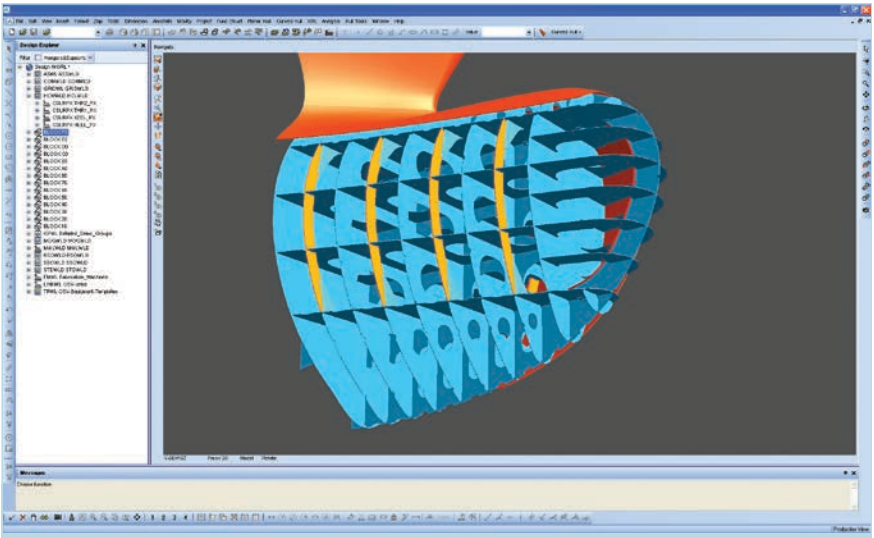
AVEVA **Hull** Detailed Design

Detailed design and production information for main hull steel structures

Being in full control of the hull design and fabrication processes is vital for a shipyard, as this represents the core know-how of this industry. Even as parts of the hull design are subcontracted each shipyard must fully control the hull fabrication methods and the assembly process to be successful. Dedicated engineering tools that give shipyards the freedom to adapt their design to their own fabrication process is a key constituent of this success.

AVEVA Hull Detailed Design™ is a powerful, datacentric application for the design and creation of production information for main hull structures. The application covers the entire process, from hull design to parts manufacture and block assembly, for all types of ship. This application creates, not only drawings and parts lists, but also all the production information and documents required in the design and building process.

The application handles the complete flow of information, from the use of customised parametric standards, to modelling, automatic parts generation, and advanced support for generation of drawings to production.



A hull block in planar hull modelling with some plates removed to show the internal structure

Business Benefits

Reduced design man-hours and time:

- Powerful design definition functions developed specifically for the detailed design of main hull structures.
- Automatic creation of production information for parts manufacture and for assembly, so a separate lofting stage is not needed.
- Fewer revisions of drawings and other outputs – these can be automatically produced just before being required in production.
- Reduced rework because of better communication between design disciplines through a common model database.

Reduced production man-hours and time:

- Available manufacturing equipment of the shipyard is considered during design, and the design altered to use the equipment to best advantage.
- Production output of highly accurate cutting and marking information, with allowances for weld shrinkage, can be used to directly drive all numerical controlled production equipment, such as plate-cutting machines and panel lines.
- Automatically provided check marks on parts allow for quality checking and accurate assembly positioning relative to other parts, ensuring that all parts fit first time, without rework.

Key Features

An important basic feature of AVEVA Hull Detailed Design is the panel concept. A panel is a functional structure ranging in size from a small, bracket-like structure, to the level of webs, girders, decks and bulkheads. A panel, with its plate parts, profiles, brackets, and so on, is the basic modelling unit in AVEVA Hull Detailed Design, whereas most other systems work on the lower level of a piece part. In the object-oriented AVEVA Hull Detailed Design application, the associated piece parts are generated automatically from the panels.

- A new project starts with the hull form defined in the AVEVA Initial Design™ application, or with a form from an external source, brought into the database using AVEVA Surface Manager™, for example.

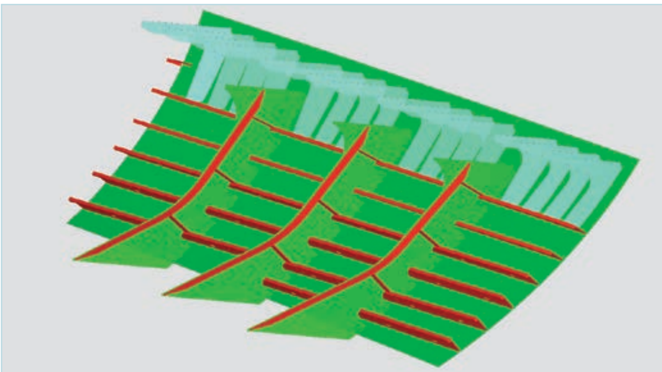
- AVEVA Hull Detailed Design is delivered with an extensive range of customisable intelligent shipbuilding standards for brackets, stiffeners, notches, cutouts and holes. These standards automatically adapt their geometry to the context in which they are used, in accordance with shipbuilding rules. For instance, the geometry on plate edges will depend on the required weld preparation type, the thickness of plating and the angle between the joined parts. The actual geometry will be automatically calculated, based on these conditions. Standards are customised and new standards added in accordance with user requirements. User-defined end cuts of stiffeners, for example, can be defined in the system catalogue.

Design Intent

- The AVEVA Hull Detailed Design model is stored with definition data, topological information and shipyard rules for the specific type of design. The design intent, defined during modelling, is used to make the hull model as independent of fixed geometry as possible. The design intent for each design object is stored, rather than the simple 'numeric' geometry of the design. AVEVA Hull Detailed Design automatically uses design intent information to carry out the lofting work and determine the exact coordinate information that defines the shape and the characteristics of the parts. Changes in one part will automatically be reflected in changed connected parts.

Curved Hull Modelling

- Various curved hull objects are interactively generated in any of the hull surfaces. Extensive interactive facilities enable the user to define any curved member with respect to basic geometry locations or relative to existing curves. The curved plates are automatically developed according to the workshop methods that are used at the shipyard. Holes in curved plates can be defined, developed and used for marking or cutting.



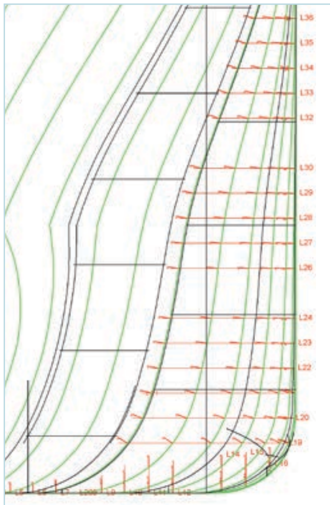
Curved panel

- Early material estimates for shell profiles can be obtained using the longitudinal tracing facility. Material quantities for the shell plates are obtained from the shell plate development functions.

- A curved panel generation facility is used to build the complete shell panels of the vessel, including the shell plates and the detailed descriptions of longitudinals and or transversals, for production purposes.

- A shell expansion view can be generated automatically. This view has a structure similar to all other model views and may thus be used for modelling and queries. Shell expansion views normally show half the ship (either port side or starboard side) developed from the centre line. However, they may also be developed across the centre line, be restricted to certain parts of the shell, be developed from arbitrary curves or planes, and so on. Holes in the shell profiles and in the internal structure against the shell can be shown symbolically in a shell expansion view.

- Body Plan views are also created automatically and can, in the same way as the shell expansion views, be used for modelling and queries as in any other hull view.



Body plan view

Planar Hull Modelling

- The complete inner steel structure of a vessel is modelled as plane panels, including plates, stiffeners, brackets and flanges, creating a complete and detailed model to be used for the retrieval of manufacturing and assembly information.

- Knuckled and swaged panels can be defined, and their production information is also available.

- The extensive shipbuilding standards, that adapt their geometry automatically, are important tools for high efficiency in model work.

- Panels can be moved and duplicated to speed up the design process. The panels will automatically adapt their shapes to the new surroundings. The new parts can be automatically numbered using customised rules for comparison and number series.

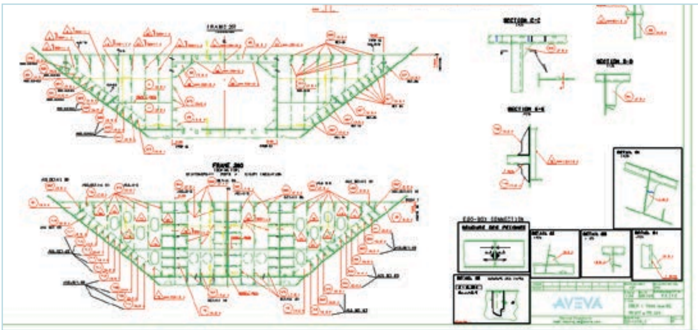
- The associativity of the model defined during modelling means that model parts are connected to the edges of adjacent parts, so the model can easily adapt to a change of the hull form or the position of a deck. This feature means that a design can be developed quickly, because the application automatically uses the references to connected parts to carry out the lofting work and determine the exact coordinate information which defines the shape of the parts. A change in one part will automatically be reflected in changes to other connected parts.

Drawing Generation

- A powerful feature is the possibility to 'model in a drawing'. This means that all kinds of panel drawings derived from the model maintain a link to the panels in the model. Changes in the panel can therefore be carried out via the drawing. This feature ensures consistency between the model and the related drawings, and reduces the time for documenting the design.

- Drawings can be made in two different styles, either with a symbolic representation of stiffeners, seams, notches and drain holes, or with full three-dimensional representation. The symbolic-style drawings are traditional for classification and working drawings, whereas the full representation can be used for the various assembly and erection drawings. The drawing functions provide the following features:

  - General 2D drafting.
  - Model picture generation.
  - Automatic generation of a shell expansion and body plan views.
  - Access to, and viewing of, outfitting objects such as equipment, pipes and cables.
  - Associative labels and dimensions.
  - Hidden line removal.
  - Section details.

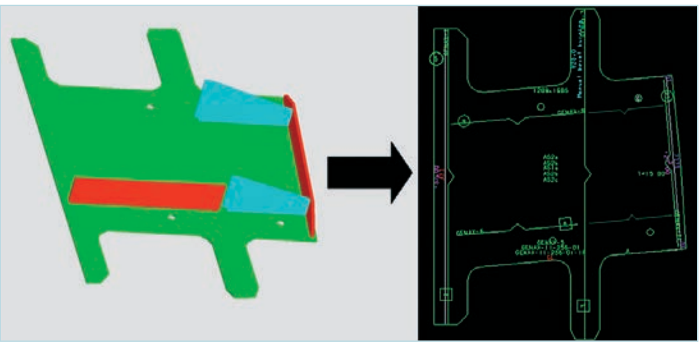


Steel workshop drawing

Production Information

All the necessary manufacturing and assembly documents can be created by the system.

- Automatic Parts Generation. The plates and profiles to be manufactured (including all small parts like clips and collars) are created entirely automatically from the hull panels. All types of adjustments to part shapes, for example, shrinkage for welding or edge preparation, are considered during this process. Metal touching marking and alignment marking are available and can be customised to yard practice. Each piece part is marked to contain all the necessary information for a simplified assembly process.



- Shrinkage Facility. This facility is used to compensate for the shrinkage caused by welding in the assembly process. The calculations are based on a shrinkage table that contains the amount of shrinkage actually measured in the workshops. From an analysis of the welds, and based on this shrinkage table, the shrinkage facility will automatically evaluate the amount of shrinkage and directions in which it should be applied. Plates and profiles are both considered.

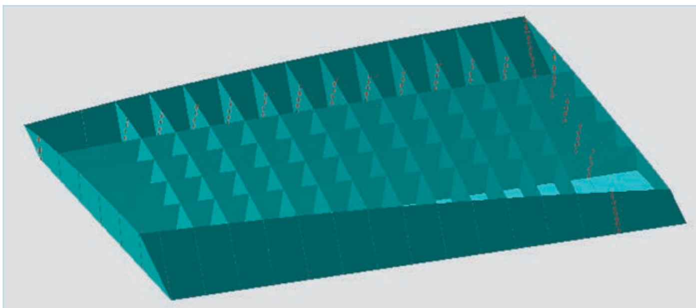
- Part Checking Function. This displays the automatically created part with all labels, marking, excess material and bevel information.

- All necessary production information can be automatically or semi-automatically extracted from the Hull model:

  - 2- or 3-axis plate cutting.
  - Templates for the rolling and bending of the shell plates.
  - Plate jigs and pin jigs for curved assemblies (there is an additional feature for interactively changing the automatically created jig planes).
  - Manufacturing lists, sketches and robot information for longitudinal and transverse frames and webs including information for inverse line bending.
  - Lists of weights and centres of gravity.
  - Manufacturing lists and sketches for stiffeners.
  - Material lists.
  - Part lists.
  - Early estimates for material and welds.

- The plate nesting function is used to nest plate parts on raw plates and produce NC/CNC data for cutting and marking together with a workshop sketch. Quick nesting of plates using automatic selection of parts from the parts menu is available, and there are facilities for the handling of surplus plate material. Parts can be clustered and the nesting of smaller parts in openings is supported.

- Profile nesting. Profiles generated as planar stiffeners, flanges or pillars, or as curved longitudinals and transversals, can be automatically nested on a set of raw profiles defined by the shipyard. Any steel quality exchange rules (substitution rules) set up by the shipyard are considered during the selection of suitable raw material for the profile nesting. The nesting algorithm will minimise the scrap percentage, taking into consideration the geometry of the end cuts, any defined bevel and different orientations of symmetrical profiles.



Eggbox type template

Left: An example of part checking which shows the original model panel and the resulting part with marking lines created by automatic parts generation. Note that the part has marking lines for both the pieces attached to the model panel and the pieces attached from adjacent panels in the model database.

Optional Modules

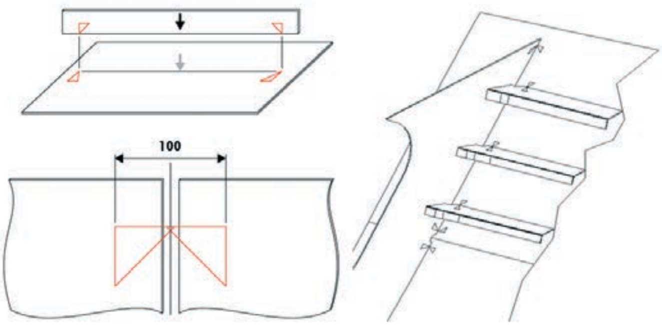
AVEVA Hull Panel Line Control
The Panel Line Control module is used to nest assembly parts onto large raw plates and produce NC information for blasting, marking, burning and text labelling. The option supports the following activities:

- Automatic creation of the large assembly parts and the individual piece parts.
- Automatic nesting of one or many assembly parts on the large raw plate.
- Nesting of other none panel line plate parts on the raw plate to minimise scrap.
- Parallel blasting, marking and burning (including bevel cutting).
- Text labelling.
- Raster marking.
- Automatic mounting of profiles.
- NC data and sketches.

AVEVA Hull Profile Cutting Interface
This option enables the transfer of nested profiles, or profiles, to profile-cutting robots or other systems for profile manufacturing.

AVEVA Hull Plate Cutting Interface
This option enables the transfer of plate parts to external systems for plate manufacturing.

AVEVA Hull Genauigkeit – GSD Marking Triangles
For any shipyard using automatic marking equipment, this option enables increased accuracy without extra design hours. Hull Genauigkeit is an option to improve accuracy by making the alignments of parts in the assembly process easier. This is achieved with marking triangles and lines that are created automatically in the automatic parts generation, with an option to add more triangles manually. The concept here is that the component itself represents the workshop drawing.



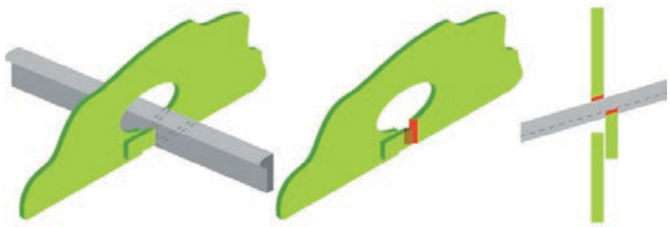
Examples of the use of marking triangles

- Accuracy Control. Even if the primary use is in the assembly of parts, marking triangles may also be used for accuracy control.
- The primary use of marking triangles is in the assembly of parts, however they may also be used for accuracy control.
- Alignment of Parts. Compared to traditional alignment lines, the marking triangles have the advantage that they 'lock' the parts to be connected in three directions, longitudinal, transversal and vertical. The marking triangles are generated in both of the involved parts in butt and fillet joints, and in plates as well as profiles. The position of the triangles will, for example, consider expected bevel gaps in butt welding, and the shrinkage compensation in such joints. Hull Genauigkeit is supported for both the planar hull and the curved hull in the shell of the ship.

AVEVA Hull Dotori – Variable Bevelling
Hull Detailed Design has an advanced feature for the set-up and control of bevel standards, both for bevel types with fixed angles and where the bevel angles vary. Support for the latter category is identified as the Hull Dotori option. With Hull Dotori, production parts will be generated with a high degree of accuracy.

The Hull Dotori calculations support the definition and use of bevelling for fillet welding whenever there is to be a dependence on the connection angle between the elements involved and/or their material thickness. Hull Dotori can be used to calculate bevels in many situations:

- At plate edges.
- In the lugs of cutouts.
- Along profile traces (shell and planar).
- In profile ends.
- At bracket edges.
- In holes.
- In flange ends.
- In clips.

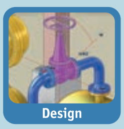


An example of Dotori in a cutout and a lug

The Hull Dotori option automatically generates information to control the angle of the cutting heads according to the variety of rules specified by the customer. The actual geometry of the part is adjusted to fit with the calculated information.

AVEVA Robot Interface
This option enables the transfer of the hull model in a volume format, suitable for processing by an offline programming system for welding robot facilities.

AVEVA Robot Interface 2
This option is a variant of the Robot Interface. It exports part geometry and welding data based on the assembly structure and the results from Hull Weld Planning.



AVEVA Hull Detailed Design is one of AVEVA's Design products, which create 3D models for detailed design and produce all associated deliverables

Information in this datasheet relates to product version 12.1 unless otherwise stated.

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