ShipShape

WOLFSON UNIT SOFTWARE©

WOLFSON UNIT
FOR MARINE TECHNOLOGY & INDUSTRIAL AERODYNAMICS

SHIPSHAPE

ShipShape is a program for creating, fairing, and interpolating a set of ship's lines. It has been configured to interface with the existing Wolfson Unit Hydrostatics and Stability suite of programs. **ShipShape** is Windows XP/Vista/7 32-bit and 64-bit compatible.

ShipShape is highly flexible and can be used to create many different hull forms, including merchant and fishing vessels, chine craft, yachts and multi-hulls. It employs a fairing method which is intuitive for the user and produces the exact shapes the designer wishes to achieve.

Parametric cubic splines are used to create the curves that define the hull form. This method of curve definition is both versatile and easy to understand, as the cubic spline models a flexible batten held down by spline weights. Since the points defining the curve lie on the hull surface, the approach employed allows the curve to be precisely located at known points, and facilitates the transfer of existing drawings into the fairing program.

A network of interconnected spline curves defines the hull surface. Longitudinals run principally lengthwise along the hull and sections running principally girthwise around it. These curves are linked to each other at specific nodes to create the network.

ShipShape allows initial entry and editing of the curves. To define a new curve the user enters its description, its type (Section or Longitudinal) and the number of points defining the curve. The points can then be entered numerically, in a spreadsheet-like table, or linking to existing curves in the network, or by digitising an existing sketch or lines plan.

Each curve can be edited by moving the points defining it or editing the curvature at the node points. It is also possible to specify the end conditions of the curve, which can be defined as free (no curvature), specified slope or specified curvature. None of the network section or longitudinal curves needs to be plane curves, i.e. longitudinals do not have to be conventional waterplanes nor sections conventional plane transverse sections.

Typically there will be longitudinals representing the deck edge, keel, turn of bilge, garboard and any discontinuities such as chines or knuckles, plus any others needed to adequately define the shape. There will be sections at the stem, amidships and transom, plus a number of intermediate sections, depending on the complexity of the shape. Additional curves may be added as the hull definition progresses, if found necessary, and redundant ones deleted.

Once a curve has been entered, it can be edited by selecting a point and moving it to its new location. If the curve has been linked to other curves in the network, the corresponding points in the other curves will also be moved. The curvature and slope for the curve can be constantly displayed while it is being edited, to show subtle unfairness invisible in the curve display itself. The curvature values themselves can also be edited, giving fine control over the fairness of the curve.

Once curves have been entered, linking them defines where each curve lies on the network. The network is a schematic representation of the ship, consisting of a grid of longitudinal and transverse lines. Each longitudinal and sectional curve must lie along one of these grid lines, although each network grid line may be composed of several individual curves. The user specifies on which network grid line, and where along that line, the curve lies. If the curve crosses a network node where another curve has already been set (e.g. a longitudinal crosses a previously linked section), the existing data for that node are transferred to the new curve. Thus the order in which curves are linked defines which curves are forced in to compatibility with other curves.

When the sections and longitudinals are faired to the user's satisfaction, the data output can be used to generate true sections, waterlines, buttocks and inclined planes at specified planar locations. These can then be output directly to a printer, .DXF file, an offset table file or a file for conversion to another format such as Wolfson Unit Hydrostatics. This module also computes the basic hydrostatics for the ship, including displacement, form parameters, metacentres, centres of buoyancy and flotation, sectional areas and wetted surface area.

ShipShape represents the ship hull by a network of longitudinal and transverse three-dimensional spline curves on the hull surface, as described above. A rectangular grid of intersecting longitudinals and sections represents this network.

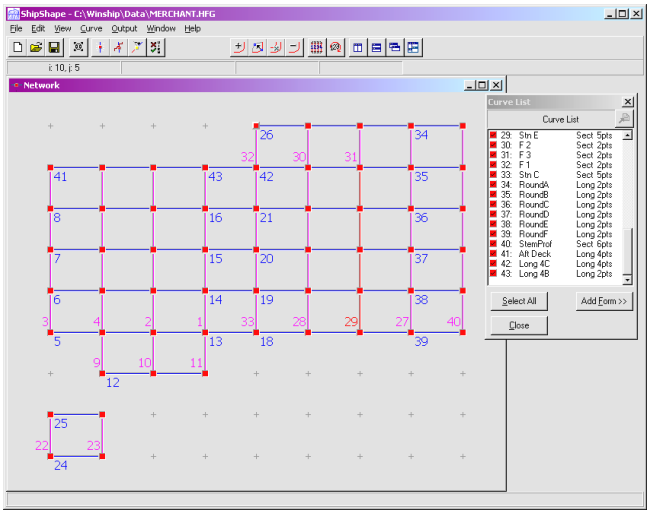


Figure 1 – Defining network of sections

Figure 1 shows such a grid for a typical hull, as seen when linking curves into the network. Horizontal lines represent the longitudinals, and vertical lines represent the sections. A curve number next to the curve start point shows the locations of curves within the network in the grid.

Curves do not need to be continuous across the network, but can start and stop at any intermediate point. This allows for slope discontinuities, such as chines and knuckles. Holes are permitted in the network, allowing for features such as skegs, forecastles, appendages and multihulls.

Wolfson Unit MTIA, University of Southampton, Southampton SO17 1BJ, UK
Tel: +44 (0)23 8058 5044 Fax: +44 (0)23 8059 7594
Email: wumtia@soton.ac.uk Website: www.wolfsonunit.com

UNIVERSITY OF Southampton

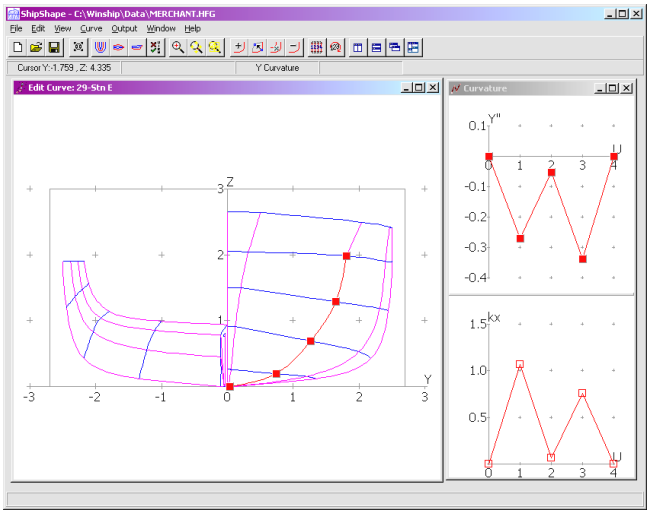


Figure 2 – Manipulating section shape and curvature

Once a curve has been entered it can be edited, using the keyboard, mouse or digitiser. The editing window and curvature window are shown in Figure 2. The editing window shows the curve itself, in this case a section shown in a Body Plan view, but it could equally be a Plan or Profile view.

The other windows show plots of the second derivative of one co-ordinate X, Y or Z, against the spline parameter U, the radius of curvature. The curve can be edited by moving points on the curve itself, in the editing window, or by altering the curvature in the curvature display window. The latter gives a fine control for final fairing of the curve. In either case, the point to be edited is selected by the cursor and moved to the desired location.

Figure 2 shows a section near the bow of a merchant ship with an obvious 'flat spot' at the mid-point of the curve. Note that the plot of the curvature shows rapid changes, indicating unfairness.

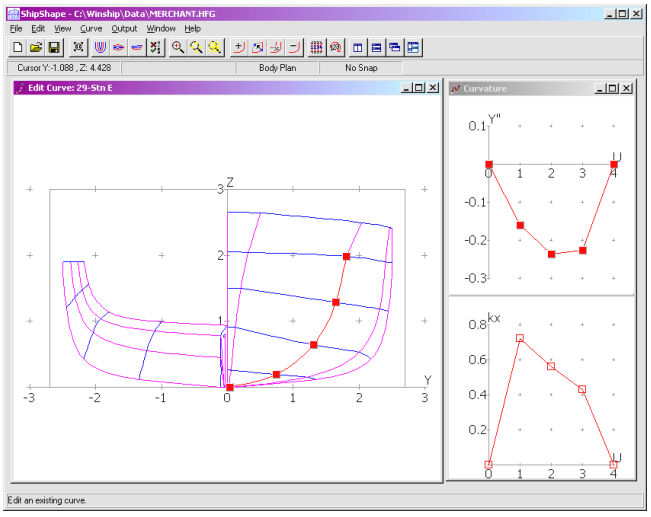


Figure 3 – Edited section curvature

In Figure 3 the points have been edited, so that the curvature varies more smoothly through the curve.

Once the curves in the network have been linked, editing a point on one curve moves the corresponding points on other curves that are linked to the curve at that point. The editing window can display the other curves in the network so that the effects of changes to the current curve on other curves can be visually monitored.

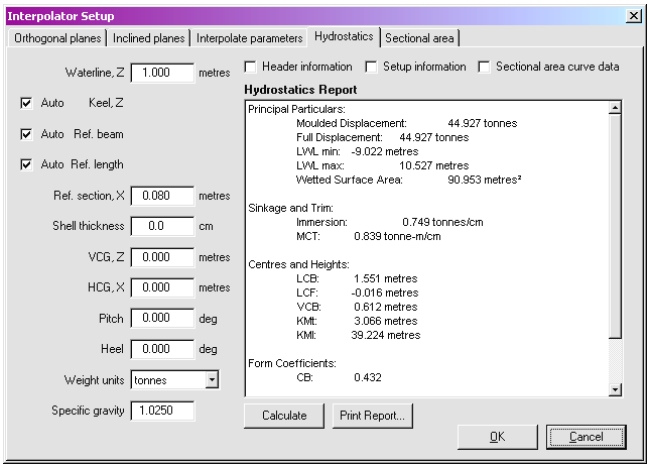


Figure 4 – Input for report

Once a preliminary fairing of the network has been completed, hydrostatics can be calculated, and any adjustment to the lines found necessary can be made. Figure 4 shows the input required by the Hydrostatics routine and the computed output. This output can then be printed. When the network of curves has been finally linked and faired, the data can be transferred to a .LFH file for importing into the full Wolfson Unit Hydrostatics and Stability Program Suite.

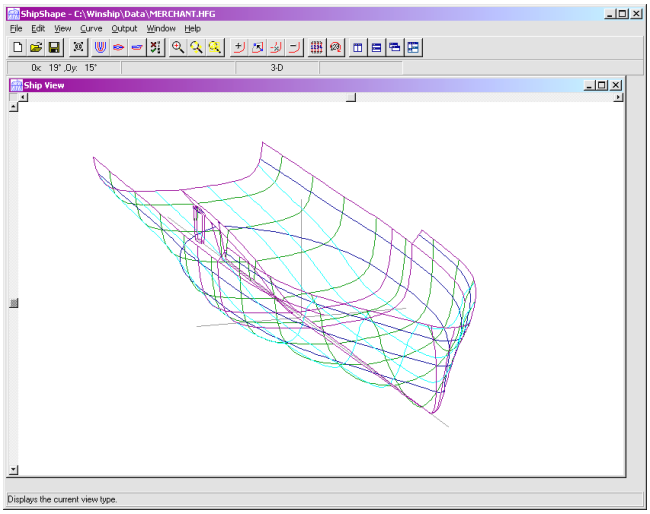


Figure 5 – Parametric view of hullform

The fully faired network is interpolated to give regularly or irregularly spaced sections, waterlines, buttocks and inclined planes, as specified by the designer. The interpolated lines plan can be shown in any view as seen in Figure 5.

Wolfson Unit MTIA, University of Southampton, Southampton SO17 1BJ, UK
Tel: +44 (0)23 8058 5044 Fax: +44 (0)23 8059 7594
Email: wumtia@soton.ac.uk Website: www.wolfsonunit.com

UNIVERSITY OF Southampton

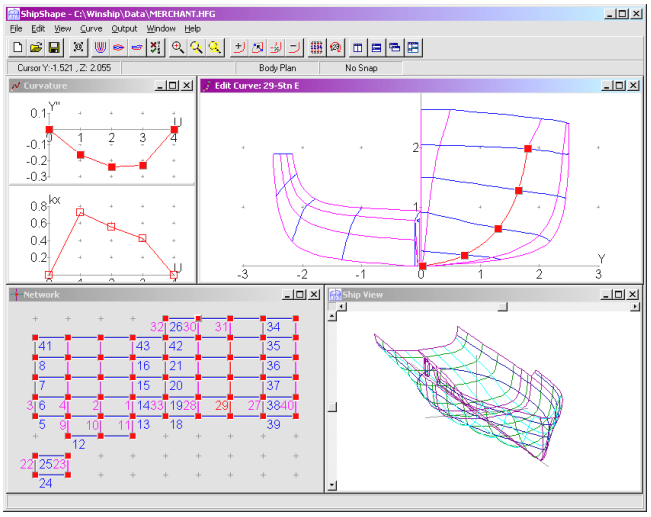


Figure 6 – Multi-window view

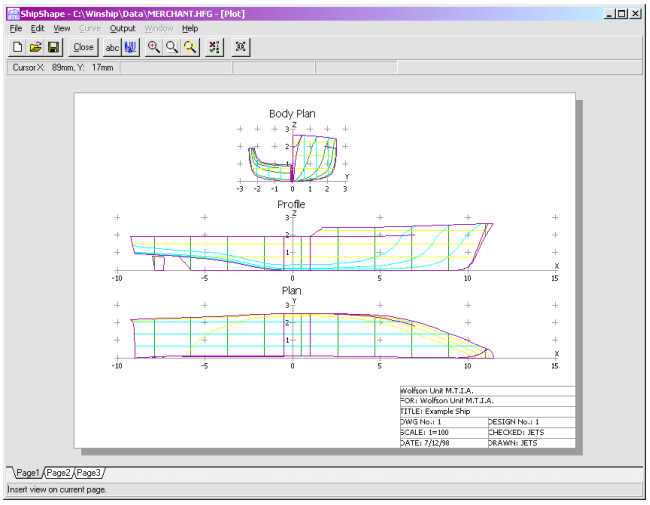
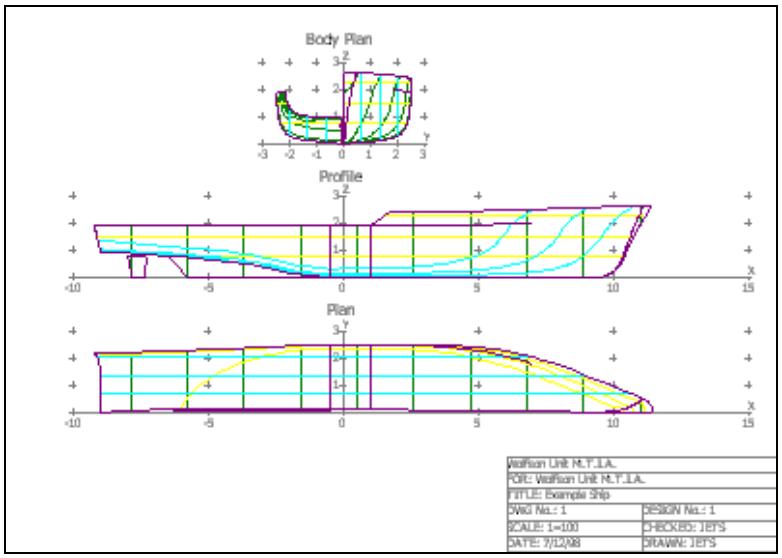


Figure 7 Lines plan

All the features of editing, fairing, the network and a ship view can be seen simultaneously as shown in Figure 6. Information displayed to these views is automatically updated as the user makes changes to the ship.

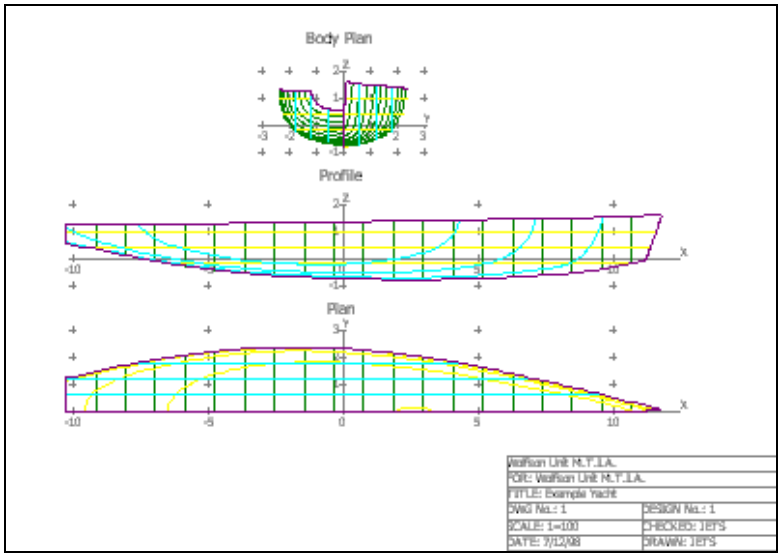
ShipShape has advanced plotting procedures with multiple plotting pages, each page can have multiple views and text as shown in Figure 7. The plots can then be output to any printer, .DXF file or other file formats.

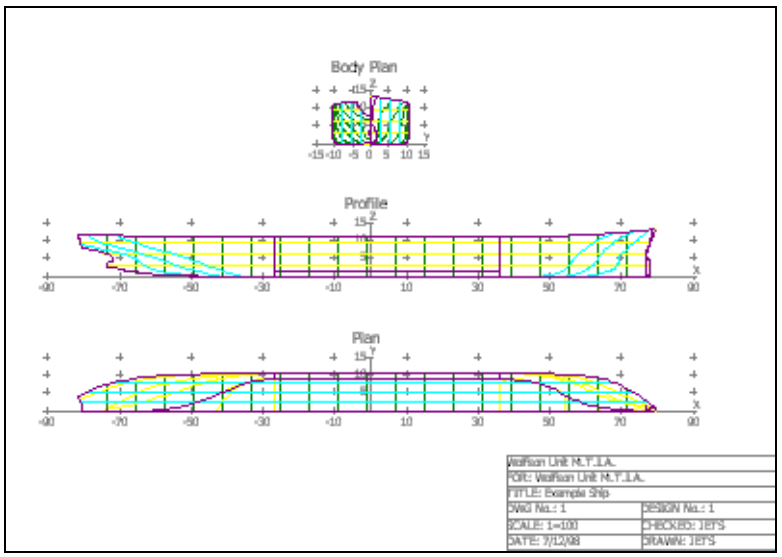
EXAMPLE OUTPUT



Wolfson Unit MTIA, University of Southampton, Southampton SO17 1BJ, UK
Tel: +44 (0)23 8058 5044 Fax: +44 (0)23 8059 7594
Email: wumtia@soton.ac.uk Website: www.wolfsonunit.com

UNIVERSITY OF Southampton





Wolfson Unit MTIA, University of Southampton, Southampton SO17 1BJ, UK
Tel: +44 (0)23 8058 5044 Fax: +44 (0)23 8059 7594
Email: wumtia@soton.ac.uk Website: www.wolfsonunit.com
UNIVERSITY OF Southampton