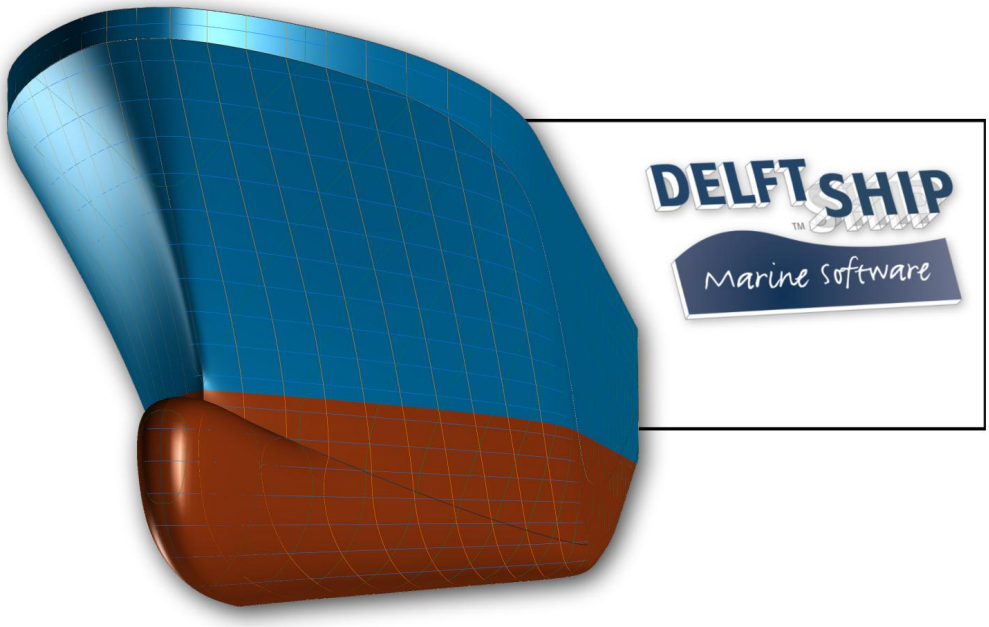
DELFTSHIP MARITIME SOFTWARE

DELFTship manual

User manual

by DELFTship maritime software



DELFTship manual

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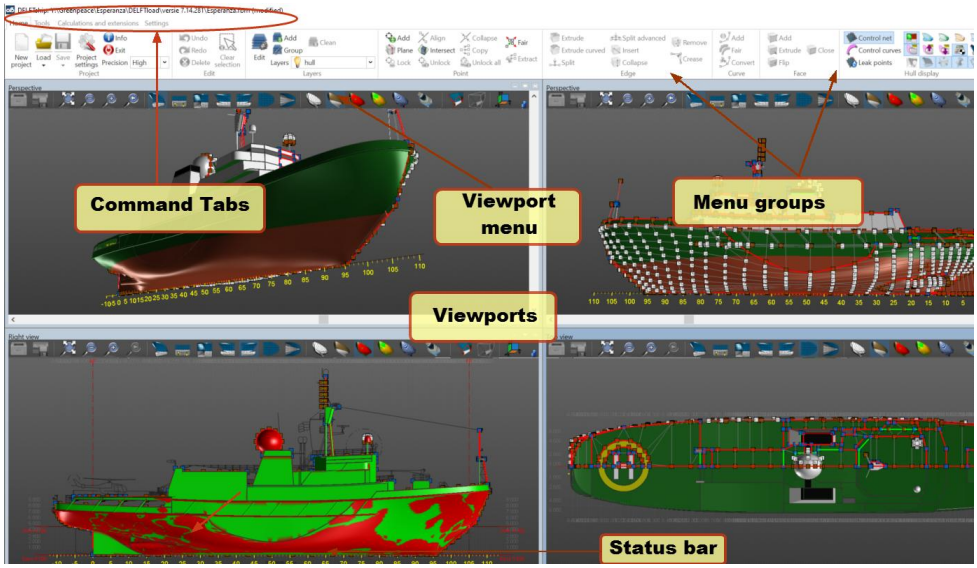
The DELFTship interface

Part I

Part I The DELFTship interface

1.1 DELFTship main window



Main window

The ribbon menu

There are 5 main tabs on the ribbon interface, accessible through the tabbed buttons at the top. By default the '*Home*' ribbon is displayed. Other tabs are: '*Tools*', '*Calculations and extensions*' and *'Settings'*. Each ribbon has menu groups, where buttons are grouped logically. Each menu group has a help function, accessing by clicking on the help button to the right of the group name.

Quick access toolbar

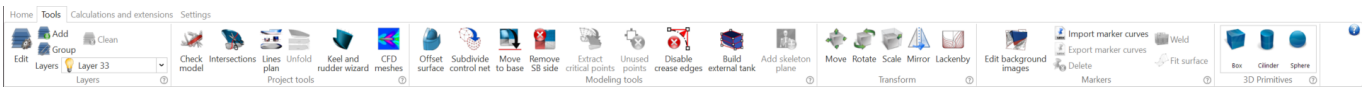
Opening saving, importing and exporting of DELFTship models can be done via this rapid-access menu, which is further described in the paragraph on the File group.

Home Tab

The Home tab contains menus with general commands for selecting, editing, display etc.

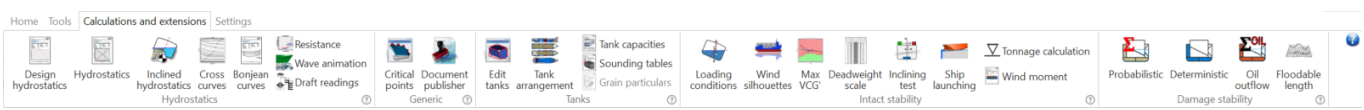
Tools Tab

The tools tab contains menus with a variety of hull modeling tools.



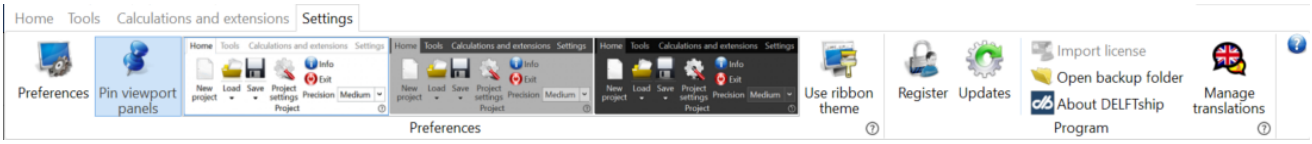
Calculations and extensions Tab

The calculations tab contains a variety of calculation commands. In addition it gives access to specific extensions of DELFTship. Availability of extensions depends on your licenses.



Settings Tab

The Settings tab gives access to various system settings as well as information about the version and licenses of your DELFTship installation and an update button.



Help

Most menu groups have context sensitive help available. Clicking the help button next to the menu group name will display the help section related to that particular menu group.

Viewport area

By default the viewport area will show a perspective, front, right and top view of your model. You can fully customize this layout through the viewport drop-down menu.

Status bar

The bottom bar contains the status bar, which displays selected technical meta information:

First the size of the 'undo' memory, then information on the amount of entities in your model, the currently active layer and the curvature scale. If edges are selected (highlighted) it also will show the total length of the currently selected edge(s), and the toital dX,dY and dZ of the edges.

1.2 Zooming, panning and rotating

After starting a new model DELFTship by default adds 4 windows. Each window has a different view on the 3D model. The area of the window in which the model is drawn is called a viewport. These viewports also appear in other windows, for example when viewing plate developments. Zooming and panning works the same in all viewports used throughout the program.

Zooming

Zooming can be done in the following ways:

- The scroll wheel of your mouse (scroll up to zoom in)
- Use the zoom-all button from the viewport menu to zoom to the extents of the model, or use the *Alt+E* shortcut.
- Drag a window around the area to be magnified.
- Press *Alt+I* (zoom in) , *Alt+O* (zoom out) or *Alt+J* (zoom previous)
- *Alt-J* restores the previous zoom setting which is equivalent to using the zoom previous button

Panning

Panning (moving the model in screen space) is done by holding the right mouse button down and dragging the image .

Rotate

If the viewport displays a perspective view, two scroll bars will be visible located on the bottom and to the right of the view port. These scroll bars can be used to rotate and tilt the model in order to see it from different angles. An easier way to rotate the model is to keep the middle mouse button (or mouse wheel) pressed while dragging the mouse.

This does not work in 2D (orthogonal) views like front, aft, top.

1.3 Selecting objects

Selecting objects

Almost any visible object in the hull modeling windows can be selected by clicking on it with the mouse. Clicking it again (or hitting Esc) will then deselect it. Selected objects are highlighted in yellow- although this color can be changed in the Program Preferences.

For some objects there are methods to extend the selection:

- **Points.** If a point is selected, clicking on another point will select this new point- and the previous point will be deselected. To select multiple points hold down the CTRL-key while selecting additional points.
- **Edges**. If the CTRL key is pressed while an edge is clicked, the program tries to trace the entire edge- until a irregular point or an edge with a different crease-property is encountered . This helps to select an entire row of edges (edge loop), like the sheerline or a hard chine.
- **Faces**. Faces can be CTRL-selected: all the faces belonging to the same layer and connected to the selected one are also selected or deselected. Faces that are isolated from the selected face because they are totally surrounded by crease edges are not included.

Select all

With this command (available by pressing the shortcut Ctrl-A) all visible objects are automatically selected.

Selecting groups

Drag the mouse while holding the CTRL key to select all objects within the dragged window. When CTRL- dragging from *left* to *right* a green rectangle is drawn, and only elements that are *completely inside* this rectangle are selected.

CTRL-dragging from right to left draws a *red* rectangle, and all elements that are *partly or completely* inside this rectangle are selected.

Clear Selection

This button deselects all currently selected items. Pressing the Esc-key has the same result.

1.4 Manipulating geometry

Control points

One of the most important features when it comes to surface modeling is the ability to move individual (or groups of) control points. In order to do this, the control net must be visible (see Display menu). Select multiple points by holding down the CTRL key while selecting, or drag-to-select (See Selecting objects).

When moving a control point so that the edge it is on is a near the straight line between neighboring control points, the edge will light up green. Releasing the point then will snap it to that straight line. If you do not want this, un-check the 'Snap to line' box in the point control window.

It may be useful to increase the control point size: if set to small, selection may be difficult.

Move vs Extrude

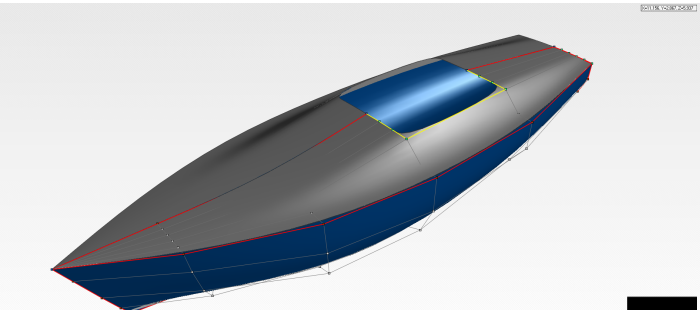
While in many ways similar, there is a fundamental difference between moving and extruding:

Moving (part of) a face will adjust surrounding control points. The entire face, and connected faces, will be affected by a move. Extruding a face will create crease edges around the selected area before moving it. Effectively, new faces and edges are inserted to keep the extruded face connected.

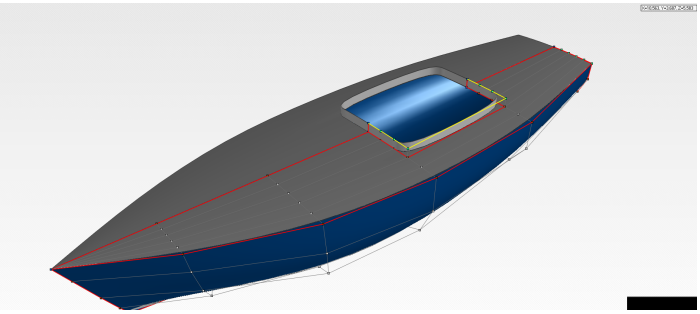
Edges- Move, Extrude

Moving an edge is very similar to moving a point: when an edge is moved, all points on that edge are moved at the same time, and all connected edges are adjusted accordingly. Simply select an edge, click and drag to move.

Extruding an edge is done by holding down the shift key while moving it. Note that only boundary edges can be extruded. See the Edge menu chapter for more information.



Moved edge



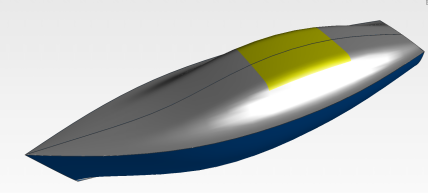
Extruded edge

Faces- Move, Extrude, Copy

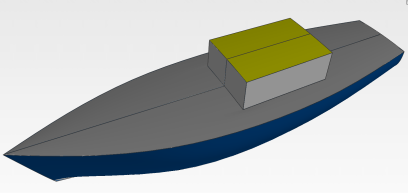
Moving a face is essentially a move of multiple points (but the control net does not need to be visible). Simply select the face, click and drag to move.

Extruding a face moves the surface and inserts crease edges around it (see image below). Hold the SHIFT key when moving a face to extrude, see Face menu.

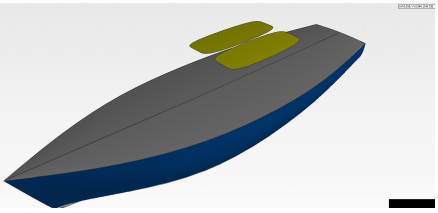
Copying a face creates a new, *disconnected* face. Hold the CTRL + SHIFT keys down when moving a face to copy.



Moved face



Extruded face



Copied face

Tips

Note that the 3D view can be very disorienting when manipulating geometry. Copying and extruding geometry always ends with a confirmation dialogue with the three coordinates of the action. Always check the direction of any manipulation!

Moving a face does not show this dialogue, so confirm the three dimensions of any move to make sure the face sits where it is supposed to.

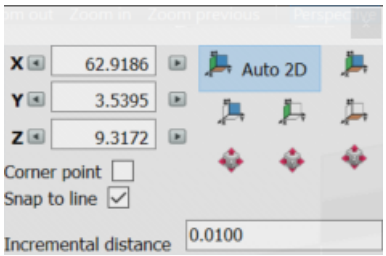
For hints on selecting points, edges or faces see Selecting objects.

When it is difficult to select individual control points it may help to increase the control point size.

While dragging, all *visible* geometrical information is updated in real-time. This includes intersection curves, control curves, flow lines and tanks. Especially when the precision of the model is set to a high level this can become slow. If that happens use a lower precision or turn off the display of some of these objects.

1.5 Manually modifying points

If a point is selected, the control point window opens to display all the information for that point, including the position of the point in 3D space. These properties can be altered by changing the values in the appropriate fields (or clicking the < and > buttons next to the fields to move a single increment) or by using the **cursor keys**. The selected point moves in the direction of the arrow key that was pressed. how much it moves, or the "*incremental distance*", can be set in the control point window. More information on the grid used can be found in the coordinate system paragraph.



Control point window

To assist accurate operation, or to limit unwanted movement when using a mouse to move points, the following options are available :

- **X-axis**. Point movement is restricted to the direction of the X-axis.
- **Y-axis**. Point movement is restricted to the direction of the Y-axis.
- **Z-axis**. Point movement is restricted to the direction of the X-axis.
- **YZ-plane**. Point movement is restricted to the YZ-plane.
- **XZ-plane**. Point movement is restricted to the XZ-plane.

-  **XY-plane**. Point movement is restricted to the XY-plane.
-  **Auto 2D**. Depending on the viewing angle the nearest orthogonal plane is chosen, and then point movement is restricted to this plane. For example if a model is viewed from forward to aft, the program will select the YZ-plane as the appropriate plane. In that case only the Y and Z coordinate of the control point will be updated if the point is dragged with the mouse.
-  **3D**. Movement of a control point is not restricted. When moving a point all three coordinates will be updated. This setting is only useful in a perspective view.

1.6 Viewport menu

All DELFTship viewports that contain 3D elements have a drop-down menu with view controls. These controls may not always be enabled- in some cases certain functions will have no meaning in the active context. All possible viewport menu buttons are described in this paragraph. The drop-down menu can be activated (or opened) by moving the mouse to the very top of the viewpane canvas. It will auto-hide when the mouse pointer leaves its area.

Viewport menu

Printing

 *Print*

Print the viewport

 *Save*

Saves the current viewport as an image

Zoom

 *Zoom All* (Alt-E)

Adjust zoom level to fit model into the window

 *Zoom in* (Alt-I)

Zoom in on the model (increase magnification)

 *Zoom out* (Alt-O)

Zoom out from the model (decrease magnification)

 *Zoom previous* (Alt-J)

Restores the previous view

Views

 *Perspective* (Alt-P)

Switch to perspective view. In this view the model can be freely rotated using side bars or the middle button (or scroll wheel) of your mouse.

 *Front* (Alt-F)

Switch to a body plan view, looking to the bow of the vessel.

 *Aft* (Alt-A)

Switch to a body plan view, looking to the stern of the vessel

 *Left* (Alt-L)

Switch to a profile view, looking to the port side of the vessel

 *Right* (Alt-R)

Switch to a profile view, looking to the starboard side of the vessel

 *Top* (Alt-T)

Switch to a plan view, looking at the deck of the vessel

 *Bottom* (Alt-B)

Switch to a plan view, looking at the bottom of the vessel

Shading options

Most shading options are implemented to assist in fairing, or at least to make irregularities in a surface more visible. In most types of shading some kind of reflection plays a role; consider it similar to holding your model to the light in order to find irregular patches in the surface. Exceptions to his are zebra, developable and curvature shading. In these modes coloration or patterns are applied to levels of curvature. Rendering of shaded shapes is done real time, so any modifications made are reflected immediately.

 *Wire frame* (Alt-W).

Only the points, lines and edges are drawn. Any objects, such as tanks for example, are drawn using line representations.


Smooth (Alt-S).

The surfaces are drawn in a solid color, lines and curves are drawn on top of the surfaces. Submerged areas of surfaces can optionally be displayed using a different color (see Preferences)


Developable (Alt-D).

The surfaces are shaded, developable areas in green and not developable ones in red. More about developable surfaces can be found in the *'plate developments'* paragraph.


Curvature (Alt-C).

Used to check the fairness of a surface. The model is drawn using a range of colors, based on the discrete Gaussian curvature in each point of the subdivided surface. Most surfaces are curved in two directions, called the principal curvature directions. The Gaussian curvature is the product of these two principal curvatures. For the sign of the Gaussian curvature there are 3 possibilities :

1. Negative Gaussian curvature. One of the curvature components must be positive while the other is negative, meaning that the surface is curved in opposite directions. The area surrounding the point is concave and resembles the shape of a saddle. Areas with negative Gaussian curvature are colored blue.
2. Zero Gaussian curvature. At least one of the two principal curvatures is zero, so the surface is either completely flat or curved in only one direction. In both cases the surface is developable (This is a very important property of developable surfaces). These areas are colored green.
3. Positive Gaussian curvature. The curvature in both directions can be positive or negative, but must have the same sign. These areas are convex and colored red.


Zebra (Alt-Z).

Another option to check the model for fairness. Regions with a constant light-reflection intensity are shaded in bands. This is similar to the way the human eye detects unfair spots on a surface since the shininess and shadows vary in those areas. If the edges of the zebra stripes are curved smoothly then the surface is smooth in these areas. At knuckle lines they vary abruptly.


Sphere map (Alt-H).

Reflective shading using an image called "environment map". This image is projected onto the model to simulate reflections from the environment. These reflections are used to visualize unfair areas of the surface. The drop down menu to the right of this button gives access to several maps that can be used for shading.

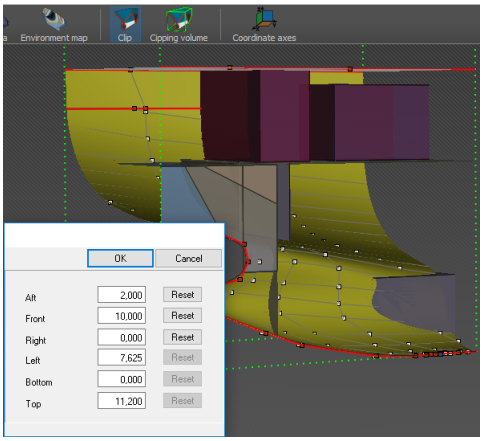
Miscellaneous options


Clip (Alt-Q)

Sometimes it is useful to look *inside* the model- that is, see a slice of it. This can be particularly useful when viewing tanks or hull geometry that is partly obscured by other parts of the design. Select Clip to clip ('slice') the model at distances defined in the Clipping volume window (directly below)

Clipping volume

The clipping volume button is enabled when the Clip function is selected. Use this function to specify where the model should be clipped (aft, front, right, left, bottom and top) . Distances are given from the model origin.



A clipped hull

Coordinate axes (Alt-X)

Draws the coordinate system (colored X-Y-Z planes) in the viewport.

Pin or Unpin (Alt-N)

The far right of the menu holds a *pin* button. Pin the menu bar for permanent access- unpin to enable auto-hide.

1.7 Commandline options

There are two command line parameters in DELFTship (as of version 14.4):

- Run a Script (e.g. for batch processing)
- Configure floating license server (only for Network versions of DELFTship)

The DELFTship executable will normally not be in your system path, so you need to either start it from the program folder, or include the path in the command. As there is a space in the path, it must be typed in double quotes:

```
"C:\Program Files\DELFTship\delftship.exe"
```

Running a script

DELFTship can be started with a commandline parameter to immediately execute a specified script:

```
delftship.exe -r <scriptname> [-L]
```

The Scriptname speciefied must include the full path and the extension. It must refer to the project file (.dpp) rather than the actual script. Use double quotes if there are spaces in the path or filename(note that BOTH the call to the DELFTship executable as well as the script project file are in quotes:

```
"C:\Program Files\DELFTship\delftship.exe" -r "E:\scripts\stab_calculat
```

The optional -L parameter creates a log file of any output (WriteLn and compiler output). This log file will have the name of the project(e.g. "calculate_all.log"), in the folder of the project (.dpp) that you ran

Configure the Floating License server address

```
delftship.exe -FLM <host> <port> [<password>]
```

So:

```
"C:\Program Files\DELFTship\delftship.exe" -FLM myserver.local 2060 "My S
```

Host (required) - The "host" can be the IP address of the FLM or the server name, as long as the computer can resolve the hostname to an IP address. Examples can be *yourservername* or *yourserver.yourdomain* of *yourservername.yourdomain.local* . It is advised to test if the hostname resolves to an IP address (use *ping hostname)*

Port (required) - The port taht your Floating license manager is configured to listen to.

Password (optional) - If specified, place it between double quotes: "your password"

If a network version of DELFTship is started with the -LFM command line parameters, it will write the host and port to its configuration, start DELFTship and try to connect to the specified server. If that fails, the user will be prompted for the information.

Project settings and program preferences

Part II

Part II Project settings and program preferences

DELFTship distinguishes *'program preferences'* and *'project settings'*.

Program related preferences are located on the Settings tab while project settings can be found on the Home tab.

'Preferences' control application specific properties of DELFTship such as background color, 'project settings' only affects your current project like project name. Poject settings are saved with the model.

2.1 Project settings

The *'Home'* tab contains the '*Project settings*' button. In the project settings window you can modify various settings specific to the currently open project. Its content depends largely on the installed extensions.

2.1.1 General

The first tab page is used to enter general project information such as:

- Project name or description
- Name of the designer
- Comment This can be any descriptive text for your design.
- The name of the person who created the file
- Report header and footer text
- The underwater shading color sets the color to indicate 'wet' surfaces, when shaded view is selected
- Rotate large images When an image is wider than it is high, it will be rotated 90 degrees in reports

2.1.2 Coordinate system

- Edit project units Set the units you want to use for your project, as well as the number of decimal required per unit. Metric is default.
- Longitudinal reference point Set the reference point for length reference: Aft perpendicular, midship location, Forward perpendicular or a custom (user defined) location. The midship setting can be defined in the 'Main particulars' tab, and defaults to 0.5 * design length. When specifying a custom location the value is referenced from the coordinate system origin.
- Transverse reference Set SB or PS as positive. Note that this setting is mainly intended for calculation purposes but also effects hull modeling. Even though starboard side might be set to the positive side of the coordinate system, DELFTship still expects the hull geometry to be on port side.

See also program preferences for the default settings.

2.1.3 Notes

The *'Notes'* tab offers a place for project notes in free but unformatted text.

2.1.4 Main particulars

The tab sheet to enter the main particulars contains the following fields:

- **Length** - The project length is used to calculate the vessels trim, (see definition) but also in the hydrostatic calculations to determine coefficients such as the block coefficient. The project length can have various interpretations and therefore has to be specified manually.
  For ships the project length generally corresponds to the length between the perpendiculars.
  For boats and yachts most often the length at the waterline is used.
- **Beam** - For *boats and yachts* the beam is measured to the outside of the shell plating, for *merchant ships* one uses the moulded beam. The moulded beam is measured to the inside of the shell plating. When the moulded beam is used the extra volume of the shell can be accounted for in the hydrostatic calculations by entering the mean shell thickness.
- **Draft** - The draft is always measured from the base plane which is the horizontal plane through the origin. Just as for the beam a distinction can be made between the moulded draft and the draft above the bottom of the keel (draft BoK). The draft BoK is obtained by adding the shell thickness of the bottom to the moulded draft. The thickness of the bottom is also referred to as the keel plate thickness.
- **Mid-ship location** - The default location of the mid-ship is halfway the aft and the forward perpendicular. The location can be changed by unchecking the "*Default at 0.5*L*" box next to the input field and entering the non-standard value.
- **Aft perpendicular** - The aft perpendicular is located at the origin at x=0.0 by default. The value of the aft perpendicular can optionally be changed. When changing the location of the aft perpendicular, all longitudinal dimensions are automatically updated if the longitudinal reference point is set to the aft perpendicular. The location of the forward perpendicular is found by adding the project length to the location of the aft perpendicular.

2.1.5 Hydrostatics

This tab page contains all hydrostatics related settings, such as:

- **Relative water density** - This is the density of the surrounding water relative to the density of fresh water, which is 1.000. The relative density of sea water for example is 1.025.
- **Shell thickness -** Commercial vessels are usually modeled to the inside of the shell plating. The mean shell thickness is multiplied with the wetted surface area to calculate the submerged volume of the shell, which is added to the moulded volume to calculate the total displaced volume.
- **Mean shell thickness** - When *'use mean shell thickness'* is selected in the *'shell thickness'* field, here you can set the value you want to use for the calculations.
- **Appendage coefficient -** This is a multiplication factor commonly used to compensate for appendages of the vessel which not have been modeled but contribute to the displacement, such as a rudder or propeller. The default value for the appendage coefficient is 1.000. The default value to compensate for rudder and propeller is ranges from 1.005 to 1.010 depending on the size and number of appendages.
- **Coefficients based on -** Hydrostatic coefficients such as the block coefficient and prismatic coefficient can be calculated according to two different methods. The first is by using the dimensions for length and beam as specified on the project page, which is the preferred way for large ships. The second method uses the actual length and beam of the submerged body. This method is more appropriate for yachts and small boats. If the second method is selected, the submerged length and beam will vary with the draft.

> *The program cannot verify if the specified length and beam are correct. If incorrect values have been specified on the main dimensions tab page, the calculated coefficients mentioned above will also be incorrect!*

- **Disable surface check -** Each time hydrostatic properties need to be calculated, the program checks if the direction of the surface normals of faces is consistent, correcting the direction if necessary. In some rare cases it is possible that the surface normals point in the wrong direction once this check has completed. In that case the hydrostatic values will be incorrect, even to the point of negative volume and displacement. If this happens it is recommended to first disable the automatic surface check and then to manually correct the surface normals by inverting the corresponding faces. When in doubt, always visually check the direction of surface normals by selecting one or more control faces. It is important to realize that the program fails to calculate hydrostatic properties if one or more leak points become submerged. See also the paragraph on leak points.
- **Display hydrostatic features** - allows to enable or disable the real time display of certain hydrostatic properties of the model

2.2 Program preferences


The Preferences button opens a detailed settings window. The actual appearance of this window differs depending on which extensions are installed with the main program: generally each extension has its own tab page. 'Reset' can be used to revert to the default settings. Please note that the professional edition has significantly more options and properties than the free edition. Always available are:

General

Modify various general settings of the program, such as:

- Reopen last used project on startup - Loads the project which was open the last time the program was shut down.
- Cleanup recently opened files list - Searches the list for files that do not exist and removes these from the list.
- The language used by the program. Language files are located in the sub folder delftship\languages of the program folder and only languages defined in this folder will be shown. A special tool is available from www.delftship.net to create new translation files or to modify existing files.
- Automatic Updates - controls the frequency with which DELFTship checks for updates
- Maximum size of undo memory
- Automatically hide viewport buttons
- Control point size - larger points are easier to select
- Viewport background mode - select a gradient or solid color as a background
- Viewport background color
- Selected items color
- Viewport small font height - Adjust the size of the small fonts used in viewports
- Viewport regular font height- Adjust the size of the small fonts used in viewports

Coordinate system

Specify defaults for the following settings when a new project is started:

- **Edit default project units** Set the units you want to use, as well as the number of decimal required per unit. Metric is default.
- **Longitudinal reference point** Set the reference point for length reference: APP, midship, FPP. The midship setting can be defined in the 'Main particulars' tab, and defaults to 0.5 * design length.
- **Transverse reference** Set SB or PS as positive

Hullform

Define the visual aspects of model related entities.

Hydrostatics

Select which hydrostatic properties should be displayed in the hydrostatics report, or modify the order of appearance by dragging the various properties in the list. Selected items will appear in the report in the order of this list. The Professional edition is far more complete in the elements if items that can be reported.

General report settings

Modify the default font type and size used in the reports throughout the program.

Log

If DELFTship encounters (critical) errors, it creates a logfile. From this tab you can view the contents of these log files.

Restore Defaults

If you want to restore the program preferences to their defaults, there are two options available. If you can still normally access the program window, the preferences window has a "*Reset*" button that will restore defaults. If for some reason the DELFTship window can not be accessed (for instance a display option with multiple monitors that has gone wrong) you can start DELFTship while holding the SHIFT key. The program will then start in safe mode and it all program preferences will be restored to their defaults.

2.3 backup folder

The Backup folder normally holds the current file backup, your preferences and license file.

Preferences

Your program preferences are stored in the Delftship.bd7 file in this folder. On very rare occasions an error in this file can cause DELFTship to become unstable. This can be tested by starting DELFTship while holding down the Shift key- this start DELFTship in safe mode and bypasses your preferences.

Deleting this file can solve an instability and will restore your settings to the program defaults

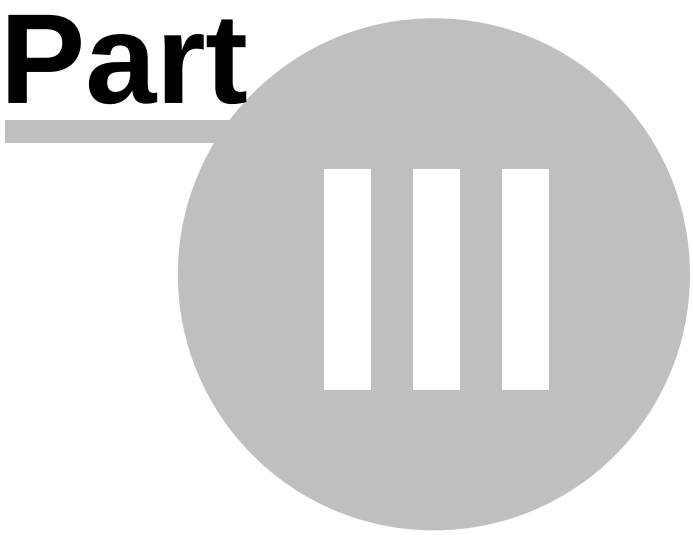
Backup file

DELFTship creates and maintains a backup copy of your project. The file has a random number as file name, and is created when the first change in a newly opened model is recorded. Every subsequent change you make will be stored in this file.

Note that this file is removed again when DELFTship closes- so if you want to safeguard the file after a program exception, make sure you hold down the Shift key when closing DELFTship

The file is stored in the backup folder, and can be accessed via the Settings tab. The file

Hull modeling

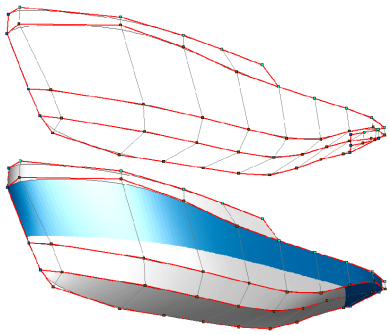


Part III Hull modeling

3.1 Background to surface modeling

Surface modeling

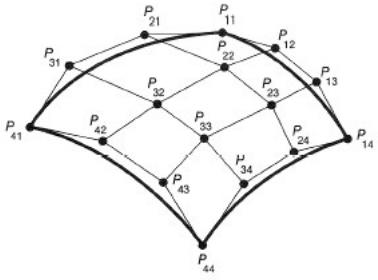
DELFTship uses a technique called surface modeling to completely define the outer shape of a ship. This technique involves "sculpting" the hull as if it were a very thin and flexible piece of cloth by pulling and shifting so called control points. Modeling is not limited to the hull alone: decks, superstructures, masts, keels and rudders can be modeled this way too. The biggest advantage of surface modeling is that the model can be completely and accurately described using only a few points. The illustration on the right shows an example of a developable tug that was created with only 54 points. Unlike most other programs, DELFTship uses subdivision surfaces for this task. Compared to other types of surface definition, subdivision surfaces give the designer more flexibility in designing any desired shape. In order to maximise the benefits of this technique it is important to have a basic understanding of some of its underlying principles.



Surface modeling

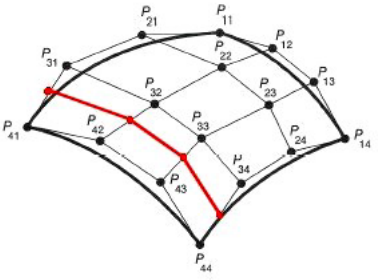
Subdivision surfaces

A subdivision surface is a special type of spline-surface. Conventional modeling programs work with parametric spline surfaces like B-Spline surfaces or NURB surfaces. These surfaces are completely defined by a set of control points. These are the points which the user can modify to control the shape of the surface. Any point on the surface can be directly calculated from these control points using a set of parametric formulas. The drawback of these parametric surfaces is that they always require a topologically *rectangular grid of points*. This grid almost always follows the shape of a hull, so it does not look like a true rectangular grid. But it always has say *N* points in the longitudinal direction and *M* points in the vertical direction where both *N* and *M* might be any number equal to or larger than 2.



Parametric spline surface

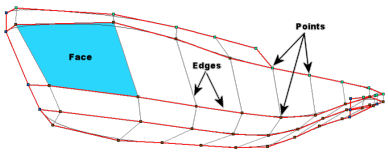
In the 'parametric spline' illustration *N*=4 and *M*=4 and the total number of control points equals 4*4=16. Using parametric spline surfaces it is not possible to insert a single new point in the control grid. To maintain the rectangular topology an entire row of points have to be inserted as demonstrated in the 2nd illustration 'Inserting a row or column'. This results in more control points than actually needed or desired, and more control points means more work to the designer. Very complex shapes cannot be modeled using a single surface. But when using multiple surfaces the designer is challenged with the difficult task of aligning these surfaces at their boundaries. It is often desirable to maintain a smooth transition along these boundaries. Each time one of these surfaces is modified, the adjacent surface has to be modified manually to maintain this smooth transition.



Inserting a row or column

To overcome these problems DELFTship makes use of *subdivision surfaces*. Subdivision surfaces also use control points as a modeling handle, just like NURBS or B-Splines and they share the same mathematical background. The main difference however is that the formulas are no longer restricted to a rectangular grid of points. The downside is that points on the surface can no longer be directly calculated. Instead the original set of points (called the control mesh) is refined and smoothed in a number of steps. Each step is called a "subdivision step", hence the name subdivision surfaces. Before explaining in detail how subdivision actually works it is important to know something about the internal geometry of subdivision surfaces. The surfaces are build from the following three components:

Points



Points, Edges and Faces forming a surface

Points form the basis of the surface. In fact most of the modeling is done by moving points to different locations since this changes the shape of the surface. Additionally, new points may be inserted or existing points can be removed. There are two different types of points:

- 'Ordinary points' - These are all points that are not corner points. It is important to realize that these points have a certain offset to the resulting surface. This deviation is larger in surface areas with high curvature. It becomes smaller when more points and edges are inserted.
- 'Corner points' - These are very specific points, usually connected to 2 or more crease-edges. Just like a crease-edge can be used to specify that two faces have to be connected in a discontinuous way, corner points may be used to do so with two adjacent edges. Corner points are the only type of points actually located on the hull surface. Points where 3 or more crease-edges meet are automatically set to corner points by the program. Corner points are displayed in blue.

Edges

All points are connected with lines which are called *edges* in subdivision surface terminology. Edges also be divided into two different categories:

- 'Boundary edges' - These are edges which are located, as the name suggests, on the boundary of the surface. A boundary edge is characterized by the fact that it has always only 1 face attached to it. Examples of boundary edges are the sheer line (if the ship is not fitted with a deck) or the center line of the ship. The center line, or profile, is in fact a special case. When defining the hull only its port side is created. So all edges on the center plane are boundary edges as they have only one face connected to it. In reality the ship is symmetric, and when performing calculations DELFTship creates a virtual symmetric ship by mirroring the model in the center plane.
- 'Internal edges' - These are all other edges away from the boundary of the surface, and they must always be shared by 2 adjacent faces. Internal edges are drawn as dark gray lines. The two faces connected to an edge are joined smoothly along their shared edge.
- 'Crease edges' - It is possible to mark an edge as a *crease-edge*. When doing so, the two faces are joined in a tangent-discontinuous way. In other words, crease-edges are used to define knuckle lines. A boundary edge is in fact a specific case of a crease edge since there is no second face to make a smooth transition.

Faces

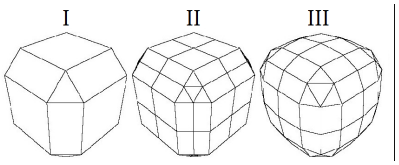
A face is a little piece of the entire surface (sometimes called a 'patch') that is completely surrounded by edges and is usually defined with 4 points. In some areas it is desirable to have less (or even more) points, but generally the best results are obtained when most of the faces consist of 4 points. Faces are divided by edges where the type of edge determines how the faces should be connected to each other.

Intersections

Stations, buttocks, waterlines and diagonals can be added to the model via the Intersections button (Project tools menu on the Tools tab)

Subdivision explained

Now the basics of the underlying geometry should be clear, let's continue with the process of transforming the control mesh into the final hull surface. The illustration to the right shows the process of one subdivision step:



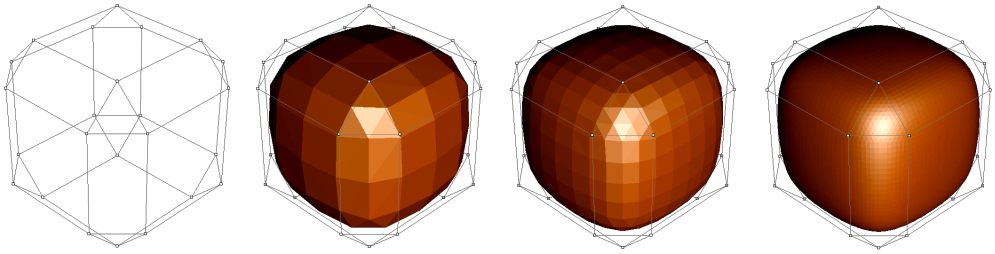
One Subdivision Step

I. To the left the original control mesh of a beveled cube is visible. The first step in the subdivision process is refining the mesh. This is done by inserting a new point in the middle of each edge (called an edge-point).

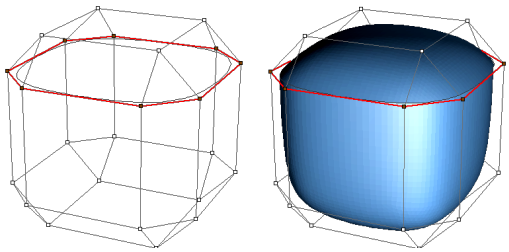
II. New points are also inserted at the center of each face (called a face-point) which has more than three points. For faces with three points each new edge-point is connected with the new point of the previous edge, thus creating 4 new triangles. All other faces are subdivided by connecting all surrounding edge-points to the face-point. This results in a refined mesh which still has the same shape as the original.

III. Finally all the points in the surface are shifted to a new location in such a way that the refined surface is smoothed. This is called *averaging* in subdivision terms.

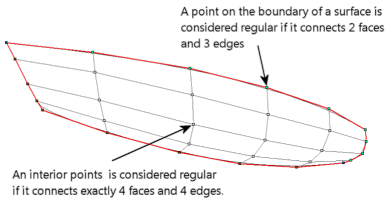
When this process of subdividing is repeated a number of times a very fine and smooth mesh is the result. The illustration below shows the same beveled cube after a number of subdivision steps.


Original control mesh and resulting subdivision after 1,2 and 4 subdivision steps

The illustration below shows the same control mesh, but this time a number of edges have been marked as crease-edges (red lines). The result is a sharp *knuckle line* going around the cube. It is clearly visible that the faces on both sides of the crease-edges are no longer joined in a smoothly.


The effect of crease edges on a surface

Guidelines to subdivision modeling



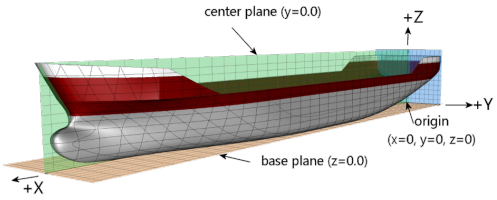
Regular Points

In theory almost any control mesh is valid, however when designing ships the *fairness* of the resulting surface is of the utmost importance. In this paragraph some guidelines are given to assist you in obtaining the best results.

- Use a *regular grid* whenever possible. A grid is considered regular if all faces consist of four points, and all points are connected to four edges and faces. A point on a boundary edge is considered regular if it has 3 edges and two faces connected to it. Of course this is not always possible. Triangular faces may be used as a means to reduce the number of points in an area. 5-sided faces, or 5 different 4-sided faces can be used to increase the number of points.
- Always have **two** faces connected to all edges other than boundary edges. If more than two faces are connected to an edge, that specific edge will be drawn thicker and in a light green color. This *must* be avoided for the hydrostatic model as it breaks the hydrostatic calculations. Once they become submerged, hydrostatics will no longer be calculated. Boundary edges are allowed for cosmetic purposes, so make sure you put these faces in an other layer that is not included in the hydrostatics.

Ensure that the normals of all the faces point outward (in the direction of the water). This is of crucial importance since DELFTship calculates hydrostatics by integrating the enclosed volume **at the back** of the faces. If the normal of a face points inward, the volume **outside** the hull would be added to the total volume. By using the actual surface for hydrostatic calculations instead of a number of stations, a higher accuracy is obtained compared to the conventional method of using cross sections. This is especially true if the model has a heeling angle and/or trim, or is fitted with a superstructure. DELFTship can also check the direction of normals automatically, it's the command *'Check model'* in the main menu tab *'Tools'*. Automatic checking can be disabled in the project settings dialog.

3.2 DELFTship coordinate system



DELFTship coordinate system

DELFTship uses the coordinate system as displayed in illustration on the right. The aft perpendicular is always located at the origin of the coordinate system. The axes have the following directions with respect to the ship model:

- The X axis corresponds to the longitudinal direction of the ship. The origin is the APP by default, but this can be changed in the Program preferences
- The Y axis is oriented transversely. Positive values are located on port side. (this van be changed in program preferences)
- The Z axis is oriented vertically and points upward.

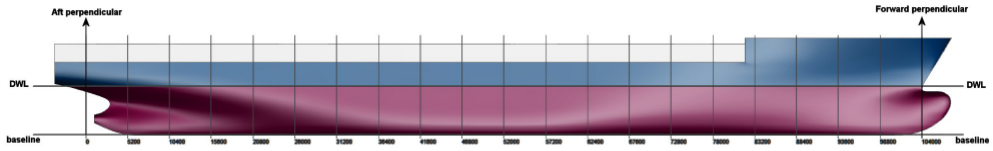

Use the "show axes" button in the viewport menu to show the axes with your model.

Reference, perpendiculars and baseline

Positive values for heeling angles are also to port side, so for negative values the ship heels to starboard side.

Illustration below shows the key **reference lines**. The most important are:

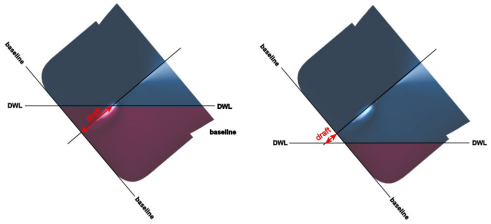
- The aft perpendicular which is located at the origin (x=0.0). This can be changed to mid ship of forward perpendicular in the Program preferences
- The forward perpendicular. The location is specified by the user in the project settings and must be a a value greater than zero since the aft perpendicular is located at the origin. The length of the ship is defined as the distance between the two perpendiculars.
- The base line. The base line corresponds with the horizontal plane through the origin (z=0.0). All molded drafts are measured with respect to this baseline.



Reference lines

Draft

Draft is defined as in the illustration on the right:



Draft measured when heeled

- *draft aft*: The distance measured along the aft perpendicular from the base plane to the intersection of the water plane with the center plane.
- *draft forward*: The distance measured along the forward perpendicular from the base plane to the intersection of the water plane with the center plane.
- *(Average) draft*: The average of both drafts =0.5* (T_{Aft}+$T_{Forward}$)

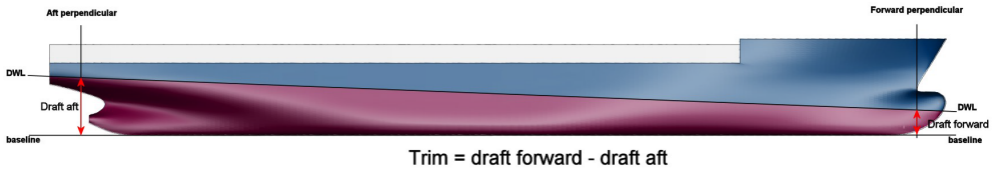
These definitions are valid both in upright and heeled conditions. Note that in the event of large heeling angles and small values for the displacement this can lead to negative values for the draft as can be seen on the illustration to the right. The intersection of the water plane and the center plane is located below the base plane resulting in a negative value for the draft.

Trim

Trim is defined as the difference in draft at both perpendiculars.

$$\text{Trim} = T_{forward} - T_{Aft}$$

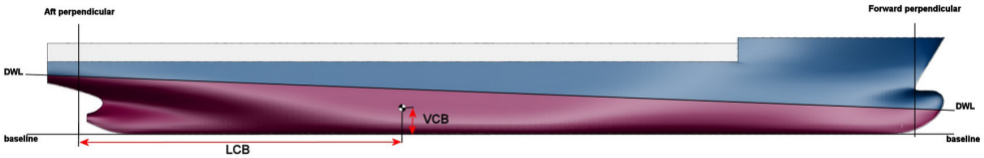
If the draft aft is greater than the draft forward the trim will be negative. So negative trim values indicate the ship is trimmed by the stern, while for positive trim values the ship is trimmed by the bow.



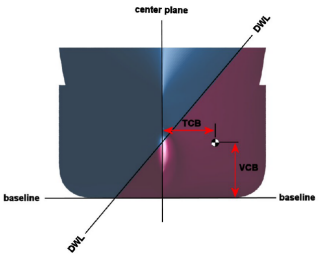
Trim = draft forward - draft aft

Definition of Trim

Finally all values for the various hydrostatic properties are measured with respect to the the ships main axis with the ship in upright position. Illustrations below show a ship with trim and a ship heeled to port side. Rather than heeling the ship the water plane is heeled instead. All dimensions are given perpendicular to the 3 main planes that pass through the origin.



Longitudinal en vertical measurements for a trimmed ship



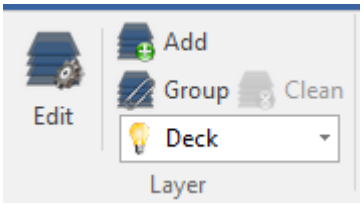
Transverse and vertical measurements for a heeld ship

Both illustrations show the presentation of the location of the center of buoyancy in 3D space as an example. This presentation will be consistently used throughout the program.

3.3 Organizing your model with layers

General layer information

The hull created with DELFTship consists of only 1 mathematical surface, even if the model contains multiple isolated layers or faces. When modeling it is often desirable to divide the model into different parts with different properties, for example the color. Therefore layers have been implemented into the program. A layer is a container that groups faces with the same properties together.



Active layer

There must always be at least one layer in your model, and one layer will always be active. When a new element is added to the model it will be assigned to the active layer. You can see which layer is active in the layer toolbar at the top of the screen. This contains a drop-down list of all layers, and it displays the name of active layer. You can modify which layer is active when no faces are selected by simply selecting another layer from the drop down list in your toolbar. Selecting a face will show the layer containing that particular face (but this is *not* the active layer). Please note that when faces from more than one layer are selected, this field will be blank- it is no longer certain which layer name to show.

In the event that faces have been selected there are two possibilities:

1. All selected faces belong to the same layer. In that case the name of that layer is shown, even if it is not the active layer.
2. The selected faces belong to different layers. No layer name is shown in the toolbar at all, it will be blank.

By selecting a layer from the drop-down list with layers while faces are selected, all the selected faces will be moved from their current layer to the newly selected layer.

Edit

Opens the layer window (Ctrl-L). See below

Add

Adds a new layer and names it "LayerX", where X is an increment. Note that this increment does not necessarily reflect the currently available number of layers- it is the number of layers that has, at one point, been added to the project. This is to prevent duplicate naming.

Group

Create new layers from groups of faces which are completely surrounded by crease edges. Each group of faces is subsequently assigned to a new layer. If no faces are selected, every visible layer will be processed, otherwise only the selected faces.

DELFTship tries to save as much of the present layer information as possible. If a set of faces is extracted, and they already belong to the same layer then this layer is left undisturbed. Auto grouping is only enabled if the display of interior edges is switched on.

Clean

Removes empty layers.

Active layer

You can modify which layer is active when no faces are selected by selecting another layer from this drop down list: Changing this field with faces selected will add the selected faces to the selected layer. If a face is selected, this field will show the layer it belongs to. Not that this is *not* the active layer: the currently active layer is shown in the status bar. When faces from more than one layer are selected, this field will show "Multiple layers".

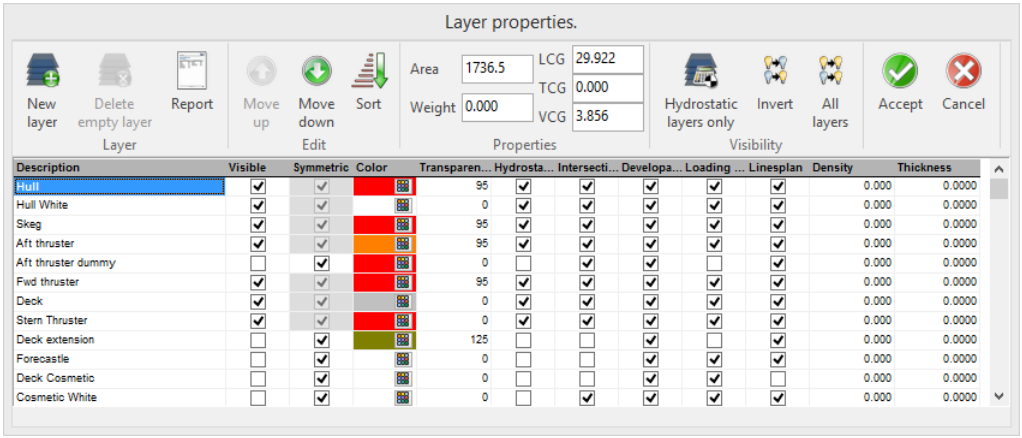
In the event that faces have been selected there are two possibilities:

1. All selected faces belong to the same layer. In that case the name of that layer is shown, even if it is not the active layer.
2. The selected faces belong to different layers. No layer name is shown in the toolbar at all, it will be blank.

By selecting a layer from the list with layers while faces are selected, all the selected faces will be moved from their current layer to the newly selected layer.

The layer dialog

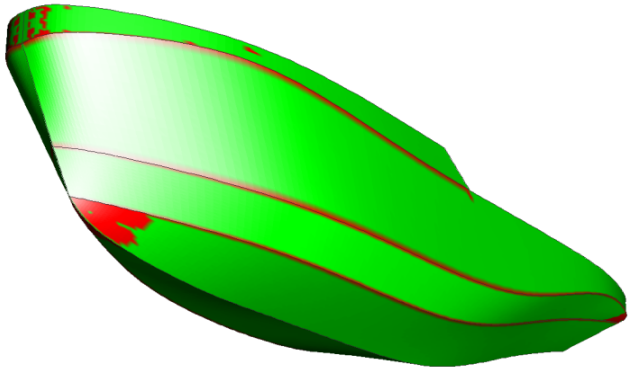
Clicking the "Edit" button in the layer panel brings up the window where you can view and modify the layers. The following layer properties can be modified:



Layer properties window

- **Description** - The layer name displayed in the leftmost column is used to show which layer is active or selected. DELFTship does not require the layer name to be unique, however it is recommended to keep names unique and to not use spaces: some CAD programs (such as AutoCAD) do not allow spaces in the name of a layer or duplicate names. Exporting to such a program can cause problems if layers with identical names are used.
- **Visible** - Set the corresponding layer visible or invisible: click on the check box to turn the layer on or off. Points or edges from the control net belonging to invisible layers are also hidden, which makes manipulation of complex models easier by showing only relevant elements. (the top ribbon has options to show all and invert selection for visibility)
- **Symmetric -** The free version of DELFTship does only support asymmetrical layers that do **not** contribute the hydrostatic calculations. The professional version allows for asymmetrical layers provided that those layers are completely (physically) separated from any symmetrical layers in your model.
- **Color -** The layer color is used for drawing the model. It is also used in the lines plan and for plate developments. The color of a layer can be modified by clicking the small button displayed in the color rectangle. A window is opened in which a new color can be chosen.
- **Transparency -** Sometimes it is nice to shade certain surfaces such as windows (partially) transparent. The amount of transparency can be modified by editing the value: the transparency can range from 0 (totally solid) to 255 (invisible). Note that transparent shading might consume a lot of memory and significantly slow down the shading process. Since normal Z-buffer shading or plain alpha blending produces strange artifacts, the only way to do this properly is by keeping track of all surfaces covering a particular pixel on the screen and then drawing all these surfaces from the back to the front. This process uses extra memory and CPU time.
- **Hydrostatics** - DELFTship uses the faces of the subdivision mesh for hydrostatic calculations. It calculates the volume enclosed by these faces. Sometimes the surface contains faces that should not be included in the hydrostatic calculations. This is particularly the case if the faces of a layer do **not** form an enclosed volume, but only a bounded surface, such as a sail. If a sail were to be included in the calculations, DELFTship would calculate the volume aft of the sail (if it is submerged) as a volume. Since this volume extends to infinity (there is no backside surface present) it would produce an error. So specific layers can be excluded from the calculations. See also paragraph for more information concerning leak points. Since asymmetrical layers are not allowed in hydrostatic surfaces (unless completely separated from any symmetrical layer) the "Symmetrical" field will be disabled when Hydrostatics is selected.
- **Intersections -** This property tells the program if a layer should be included when intersection curves are calculated. For complex models it is often convenient to display stations, buttocks, waterlines and diagonals of the hull only, and not for the deck, superstructure etc. This setting has **no** influence on the hydrostatics.

- **Developable -** Developable hulls are of particular interest to shipbuilders since they can be build from flat plates which are only bend in one direction. Most hulls are not developable since the surface is curved in two directions (called compound curvature). Developable layers can be shaded differently. Developable areas of these layers are colored green while areas which are not developable are colored red. This is a convenient way to visually check if a hull is indeed developable. Illustration on the right shows an example of a developable tug. It can immediately be seen by the green color that almost the entire hull is developable. Just a few very small spots in the topside and a larger area in front at the bottom are colored red. Those very small spots are mostly numeric errors (DELFTship uses a very small tolerance). The larger red bottom area however is not developable from a mathematical point of view. Developable hulls are often made of sheet material (plywood, steel). In reality layers that are "almost" developable can perfectly be build using plywood, whereas the same hull build of metal requires forming the metal to get it into shape. Developable layers can be unfolded (or developed) by the program onto a flat plane for building purposes. This will be explained in the 'Tools' tab under 'project tools'.



Developable areas

- **Loading conditions -** If this option is enabled the layer will be drawn in the loading conditions extension and the inclined hydrostatics extension. By excluding some layers you can have a better view on the model. This setting will not affect hydrostatic calculations.
- **Lines plan -** Sometimes a layer contains items you don't want to be seen in the lines plan. Be aware though that the scale of items in the lines plan is also determined by the intersection curves. If a layer would contain a sail, and the intersection curves property is checked, intersection curves of this sail would still be calculated and seen in the lines plan, even if the sail as a surface is not being drawn. Therefore it is recommended if you want to hide layers from this view to also disable calculating intersection curves from those layers.
- **Density -** The relative density (compared to fresh water) of the material for a particular layer, for example 7.8 for steel.
- **Thickness -** The thickness of the surface. This value is only used for weight calculations, so stations for example are not corrected for the shell thickness of the hull. By combining the surface area, thickness and density the approximate weight can be calculated. This weight is displayed in the design hydrostatics report together with the center of gravity for each layer. If you want to use this setting, make sure shell thickness is taken from layer settings in the Project settings window.

The up and down arrows in the ribbon can be used to move a selected layer up or down in the list. Developable layers will appear in the same order in the window with developed panels as displayed in this list. The toolbar also contains a number of buttons that can be used to quickly make all layers visible, or only the layers that are included in the calculation of hydrostatics or to invert the visibility of all layers. The 'Properties' section shows surface, weight and selected properties of the selected layer.

In the layer dialog you can use *Ctrl-C* to copy all the properties of the selected layer. By pressing *Ctrl-V* these properties can be quickly copied to another layer.

3.4 Control curves and fairing

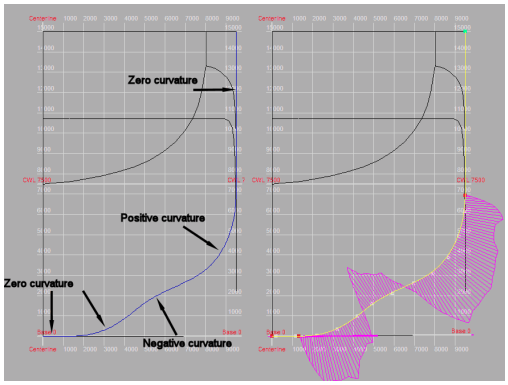
For increased control over the shape of the surface, control curves can be added to the model. These control curves are assigned to edges, and after each subdivision step the new edge-points are not only inserted into the surface but also into the curve. This ensures that the control curves are always exactly embedded in the surface. If the display of curvature

plots is enabled from the display menu, *selected* control curves will be drawn including their curvature plot. This curvature plot is updated in real-time if one of the control points of the curve is moved making it an excellent fairing tool. If the curvature plot is interpreted and used correctly it is possible to produce a perfectly fair surface provided the surface contains no irregular points. Bumps or dents in the surface that are normally too small to be seen on screen with the naked eye are easily identified. Control curves are especially useful for fairing knuckle lines on the hull such as the deck line, profile, and chines but they can also be used for fairing internal edges.

> *What is curvature ? The curvature of a curve can be defined as follows:*
> *the rate of change (at a point) of the angle between a curve and a tangent to the curve*

Curvature is a measure for how strongly a curve changes in a point. In shipbuilding it is important that fair lines are produced where the curvature changes gradually along that curve.

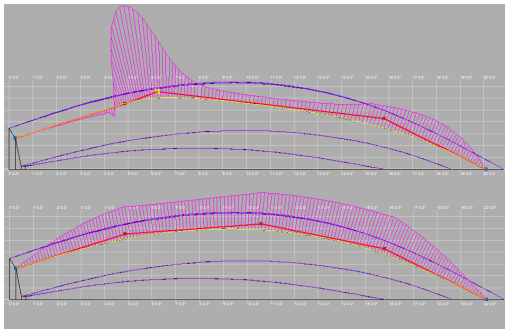
The illustration on the right shows a control curve in the aft part of a container ship. The left part of the image shows the control curve (in blue), to the right it is selected (yellow) and its curvature plot is shown (fuchsia). The straight parts of the curve have zero curvature. If you travel along the curve from the bottom to the deck, first the curve starts bending to the left. In this area the curvature is positive. At a height of about 2.5 meters the curve starts bending to the right, here curvature becomes negative. A little bit further along the curve it bends to the left again, so the curvature becomes positive.



Control curve with curvature plot

So how is this information translated into the curvature plot? At regular intervals on the curve the curvature is calculated and drawn as a line, perpendicular to the curve. The length of this line segment is proportional to the curvature in that point. If the curvature is negative the line is drawn on the opposite site of the curve. While the absolute value of the curvature in a point is generally not relevant, the way it changes along the curve is: it is a measure of the fairness of the curve. Abrupt changes in the curvature plot are, as a rule, not desired- it should vary as smoothly as possible. Especially with small boats and yachts, a change of the sign of the curvature (as seen in the second image), is highly undesirable.

The next illustration to the right shows an example of a control curve from a sailing yacht. The upper part of the image shows a poorly faired curve. We see a change of the curvature sign in an area where it should not occur, followed by a sudden peak. The lower half of the image shows the same control curve after being faired using the automatic fairing tool for curves. The curvature now changes gradually and the curve is very smooth.


Controle curve of a sailing yacht

For high accuracy, the scale of these curves can be changed- zooming in as the fairing gets better. The curvature scale in use is shown in the status bar, at the bottom of the screen. The current curvature scale is shown in the status bar at the bottom of the screen. If this value is too low you may not see any curvature lines.

Control curve controls are available on the "Home" tab, in the "Hull display" section.

> *Remember that the curvature at the first and the last point of the curve is always zero. The curve has unclamped end conditions that correspond with a natural wooden spline batten that has no moment forced upon its ends. This can be seen by the way the curvature plot coincides with the end points of the curve.*

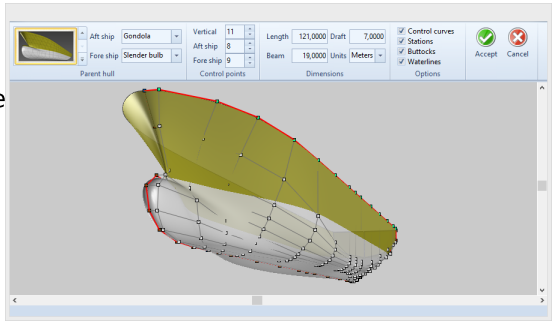
> *Control curves are easier to fair if the points are spaced more or less evenly along the curve and are regular whenever possible. The fewer points a curve has, the easier it is to produce a good running smooth curve.*

3.5 Project group

PrecisionProjectProjectPrecisionProjectSettings

3.5.1 New Project

Starting a new project



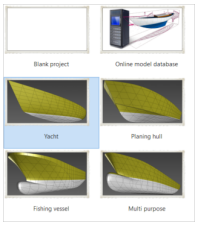
New project window

Because starting a new project can be challenging DELFTship offers some default templates to start with. It is very uncommon to start with a completely empty screen- it is much easier to start with a shape that resembles the design idea and work towards the ultimate design plan. With this in mind the New Project dialogue offers a number of templates to choose from, as well as access to our hull forms database. Templates can be customized to a great detail, database models can be scaled to a specific length, beam and draft.

The new project window

The "*New Project*" button in the Project menu group opens a window where details for the new project can be configured.

Parent hull



Templates

The parent hull menu group offers a choice of template and public domain designs. These can be used as a starting point for a new project. Standard available are available are *Yacht and Planing hull. Fishing vessel* and *Multi purpose* are available in the Pro version

The *aft ship* and *fore ship* fields are only available for the *multi purpose* hull template: These fields add variations to the hull form by allowing the combination of several predefined fore and aft ship configurations. Available options are:

Aft ship

- Gondola
- Pram

Fore ship

- Conventional
- Vertical stem
- Conventional stem with knuckle
- Slender bulb
- Full bulb

Control points

Control points play an important role in building the model- see more information on control points in the paragraph on *surface modeling (In this context control points are simply referred to as points)*

Adding more points a finer mesh is created, which gives more control over the shape. This is at the expense of ease of modification: more points implies more work when the shape is to be modified. For most cases it is recommended to use the default setting, and use the *subdivide control net* function when a finer grid becomes necessary. Because the subdivide function multiplies *all* points of the model, it can be advisable to insert more control points at this stage when a significant difference in detail between fore and aft ship is expected.

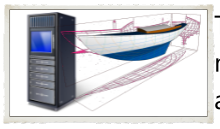
Dimensions

Specify the main design dimensions (length, beam, draft). The Units field sets the units to be used for this project. Please note that, while units can be *converted* at any time in the general tab of the project settings window, this is not simply changing Meters to Feet (Metric to Imperial) but a conversion: the model will be scaled (e.g. when switching from meters to feet all dimensions are divided by 0.3048). You can of course scale the model back after this conversion- see the Transform menu

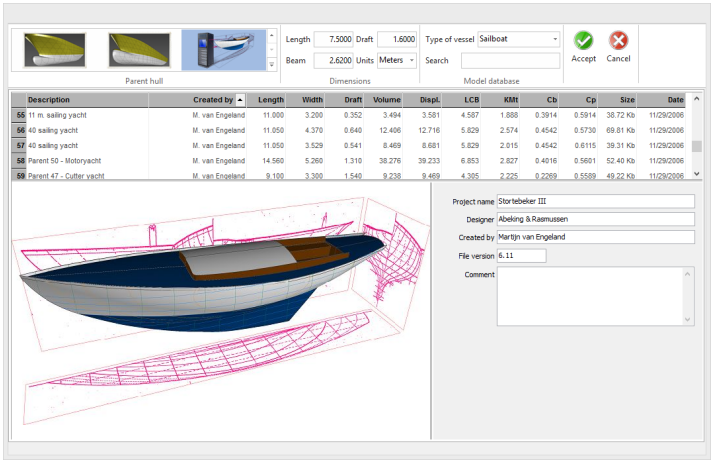
Options

Specify whether DELFTship should add control curves, Stations, buttocks or waterlines to the new project.

Online model database



The DELFTship user community has made a large number of models available to the public. These models can be used as a starting point for a new project. When using a database model it can be scaled to fit your design particulars (length, beam, draft) but the number of control points can not be altered.



New project from database

3.5.2 File import

Here you will find a number of file types that can be imported and the conditions if they apply.

Please note that the professional edition of DELFTship also supports IGES files.

Chines

When importing a hard chined hull, ruled surfaces are fitted between two successive chines. The coordinates of each chine are read from an input file with the extension *.txt*. The input file has the same format as described in the paragraph about importing surface, except for the fact that the type of curves in the file is restricted to longitudinal curves only.

Once the data points of each chine have been read from the file curves will be fitted to those points in such a way that the chines from the DELFTship hull match these curves. The number of control points is the same for each chine and can

be specified by the user. The original curves are also added to the model as markers as a reference. The file *chines import demo.txt* contains a more elaborate demo. It can be found in the *DELFTship\ships* sub folder. The chines must be ordered from the bottom up with coordinates going from aft to front.

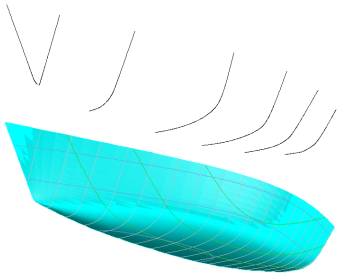
At least three curves must be in the file, representing:

1. The keel line
2. At least one chine
3. The deck- or sheer line.

Control curves are added to the crease edges corresponding to each chine to make it easier to fair the chines.

Surface

Use this feature to import 3D curves from a text file. DELFTship will fit a lofted surface through these curves. This is a good way to import round bottomed hulls. The curves may have any number of points, and the number of points might differ from curve to curve. Usually the curves run from the bottom of the hull upwards, however longitudinal curves are allowed too, as long as *all* the curves have the same orientation and run in the same direction. It is important that the curves do not overlap each other.



Hull defined with transverse curves

After opening the data file you will be prompted to specify the number of points in longitudinal direction (number of columns) and in vertical direction (number of rows) the imported hull must have. Then a B-Spline surface is fitted through these points so that the new surface interpolates the original points.

The format used for the file is as follows:

- The file must start with a line containing only a 0 (zero) or a 1. A zero indicates units are in meters, a one in feet.
- Each curve is defined by a sequence of X,Y and Z coordinates separated by at least 1 space.
- After the last coordinate of each curve there should be an empty line.
- The last line in the file should be '*EOF*' in capitals.

An extensive sample file can be found in the the *DELFTship\ships* sub folder and is named *Round hull import demo.txt*. When importing such a text file DELFTship assumes the following:

- X-coordinates are longitudinal. Positive Y coordinates correspond with the port side of the ship. The base lies at z=0.0 and the aft perpendicular at x=0.0 (see coordinate system).
- All curves must be singular: 2 curves at the same location leads to errors. Whenever 2 curves exist at the same location, for example if the hull is fitted with a bulbous bow, these curves must be combined into a single curve by connecting the segments with a line lying on the center plane. These segments can later be removed.

Part

This imports a previously saved "part" from a file with all related settings such as layer settings etc. For more info regarding parts see this link.

VRML

Imports a mesh from VRML 1.0 files. For information regarding the VRML format please see: http://en.wikipedia.org/wiki/VRML. When a VRML file is imported only the boundary-edges are set as crease-edges. All other crease-edges should be manually after import.

> *Note: The only information imported from a VRML file are indexed face sets.*

Coordinates

Used to import a set of 3D coordinates from a text file. The program will add these as control points. Please note that only points are added, no edges or faces are created in between these points.

Marker curves

Import 2D or 3D marker curves which function as reference curves. For more information see the following section.

Table of offsets

The following is a description of the file format that is used for importing a table of offsets. The file should be an ASCII text file with the extension *.txt*. The file content should adhere to the following standards:

- The first line contains the number of waterlines.
- The second line the number of stations
- The third line indicates whether data describing the deck line at each station is present (1) or not (0).
- The fourth line indicates whether data describing the contour line at each station is present (1) or not (0).
- The fifth line indicates whether data describing the aft contour at each waterline is present (1) or not (0).
- The sixth line indicates whether data describing the forward contour at each waterline is present (1) or not (0).
- The seventh line indicates whether data describing the flat of bottom at each station is present (1) or not (0).
- The next three lines describe the length, beam and draft of the ship as used in the project settings respectively.

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
       0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
       5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000  0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600  0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200  0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800  0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400  0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000  0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600  0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200  0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800  0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400  0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000  0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600  0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200  0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800  0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400  0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000  0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600  0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200 0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800 0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400 0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
       6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Information stored in the file header

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
       0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
       5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000  0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600  0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200  0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800  0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400  0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000  0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600  0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200  0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800  0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400  0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000  0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600  0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200  0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800  0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400  0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000  0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600  0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200 0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800 0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400 0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
       6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

This line represents the heights of each of the 11 waterlines

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800  0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Distance of aft contour points to origin on each waterline

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800  0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

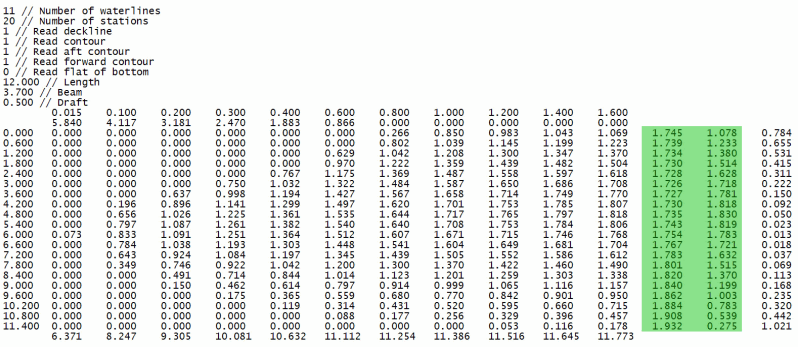
Distance of each of the 20 stations ordered from aft to front

```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800  0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Distance of forward contour points to origin on each waterline

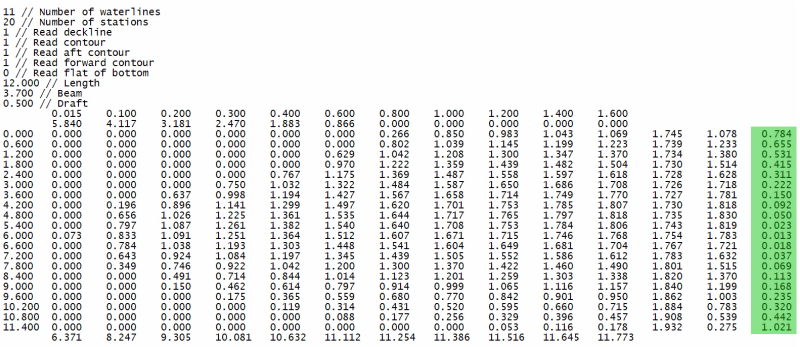
```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
        0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
        5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600   0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200   0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800   0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400   0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000   0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600   0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200   0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800   0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400   0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000   0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600   0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200   0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800   0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400   0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000   0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600   0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200  0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800  0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
        6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Actual offsets data. The intersection of each column and row gives the beam on that waterline and station. The bottom right value in the green rectangle indicates that on station 11.400 and waterline 1.600 the beam is 0.178.



```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
       0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
       5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000  0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600  0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200  0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800  0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400  0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000  0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600  0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200  0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800  0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400  0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000  0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600  0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200  0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800  0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400  0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000  0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600  0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200 0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800 0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400 0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
       6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

Data describing the deck line height (left column) and beam (right column) measured on each station.



```
11 // Number of waterlines
20 // Number of stations
1 // Read deckline
1 // Read contour
1 // Read aft contour
1 // Read forward contour
0 // Read flat of bottom
12.000 // Length
3.700 // Beam
0.500 // Draft
       0.015   0.100   0.200   0.300   0.400   0.600   0.800   1.000   1.200   1.400   1.600
       5.840   4.117   3.181   2.470   1.883   0.866   0.000   0.000   0.000   0.000   0.000
0.000  0.000   0.000   0.000   0.000   0.000   0.000   0.266   0.850   0.983   1.043   1.069   1.745   1.078   0.784
0.600  0.000   0.000   0.000   0.000   0.000   0.000   0.802   1.039   1.145   1.199   1.223   1.739   1.233   0.655
1.200  0.000   0.000   0.000   0.000   0.000   0.629   1.042   1.208   1.300   1.347   1.370   1.734   1.380   0.531
1.800  0.000   0.000   0.000   0.000   0.000   0.970   1.222   1.359   1.439   1.482   1.504   1.730   1.514   0.415
2.400  0.000   0.000   0.000   0.000   0.767   1.175   1.369   1.487   1.558   1.597   1.618   1.728   1.628   0.311
3.000  0.000   0.000   0.000   0.750   1.032   1.322   1.484   1.587   1.650   1.686   1.708   1.726   1.718   0.222
3.600  0.000   0.000   0.637   0.998   1.194   1.427   1.567   1.658   1.714   1.749   1.770   1.727   1.781   0.150
4.200  0.000   0.196   0.896   1.141   1.299   1.497   1.620   1.701   1.753   1.785   1.807   1.730   1.818   0.092
4.800  0.000   0.656   1.026   1.225   1.361   1.535   1.644   1.717   1.765   1.797   1.818   1.735   1.830   0.050
5.400  0.000   0.797   1.087   1.261   1.382   1.540   1.640   1.708   1.753   1.784   1.806   1.743   1.819   0.023
6.000  0.073   0.833   1.091   1.251   1.364   1.512   1.607   1.671   1.715   1.746   1.768   1.754   1.783   0.013
6.600  0.000   0.784   1.038   1.193   1.303   1.448   1.541   1.604   1.649   1.681   1.704   1.767   1.721   0.018
7.200  0.000   0.643   0.924   1.084   1.197   1.345   1.439   1.505   1.552   1.586   1.612   1.783   1.632   0.037
7.800  0.000   0.349   0.746   0.922   1.042   1.200   1.300   1.370   1.422   1.460   1.490   1.801   1.515   0.069
8.400  0.000   0.000   0.491   0.714   0.844   1.014   1.123   1.201   1.259   1.303   1.338   1.820   1.370   0.113
9.000  0.000   0.000   0.150   0.462   0.614   0.797   0.914   0.999   1.065   1.116   1.157   1.840   1.199   0.168
9.600  0.000   0.000   0.000   0.175   0.365   0.559   0.680   0.770   0.842   0.901   0.950   1.862   1.003   0.235
10.200 0.000   0.000   0.000   0.000   0.119   0.314   0.431   0.520   0.595   0.660   0.715   1.884   0.783   0.320
10.800 0.000   0.000   0.000   0.000   0.000   0.088   0.177   0.256   0.329   0.396   0.457   1.908   0.539   0.442
11.400 0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.053   0.116   0.178   1.932   0.275   1.021
       6.371   8.247   9.305   10.081  10.632  11.112  11.254  11.386  11.516  11.645  11.773
```

The last column represents the height of the contour line on each station.

Import data

This feature is use to import data directly from another DELFTship project. After selecting a file a dialog will be displayed with data that is available for import into your current project. Currently the following objects are supported:

- Reference images
- Marker curves

3.5.3 File Export

This chapter describes the file types DELFTship can export, and any conditions that may apply.

Please note that the professional edition of DELFTship supports additional formats: IGES curves, IGES surfaces and CFD meshes.

Coordinates

This option saves the coordinates of all the control points from the model to a textile. This text file can be read directly into for example Rhino. Note that only the control points are exported; other information like the actual surface geometry is ignored.

Offsets

Calculates and saves offsets to a file as described in the paragraph about importing a table of offsets. This option is only enabled if the model contains stations and waterlines.

DXF Curves (2D)

The intersection curves (except diagonals) can be exported to a 2D DXF file. A dialog allows to specify the directory where the files should be saved.

GHS

Exports all available stations to a GHS file. GHS is a widely accepted format and can be imported by most hydrostatic programs that perform calculations based on a body plan.

Octopus

Exports all stations for processing in Octopus (http://www.amarcon.com/octopus-tms.html). Octopus is a strip-theory program which is used to calculate motions of vessels in waves.

Stations

Exports the coordinates from all calculated stations to a text file, including knuckle point information.

DXF 3D curves

All visible intersection curves such as stations, buttocks, waterlines, diagonals and crease edges are exported to an AutoCad DXF file as 3D polylines. Control curves will also be exported. Only information visible in the view ports is exported.

Part

It is possible to save a selection of the model as a part to a so called part file. You can do this by selecting the desired faces manually, or by selecting layers in the layer selection dialog. Next to the geometry the corresponding layer information will be saved. This way any re-usable component (e.g. a keel) can be saved to file and imported in another design.

DXF mesh

The same algorithm as described in the paragraph about exporting IGES surfaces is used to assemble small polygonal meshes into larger sets. These meshes are exported as DXF polymeshes. Single faces that cannot be converted to meshes are exported as 3D faces. 3D faces are small three or four sided surfaces used in AutoCad. Only visible layers will be exported. If the view port shows both halves of the ship, both are exported

Wavefront file (obj)

Visible parts of the surface are exported to an .obj file as specified at *http://www.fileformat.info/format/wavefrontobj/egff.htm*.

Color information is not included.

STL

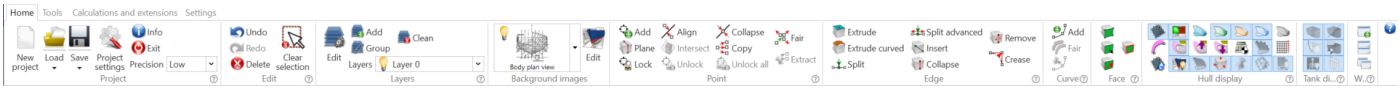
The STL format (stereo lithography) is mainly used for manufacturing purposes, but sometimes also for exchanging data with other CAD programs. All visible parts of the surfaces are exported as a large collection of small triangles. DELFTship exports both ASCII and binary STL files.

Reference images

Saves all reference images, including scale settings etc. to a native DELFTship reference image file for use in other projects. See also Reference images

3.6 Top menu ribbon and tabs

3.6.1 Home tab



Home Tab

Next to access to the project settings, this tab contains menus with editing and viewing commands. The ribbon is subdivided in menu groups (Project, Edit, Layer, etc), which will be outlined in this chapter. Note that availability of many functions is conditional on the current status of the viewport (which objects are selected) and the project (what elements are present).

3.6.1.1 Project menu

This group of buttons allows for creating, opening, saving, importing and exporting of projects, and to close DELFTship. A list of recent files is available under tje load button.

New project

Opens the new project window to start with a blank project, or load a template.

Load

Opens your file browser to open an existing DELFTship project file (Ctrl+O)

If you are working with shared project files (e.g. on a network drive) a lock-file is created when you open a project. If you open a file that is already in use you will receive the following warning:

Model <file name> is claimed for editing by <user name> OR *<another instance of DELFTship>*

Where*:*

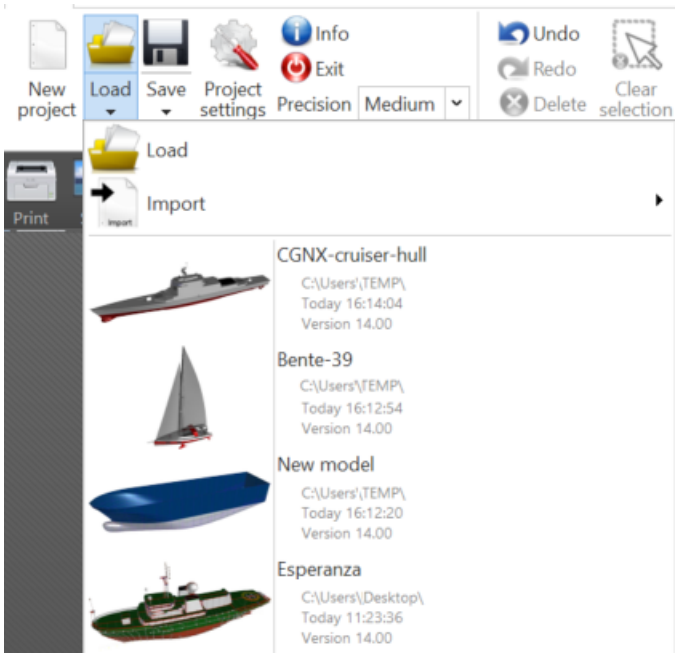
Value	Meaning
<file name>	Refers to the file name of the model you are trying to open
<user name>	The model is claimed by another user or computer where *<user name>* refers to the name of the user
<another instance of DELFTship>	The model is already claimed by you (or your computer) by another running instance of DELFTship. If you want to continue and edit this model you should first close the other instance of DELFTship

If the model has an active lock you will only be able to open it in read only mode.

If the lock on the file is no longer appears active (say the PC locking the file is sleeping) you will get the option to remove the existing lock and claim it for yourself. The former 'owner' of the project can, should he resume work, save the file as a copy, as his version is now read-only.

Clicking the pull-down arrow below the open button shows import options, and a list of recent projects.

Import

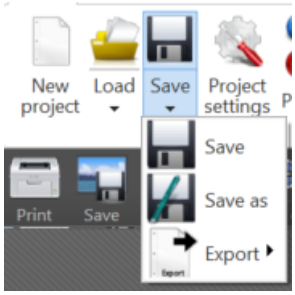


Import a file (not a DELFTship file).

Save

Save file without prompting for the file name (CTRL+S). Clicking the little drop-down arrow opens the File Export menu. This menu has the following options:

Save As and Export



Save file with prompting for a file name (Shift+Ctrl+S).

Export

The Export option allows to export (parts of) your model to file. See the screen shot to the right for an overview of available formats, or open the File Export page for more details.

Project settings

Modify the project settings and main particulars.

Exit

Close DELFTship

Precision

Use this drop-down to select the precision you want used for display (rendering) and calculations of your model. This control has an impact on both accuracy and speed of operations. If a large and complex model becomes sluggish it can be useful to set the precision to a lower setting, until a higher precision is required.

3.6.1.2 Edit menu

Undo

Undo previous editing actions. DELFTship stores all actions into memory. Please note that this information is not stored on file: when DELFTship is shut down the undo data is permanently lost.

Redo

Redo a action that has been undone with the undo command.

Delete

Use this to delete items that have been selected. The program first deletes all selected faces, then the edges and finally the selected points. Any unlocked points or edges that remain unused after this process are deleted also.

Clear selection

De-select any selected items (points, faces, edges)

> *If a point is deleted all attached faces and edges are deleted too. If an edge is deleted, any attached faces will also be deleted - even if they are part of another, hidden layer. For removing a point without deleting the connected faces and edges, use 'point collapse' command. For removing an edge without deleting the attached faces use the 'edge collapse' command.*

> *Not only items from the surface geometry but also markers, control curves, flow lines and tanks can be deleted this way.*

3.6.1.3 Layer menu

Edit

Opens the layer window (Ctrl-L).

Add

Adds a new layer and names it "LayerX", where X is an increment. Note that this increment does not necessarily reflect the currently available number of layers- it is the number of layers that has, at one point, been added to the project. This is to prevent duplicate naming.

Group

Create new layers by extracting faces from the current layer. Specifically, this function extracts groups of faces which are completely surrounded by crease edges. Each group of faces is subsequently assigned to a new layer. If no faces are selected, every visible layer will be processed, otherwise only the selected faces. DELFTship tries to save as much of the present layer information as possible. If a set of faces is extracted, and they already belong to the same layer then this layer is left undisturbed. Auto grouping is only enabled if the display of interior edges is switched on.

Clean

Removes empty layers.

Active layer

You can modify which layer is active when no faces are selected by selecting another layer from this drop down list: Changing this field with faces selected will add the selected faces to the selected layer. If a face is selected, this field will show the layer it belongs to. Not that this is *not* the active layer: the currently active layer is shown in the status bar. When faces from more than one layer are selected, this field will show "Multiple layers".

In the event that faces have been selected there are two possibilities:

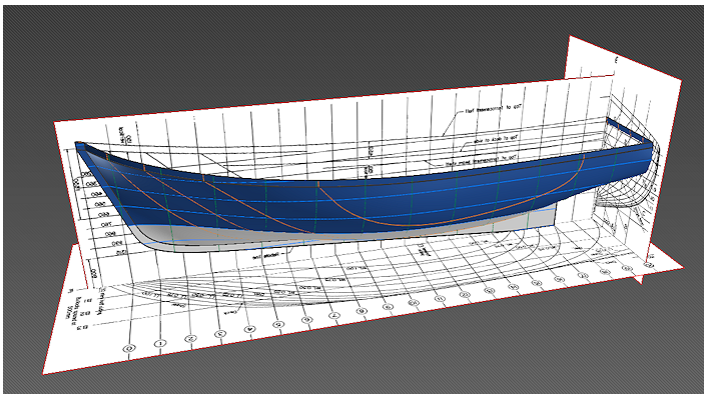
1. All selected faces belong to the same layer. In that case the name of that layer is shown, even if it is not the active layer.
2. The selected faces belong to different layers. No layer name is shown in the toolbar at all, it will be blank.

By selecting a layer from the list with layers while faces are selected, all the selected faces will be moved from their current layer to the newly selected layer.

3.6.1.4 Reference images

A core feature of DELFTship is the ability to display reference images with your model. This functionality is convenient if you have a image or scan of an existing drawing which you will need to (re)create in DELFTship, such as a lineslan, tank arrangement drawing, or opening arrangement. You can load and manage reference images through the *'Edit reference images'* button which is available in various windows in the program.

In the example image below, three images have been imported to recreate a hull model from a linesplan drawing:



Example of images as design support

The General tab provides tools to import an image, of to create a reference image from a screen shot. This is also where you link an image to a perspective (Profile, plan or body plan) and set transparency.

If your image needs more adjustments, the Edit tab holds a number of image post processing tools, such as crop, rotate and align.

There are two main views to see the created reference images:

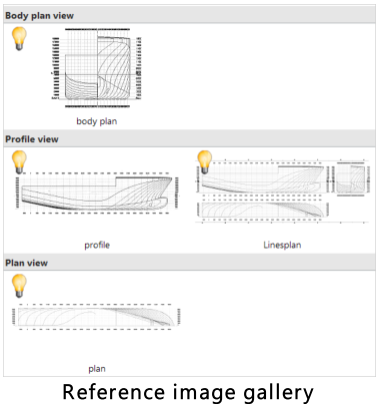
2D : The 2D view shows the basic image and allows you to set the origin of the image. The origin will be used to position the image relative to your model.

3D: The 3D view renders the image and your model in the same view, so you can position and scale the reference image to your needs.

Showing / hiding reference images

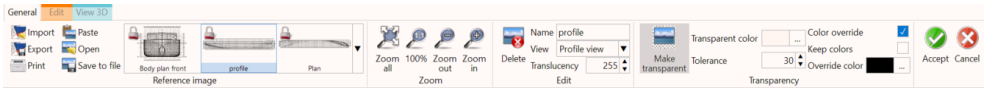
In every window where reference images are supported, there will be a 'Reference images' gallery in the ribbon menu. This gallery will show all available images grouped by perspective, and it allows to show or hide each image by clicking the light bulb icon.

 A yellow light bulb indicates the image is shown, a grayed out light bulb is shown for hidden images.



Reference image gallery

3.6.1.4.1 General tab



Import

Use this option to import a .dbi file containing one or more reference images that was exported from another DELFTship project. The file contains both the images and all settings applied to these images such as scale origin, transparency etc.
See also the "Import data" feature from the File import menu on how to import background images from an existing DELFTship project.

Export

If you want to backup your reference image settings or use the current set of reference images for an other project, with this command you can export the images including all settings as a .dbi file.

Print

A print dialog opens, allowing you to print the currently selected image.

Paste

The image on your clipboard (maybe from the 'Screenshot' feature) is pasted as a new reference image.

Open

A browser will pop-up to select an image (jpg, jpeg, bmp or png). After loading you can assign it to the correct view (profile, plan, body) and edit settings.

Save to File

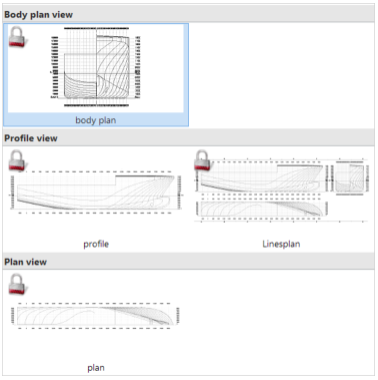
Saves the selected reference image to a file.

Screenshot

Opens the Windows screenshot tool (alternatively, use Win + Shift + S) to grab an image from your screen

Gallery

Shows thumbnails of all available reference images. Select an image to edit.



The lock in the upper left corner of each thumbnail indicates a locked aspect ratio- this means the image is identically scaled in both directions and you can re-size the image without distorting it. To re-size images see the 3D tab. If the aspect ration is unlocked you can use a different scaling to adjust the width or height of the image.

Zoom

Set the zoom level to 100%, all, or zoom in or out. You can also use the scroll wheel to adjust the image zoom.

Delete

Remove the reference image. This can also be done by selecting the image in a viewport and then press the Delete key.

Name

Enter the name of the selected reference image. The default name is the file name.

View

Set the perspective for the selected image: Profile, plan or body plan (according to the coordinate system page):

Profile - sets the image on the X-Z , or the center plane

Body plan - Sets the image on the Z-Y plane

Plan - Sets the image on the X-Y, or the *base plane*

Translucency

The translucency control can be used to fade the image in the background by setting the image transparent (note: this is *not* the same as the Transparency options discussed below). Valid values range from 0 (completely transparent) to 255 (completely opaque) and can be directly entered into the field, or modified using the arrow buttons. There are two sets of buttons; one (the smaller, inner button) changes in single steps, the larger (outer) button changes in increments of 10.

Background image

When checked, the image will always be kept in the background. If it is not checked, a distance can be specified where the image should be located.

Distance

Distance to the origin of the reference image. This can be used to draw images of transverse sections or decks on their respective locations. It can also be used to assign images to certain 2D cross sections of 2D (tank) arrangements.

Make transparent

Click this button to 'remove' the background of the loaded image, essentially making it transparent. Normally the color of the background to be made transparent is white, but other colors can be selected- the color used to make transparent is shown in the 'Transparent color' field. See below.

Transparent Color

Move the mouse over the image to select the color from the image that will be made transparent. (normally white or black). Alternatively, the color control can be used to select the color to be made transparent.

Tolerance

Setting the transparency of the background can have fuzzy results: there is not always a sharp border between background and drawing color. Especially in compressed jpegs there some grading can occur (artifacts): what once was a purely black-and-white image can contain many shades of *almost* black and *almost* white. To correct this fuzzyness you can set the tolerance levels to a value between 1 and 255 where 1 is the most tolerant. Higher values will make more of the background transparent, which sometimes cleans up finer details (text, thin lines). Too high a value may make the entire image transparent. To assist in finding an optimum setting the images displayed in the hull module viewports and the image in the active window are updated real-time, reflecting the current settings.

Color override

The Color override check box will set all remaining, non-transparent pixels to the same color- normally this will enhance the image, but it can blur finer lines.

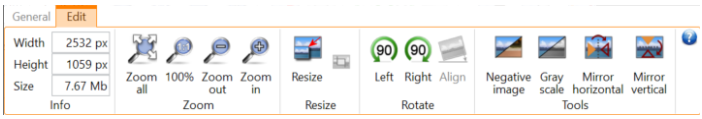
Keep Colors

If Color Override is enabled, this option forces only grey-scale (normally border) pixels to be overridden. Non-gray colors are left unchanged.

Override color

The Color override check box will set all remaining, non-transparent pixels to the chosen color

3.6.1.4.2 Edit tab



The Edit tab is only available in the 2D perspective

Resize

The Resize button brings up a dialog showing the current width and height of the image in pixels. Changing one will automatically change the other to maintain the aspect ratio.

Crop

The 'Crop' button becomes active when an area of the image is selected: Click and drag to select the part of the image you want to crop.

Left

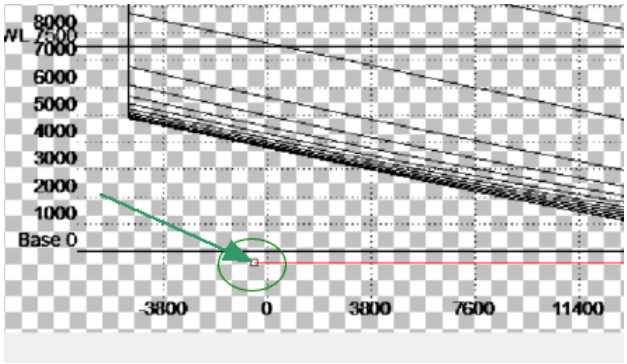
Rotate the image 90 degrees counter-clockwise.

Right

Rotate the image 90 degrees clockwise.

Align

The backgound image has an added 'horizon' (see image below). By dragging the endpoints of this horizon you can accurately adjust minor rotations in your image: Make sure both end points of the horizon are at a position that you know is level (e.g. the baseline) and click the 'Align' button to apply the rotation.



Negative image

Invert colors of your image. This function does not work if you have 'color override' enabled as this takes precedence.

Gray scale

Remove color by turning the image to grays. This function does not work if you have 'color override' enabled as this takes precedence.

Mirror horizontal

Flips the image horizontally (left becomes right).

Mirror vertical

Flips the image vertically (top becomes bottom).

3.6.1.4.3 2D

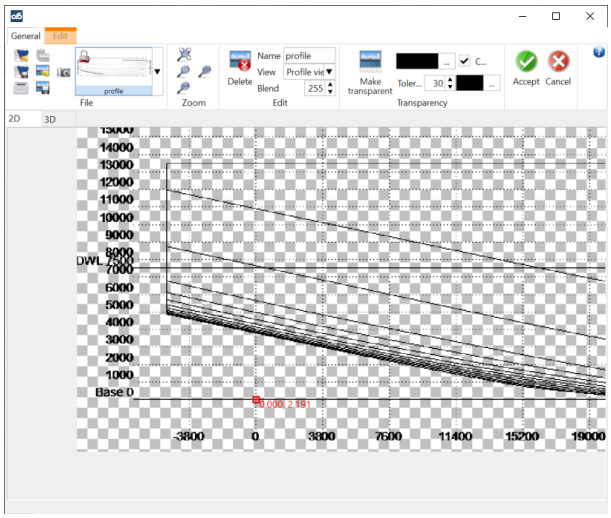
The 2D perspective shows the selected reference image without rendering your model. Use this perspective to prepare your image.

Origin

To mark the origin of your reference image, make sure you have the General tab active. Locate the red cross hairs indicator and drag it to where you have defined the origin in your model- in the screen shot below it is the aft perpendicular.

Zoom in to place the origin more accurately

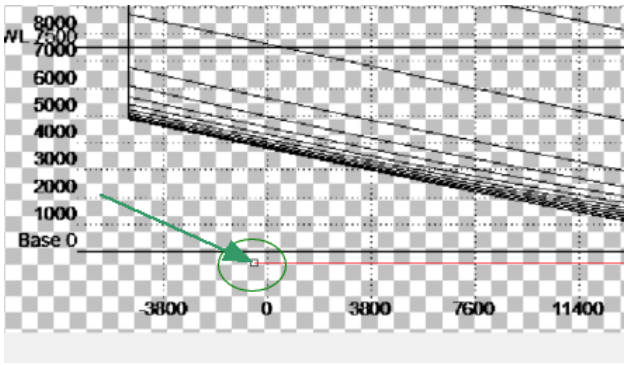
When the image is used in DELFTship it will be placed with this origin at the zero coordinate of the chosen perspective.



The 2D perspective with the General tab active: Place the Origin

Align

With the Edit tab active the image is shown with a red line showing the horizontal, or the horizon. If your image is slightly rotated you can drag the endpoints of this line to what should be an exact horizontal (or vertical), like the baseline of a lines plan. Clicking the 'Align' button will rotate the image to match.



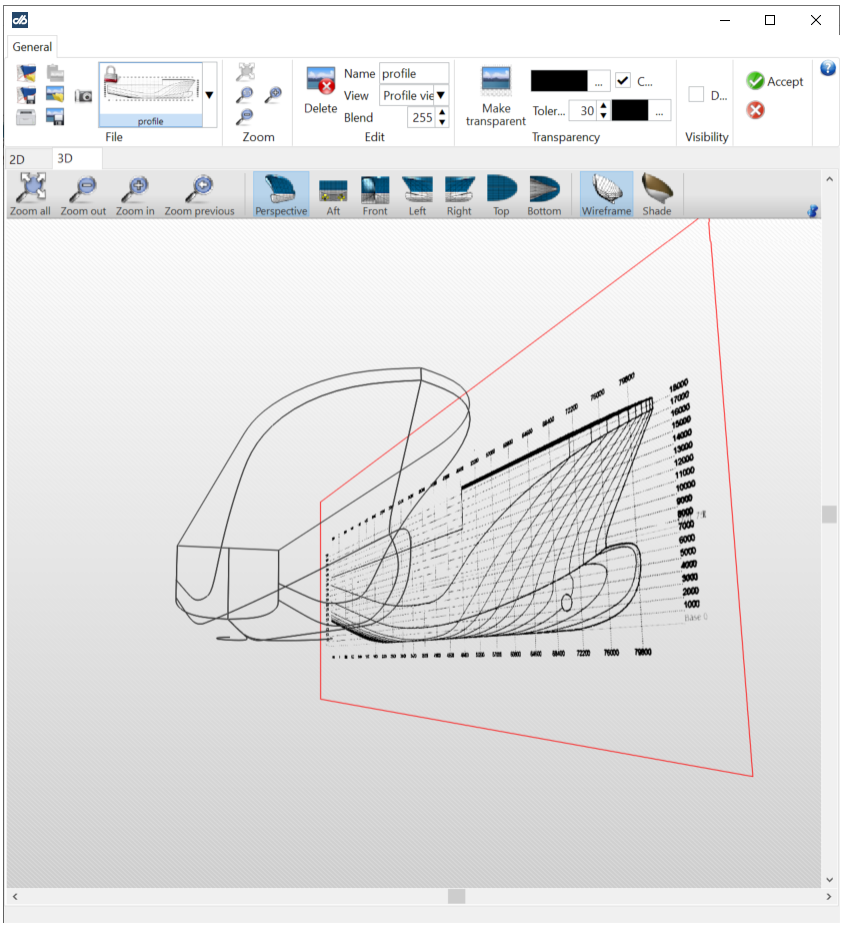
2D perspective with the Edit tab active: Horizon

3.6.1.4.4 3D

The 3D perspective allows you to place the backround image in your project.

Scaling your image

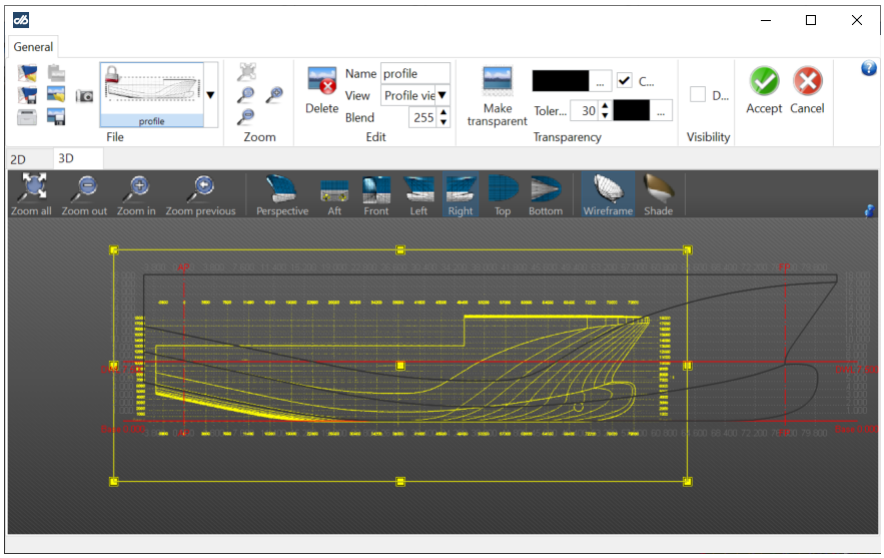
The origin (as set in the 2D perspective) of the image is placed at the origin of your image. Change to the relevant view to scale your image, in this example we are placing the profile, so a side view is approprate.



In the "Right" view we can now scale the reference image so it fits the model. To do this we can drag any of the points in the frame around the image. As the origin of the image is pinned in 3D space, the image will scale to fit while keeping the origin of the image in place.

 As long as the lock in the gallery is closed, the image will maintain its original aspect ratio.

 If you click on the lock icon, it will allow you to 'stretch' the image, as width and height are no longer locked to each other.



3.6.1.5 Point menu

Please note that all point operations depend on the control net:  (see the Hull display menu)- if the control net is hidden, there are not points or edges to operate on.

Add

Adds a new point located at the origin (0.0, 0.0, 0.0) which is automatically selected. The control point window for that point will open automatically. Adding new points is only enabled if the control net is visible.

Plane (intersection)

This is a convenient way to insert a range of points at a certain ordinate location: the plane intersection intersects all visible edges with a plane. It inserts control points on each intersecting edge and splits faces with multiple points by inserting edges. There is also an option to add a control curve to the newly created edges.The type of plane (vertical, horizontal or transverse) and the offset can be specified in the dialog.

Lock

All selected points will be locked. Locked points appear dark gray on your screen and cannot be modified. This option is enabled if at least one unlocked point is selected.

Align

If multiple points are selected, these can be aligned on a single straight line. This is done by projecting all the selected points on the line that goes through the first and last selected point. They are *projected* on the line rather than uniformly distributed to keep the displacement of the points minimal. Additionally you can choose to only modify certain coordinates of the points. For example: when you have selected multiple control points forming the outer edge of a transom you should only adjust the X-coordinate in order to put all the points in the same plane seen from the profile view. The shape of the transom, as seen from the back, will remain unaltered.

Intersect (layers)

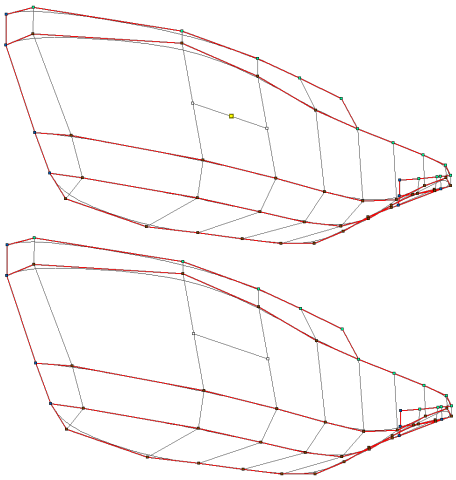
Use this option to insert points at the intersecting curve of two layers. This option is disabled in the menu if the model has only one layer. All the edges of the first layer are checked for an intersection with the faces of the second layer. If an intersection exists, the intersection point is inserted on the edge. All inserted points are connected with new edges which form the intersecting curve of the two layers. Note that *only the first layer* is affected by this operation, the second layer is unmodified. Note that points are only inserted in *edges*, **not** in faces. Intersecting layers can be useful to find the intersection of the hull with a keel or rudder.

Unlock points

Unlocks selected points if they are locked. This option is only enabled if at least one locked point has been selected

Collapse

Removes selected points without deleting the surrounding geometry. A point can only be collapsed if it is attached to exactly two edges. The point is removed, and the two edges are replaced by a single edge. If a point is attached to more than 2 edges, the other edges need to be removed first, possibly by collapsing these edges. Collapsing a point is illustrated in the image on the right. Note that the point that is to be collapsed is irregular since it has two faces and two edges connected to it. By collapsing the point the number of points of the two attached faces is reduced to 4 and the control net is made more regular, making it easier to produce a fair hull surface.



Removing a point with 'collapse'

Copy (coordinates)

If multiple control points have been selected you can copy selected values from the first selected point to all the other points. This way you can quickly assign all selected points the same X, Y or Z coordinate.

Unlock all

All locked points in the model will be unlocked, selecting them is not necessary.

Extract (points from marker)

When a marker curve has been imported, this function will extract all points from the currently selected markers and add those as control points to the subdivision surface. Please note that these control points can not be connected automatically to edges or faces.

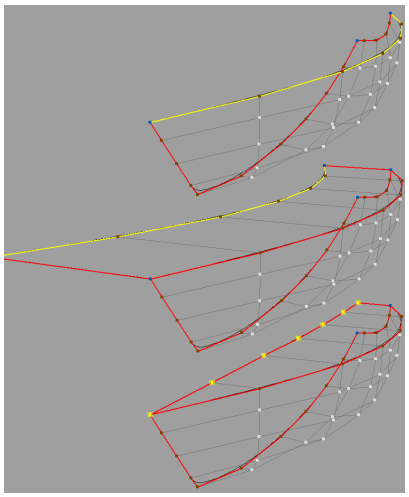
3.6.1.6 Edge menu

Extrude

The most common (and preferred) way to create new surfaces is by extruding edges. Selected edges are copied in the specified extrusion direction and new faces are created between each old and new edge. Since an edge has a maximum of two faces attached, *only boundary* edges are allowed to be extruded. (Boundary edges are defined by hydrostatic enabled layers - if an edge is bounded by a face in layer that has hydrostatics disabled in the layer settings, the edge will be treated as boundary. Please be aware that enabling hydrostatics again for the bounding layer will result in errors in your model). The new faces are assigned to the active layer.

An edge can also be extruded using the mouse: Select the edge(s) and hold down the SHIFT key- then drag the edge in the direction it should be extruded. When releasing the mouse button, a dialog will allow you to fine tune the direction and offset of the extrusion

The illustration to the right shows how a deck is added by extruding the sheer-line. The three stages of the process are:



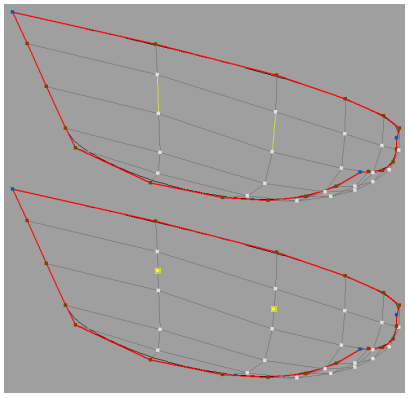
1. Select the boundary edges that you want to extrude. Then choose the *edit => edge => extrude* option from the main menu. A window will appear requesting direction of the extrusion. In the example the extrusion direction is (0.0, -2.25, 0.02) meaning that a copy of all selected edges will be created and moved 0.0 units in longitudinal direction, -2.25 units in the transverse direction and 0.02 units upwards.
2. The extrusion command creates new faces between each original edge and its copy. These new faces will be assigned to the active layer.
3. After moving the newly created edges to the center line (optionally, use the align function)- the deck is finished.

Extrude curved

Sometimes it is required to create a deck with a deck-camber. This can be done by using the 'extrude curved'. Select the sheer line and then click Extrude curved. You will be asked to enter a number of faces and a percentage. The amount of faces is used to create the deck and will define the curvature (1 face will result in a flat deck resulting in a knuckle at the center line, a number higher than 1 will create curvature). The percentage is the height of the deck related to the beam of the ship.

Split

Selected edges are split by inserting a new point in the middle. After the operation all newly created points are selected. This is a convenient way to insert new edges. Multiple edges can be selected and split. All selected points belonging to the same *face* may then be split by inserting a new edge. The image to the right shows two selected edges before and after the split. Note that this way a face consisting of 6 points is created, resulting in an irregular mesh. The two selected points should be connected, splitting the face in two regular faces. This ensures a more regular grid and a smoother surface. Splitting an edge in curved surface may flatten the surface in that area. If you don't want the curvature to change, consider using the advanced edge split command.



Inserting points on an edge

Please note that this example leaves us with two irregular faces: those bordering the split face to the aft and front: those faces now have 5 points, which to difficulties.

Split advanced

Advanced differs from the regular edge split in that it tries to maintain the current shape and curvature by modifying the coordinates of the adjacent points.

Collapse

Collapsing an edge removes the edge and combines the two attached faces into a single face. Since edge collapsing requires two faces it can only be applied to internal edges. Using the 'edge collapse' command can locally change the shape of your surface.

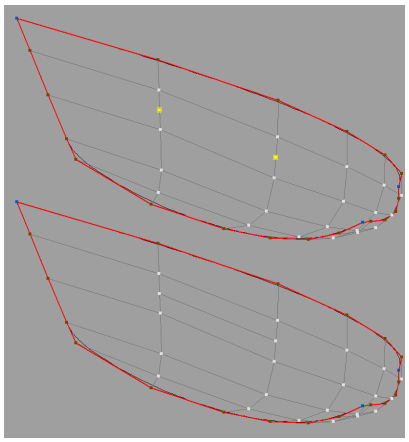
It can be necessary to collapse *all* edges of a certain type- when all visible edges are selected, the collapse edge function will ask for a selection ('Crease only', 'Regular only' or 'All edges')

Remove

This command is similar to the edge collapse command above, except after collapsing the edge, it alters the coordinates of adjacent control points in order to minimize shape changes of the surface..

Insert

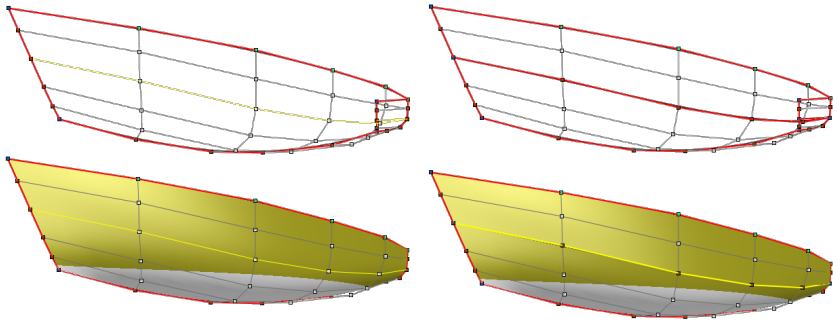
A face can be divided into two new faces by inserting an edge. To do this at least two points have to be selected. Both points must share the same face, and no edge is allowed to already exist between the selected points. To ensure a fair surface it is recommended to extend inserted edges as those seen on illustration *'inserting an edge'* to a crease or boundary edge if possible.



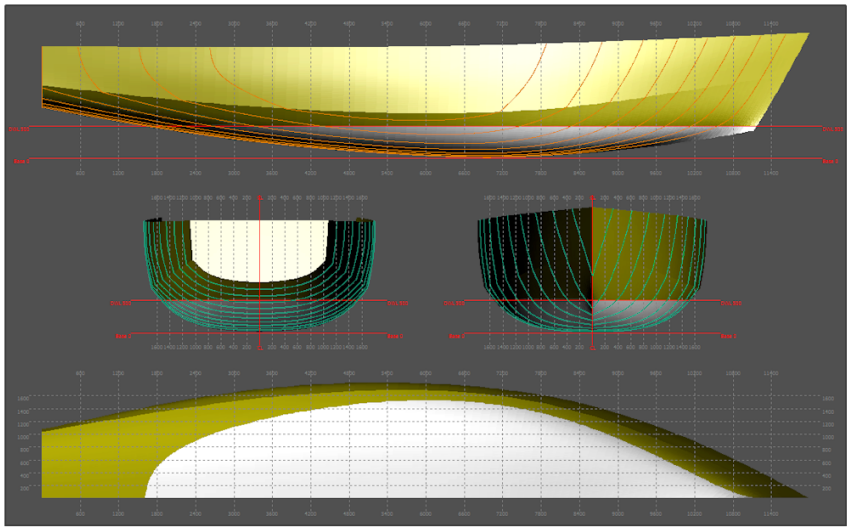
Inserting an edge

Crease

Setting selected edges as crease-edges allows you to add knuckle lines to the hull. The crease property of boundary edges cannot be changed, since they are natural crease edges. The illustration below shows how a hard chine is created. To the left the model without the hard chine is visible. To the right the yacht with the new knuckle line is displayed. Below is a second image showing the lines plan of the yacht after the crease edges have been set. In this specific example the knuckle line runs over the full length of the hull but this is not necessary: knuckle lines may run freely over the surface.



Creating knuckle lines / crease edges



Lines plan of a hull with crease edges set

3.6.1.7 Curve menu

About Curves

Control curves are a tool for fairing- for more information on control curves see the paragraph on control curves and fairing.

Add

First select a number of connected edges. (Automatically select an entire connected edge by holding down the control key when clicking on an edge) Then click the *add* button to create and assign a control curve to these edges. Only one curve can be assigned to each edge. If the new curve is not shown on the screen, make sure that control curves are made visible in your display settings.

Convert (to marker)

This option is only enabled if at least one control curve is selected. It converts the control curves into a marker curve for future reference or export. See also the paragraph about markers for more information on this subject.

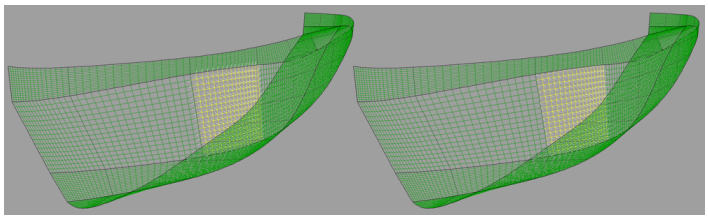
3.6.1.8 Face menu

As described in the paragraph Background to surface modeling, faces are the surfaces that close the space between edges- they are the ultimately visible part of your model when shaded.

Add

Creates a new face between selected points. These points have to be selected in the correct order (normally clockwise or counter clockwise) to create a regular face.

Flip normal



Manually inverting the direction of face normals

This option can be used to manually flip the direction of normals of selected faces to the other side in case the automatic surface check has failed. All surface normals should point outwards, in the direction of the water. The normals of a face can be visualized by selecting the specific face, provided that you have selected the wire frame (no rendering) from the Shade menu and the mesh is made visible in the hull display settings. Each displayed normal is calculated as the average normal in a point of the refined subdivision mesh. This average is calculated from all faces surrounding that point. Along the boundary of an edge sharing two faces with opposite normal directions, this may seem a bit peculiar as can be seen on the left side of the illustration. The normals along these boundaries look as if they are projected on the surface. The right side of the illustration shows the normals after the face has been inverted and the normals face the right direction.

Extrude

Extrude a face: move the face in a given (orthogonal) direction while leaving it connected to its neighboring faces

Faces can also be extruded using the mouse: Select the face and hold down the SHIFT key- then drag in the direction it should be extruded. While dragging the outline of the face will be shown. This may differ from the size and shape of the selected face depending on the control net.

When releasing the mouse button, a dialog will allow you to fine tune the direction and offset of the extrusion. After extrusion, all bordering edges will be made crease-edges.

Close

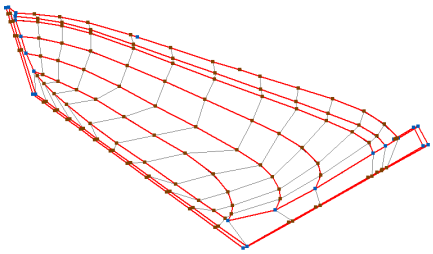
Fill a selected and closed loop of edges with new faces

3.6.1.9 Hull display menu

The hull display menu has controls that allow you to switch specific rendering elements and tools on or off. Most of this is functional: without the control net enabled points can not be manipulated, without the surface mesh normals will not show.

Control net

Show or hide the control net.



Control net

The control net is the combination of all points and edges that form the initial subdivision mesh. These are the entities that can be manipulated by the user to shape the surface. Elements from disabled layers will not appear. That way the interface can be kept clean by showing only the points or edges of interest.

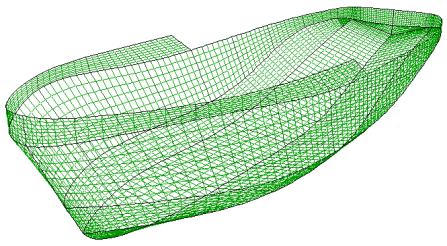
Both sides

Displays both sides of the symmetrical model.

Since most surfaces will be symmetrical with respect to the center plane, only the port side of the hull is modeled. This symmetry not only applie to the surface but also to the intersection curves, flow-lines, control curves etc. Symmetrical elements are mirrored by the software to reduce the modeling time. With less information on the screen it is easier to select a point, edge or face. Enable the 'Both sides' option to display the entire model.

Mesh (Interior edges)

Show or hide interior edges.



Interior edges

The interior edges are the edges of the subdivided surface. With higher precision settings, more edges are shown. Interior edges are drawn in the color of the layer they are assigned to. You can select a face by clicking on one of the interior edges of that face. Since the mesh *is* the surface, it can not be shown in a shaded view- it will only show on a wire frame.

Stations

Use this button to toggle the display of stations. If no stations have been added to the model the option is disabled in the menus. Stations can be added to the model from the Intersections dialogue.

Buttocks

Use this button to toggle the display of buttocks. If no buttocks have been added to the model the option is disabled in the menus. Buttocks can be added to the model from the Intersections dialogue.

Waterlines

Use this button to toggle the display of waterlines. If no waterlines have been added to the model the option is disabled in the menus. Waterlines can be added to the model from the Intersections dialogue.

Diagonals

Use this button to toggle the display of diagonals. If no diagonals have been added to the model the option is disabled in the menus. Diagonals can be added to the model from the Intersections dialogue.

Control curves

Show or hide control curves.

Control curves are curves that are assigned to edges of the control net and are used to fair the surface. The visibility of these control curves does not depend on the visibility of the control net. In fact, selecting and manipulating control curves is often easier if the control net is not visible. Points and edges assigned to a control curve become visible when a control curve is selected, all other points will remain hidden.

Curvature

This option enables or disables the visibility of the curvature plot of control curves and certain intersection curves. To include an intersection curve in this plot, make sure it is checked in the intersection dialog. Note that curvature visibility depends on the curvature scale, the current scale is shown in the status bar. If the scale is set too low, curvature will not be visible.

Increase scale

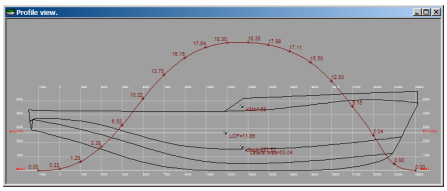
Increase the scale of the curvature plots (F9). The current curvature scale value is shown on the status bar, at the bottom of your screen.

Decrease scale

Decrease the scale of the curvature plots (F8). The current curvature scale value is shown on the status bar, at the bottom of your screen.

Real-time hydrostatics

DELFTship provides the option to plot some key hydrostatic values in the wire-frame of your model for the design draft.



Hydrostatic features

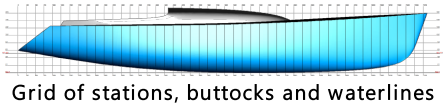
These are:

- Displacement and center of buoyancy
- Center of flotation
- Lateral area and center of effort
- Transverse metacentric height
- Curve of sectional areas. Contrary to the other values this curve is *only* plotted in the left, right or perspective view of the hull.

These values can only be displayed if the model is sufficiently consistent to calculate the hydrostatics: if the model contains leak points below the water plane no values will be calculated or displayed. The values are updated in real-time when the model is being modified. You can specify which data should be shown in the project settings window.

Show grid

If intersection curves are added to the model it is possible to display a grid marking the location of these intersection curves. It is visible in wire-frame and shaded mode. Next to each line its distance to the origin is printed, and the baseline, center line and design waterline are also indicated. The grid is visible in



Grid of stations, buttocks and waterlines

all views except for the perspective view. This grid is displayed regardless of the display settings of the intersection curves. The same grid is also visible in the lines plan.

Leak points

The Leak points function will hide all regular control points, showing only points that are considered “leak” by the program. This enables easier identification of points restraining the hydrostatic calculations. For more information about leak points, see check model.

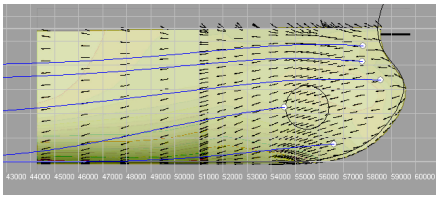
Display flow lines

Show of hide flow lines.

Add a flow line by holding down the Alt-key while clicking be,ow the waterline.

The flow lines displayed by DELFTship are calculated through analysis of the surface geometry only and have *nothing* to do with CFD. This is a huge simplification since hull speed, pressure and waves are excluded from the calculation. Despite this simplification the flow lines show a remarkable resemblance with those calculated with CFD programs but keep in mind that the only purpose of this function is to give the designer an impression of how the water will *approximately* flow. Real CFD calculations will be much more accurate and reliable.

> *To add a flow lines keep the alt-button pressed and click on a point below the waterline (profile, plan or body plan view only). This point is used as the origin of the flow-line. From there the flow is traced as far as possible to the stern until it crosses the design waterline.*



Flow lines

Flow lines are only traced along surfaces that belong to a layer that is used for hydrostatic calculations - generally the shell of the hull. (enable hydrostatics in layer settings). The image above shows some flow lines at the bow of a hull with a bulb fitted. The reference image shows the results obtained from a CFD calculation. The small black lines represent the direction of the flow as calculated with CFD, the blue curves are the flow lines calculated by DELFTship. Flow lines can be selected and deleted like any other geometry.

> *Surface areas where flow-lines are converging are high pressure areas, where they diverge are low-pressure areas.*

Normals

If this option is switched on, normals of faces that have been *selected* are displayed. These normals are drawn as thin white lines, pointing either inward or outward from the hull. This display option is disabled if the display of interior edges is toggled 'off', and only works if the wire-frame is displayed. A normal is drawn at each interior point of the subdivision surface so with a higher precision more surface normals are drawn.

Display markers

Markers are curves that are added to the model as a reference. For example the body plan of an existing design could be imported as markers. Stations could then be added to the DELFTship model at the same location as the markers. Points can be dragged until the stations and the markers are exactly on top of each other. In that case the DELFTship hull matches the hull from the existing design. For more information about markers please see the *'Tools tab'/ 'Markers'* menu.

Marker points

Sometimes markers contain so many points that displaying these points obscures the marker or even the model. Sometimes the shape of the markers is interesting, not the points used to model the markers. In those cases the marker points can be hidden. Note that this option is only enabled in the menus if the display of markers is set to true.

3.6.1.10 Tank display menu

These buttons control the visibility of tanks that are already present in the model. The 'Tanks' extension is required to be able to add / delete / edit tanks.

Display tanks

Enables/disables the drawing of tanks. If the model contains tanks and a number of modifications to the hull have to be performed it is better to turn off the displaying of tanks: all tanks are rebuilt after each hull modification which can be time consuming.

Transparent shading

Switch between solid or transparent shading of tanks.

Show sounding pipes

Display sounding pipes of tanks (only enabled if the model contains tanks and the display of tanks is enabled / tanks are visible).

Tank labels

Display the names of tanks in the model.

Skeleton

Switch between showing or hiding skeleton planes

Frame numbers

When a frame spacing is defined, the user can show or hide frame numbers with this command

3.6.1.11 Window menu

New window

Open a new window- the view point can be chosen with the view button group (front/aft, left/right, top/bottom and Perspective)

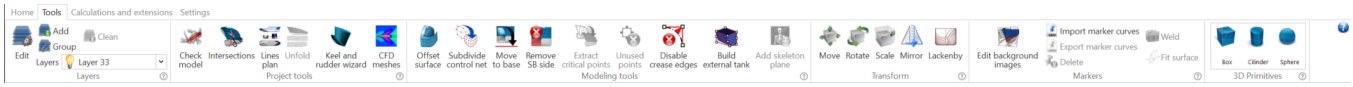
Tile

Tile all open windows horizontally or vertically, depending on the number of open windows. Use this function to restore the viewports if resizing or moving to another monitor confused the viewport sizes

Cascade

Cascade all open windows

3.6.2 Tools tab



Tools tab

The tools tab gives access to a variety of modeling tools.

3.6.2.1 Layers

Edit

Opens the layer window (Ctrl-L).

Add

Adds a new layer and names it "LayerX", where X is an increment. Note that this increment does not necessarily reflect the currently available number of layers- it is the number of layers that has, at one point, been added to the project. This is to prevent duplicate naming.

Group

Create new layers by extracting faces from the current layer. Specifically, this function extracts groups of faces which are completely surrounded by crease edges. Each group of faces is subsequently assigned to a new layer. If no faces are selected, every visible layer will be processed, otherwise only the selected faces. DELFTship tries to save as much of the present layer information as possible. If a set of faces is extracted, and they already belong to the same layer then this layer is left undisturbed. Auto grouping is only enabled if the display of interior edges is switched on.

Clean

Removes empty layers.

Active layer

You can modify which layer is active when no faces are selected by selecting another layer from this drop down list: Changing this field with faces selected will add the selected faces to the selected layer. If a face is selected, this field will show the layer it belongs to. Not that this is *not* the active layer: the currently active layer is shown in the status bar. When faces from more than one layer are selected, this field will show "Multiple layers".

In the event that faces have been selected there are two possibilities:

1. All selected faces belong to the same layer. In that case the name of that layer is shown, even if it is not the active layer.
2. The selected faces belong to different layers. No layer name is shown in the toolbar at all, it will be blank.

By selecting a layer from the list with layers while faces are selected, all the selected faces will be moved from their

current layer to the newly selected layer.

3.6.2.2 Project tools menu

Check model

DELFTship can check the model for inconsistencies and it will correct most of them automatically. This check is also automatically silently performed each time hydrostatics are calculated, unless automatic checking is disabled in the project settings.

First the entire surface is checked for disjoint segments. Then each segment is checked for a consistent direction of the face normals. If inconsistencies are found, those faces will be adjusted. Next the lowest point of each isolated surface segment is identified. For conventional ships this usually is the bottom. If this is indeed a point on the bottom then the average normal of this point should point down in order to face the water. Under this assumption all faces are modified so that the direction of their normal corresponds to the direction of the normal of this particular point. In some rare cases this might cause the normals to point in the wrong direction. In that case it is recommended to manually flip the normals to the correct side (see 'Face menu' under the '*Home tab*') and to disable automatic checking of the surface. This test also identifies edges with more than two faces attached. Lastly a list of leak points is provided; a point is considered "leak" if the following 2 criteria are met:

- The point is not located on the center plane, meaning that the y-coordinate of the point >0.0001.
- The point is situated on a boundary edge (An edge with only 1 face attached to it). Faces that belong to a layer that is not included in the hydrostatic calculations are not taken into account in this test., see also the note below.

> *For hydrostatic calculations, an edge is a boundary edge if one of the connected faces is excluded from hydrostatic calculations. This could be the case for a ship with a closed deck, where the deck is not included in the hydrostatics calculations. In that case DELFTship keeps calculating until the deck line is submerged. Windows and other none watertight surfaces could be treated similarly.*

> *It is important to realize that leak points are not necessarily leak in the sense that they will always make water. A leak point in DELFTship is a point that is* potentially *leak and only becomes* actually *leak if submerged. So the presence of leak points does not always have to pose a problem, as long as they are not submerged.*

If more then 10 leak points are found, only the first 10 are displayed. The points are shown sorted in ascending height above the base plane. Leak points will be rendered a bright green in the view ports, but this color can be configured in the preferences - hullform menu.

Finally a dialog containing the corrected items and possibly remaining errors is opened.

Intersections

Opens the intersection curves window

Lines plan

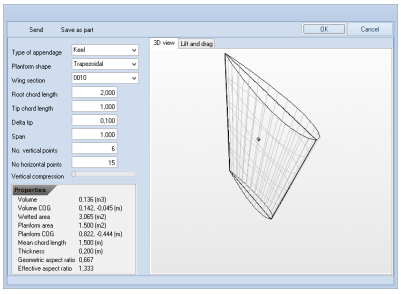
Opens the lines plan window.

Unfold / Plate developments

Opens the Unfold window

Keel and rudder wizard

The keel and rudder wizard helps to quickly define a keel or rudder with a predefined planform. You can select the desired wing section from a list of standard NACA sections. The keel or rudder is show in 3D along with it basic properties such as aspect ratio, volume, center of buoyancy etc. The lift/drag tab shows an estimate for the lift and drag curves. Once the keel or rudder is complete it can be exported in two ways send or save. Using the "send" button it is inserted at the current DELFTship model at the origin, using the "save as part" button saves it to a file as a DELFTship part. Parts can be imported in other designs.



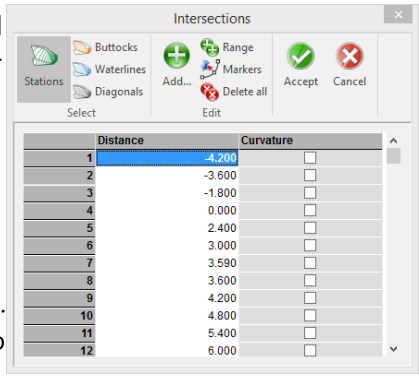
Keel and rudder wizard

CFD Meshes

Opens the CFD meshes window

3.6.2.2.1 Intersections

In the intersection window stations, buttocks, waterlines and diagonals can be added to the model. Intersection curves are calculated from the surface model, so only their location needs to be specified. Diagonals by default are created using an angle of 45 degrees to the center plane but this angle can be adjusted in the intersections window.



Intersections window

When the model is modified the intersection curves are recalculated and updated. The *select* buttons in the intersections window switch between the different types of intersections. You can an intersection by selecting the *Add* button in the *select* menu. A window is displayed asking for the location of the intersection. It is also possible to add a range of intersections by pressing the *range* option. In that case the location of the first and last intersection are requested as well as the spacing between the successive intersection curves. If an intersection with a surface has been found it will be added to the model. The intersection curves appear in ascending order of location starting in the origin.

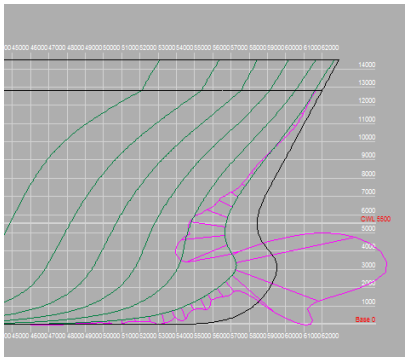
To delete a single intersection, select it and press the *delete* key on your keyboard.

All intersections in a group (e.g. *buttocks*) can be deleted by selecting that group and pressing the *delete all* button on the toolbar.

The *Markers* button converts all the intersections from the current group into markers.

the *Accept* button submits the changes and closes the window. To drop changes, click the *cancel* button: this will ignore the changes made and return to DELFTship.

The *check box* displayed to the right of each intersection indicates if the curvature plot of that specific intersection curve must be plotted (for more information about curvature plotting, see paragraph about 'control curves' in the 'curve menu'). Due to the limited size of computer screens it is almost impossible to determine if a curve is perfectly fair. To overcome this a curvature plot can be drawn. A curvature plot is created by calculating and plotting the curvature in many points along the curve (the pink line). Since the curvature can be both positive and negative, the plot can be drawn on both sides of the curve (see illustration on the right). Where the plot coincides with the curve the curvature is zero. In contrast, at knuckle points the curvature is infinitely high. The higher the absolute value of the curvature, the

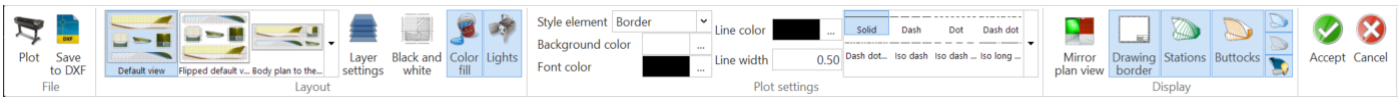


Curvature plot of a buttock

further away from the curve the curvature plot is drawn. Smooth curves are characterized by curvature plots with no unexpected humps or hollows. The scale of the curvature plot can be decreased by pressing the F9 key and increased by pressing the F10 key. Make sure that the curvature plot is switched on in the hull display settings.

3.6.2.2.2 Linesplan

DELFTship can create and display the complete formatted lines plan of the ship. The *Lines plan* button gives access to the lines plan dialog, where the lines plan can be configured in detail:



File menu

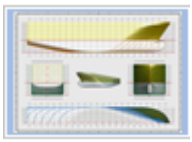
Plot

Prints the lines plan to scale to a printer or a plotter.

Save to DXF

Save the lines plan as a DXF file. (to save as an image, see the Viewport menu)

Layout



The Layout menu contains a control with a choice of views or layouts of the plan. Scroll the small window, or click the arrow to open a larger select window, showing the options side by side.

Layer Settings

The layer settings button provides access to the layer settings window, where you can set layer properties such as visibility and color.

Black and white

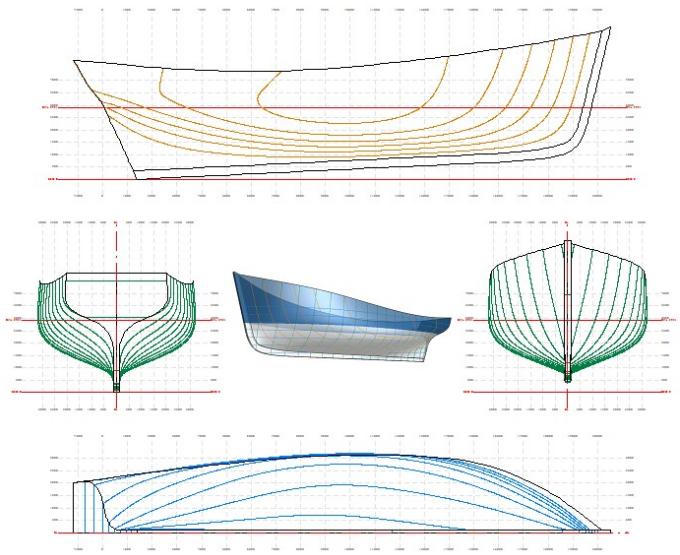
The lines plan can also be drawn in black & white by clicking on the appropriate button in the toolbar. Using fill colors and lighting options is not possible in black & white mode.

Color fill

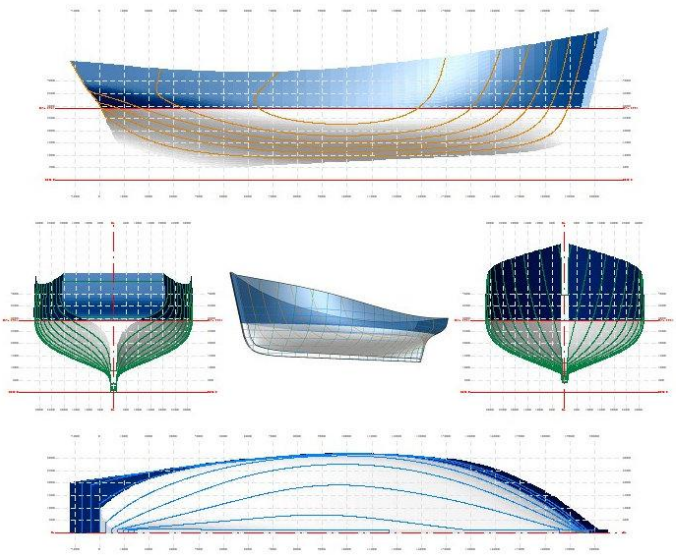
Fill the image with the colors as defined in the layer window (and the preferences for submerged surfaces color) Use the Lights option to show curvature.

Lights

Use lighting effects to show curvatures by adding shading and highlights.



Lines plan, no fill



Linesplan, fill and lights

Plot settings

This menu group contains controls for the plot- line thickness, colors et cetera

Style element

Select the element to modify. When set to 'Border', generic elements such as background color can be set.

Background color

Set the background color of the lines plan

Font color

Set the color of the font for the selected item- if appropriate

Line color

set the color of the line for the selected item

Line width

set the thickness of the selected line

Line type

Choose from a range of line types (solid, dash, dash-dot, ISO dot or dash, etc)

Display

Mirror plan view

Add the normally hidden symmetrical half. This option is only enabled if diagonals are not drawn to the linesplan.

Drawing border

Show or hide a border around the lines plan

Stations

Show or hide stations

Buttocks

Show or hide buttocks

Waterlines

Show or hide the water lines

Diagonals

Show or hide diagonals

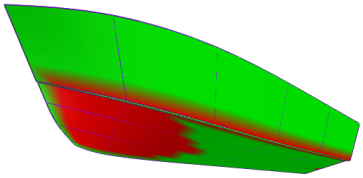
Only if the model contains no diagonals, the plan view might optionally be mirrored so that both sides are visible.

3D View

Show (or hide) a 3D rendering of the hull in the center of the lines plan.

3.6.2.2.3 Unfold / Plate development

All layers that are marked as developable in the layer properties window can be unfolded into flat plates (a process also called developing or flattening).



Developable shading

> *If the model contains no developable layers then this feature will be disabled in the menus.*

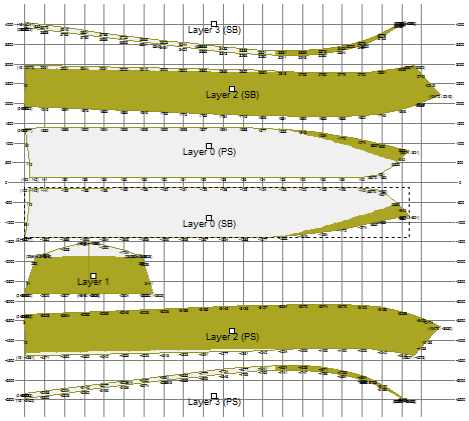
Because it is not always clear which surfaces may be developable, DELFTship assists with the Developable option in the shading menu. Green areas are considered developable, red areas less so. The extent to which surfaces are developbable depends greatly on the materials used- or more precisely, on the elasticity of the materials used. For this reason the developability is only an *indication*. Please not that although the 'developable' shading gives an indication to the developability of a surface, setting the developability option in the containing layers is a manual action.

Note that the algorithm used for unfolding is only valid for truly developable surfaces. A surface is considered developable if it is *curved in at most one direction*. Surfaces with compound curvature will also be flattened, but the

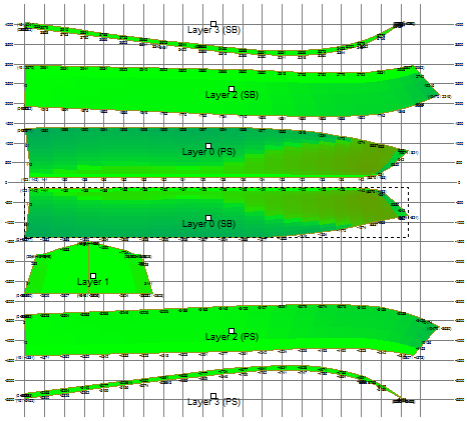
resulting surface will not be correct because stretching or compression of some areas of the surface is required to obtain the correct shape. Take, for example, a sphere: its surface cannot be flattened without stretching or compressing certain areas, unless cuts are made in the surface: a sphere is not a developable surface.

During the unfolding process the program will flatten all selected layers for both sides of the ship and a window is opened showing the resulting plate developments. It is best to assign each strake, or part of the hull, to a different layer. If a layer consists of multiple isolated parts, each part will again have its own unfolding.

Each part can be moved and rotated to optimize the use of available space.



Developable surface plates

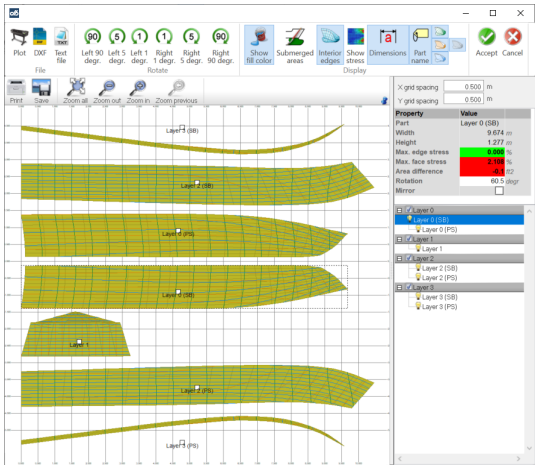


surface stress view

The unfold window

There are many possible lay out variations- the Unfold window allows you to tweak display variables as well as export, save or print the results.

The unfolded panels can be moved by dragging them with the mouse. Buttons on the toolbar at the top of the window can be used to rotate the currently selected plate. . Zooming and panning is done exactly as in the normal DELFTship interface.


the unfold window

Plot

Prints the plate developments to scale to a printer or a plotter.

Save to DXF -

Save the plate developments as a DXF file. (to save as an image, see the Viewport menu)

Save to text

Save to a text file

Rotate

Rotate the selected part in the indicated direction to better fit a plate layout

Several display options are available to fine tune the result:

Solid

Fill the parts with the assigned layer color

Show Submerged Area

Renders the submerged area with the color specified in the preferences.

Interior edges

Displays the interior edges- only available when Show stress is disabled.

Show stress

Display the calculated stresses in the surface due to curvature: Once the plates have been unfolded to 2D, DELFTship compares the length of the unfolded interior edges to the length of these edges in 3D. If this length is smaller then the edges are compressed (drawn in blue). If the unfolded edges are longer then these edges are stretched (drawn in red).

Show Dimensions

Show or hide the part dimensions

Part name

Label the parts with the layer names.

Intersections

Visibility of stations, buttocks, water lines and diagonals can be toggled on or off for display on the flattened surfaces.

Grid spacing

There are also two input fields to adapt the X and Y grid spacing. The grid can be turned on and off from the toolbar using the Show Dimensions button. Each intersection of a grid line and an unfolded panel has a number displayed next to it indicating the coordinate of that intersection.

If two panels border the center plane of the hull, are completely flat and belong to the same layer (such as for example a flat transom or bottom) then these 2 panels will be merged into one larger panel.

In the layers menu in the right bottom pane, the visibility of layers can be toggled on or off. Select the layer either by clicking on the name, or by clicking on the part in the main view: the corresponding layer will be highlighted.

Judging correctness of the unfolded surfaces

Stress and distortion

In the Properties box in the right hand pane, come crucial information about the development of the selected plate is shown (Select a plate by clicking on it). The calculated values include maximum values for edge and face stress, and difference in area (that is, the difference in surface area between the 3D shape and the flattened one). These values are color coded to indicate suitability of plate development for the selected surface. Please note that this indication does not consider the chosen construction materials.

Property	Value	
Part	Layer 0 (SB)	
Width	9,674	(m)
Height	1,277	(m)
Max. edge stress	0,000	%
Max. face stress	2,108	%
Area difference	-0,00970	(m2)
Rotation	60,50	(Degr.)
Mirror	☐	

Properties of plates

Also shown are the dimensions of the plate and the rotation currently applied to the plate.

Generally, surfaces that are truly developable have zero Gaussian curvature, meaning that unfolded the edge and face stresses will also be zero. Surfaces that are not exactly developable can in most cases still be unfolded but might have significant edge or face stress since the surface was curved in two directions. It is *very important* to check these stress values if you actually want to use the unfolded plates for construction purposes!

> *The free version of DELFTship does not support printing or exporting the unfolded plates.*

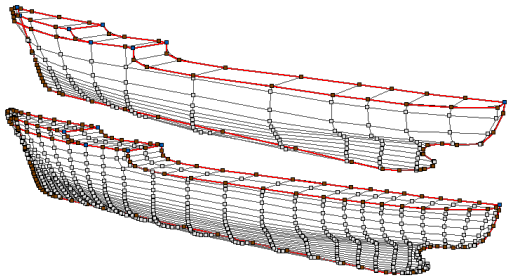
3.6.2.3 Modeling tools menu

Offset surface

The offset function creates new surfaces from existing ones. It will ask which layer to offset and an offset distance, and then creates a new surface from all surfaces in the selected layer by offsetting the specified amount perpendicular to the existing surfaces, in the direction of the normals. If the amount is negative, the offset direction is opposite the normals. Beware that prior to offsetting the surfaces, the model is checked, and normals are repaired. This option can be disabled in hydrostatics tab of project settings.

Subdivide control net

If a model needs more control points, for instance for more detailed modeling, the control net can be sub divided (quadrupling the number of surfaces). Please note that this is a global action, increasing the number of points in the entire model. This option can be particularly useful in combination with the automatic fairing function.



Controlnet before and after subdividing

Move to base

In DELFTship the draft is always measured from the baseline. If the lower point of the hull does not coincide with Z=0.0, this command simply moves the model to the correct vertical position. In order to do this, the lowest point of all layers *included in hydrostatics* is calculated and the model is moved vertically so that this lowest point will be on the baseline. Note that surfaces *not* included in the hydrostatic calculation can still be located below the baseline.

Remove SB side

Sometimes after importing a hull the geometry, both sides of the ship are present while DELFTship only needs the port side. This option removes all faces from the model that are completely on the starboard side.

Unused points

Remove all points from the model that have no edge or faces connected to it.

Disable crease edges

Disables all crease edges in the visible layer. This function needs the control net to be visible.

3.6.2.4 Transform menu

The operations *move*, *rotate and scale* work on an actual selection of *points*. If nothing is selected, a window is presented in which entire layers can be selected. If the checkbox at the bottom of this dialog is checked ("include points that are shared with unselected layers") then a point is selected automatically if *at least* one attached face belongs to a selected layer. If the checkbox is not checked, then a point is selected only if *all* the faces around it belong to selected layer(s). If all the points of the model are selected (all layers), then not only is the hull scaled, but all other information such as main particulars, intersection curves, tanks and critical points too. More about selecting object can be found in the *selecting objects* paragraph. Unlike moving control points with the mouse, this option can move a selection of objects.

If the entire project geometry (all points, all layers) is selected when transforming, a dialog will ask to select project related items to be scaled as well. Which items appear in the list depends partly on installed extensions (such as Tanks, Critical points) but at the very least includes reference images, markers and project dimensions.

Move

Moves (part of) the model in the direction specified.
Works on the selection as described above.

Rotate

Rotates (part of) the model. Works on the selection as described above.

The dialog that appears after a selection is made asks for a startpoint and endpoint. These points define the axis of rotation. To rotate around the Z axis specify (0,0,0) (0,0,1).

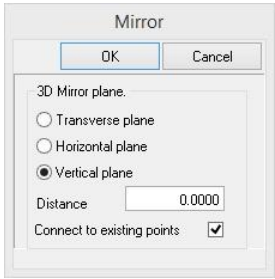
Scale

Scales (part of) the model. Works on the selection as described above.

The scaling vector (X, Y and Z) are applied relative to the origin of the model.

Mirror

Unlike the previous transformation commands, mirroring is based on selected *faces* only- not points. Selection works the same as before: either manually select faces, or if no faces were selected, the layer select dialog is shown. The mirror plane can be either transverse (YZ plane), horizontal (XY plane) or vertical (XZ plane). The distance of the mirror plane to the origin can be specified in the distance field. Tick the checkbox at the bottom to connect the mirrored points to the original points lying on the mirror plane.



Mirror faces

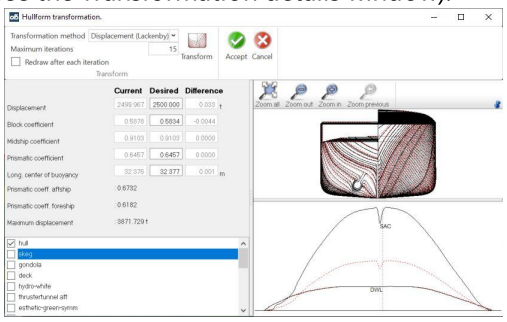
Lackenby

DELFTship has the ability to automatically adjust some hull form parameters in order to obtain desired characteristics. You can use two different types of transformation:

- *Displacement* - The hull form transformation method developed by Lackenby is used to transform the hull to match a desired displacement or longitudinal center of buoyancy while maintaining fairness of your design. This is done by shifting control points in the longitudinal direction. The overall length of the design will be different after the transformation.
- *Midship coefficient* transformation adjusts the shape of the hull so that a specified midship coefficient is met. Note that after this transformation the displacement is also altered. If both the midship coefficient and the

displacement need to be modified it is advised to adjust the midship first before transforming the hull to the desired displacement or center of buoyancy. The midship coefficient transformation may result in a distorted deck line.

This method opens a window where transformation details can be specified (see the Transformation details window).



Transformation details window

The first row of controls allow to select the desired method (displacement or midship), and the maximum amount of iterations allowed. If the desired specifications are not attained within this number of iteration, an error message is displayed. Some cases warrant a higher iteration setting: when a design has a high prismatic coefficient in the aft ship, such as planing motor craft, or when the midship location is far from the usual place at 0.5*Length, the default 15 iterations may not be enough.

The checkbox to redraw after each iteration can be un-checked if iterations are getting too slow. When the box is unchecked only the final result (if attained) is shown, both in the preview window and in the DELFTship viewports.

The  transform button will execute the transformation. If the results are OK, they can be accepted into the model by clicking Accept. Cancel will discard all changes and close the window.

The input fields to the left are divided in 3 columns. The left column shows the current values as calculated from the model. The middle column allows to set the desired values. Depending on which transformation method is selected some input fields can be disabled. The right column shows the difference between the current and desired values. The left and right column are updated after each iteration so the progress can be monitored.

Below these calculated prismatic coefficients and maximum displacements are shown.

Finally all layers of the model are shown. The transformation is *only* applied to selected (checked) layers. As the transformation consists of shifting control points longitudinally, the locations of for example a keel, centerboard or cabin are also likely to change. By excluding layers from the transformation they remain unchanged, potentially leading to a distorted or unfair model.

Hull display, before and after: the main viewport of the transformation window shows the body plan of the original hull displayed in black. If the transformation was successful then the transformed body plan is displayed in red lines on top of the original body plan to visualize the difference between the original and transformed hull.

Below the hull the original sectional area curve and design waterline are displayed in black, the new sectional area curve and design waterline are displayed in red. The dark gray dashed line is the location of the midship section as defined by the user in the project settings. It is important to know that in contrast to the hydrostatics calculated elsewhere in the program here it is calculated using *ordinates*, and not *surface panels*. This can cause a slight difference between the displacement shown here and calculated elsewhere. A total of 82 ordinates is used to calculate the sectional area curve and hydrostatics, 41 for the aft ship and 41 for the fore ship.

3.6.2.5 Markers menu

Markers are points that can be added to the model as a reference: the offsets of another design can be imported as markers to serve as a blueprint for a new model. After importing marker points intersection curves can be specified in DELFTship at the same location as the offset data. If the intersection curves coincide with the markers both models are exactly the same. Another use for markers is to visually check the differences between two versions of a design. If you convert all stations to markers before modifying the model then the difference between the markers and updated stations will reflect the modifications made to the design.

See the "Import data" feature from the File import menu on how to import markers from an existing DELFTship project.

Import markers

DELFTship can read the following file formats and convert the data into markers:

- Autocad DXF files (*.dxf). All types of lines and curves are imported as markers.
- IGES files (*.igs, *.iges). The following entities are imported as markers:
  - ✓ NURB curves (entity 126)
  - ✓ Copious data (entity 106)
- DELFTship marker files (*.mrk). This native file format is supplied to exchange markers between different (versions of) designs. See also File import how to import markers directly from an existing DELFTship project.
- Text files (*.txt). If you need a different way to import markers you can specify the data yourself in a text file. The file should meet the following format:
  - ✓ The first line of the file must either be a 0 (zero) or a 1. A zero indicates that all coordinates are in meters while a one indicates that the coordinates are in feet.
  - ✓ Each curve is defined by a sequence of X,Y and Z coordinates separated by at least 1 space.
  - ✓ Optionally add the word "KNUCKLE" after the z coordinate to introduce a knuckle point in the curve.
  - ✓ The end of a curve is indicated by an empty line after the last coordinate.
  - ✓ The last line in the file should be 'EOF'. The following is an example of a file containing 3 longitudinal curves.

```
1
        0.000   0.000   0.150
        0.856   0.000   0.048
        1.884   0.000  -0.046
        3.939   0.000  -0.158 KNUCKLE
        4.966   0.000  -0.184
        5.994   0.000  -0.195
        8.049   0.000  -0.192
        9.590   0.000  -0.163
       10.618   0.000  -0.122
       11.645   0.000  -0.059
       13.700   0.000   0.150

       -0.771   0.000   1.056
        0.685   0.662   0.844
        2.398   1.219   0.666
        4.110   1.536   0.565
        5.822   1.664   0.524
        7.535   1.672   0.522
        9.248   1.575   0.553
       10.960   1.300   0.640 KNUCKLE
       12.672   0.795   0.802
       14.471   0.000   1.056

       -0.053   0.000   1.683
        0.856   0.421   1.498
        2.911   1.071   1.211
        4.966   1.375   1.077
        7.021   1.436   1.050
        9.076   1.344   1.090
       11.131   0.989   1.247
       13.186   0.272   1.563
       13.753   0.000   1.683
EOF
```

example of DEFLTship marker txt file

Export markers

All available marker curves are exported to a file in the native file format of DELFTship. This file has the extension .mrk and can be imported into other designs.

Delete markers

This deletes all markers from the model. This option is disabled if there are no markers present in the model.

Weld

When a marker curve is split after import, but the separate curves share their end/starting point, they can be (re)joined. This will do two things: it will joint the two segments into one, and it will remove the knuckle that was the result of the split.

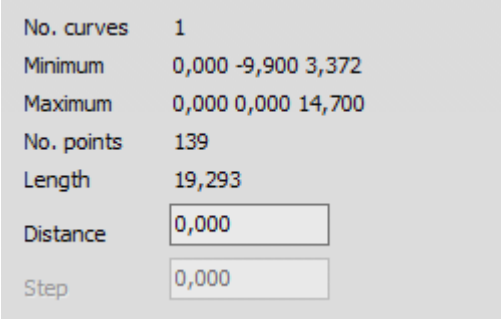
Fit surface

If multiple marker curves approach the surface you want to create (see below: Move markers on how to accomplish this) a surface can be added. This surface ill run approximately through the curves.

Select all the markers (in order!) and click the Fit surface button. It helps to not select too many points here, since the resulting surface may still need tweaking.

Move markers

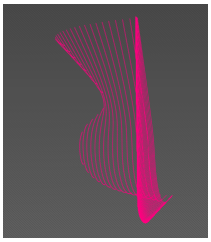
In some cases it can be useful to reposition marker curves in 3D. For example a 2D marker curves file containing stations could be placed along the hull to check accuracy and enhance understanding of the design. Click (select) a marker curve to display the marker curve details window. This window shows the number of curves selected, the minimum and maximum coordinates of the curves (the 'bounding box'), the number of marker points involved and the total length of the selected curves.



Marker curve details window

It also contains two editable fields, Distance and Step. The Distance field can be used to offset the selected curve(s) the specified amount. The curves will be moved in a direction perpendicular to the plane of the curve (so frames will be moved along the X-axis). Not that if the orientation of the intersecting plane cannot be determined, this field will be disabled. This will happen for 3D curves and for straight lines.

If multiple curves are selected, the Step field can be used to specify an increment with which subsequent curve is moved relative to the first one. This can be specifically useful in the case of frames- supposing the frame distance is a constant 0.6 meters, the shape of the hull can be re-created by selecting the curves in the desired order(back to front, since the increment is *added* to each next offset) and enter the distance and step values. The image to the left could be the result.


Marker curves moved to show hull shape

3.6.2.6 3D primitives menu

Add box

Use this option to add a box shaped volume to your model, for example to represent a superstructure or as a starting point for a new hull. The box can be added to either the currently active layer or to a new layer. Boxes are often used for on-deck structures.

If two points were selected when this button is clicked, they will be pre-entered as corner points for one side of the box.

Add cylinder

Add a cylinder or a cone to the model. You can specify the start point, endpoint, radius at start, radius at end and number of points in the pop-up. The *resulting* cylinder will have the specified radius- the actual control points may be located outside of the cylinder. Optionally the cylinder can be added to the currently active layer or to a new layer. The minimum number of points that can be used to form the cylindrical shape is 4, however 6 or more is recommended. A common use for cylinders is to model bow thruster tunnels

If two points were selected when this button is clicked, they will be pre-entered as startpoint and endpoint of the cylinder.

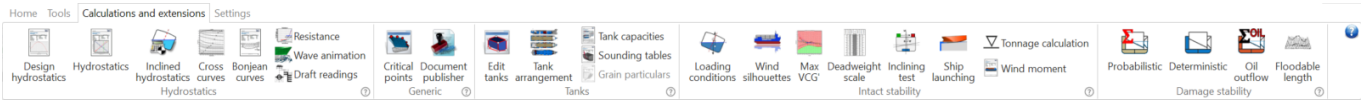
Add sphere

Adds a sphere with set center point, diameter and number of faces. The minimum number of faces required for a sphere is 4, but 6 or more is recommended. Spheres can be used as decorations (radar domes) or tanks.

If two points were selected when this button is clicked, they will be pre-entered as center (first point) and radius (second point)

> *Tip: Select two control points to have DELFTship suggest begin and end points for the shape:*
>
> *Cylinder: Start and Endpoints*
> *Box: Corner points*
> *Sphere: Center and Radius*

3.6.3 Calculations and extensions tab



'Calculations and extensions' Tab

The 'Calculations and extensions' tab gives access to DELFTship main calculation and extension tools. The image above may differ from what you see depending on the installed extensions - Extensions (and related commands) are not part of the basic Hull modeling module. More information can be found on the DELFTship website.

3.6.3.1 Hydrostatics menu

Design hydrostatics

Calculate hydrostatics for the design condition and create a report.

Hydrostatics

Calculate hydrostatics for a range of input data.

Bonjean curves

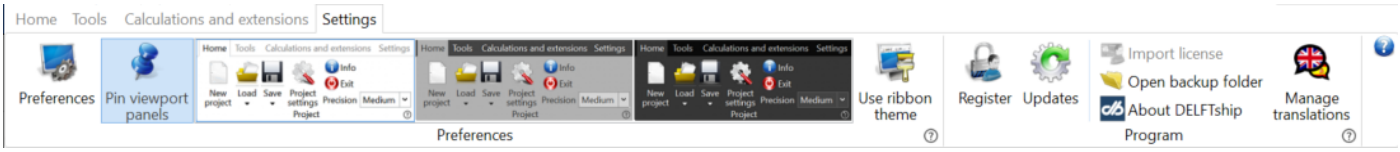
Calculate Bonjean curves

Resistance

Calculate the hull resistance.

3.6.4 Settings tab

The Settings tab contains application specific settings- use these to influence behavior of DELFTship: here you can open the detailed Preferences window, apply themes (via the Appearance group), enlarge the menu items for use with a touch screen (the Touch mode), check your registration status and program version, manually check for updates and access the DELFTship backup folder. This backup folder contains some preference files and a lock file for your currently open project.



Preferences

Preferences

The Preferences button opens a detailed program preferences window. The actual appearance of this window differs depending on which extensions are installed with the main program: generally each extension has its own tab page. 'Reset' can be used to revert to the default settings

Pin viewport panels

If you have a large enough screen it may be preferable to leave the Viewport menu visible at all times. Clicking the pin on the panel will pin them for the session, this button will save the preference after restarting DELFTship.

Ribbon themes

Multiple themes are available. Selecting a theme (by clicking it) immediately applies the theme to the ribbon menus.

Use ribbon theme

The 'Use ribbon theme' button toggles the application of the selected ribbon theme to most other DELFTship GUI elements (such as tables and screens)

Program

Upgrade to Professional

Purchase a license for DELFTship Professional. This is a software update, not an activation only, so after purchase you will have to download and install your new software. It is highly recommended to uninstall any other version of DELFTship before installing your new license.

Clicking this button will take you to our web store where you can purchase your new professional license.

Updates

Check online for updates to DELFTship and installed extensions. A dialog will show whether updates are found, and the progress of the update.

Manage translations

Help us by translating DELFTship to your own language! DELFTship now uses .po (portable object) language files, which can be edited with standard tools, such as PO Edit (https://poedit.net/)

You can also load a translation for your use in this window. See for details the Translations page.

Open backup folder

This button opens the system folder where DELFTship stores license info, backup data and many program settings. Please only modify files in this folder when instructed to do so.

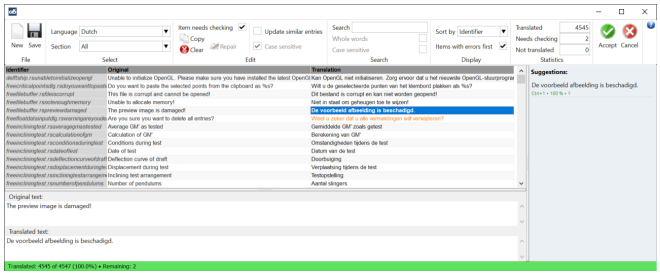
About DELFTship

Shows information about your module code (1 = Professional) version, build number etc.

About DELFTship

3.6.4.1 Translations

Translate DELFTship



Translate DELFTship

While DELFTship offers translations (Settings-> Preferences->General tab->Language) that were made available by the community, your language might not be there or be incomplete.

If you want to help us translate DELFTship, we would welcome your input! This interface is made available to help you do just that.

The language files are in your DELFTship program folder, in the 'languages' sub folder and follow the naming convention:

DELFTship.[ISO639-1 code].po, so for Dutch it will be : DELFTship.nl.po

When you open the translations window and you are running the standard English, you will be asked if you want to create a new translation. If you answer 'yes' the next window prompts for a language. Choose the desired language from the list. If your language is not in this list, send us a message- we'll add it. Choose 'No' if you want to open an existing language file for editing.

The main body of the window displays 3 columns:

- The first column display the name or identifier of the text (say the button or windows control where the text is displayed). The identifier can be useful to see what *kind* of text is represented, like a hint or a caption.
- The second column shows the original (English) text.
- The third column displayes the translated text where different font colors having the following meaning:
  - Lines which have no translation are displayed using a red background.

- Translated - but not yet accepted - entries are displayed using orange text. These are also called 'fuzzy' entries. Fuzzy entries are ignored by the GUI until these have been confirmed to be correct. Confirming a translation is done by pressing the 'Enter' key. You can also use Ctrl-Enter to confirm a translation, in this case the program will automatically jump to the next untranslated or fuzzy entry.
- Translated entries with an error are displayed using red text. These errors could indicate incorrect character casing, or an incorrect end of the line - say an exclamation or question mark is missing. Often these errors can be automatically fixed by the software.
- Finally translated and confirmed lines are displayed in black.

When you are done, click 'Save' to store your work. Clicking 'Accept' will also update the user interface to reflect the changes you have made.

New

Start a new translation (language). Choose the language from the drop down box. If you want to add a language that is not in the list (we use the ISO 639-1 list) you can add your own by creating a copy of an existing language file.

Save

Save your current translation work.

Language

The list with detected language files.

Section

Translated text is grouped in different sections. generally a section corresponds to a window. The 'resourcestring' section contains entries which do not correspond to a specific window. Most of these entries are used in various reports. The 'All' section shows the entire language file.

Copy

Copy the original (source) sentence into the translation field

Clear

Remove the selected translation (sentence)

Repair

The repair option will try to automatically repair a translation when an error is detected.

The following errors are currently detected:

- Mismatch at the start of the sentence - The first translated character should be either upper or lower case to correspond with the original sentence. This can be automatically corrected.
- Mismatch at the end of a sentence. In most cases this means a period, exclamation or question mark is missing at the end of the translation. This can be automatically corrected.
- Mismatch in variable count. A lot of the original sentences contain a number of '*%s*' words. These are variables. Each %s entry is replaced by a word or sentence by the software. The number of variables in the translated text

must be identical to the original text. This error can NOT be automatically corrected since the position of each variable in the trasnslated sentence is language specific and cannot be predicted by the translation window.

Update similar entries

When enabled the software will automatically search for identical entries to the one you are translating. All identical entries will be receive the same same translation.

Case sensitive

Will only be enabled when 'Update similar entries' is enabled and indicate if a case sensitive search is applied when finding similar entries.

Statistics

The statistics menu group shows the number of entries which have been translated, require attention (fuzzy entries) or have not yet been translated.

The status bar displays the same information in a graphical way.

Hydrostatic calculations

Part IV

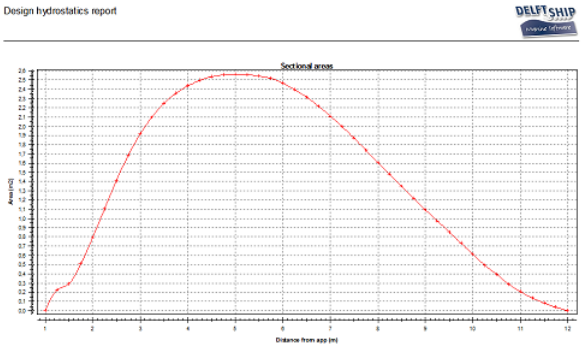
Part IV Hydrostatic calculations

4.1 Design hydrostatics

Create an elaborate design hydrostatics report based on level trim and design-draft condition. The design draft is specified in the Main particulars tab of the project settings. How coefficients are configured and calculated is explained in the project settings chapter.

In addition to the common hydrostatic properties the report includes the total surface area and center of gravity for each layer. These layer properties are calculated for the entire ship (i.e. both sides).

If your model contains stations the sectional area curve is also plotted.

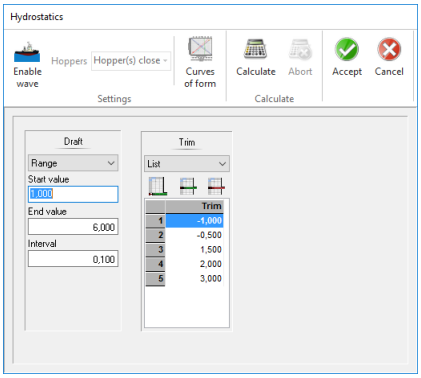


Sectional area curve

The units used for the report are configured with the 'Project units' button, on the Coordinate system tab of the project settings.

4.2 Hydrostatics

Calculate hydrostatic properties of your hull. The image to the right shows the hydrostatics window where the range of drafts and trims to be used for the calculations can be specified.



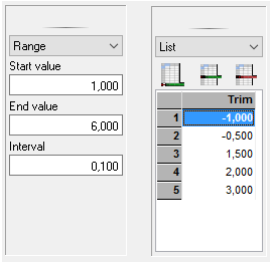
Draft and Trim are given in in meters, as defined in the DELFTship coordinate system.

Values can be specified either as a list (manually entered values) or as a logical range (start, end and incremental value).

- *Range* A range is an uninterrupted list, defined by a start value, an end value and an interval. The range is then created by repeatedly adding the interval to the start value until the end value is reached (or exceeded). A range is quick and simple to define but not very flexible.
- *List* Elements in a list can be edited manually- so a list is not necessary a logical uninterrupted range between values. Lists are manually entered and maintained, but very flexible.

Switching between List and Range

Once entered, DELFTship will remember both the List and the Range settings s you can switch between them freely. When there is no list defined, a list can be generated by first creating a Range and then selecting 'List' from the drop down. So, if you want to generate a list make sure you emptied any existing list before creating the Range. Switching back to List generates a list based on the specified range. This allows you to add or remove elements to a range, giving greater flexibility.



Draft and trim edit window

The free version of DELFTship can only calculate one trim value at a time. For a full list of additional functionality in DELFTship Pro, see the DELFTship site, bottom of the page. Upgrade to professional to calculate a range of trims.

 Click the calculate button to start generating the report. If the calculation takes too long or you want to interrupt the process for any reason, click the Abort button: 

4.3 Bonjean curves

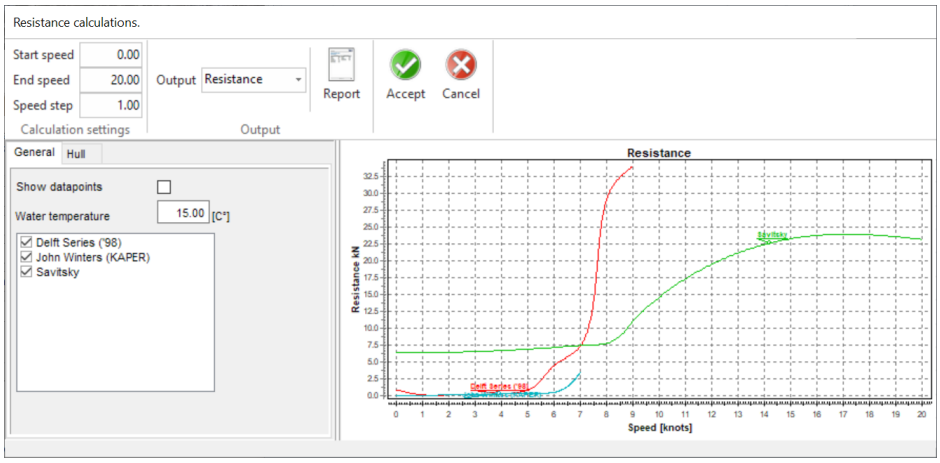
Bonjean curves are plots of the section areas versus draft for different stations in the hull of a vessel and are mostly obsolete.

The option will only be enabled if your model contains stations and it will generate a report for each station for a user specified range of drafts.

4.4 Resistance

DELFTship currently contains several empirical methods to predict the resistance of a model. The resistance module is created so all data relevant to the different prediction methods only needs to be specified once. Most hull form parameters are extracted automatically from the model, while it remains possible to enter (or override) those parameters manually.

The first tab page contains a list with the methods that are available, tick the box of those that should be included in the calculations. For easy comparison the graphs representing the results of each selected method are drawn in one window.

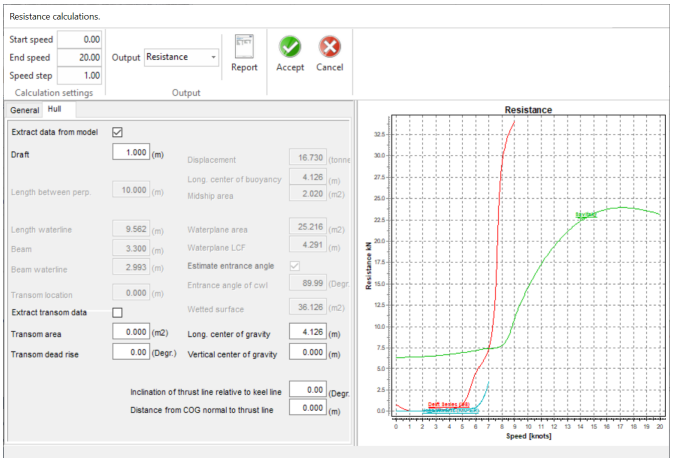


Resistance window

The report button shows the numerical results from the calculations for the selected prediction methods in a single report.

The 'Hull and Appendages' tabs give access to relevant properties that should be included in the calculations. Either get the data from the model, or modify manually to investigate the impact of different scenarios.

DELFTship Free has Delft series and Winters (Kaper) included. Savitsky (planing hulls) and Hollenbach are available as a Resistance extension



Relevant data can be read data from model

Calculation methods

- **Delft series** - The Delft series resistance calculation is a method that is intended for fin-keeled yachts. From version 3.2 and up the results are based on a the

publication from 1998. It's a statistical method based upon a whole series of models that are tested over the years in the towing tank of the Delft University of Technology. The software does not restrict the calculations to use only models that that are in the same range as those of the tested models. Results of models that are outside the range however can be very inaccurate with sometimes even negative results for the residual resistance.

- John Winters (Kaper) - The KAPER resistance method is intended for canoes and kayaks. It was originally developed by John Winters, a naval architect now specializing in designing canoes and kayaks. (See http://www.greenval.com/jwinters.html) It is based on statistical data obtained by model tests. His method is later extended by Matt Broze to higher speed/length ratios and to incorporate more variables into the equations. This extended version is available in the form of an Excel spreadsheet from http://www.marinerkayaks.com/mkhtml/downloads.htm. However while implementing this method in DELFTship two serious discontinuities showed up in the curve of residual resistance. These consist of a sudden drop in resistance of about 10% at speed/length ratios of 1.4 and 1.6 and are the result of a correction implemented by Matt. After careful consideration the decision was made to only allow calculations up to a speed/length ratio of 1.4 in order not to give the user a false sense of accuracy. The center of buoyancy used in the Kaper method is measured from the bow and made dimensionless by dividing the distance by the waterline length.

  The range of valid parameters for the KAPER method is:

  - Prismatic coefficient 0.48-0.64
  - Submerged transom ratio 0.0-0.04

  None of the other variables other than the waterline entrance angle is allowed to be zero.

Scripting tool

Part V

Part V Scripting tool

The Scripting tool allows you to automate DELFTship tasks in a script. One of the possible applications is running lengthy calculations on a schedule, another is tweaking a design to optimize for a parameter: increase a value in increments, calculate the result, stop when a value has been attained.

Delftship Scripting uses the Pascal programming language as its basis. For a list of available commends see the Syntax page.

Example scripts can be found in the Scripts folder of your DELFTship installation (for standard installations this is "C:\Program Files\DELFTship\Scripts")

Many commands available on our Syntax page are only available if you have the related extensions installed. For example, tank operations can not be performed without the Tanks extension.

Pressing the "F1" key in the Editor will open the list of all scripting commands, regardless of your extensions.

Structure

DELFTship scripting files can be divided in three types of files: Project , Progam files and Units.

Program and Unit files contain code, while the Project file contains 'meta data' such as current open files, breakpoints etc.

File types

DELFTship scripts have two distinct file types. Normally you would only ever open and use the project file, as this contains all required information for the project you are working on. You can only have one project open in DELFTship at any given time.

If you open a script file (.dps) in the editor and the script file is a Program, DELFTship will check if the program belongs to the current project. If not you will be prompted to save and close your current project before opening the new file.

.dpp

Delftship Pascal Project files contain project related information such as breakpoints, files that are open in the editor, location of the cursor in the file, etc.

.dps

Delftship Pascal Script files contains the actual code. There are two types of script files: Program and Unit

Each project must have one program file and the program file and the Project file have the same name.

A program can use multiple Unit files so logic can be re-used and organized.

Both types have their own syntax which is created for you when you create a new file.

Variables and syntax

Like any programming environment, DELFTship scripting uses variables and functions. Many of those are 'generic' code, defining the structure of the program. Examples are String, Integer, Boolean etc, and functions like For, While and If.

Then there are specific DELFTship variables, such as Ship (datatype: TFreeShip). For a list of available DELFTship commands and variables see the Syntax page. Note that the syntax page lists all existing DELFTship variables- which ones are available to you depends on your DELFTship extensions.

The 'Ship' global variable is always available, and provides access to DELFTship specific features/functionality. It is where you can get information from, perform calculations on and make modifications to your model.

5.1 Scripting tool Menu

New Project

Create a new program (project). A skeleton program file will be created.

Load

Open a unit of a program/project.

If you choose to open a program, the current program will be closed.

Save

Save the current tab to file. Please note that the file name must match the name of the unit / program or your program may not work.

New Unit

Create a new unit. A skeleton unit file will be created.

Close

Close the current tab. Only units can be closed.

Find / Find next (Ctrl-F / F3)

Search the currently active code. Optionally search/replace words in your code

Compile (Ctrl-F9)

Saves your codes and tries to compile it. Compile errors will be shown on the 'messages' tab at the bottom of the window

Run (F9)

Saves and runs your code. Compile errors will be shown on the 'messages' tab at the bottom of the window. Output of your code (e.g. writeln( )) is written to the 'Console' tab at the bottom of your screen

Stop

Stop (interrupt) the execution of your code

Step (F8)

If a break point (F5) has been encountered in your code, you can use the 'Step' function to step through your code line-by-line.

Continue (Shift F9)

If a break point has been encountered the script editor wail pause, allowing you to check variables and step through your code. the Continue buttong resumes code execution until the next breakpoint is encountered.

Break point (F5)

Place a break point at the current line in the editor.

Code format (Ctrl-D)

Format the code in the active tab by adding indentation and line breaks, making the code easier to read.

5.2 Running scripts

Running a script from the Script editor

When a script is run from the Script editor (using the 'Run' button or F9 key) the program will be compiled and run. If break points are present, code execution will pause on that line,. A paused script can be stepped through with the 'Step'(F8) key to run the code line-by-line.

or 'Continue' (shift F9) to continue running normally.

When the next break point is encountered, the script will pause again.

Running a script from the command line

Scripts started from the command line do not respond to breakpoints.

DELFTship can be started with a command line parameter to immediately execute a specified script:

```
delftship.exe -r <scriptname>
```

The Script name specified must include the full path and the extension. It must refer to the project file (.dpp) rather than the actual script:

```
delftship.exe "E:\scripts\stab_calculations\calculate_all.dpp"
```

5.3 Syntax

5.3.1 Variables

Ship = Ship: TFreeShip

5.3.2 Types

AnyMethod = procedure;

Boolean = (False, True);

HWND = LongInt;

TAlign = (alNone, alTop, alBottom, alLeft, alRight, alClient);

TAlignment = (taLeftJustify, taRightJustify, taCenter);

TBorderIcon = (biSystemMenu, biMinimize, biMaximize, biHelp);

TBorderIcons = set of TBorderIcon;

TBorderStyle = TFormBorderStyle;

TCloseAction = (caNone, caHide, caFree, caMinimize);

TCloseEvent = procedure(Sender: TObject; var Action: TCloseAction);

TCloseQueryEvent = procedure(Sender: TObject; var CanClose: Boolean);

TComponentState = set of TComponentStateE;

TComponentStateE = (csLoading, csReading, csWriting, csDestroying, csDesigning, csAncestor, csUpdating, csFixups, csFreeNotification, csInline, csDesignInstance);

TCursor = Integer;

TDragDropEvent = procedure(Sender, Source: TObject; X, Y: Integer);

TDragKind = (dkDrag, dkDock);

TDragMode = (dmManual, dmAutomatic);

TDragOverEvent = procedure(Sender, Source: TObject; X, Y: Integer; State: TDragState; var Accept: Boolean);

TDragState = (dsDragEnter, dsDragLeave, dsDragMove);

TDuplicates = (dupIgnore, dupAccept, dupError);

TEndDragEvent = procedure(Sender, Target: TObject; X, Y: Integer);

TEShiftState = (ssShift, ssAlt, ssCtrl, ssLeft, ssRight, ssMiddle, ssDouble,ssMeta, ssSuper, ssHyper, ssAltGr, ssCaps, ssNum,ssScroll,ssTriple,ssQuad);

TFormBorderStyle = (bsNone, bsSingle, bsSizeable, bsDialog, bsToolWindow, bsSizeToolWin);

TFormStyle = (fsNormal, fsMDIChild, fsMDIForm, fsStayOnTop);

TGetStrProc = procedure(const S: string);

THandle = LongInt;

THelpContext = LongInt;

THelpEvent = function (Command: Word; Data: LongInt; var CallHelp: Boolean): Boolean;

TIdleEvent = procedure (Sender: TObject; var Done: Boolean);

TIFException = (ErNoError, erCannotImport, erInvalidType, ErInternalError, erInvalidHeader, erInvalidOpcode, erInvalidOpcodeParameter, erNoMainProc, erOutOfGlobalVarsRange, erOutOfProcRange, ErOutOfRange, erOutOfStackRange, ErTypeMismatch, erUnexpectedEof, erVersionError, ErDivideByZero, ErMathError,erCouldNotCallProc, erOutofRecordRange, erOutOfMemory, erException, erNullPointerException, erNullVariantError, erInterfaceNotSupported, erCustomError);

TKeyEvent = procedure (Sender: TObject; var Key: Word; Shift: TShiftState);

TKeyPressEvent = procedure(Sender: TObject; var Key: Char);

TModalResult = Integer;

TMouseButton = (mbLeft, mbRight, mbMiddle);

TMouseEvent = procedure (Sender: TObject; Button: TMouseButton; Shift: TShiftState; X, Y: Integer);

TMouseMoveEvent = procedure(Sender: TObject; Shift: TShiftState; X, Y: Integer);

TNotifyEvent = procedure (Sender: TObject);

TOperation = (opInsert, opRemove);

TPoint = record X,Y: LongInt; end;

TPosition = (poDesigned, poDefault, poDefaultPosOnly, poDefaultSizeOnly, poScreenCenter, poDesktopCenter, poMainFormCenter, poOwnerFormCenter);

TPrintScale = (poNone, poProportional, poPrintToFit);

TRect = record Left, Top, Right, Bottom: Integer; end;

TScrollBarInc = SmallInt;

TScrollBarKind = (sbHorizontal, sbVertical);

TShiftState = set of TEShiftState;

TStartDragEvent = procedure (Sender: TObject; var DragObject: TDragObject);

TStringArray = array of string;

TVarType = Word;

TWindowState = (wsNormal, wsMinimized, wsMaximized);

T3DCoordinate = record X,Y,Z:TFloatType;end;

T3DPlane = record a,b,c,d:TFloatType;end;

T3DPlanes = array of T3DPlane;

TFloatType = double;

TFreeCompartmentSide = (CsPort, CsStarboard, CsCenter);

TFreeCompartmentSign = (CsPositive, CsNegative);

TFreeCompartmentType = (CtBoxSimple, CtBoxAdvanced, CtExtruded);

TFreeCoordinateArray = array of T3DCoordinate;

TFreeCriticalPointType = (CtMarker, CtDownFlooding, CtWeatherTight, CtDeckLine, CtMarginline, CtDeprecated_1, CtDeprecated_2, CtDeprecated_3, CtEscapeRoute, CtClassABulkhead, CtDeprecated_4);

TFreePlaneType = (PtXY, PtXZ, PtYZ, PtFree);

TFreeProbDamDraftSet = set of TFreeProbDamDraftType;

TFreeProbDamDraftType = (FdLightService, FdPartial, FdSummer);

TFreeSoundingDeviceType = (SgPipe, SgLevelSensorUp, SgLevelSensorDown);

TFreeStiffeningType = (stLongitudinal, stTransverse);

TFreeWeightColorMode = (cmAncestor, cmThickness);

THydrostaticsBalanceOutput = Record Draft:TFloatType; Trim:TFloatType; Displacement:TFloatType; CenterOfBuoyancy:T3DCoordinate;KNSinPhi:TFloatType; GZ:TFloatType;WaterlinePlane:T3DPlane; end;

THydrostaticsOutput = Record Draft,Trim,MouldedVolume,TotalVolume,Displacement,KMLongitudinal,KMtransverse,LengthWaterline,BeamWaterline,WettedSurface:TFloatType; CenterOfBuoyancy:T3DCoordinate;WaterlinePlane:T3DPlane; WaterPlaneArea:TFloatType; end;

TWeightInfo = record Area:TFloatType; Volume:TFloatType; Weight:TFloatType; CenterOfGravity:T3DCoordinate; end;

5.3.3 Procedures

procedure _T(Name: tbtString; V: Variant);

function _T(Name: tbtString):Variant;

function Abs(E: Extended):Extended;

function AnsiLowerCase(S: string):string;

function AnsiUpperCase(S: string):string;

function Assigned(I: LongInt):Boolean;

function BoolToStr(Val: Boolean):string;

procedure Cls;

function CompareText(S1: string; S2: string):LongInt;

function Copy(S: AnyString; iFrom: LongInt; iCount: LongInt):AnyString;

function Cos(E: Extended):Extended;

function Date:TDateTime;

function DateTimeToStr(D: TDateTime):string;

function DateTimeToUnix(D: TDateTime):Int64;

function DateToStr(D: TDateTime):string;

function DayOfWeek(DateTime: TDateTime):Word;

procedure Dec(x);

procedure DecodeDate(DateTime: TDateTime; Year: Word; Month: Word; Day: Word);

procedure DecodeTime(DateTime: TDateTime; Hour: Word; Min: Word; Sec: Word; MSec: Word);

procedure Delete(S: AnyString; iFrom: LongInt; iCount: LongInt);

function EncodeDate(Year: Word; Month: Word; Day: Word):TDateTime;

function EncodeTime(Hour: Word; Min: Word; Sec: Word; MSec: Word):TDateTime;

function ExceptionParam:string;

function ExceptionPos:LongWord;

function ExceptionProc:LongWord;

function ExceptionToString(er: TIFException; Param: string):string;

function ExceptionType:TIFException;

procedure Exclude(s; m);

function FileExists(Filename: string):Boolean;

function FindFiles(SearchPath: string; SearchMask: string; SearchSubDirs: Boolean):TStringList;

function FloatToStr(E: Extended):string;

function FloatToTxt(Input: Extended; Decimals: LongInt):string;

function FormatDateTime(fmt: string; D: TDateTime):string;

function GetArrayLength(Arr):LongInt;

function GetTickCount:Int64;

function High(X):Int64;

function IdispatchInvoke(Self: IDispatch; PropertySet: Boolean; Name: AnsiString; Par: array of Variant):Variant;

procedure Inc(x);

procedure Include(s; m);

procedure Insert(S: AnyString; s2: AnyString; iPos: LongInt);

function Int(E: Extended):Extended;

function Int64ToStr(I: Int64):string;

function IntToStr(I: Int64):string;

function Length(S):LongInt;

function Low(X):Int64;

function LowerCase(S: AnyString):AnyString;

function Now:TDateTime;

function Null:Variant;

function PadL(S: AnyString; I: LongInt):AnyString;

function PadR(S: AnyString; I: LongInt):AnyString;

function PadZ(S: AnyString; I: LongInt):AnyString;

function Pi:Extended;

function Pos(SubStr: AnyString; S: AnyString):LongInt;

procedure RaiseException(Ex: TIFException; Param: string);

```
procedure RaiseLastException;
function ReadIn(question: string):string;
function Replicate(C: Char; I: LongInt):string;
function Round(E: Extended):LongInt;
procedure SetArrayLength(arr; count: LongInt);
procedure SetLength(s; NewLength: LongInt);
function Sin(E: Extended):Extended;
function SizeOf(Data):LongInt;
procedure Sleep(TimeMsec: LongWord);
function Sqrt(E: Extended):Extended;
function StrGet(S: string; I: LongInt):Char;
function StrGet2(S: string; I: LongInt):Char;
function StringOfChar(C: Char; I: LongInt):string;
procedure StrSet(C: Char; I: LongInt; S: string);
function StrToDate(S: string):TDateTime;
function StrToFloat(S: string):Extended;
function StrToInt(S: string):LongInt;
function StrToInt64(S: string):Int64;
function StrToInt64Def(S: string; def: Int64):Int64;
function StrToIntDef(S: string; def: LongInt):LongInt;
function Time:TDateTime;
function Trim(S: AnyString):AnyString;
function Trunc(E: Extended):LongInt;
function TryEncodeDate(Year: Word; Month: Word; Day: Word; Date: TDateTime):Boolean;
function TryEncodeTime(Hour: Word; Min: Word; Sec: Word; MSec: Word; Time: TDateTime):Boolean;
function Unassigned:Variant;
function UnixToDateTime(U: Int64):TDateTime;
function UpperCase(S: AnyString):AnyString;
function VarArrayGet(S: Variant; I: LongInt):Variant;
procedure VarArraySet(C: Variant; I: LongInt; S: Variant);
function VarIsEmpty(V: Variant):Boolean;
function VarIsNull(V: Variant):Boolean;
function VarType(V: Variant):Word;
procedure Writeln(s: string);
function WStrGet(S: AnyString; I: LongInt):WideChar;
```

procedure WStrSet(C: AnyString; I: LongInt; S: AnyString);

function CoordToText(P: T3DCoordinate; Decimals: Byte):string;

function PlaneToText(Plane: T3DPlane; Decimals: Byte):string;

function SplitString(Input: string; Separators: array of string; ExcludeEmpty: Boolean):TStringArray;

function ValidFloatVal(Input: string; Output: Double; ReportError: Boolean):Boolean;

5.3.4 Classes

TBits
- function OpenBit:LongInt;
- property Bits[Index: integer]:Boolean R/W
- property Size:LongInt R/W

TCustomMemoryStream
- function CopyFrom(Source: TStream; Count: LongInt):LongInt;
- function Read(Buffer: string; Count: LongInt):LongInt;
- procedure ReadBuffer(Buffer: string; Count: LongInt);
- procedure SaveToFile(FileName: string);
- procedure SaveToStream(Stream: TStream);
- function Seek(Offset: LongInt; Origin: Word):LongInt;
- function Write(Buffer: string; Count: LongInt):LongInt;
- procedure WriteBuffer(Buffer: string; Count: LongInt);
- property Position:LongInt R/W
- property Size:LongInt R/W

TFileStream
- function CopyFrom(Source: TStream; Count: LongInt):LongInt;
- function Create(FileName: string; Mode: Word):TFileStream;
- function Read(Buffer: string; Count: LongInt):LongInt;
- procedure ReadBuffer(Buffer: string; Count: LongInt);
- function Seek(Offset: LongInt; Origin: Word):LongInt;
- function Write(Buffer: string; Count: LongInt):LongInt;
- procedure WriteBuffer(Buffer: string; Count: LongInt);
- property Handle:LongInt R
- property Position:LongInt R/W
- property Size:LongInt R/W

THandleStream
- function CopyFrom(Source: TStream; Count: LongInt):LongInt;
- function Create(AHandle: LongInt):THandleStream;
- function Read(Buffer: string; Count: LongInt):LongInt;
- procedure ReadBuffer(Buffer: string; Count: LongInt);
- function Seek(Offset: LongInt; Origin: Word):LongInt;
- function Write(Buffer: string; Count: LongInt):LongInt;
- procedure WriteBuffer(Buffer: string; Count: LongInt);
- property Handle:LongInt R
- property Position:LongInt R/W
- property Size:LongInt R/W

TList

function Add(Item: TObject):LongInt;
procedure Clear;
function Create:TList;
procedure Delete(Index: LongInt);
procedure Destroy;
function IndexOf(Item: TObject):LongInt;
procedure Insert(Index: LongInt; Item: TObject);
property Capacity:LongInt R/W
property Count:LongInt R
property Items[Index: integer]:TObject R/W

TMemoryStream
procedure Clear;
function CopyFrom(Source: TStream; Count: LongInt):LongInt;
procedure LoadFromFile(FileName: string);
procedure LoadFromStream(Stream: TStream);
function Read(Buffer: string; Count: LongInt):LongInt;
procedure ReadBuffer(Buffer: string; Count: LongInt);
procedure SaveToFile(FileName: string);
procedure SaveToStream(Stream: TStream);
function Seek(Offset: LongInt; Origin: Word):LongInt;
procedure SetSize(NewSize: LongInt);
function Write(Buffer: string; Count: LongInt):LongInt;
procedure WriteBuffer(Buffer: string; Count: LongInt);
property Position:LongInt R/W
property Size:LongInt R/W

TObject
function Create:TObject;
procedure Free;

TStream
function CopyFrom(Source: TStream; Count: LongInt):LongInt;
function Read(Buffer: string; Count: LongInt):LongInt;
procedure ReadBuffer(Buffer: string; Count: LongInt);
function Seek(Offset: LongInt; Origin: Word):LongInt;
function Write(Buffer: string; Count: LongInt):LongInt;
procedure WriteBuffer(Buffer: string; Count: LongInt);
property Position:LongInt R/W
property Size:LongInt R/W

TStringList
function Add(S: string):LongInt;
function AddObject(S: string; AObject: TObject):LongInt;
procedure AddStrings(Strings: TStrings);
procedure Append(S: string);
procedure BeginUpdate;
procedure Clear;
function Create:TStringList;
procedure Delete(Index: LongInt);
procedure EndUpdate;
function Equals(Strings: TStrings):Boolean;

procedure Exchange(Index1: LongInt; Index2: LongInt);
function Find(S: string; Index: LongInt):Boolean;
function GetText:PChar;
function IndexOf(S: string):LongInt;
function IndexOfName(Name: string):LongInt;
function IndexOfObject(AObject: TObject):LongInt;
procedure Insert(Index: LongInt; S: string);
procedure InsertObject(Index: LongInt; S: string; AObject: TObject);
procedure LoadFromFile(FileName: string);
procedure LoadFromStream(Stream: TStream);
procedure Move(CurIndex: LongInt; NewIndex: LongInt);
procedure SaveToFile(FileName: string);
procedure SaveToStream(Stream: TStream);
procedure SetText(Text: PChar);
procedure Sort;
property Capacity:LongInt R/W
property CaseSensitive:Boolean R/W
property CommaText:string R/W
property Count:LongInt R
property DelimitedText:string R/W
property Delimiter:Char R/W
property Duplicates:TDuplicates R/W
property Names[Index: integer]:string R
property NameValueSeparator:Char R/W
property Objects[Index: integer]:TObject R/W
property OnChange:TNotifyEvent R/W
property OnChanging:TNotifyEvent R/W
property QuoteChar:Char R/W
property Sorted:Boolean R/W
property StrictDelimiter:Boolean R/W
property Strings[Index: integer]:string R/W
property Text:string R/W
property ValueFromIndex[Index: integer]:string R/W
property Values[param1: string]:string R/W

TStrings

function Add(S: string):LongInt;
function AddObject(S: string; AObject: TObject):LongInt;
procedure AddStrings(Strings: TStrings);
procedure Append(S: string);
procedure BeginUpdate;
procedure Clear;
function Create:TStrings;
procedure Delete(Index: LongInt);
procedure EndUpdate;
function Equals(Strings: TStrings):Boolean;
procedure Exchange(Index1: LongInt; Index2: LongInt);
function GetText:PChar;
function IndexOf(S: string):LongInt;
function IndexOfName(Name: string):LongInt;

function IndexOfObject(AObject: TObject):LongInt;
procedure Insert(Index: LongInt; S: string);
procedure InsertObject(Index: LongInt; S: string; AObject: TObject);
procedure LoadFromFile(FileName: string);
procedure LoadFromStream(Stream: TStream);
procedure Move(CurIndex: LongInt; NewIndex: LongInt);
procedure SaveToFile(FileName: string);
procedure SaveToStream(Stream: TStream);
procedure SetText(Text: PChar);
property Capacity:LongInt R/W
property CommaText:string R/W
property Count:LongInt R
property DelimitedText:string R/W
property Delimiter:Char R/W
property Names[Index: integer]:string R
property NameValueSeparator:Char R/W
property Objects[Index: integer]:TObject R/W
property QuoteChar:Char R/W
property StrictDelimiter:Boolean R/W
property Strings[Index: integer]:string R/W
property Text:string R/W
property ValueFromIndex[Index: integer]:string R/W
property Values[param1: string]:string R/W

TStringStream

function CopyFrom(Source: TStream; Count: LongInt):LongInt;
function Create(AString: string):TStringStream;
function Read(Buffer: string; Count: LongInt):LongInt;
procedure ReadBuffer(Buffer: string; Count: LongInt);
function Seek(Offset: LongInt; Origin: Word):LongInt;
function Write(Buffer: string; Count: LongInt):LongInt;
procedure WriteBuffer(Buffer: string; Count: LongInt);
property Position:LongInt R/W
property Size:LongInt R/W

TFreeControlPlane

function UsesShell:Boolean;
property Text:string R/W

TFreeCriticalPoint

procedure Assign(Org: TFreeCriticalPoint);
procedure Clear;
procedure Delete;
procedure MoveToCorrectList;
property Coordinate:T3DCoordinate R/W
property Description:string R/W
property Enabled:Boolean R/W
property PointType:TFreeCriticalPointType R/W
property Symmetric:Boolean R/W
property Tank1:TFreeTank R/W
property Tank2:TFreeTank R/W

TFreeCriticalPointList
procedure Clear;
procedure DeleteAll;
function NewPoint(PointType: TFreeCriticalPointType):TFreeCriticalPoint;
property Count:LongInt R
property Item[Index: integer]:TFreeCriticalPoint R

TFreeFormDeformation
procedure Transform_HorPlane(Z: LongInt; Transformation: T3DCoordinate);
procedure Transform_LongPlane(Y: LongInt; Transformation: T3DCoordinate);
procedure Transform_Point(X: LongInt; Y: LongInt; Z: LongInt; Transformation: T3DCoordinate);
procedure Transform_TrvPlane(X: LongInt; Transformation: T3DCoordinate);
property ShowInteriorPoints:Boolean R/W

TFreeHydrostaticCalc
function Balance(Displacement: Double; CoG: T3DCoordinate; Output: THydrostaticsBalanceOutput):Boolean;
function Calculate:THydrostaticsOutput;
function FindDraft(Displacement: Double):Boolean;
property Calculated:Boolean R/W
property Draft:Double R/W
property HeelingAngle:Double R/W
property Trim:Double R/W
property TrimAngle:Double R
property WaterlinePlane:T3DPlane R

TFreeLayerBase
procedure Clear;
procedure Delete;
property AlphaBlend:Byte R/W
property Developable:Boolean R/W
property Name:string R/W
property ShowInLinesplan:Boolean R/W
property ShowInLoadCase:Boolean R/W
property Symmetric:Boolean R/W
property UseForIntersections:Boolean R/W
property UseInHydrostatics:Boolean R/W
property Visible:Boolean R/W

TFreeLoadcase
procedure Solve;
property Complies:Boolean R
property Count:LongInt R
property Description:string R/W
property Displacement:Double R
property DisplacementCoG:T3DCoordinate R
property Item[Index: integer]:TFreeLoadcaseItem R
property Solved:Boolean R/W

TFreeLoadcaseItem
property Description:string R/W

TFreeLoadCaseList
property Count:LongInt R

property Item[Index: integer]:TFreeLoadcase R

TFreeMarker
procedure AddPoint(Point: T3DCoordinate; IsKnuckle: Boolean);
procedure Clear;
procedure Delete;
property PlaneType:TFreePlaneType R
property Visible:Boolean R/W

TFreeProbDamageDraftSettings
property Draft:Double R/W
property GM:Double R/W

TFreeProbDamageStability
procedure Calculate(Drafts: TFreeProbDamDraftSet);
procedure GenerateDamageCases;
function IndexAttained_Draft(Draft: TFreeProbDamDraftType):Double;
function IndexRequired_Draft(Draft: TFreeProbDamDraftType):Double;
property AttainedIndex:Double R
property LightServiceDraft:TFreeProbDamageDraftSettings R
property NeedsRegenerate:Boolean R
property PartialDraft:TFreeProbDamageDraftSettings R
property RequiredIndex:Double R
property SummerDraft:TFreeProbDamageDraftSettings R

TFreeShip
procedure Clear;
procedure Extents(BothSides: Boolean; Min: T3DCoordinate; Max: T3DCoordinate);
function FindWeightGroupByName(Name: string):TFreeWeightGroup;
function Load(Filename: string):Boolean;
function NewHydrostaticCalculation:TFreeHydrostaticCalc;
function NewMarker:TFreeMarker;
function NewWeightGroup(Description: string):TFreeWeightGroup;
procedure Rebuild;
procedure Redraw;
function Save(Filename: string):Boolean;
function SaveActiveView(Width: LongInt; Height: LongInt; Filename: string; WhiteBackground: Boolean):Boolean;
function Transformation_Init(BoxMin: T3DCoordinate; BoxMax: T3DCoordinate; NoX: LongInt; NoY: LongInt; NoZ: LongInt):TFreeFormDeformation;
function Transformation_Update(TranformationBox: TFreeFormDeformation):Boolean;
property Build:Boolean R/W
property Display_ControlNet:Boolean R/W
property Display_SkeletonPlanes:Boolean R/W
property Display_Tanks:Boolean R/W
property Layer[Index: integer]:TFreeLayerBase R
property LoadingConditions:TFreeLoadCaseList R
property Marker[Index: integer]:TFreeMarker R
property NumberOfBackgroundImages:LongInt R
property NumberOfLayers:LongInt R
property NumberofMarkers:LongInt R
property Openings:TFreeCriticalPointList R

property ProbDamageStability:TFreeProbDamageStability R
property Skeleton:TFreeSkeleton R
property Tanks:TFreeTankList R
property WeightEstimate:TFreeWeightEstimate R

TFreeShipBase
procedure Clear;
procedure Delete;

TFreeSkeleton
function FindPlaneByName(Name: string):TFreeSkeletonPlane;
function NewPlane(Plane: T3DPlane):TFreeSkeletonPlane;
procedure ShellArea(Area: Double; COG: T3DCoordinate; Layers: TList; ClipPlanes: array of T3DPLANE);
property Count:LongInt R
property Item[Index: integer]:TFreeSkeletonPlane R

TFreeSkeletonPlane
procedure Clear;
procedure Delete;
procedure Rebuild;
procedure UpdateCompartments;
property Alpha:Byte R
property Area:Double R
property Build:Boolean R/W
property CenterOfGravity:T3DCoordinate R
property Description:string R/W
property Distance:Double R/W
property FrameDistance:string R/W
property Plane:T3DPlane R/W
property PlaneType:TFreePlaneType R/W

TFreeSoundingDevice
procedure AddPoint(Point: T3DCoordinate; IsKnuckle: Boolean);
procedure Calculate(Plane: T3DPlane; Sounding: Double; Ullage: Double);
procedure Clear;
procedure Delete;
property DefaultDevice:Boolean R/W
property Description:string R/W
property DeviceType:TFreeSoundingDeviceType R/W

TFreeTank
procedure Assign(Org: TFreeTank);
procedure Clear;
function Copy:TFreeTank;
procedure Delete;
function NewAdvancedCompartment:TFreeTankBoxCompartment;
function NewSimpleCompartment(Aft: string; Fwd: string; Inner: string; Outer: string; Lower: string; Upper: string):TFreeTankBoxCompartment;
function NewSoundingDevice(Description: string; SoundingDeviceType: TFreeSoundingDeviceType):TFreeSoundingDevice;
function SplitAtPlane(Plane: TFreeSkeletonPlane):TFreeTank;
property Active:Boolean R/W

property CentreOfGravity:T3DCoordinate R
property CompartmentSide:TFreeCompartmentSide R/W
property Count:LongInt R
property DamagePermeability:Double R/W
property Density:Double R/W
property Description:string R/W
property Error:Boolean R
property IsHopper:Boolean R
property Item[Index: integer]:TFreeTankCompartment R
property MaxFreeSurfaceMoment:Double R
property NonBuoyant:Boolean R/W
property NumberOfSoundingDevices:LongInt R
property Permeability:Double R/W
property ShortName:string R/W
property SoundingDevice[Index: integer]:TFreeSoundingDevice R
property TankNumber:string R/W
property Volume:Double R
property Weight:Double R
property WeightGroup:TFreeWeightGroup R/W

TFreeTankBase
procedure Clear;
procedure Delete;
property CentreOfGravity:T3DCoordinate R
property CompartmentSide:TFreeCompartmentSide R/W
property Description:string R/W

TFreeTankBoxCompartment
procedure Clear;
procedure Delete;
procedure Rebuild;
property AftBoundary:string R/W
property BreadthBottomAftInside:string R/W
property BreadthBottomAftOutside:string R/W
property BreadthBottomForwInside:string R/W
property BreadthBottomForwOutside:string R/W
property BreadthTopAftInside:string R/W
property BreadthTopAftOutside:string R/W
property BreadthTopForwInside:string R/W
property BreadthTopForwOutside:string R/W
property Build:Boolean R/W
property CentreOfGravity:T3DCoordinate R
property ClipShell:Boolean R/W
property CompartmentSide:TFreeCompartmentSide R/W
property CompartmentType:TFreeCompartmentType R/W
property Description:string R/W
property Error:Boolean R
property ForwardBoundary:string R/W
property HeightBottomAftInside:string R/W
property HeightBottomAftOutside:string R/W
property HeightBottomForwInside:string R/W

property HeightBottomForwOutside:string R/W
property HeightTopAftInside:string R/W
property HeightTopAftOutside:string R/W
property HeightTopForwInside:string R/W
property HeightTopForwOutside:string R/W
property MaxVolume:Double R
property OpenTop:Boolean R/W
property Permeability:Double R/W
property Sign:TFreeCompartmentSign R/W

TFreeTankCompartment
procedure Clear;
procedure Delete;
procedure Rebuild;
property Build:Boolean R/W
property CentreOfGravity:T3DCoordinate R
property ClipShell:Boolean R/W
property CompartmentSide:TFreeCompartmentSide R/W
property CompartmentType:TFreeCompartmentType R/W
property Description:string R/W
property Error:Boolean R
property MaxVolume:Double R
property OpenTop:Boolean R/W
property Permeability:Double R/W
property Sign:TFreeCompartmentSign R/W

TFreeTankList
function FindTankByName(Name: string):TFreeTank;
function NewTank(Name: string):TFreeTank;
property Count:LongInt R
property Item[Index: integer]:TFreeTank R

TFreeWeightAssembly
function AddPlateElement(Description: string; PlaneDefinition: string; TrimmingPlanes: array of string; Symmetric: Boolean; Thickness: Double):TFreeWeightPlateElement;
function AddShellElement(Description: string; TrimmingPlanes: array of string; Symmetric: Boolean; Thickness: Double):TFreeWeightShellElement;
function AddWebElement(Description: string; PlaneDefinition: string; TrimmingPlanes: array of string; Symmetric: Boolean; Thickness: Double):TFreeWeightWebElement;
procedure Clear;
property CenterOfGravity:T3DCoordinate R
property Count:LongInt R
property Description:string R
property Items[Index: integer]:TFreeWeightAssemblyElement R
property WeightInfo:TWeightInfo R

TFreeWeightAssemblyElement
function AddStiffener(Description: string):TFreeWeightStiffener;
function AddTrimmingPlanes(TrimmingPlanes: array of string):Boolean;
procedure Clear;
procedure Rebuild;
property Build:Boolean R/W

property CenterOfGravity:T3DCoordinate R
property Description:string R
property PlaneDefinition:TFreeControlPlane R
property Symmetric:Boolean R/W
property Thickness:Double R/W
property WeightInfo:TWeightInfo R

TFreeWeightEstimate
function AddAssembly(Description: string):TFreeWeightAssembly;
function AddSection(Description: string; Min: T3DCoordinate; Max: T3DCoordinate):TFreeWeightSection;
procedure Clear;
property ColorMode:TFreeWeightColorMode R/W
property Count:LongInt R
property Density:Double R/W
property Items[Index: integer]:TFreeWeightAssembly R
property Section[Index: integer]:TFreeWeightSection R
property SectionCount:LongInt R
property StiffeningType:TFreeStiffeningType R/W
property WeightInfo:TWeightInfo R

TFreeWeightEstimateBase
procedure Clear;
property CenterOfGravity:T3DCoordinate R
property Description:string R
property WeightInfo:TWeightInfo R

TFreeWeightGroup
procedure Clear;
procedure Delete;
property Description:string R/W
property IncludeInLegend:Boolean R
property IncludeInLoadcases:Boolean R/W
property PartOfLightShip:Boolean R/W

TFreeWeightPlateElement
function AddStiffener(Description: string):TFreeWeightStiffener;
function AddTrimmingPlanes(TrimmingPlanes: array of string):Boolean;
procedure Clear;
procedure Rebuild;
property Build:Boolean R/W
property CenterOfGravity:T3DCoordinate R
property Description:string R
property PlaneDefinition:TFreeControlPlane R
property Symmetric:Boolean R/W
property Thickness:Double R/W
property WeightInfo:TWeightInfo R

TFreeWeightSection
procedure Clear;
procedure Rebuild;
property Build:Boolean R/W
property CenterOfGravity:T3DCoordinate R

property Description:string R
property WeightInfo:TWeightInfo R

TFreeWeightShellElement
function AddStiffener(Description: string):TFreeWeightStiffener;
function AddTrimmingPlanes(TrimmingPlanes: array of string):Boolean;
procedure Clear;
procedure Rebuild;
property Build:Boolean R/W
property CenterOfGravity:T3DCoordinate R
property Description:string R
property PlaneDefinition:TFreeControlPlane R
property Symmetric:Boolean R/W
property Thickness:Double R/W
property WeightInfo:TWeightInfo R

TFreeWeightStiffener
procedure Clear;
property Build:Boolean R/W
property CenterOfGravity:T3DCoordinate R
property Description:string R
property WeightInfo:TWeightInfo R

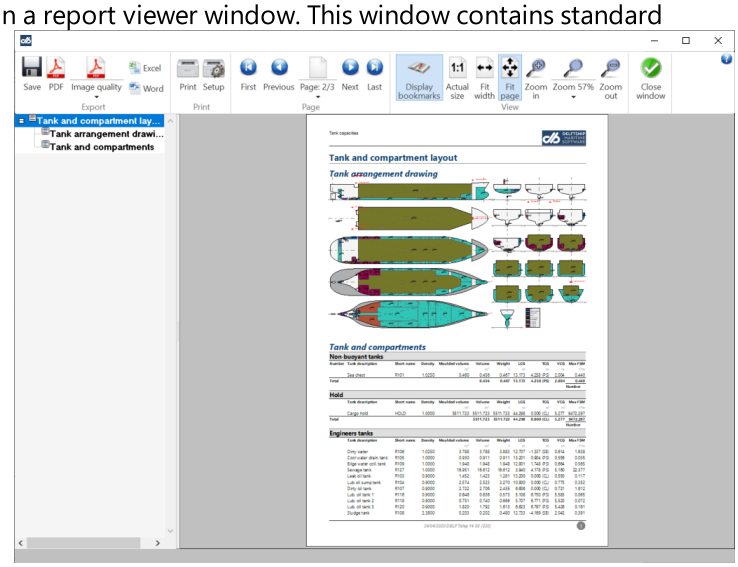
TFreeWeightWebElement
function AddStiffener(Description: string):TFreeWeightStiffener;
function AddTrimmingPlanes(TrimmingPlanes: array of string):Boolean;
procedure Clear;
procedure Rebuild;
property Build:Boolean R/W
property CenterOfGravity:T3DCoordinate R
property Description:string R
property PlaneDefinition:TFreeControlPlane R
property Symmetric:Boolean R/W
property Thickness:Double R/W
property WeightInfo:TWeightInfo R

Report viewer

Part VI

Part VI Report viewer

When DELFTship generates a report, it will be displayed in a report viewer window. This window contains standard browsing and save / export functionalities.



Report viewer

The window is divided in a top ribbon, a document navigator and a graphic viewport.

The top ribbon contains buttons for report actions, such as export, print, navigate and zoom functions. While export to PDF is available for all versions of DELFTship, exporting to Excel and Word are only available in DELFTship Pro. The "*Display Bookmarks*" button toggles visibility of the document navigator.

The navigator shows the document outline, if available. Not all reports have an outline, so the availability of this outline depends on the type of report.

The graphic viewport is where the actual report is shown. Navigate to next, previous, first and last pages using the Page menu group in the ribbon. The ribbon also contains zoom options.

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