by default when it creates an IMS file, the maximum number of points on any vertical station cut on a keel or rudder should not include more than 30 points to safely avoid exceeding the IMS file limits.

The IMS VPP also requires that keel and rudder data provide the location of the keel or rudder leading edge and trailing edge. There must be sufficient definition of the maximum thickness of the keel or rudder in the data file.

DXF FILE Entity Types

WINGS 32 requires that the entity (the kind of drawing elements) types used in a DXF file be either line or polyline segments. WINGS 32 will not import splines of any type.

How To Import Keel And Rudder Files

Select File, Import Keel and Rudders. WINGS 32 will display a standard file open dialog that shows only DXF files. You may change directories to locate the files of your choice. Select a DXF file and WINGS 32 will request the location of the keel or rudder referenced to the leading edge of the keel at the root or top. In a series of dialog boxes WINGS 32 will request the distance aft the bow or 0 location, the distance below the lwl, and the distance away from center line or position in beam. In all cases WINGS 32 expects these values in inches or millimeters, depending on the units you have chosen.

The location in beam should only be used when incorporating twin rudders set off the keel or rudder centerline.

WINGS 32 will attempt to read the DXF file and display the keel or rudder. If it detects a 3D DXF file (data provided for x, y, z locations) and proper entity types(lines and polylines) then

the appendage will be added to the keel or rudder drawing on screen. If any errors occur in reading the file, WINGS 32 will display a message that describes the problem it encountered.

Adding Multiple Keel / Rudder Elements

WINGS 32 adds one keel or rudder file each time the Import function is selected. To add another keel or rudder element to the keel or rudder, select the Import Keel and Rudder file again. Technically, WINGS 32 does not have a limit on these files, but adding large numbers of them may slow program operation significantly.

Printing

Printing a View of the Keel or rudder

Printing a Table of Offsets
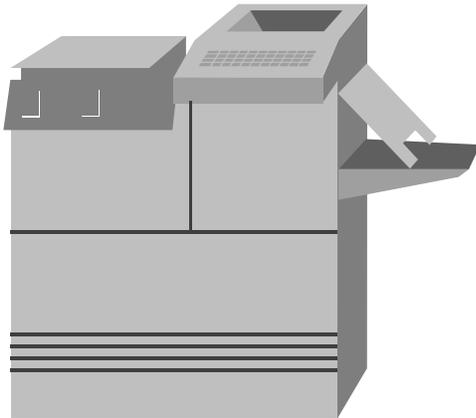
Printing Views of Your Design

WINGS 32 has the ability to print any view of a keel or rudder design to the printer to a user selected scale. Select Output, Print / Plot Keel or rudder. The Print Select dialog will appear and offer the designer a choice of views to print. WINGS 32 computes the maximim scale that can be achieved on the paper size currently selected for your printer. The scale is affected by paper orientation. For example, a larger print scale is possible in PROFILE or PLAN view if the paper is first selected to be in the Landscape direction.

Because the size of the paper available and the size of the vessel determine the maximum scale allowed please use the Print Setup Dialog first before selecting the Print Plot Option. The Print Setup DIalog is accessed by clicking on the Printer Tools button on WINGS 32 toolbar. For the highest quality output select the highest printing resolution of your printer. For a quick draft copy with poorer quality select a lower resolution. It is also possible to select FILE, Printer Setup to set resolution or enable color printing.
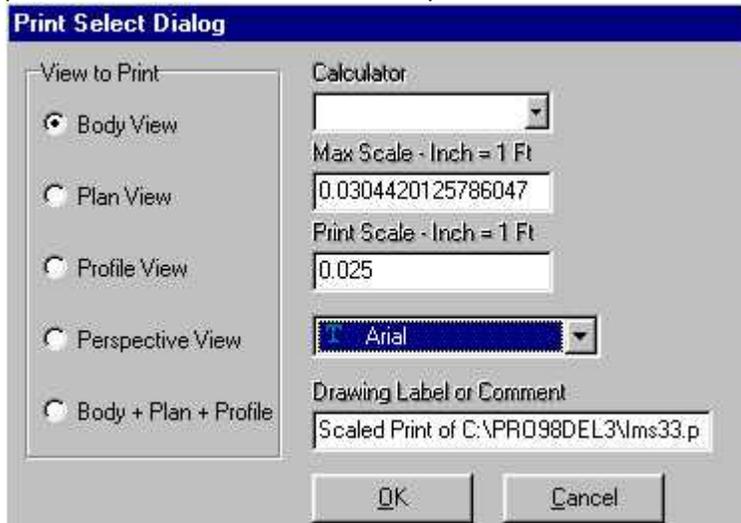
To select a view to be printed click the check box beside the view to be printed. Note that all three primary views can be printed at the same time (Body, Plan and Profile) but that the combined views are printed to APPROXIMATE scale.

Printing Keel or rudder Offsets

WINGS 32 will print two forms of a Table of Offsets. The first form is termed a "Computer Table of Offsets". This computer table provides an offset for every point computed along a station. For example, if you have specified 35 points per station, then WINGS 32 will print 35 sets of data for every station. This can lead to a great deal of printing. To restrict the volume of data, set the number of points per curve to a low number such as 10 to 15 points per station curve. Set the number of points per curve by selecting EDIT, STA/WLS/BUTT Settings. A low setting will not affect accuracy of the data.

The second form of printing is a traditional Table Of Offsets but is limited to intersections of just Stations and Waterlines. WINGS 32 will print data for the stations and waterlines that are currently displayed. Therefore adjusting the number of stations and waterlines sets the amount of data in the table. **Both Stations and Waterlines MUST be drawn to generate a traditional Table Of Offsets.**