AVEVA **Outfitting**

The 3D design application for the accurate and clash-free outfitting design of ships and offshore vessels

The design and construction of marine projects to demanding cost and delivery requirements demands the creation of high-quality, clash-free design and accurate production information covering both hull and outfitting disciplines.

AVEVA Outfitting™ enables outfitting and hull design teams to achieve this through efficient collaboration and high productivity.

As the designers work, Outfitting builds the outfitting part of a sophisticated model database that also includes the hull structure. The model database is used to create 3D layout and detail drawings, together with accurate Material Take Off (MTO) information and comprehensive reports and production information.

Outfitting enables a wide range of sophisticated design and production checks to be carried out across all aspects of the design, to verify and maximise quality. It also supports all the necessary engineering issue, revision and change-control processes.

An extensive catalogue enables predefined parametric components and objects to be quickly selected and positioned within the model, then automatically checked for clashes and for compliance with configurable design rules. Changes made as the design evolves can be highlighted and tracked, making it easier to identify, manage and communicate the changes across the different disciplines. The result is a more accurate, better quality design that can minimise construction costs and time, and avoid errors that can lead to costly rework in production.
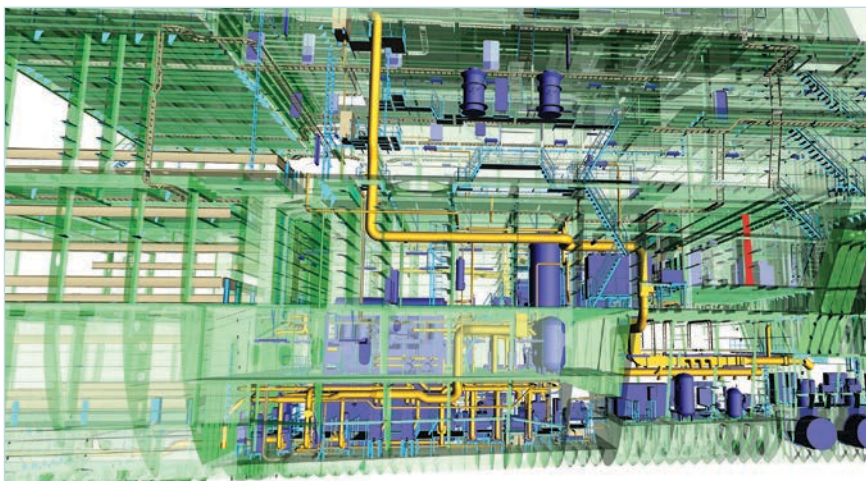
AVEVA Outfitting in a hull space

Business Benefits

Reduced design man-hours

▮ Powerful design definition and modification functions developed specifically for vessel outfitting design

▮ Reduced design rework and highest quality design, through the use of a common model database which avoids design clashes by enabling better communication between hull and outfitting disciplines

▮ When used with AVEVA Global™, Outfitting enables geographically separate design teams to work together as if in a single office

▮ High design productivity, centralised administration, robust control, and protection from communication limitations or failures

▮ Design rules and checking functions enable more right-first-time design, fewer design iterations and minimum design rework

▮ Automatic, just-in-time creation of drawings and other production information direct from the project model minimises revision work

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AVEVA™

Business Benefits

Reduced production man-hours

▮ Less design-related production rework, because outfitting and hull data are developed concurrently in a common model database

▮ Maximum steel hot work can be achieved before painting, because the common model database enables the early identification of outfitting support attachments and holes in hull steel

▮ Highly accurate cutting and marking information can be created for producing all types of outfitting items

▮ Pipe rework and remanufacturing are minimised by powerful manufacturability checks which enable the design of pipe spools that are optimised for the shipyard's pipe bending and fabrication facilities

Key Features

▮ Outfitting's fully interactive, easy-to-use 3D design environment provides every designer on the project with modern 3D graphical interaction tools, based on .NET technology and supported by a Microsoft Office-style user interface.

▮ As designers work, they have visibility of the entire design created in both the hull and outfitting applications of the AVEVA Marine solution.

▮ Designers construct a highly intelligent database for the whole ship, creating their specialists parts of the design by placing instances of parametric components from a controlled catalogue.

▮ Clash-checking and configurable integrity-checking rules identify errors and inconsistencies across the entire design for timely and controlled correction.

▮ Conventional design issue, revision, and change control processes can all be applied efficiently, even on projects which have many hundreds of users.

▮ Change highlighting and reversion can be easily applied for each branch of the design hierarchy. Reasons for the change are displayed by colour codes in the Design Explorer.

▮ Powerful 3D editing features with graphical handles and numerical feedback make design creation and modification quick and easy.

▮ Built-in intelligence, combined with configurable rules and associations, maximises design productivity.

▮ Design rules created between outfit items (for example, to link a range of pipes to a penetration in a bulkhead or to ensure that a piece of equipment is correctly located over its foundation) can be rechecked automatically at any time during the design.

▮ Design and component information from previous Outfitting projects can be reused or shared across multiple projects. Utilities for changing pipe sizes or specifications enable rapid adjustment to the new project.

▮ A general import function from Microsoft Excel allows large volumes of data from external sources to be analysed online and bulk-loaded into the design.

▮ The standard Outfitting design applications can be customised by the user to suit individual, industry or project requirements, or to add further design rules or automation functions.
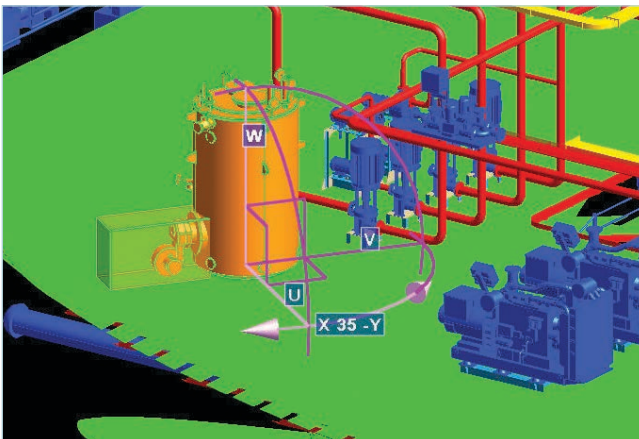
The 'graphical handle' gives measurement feedback during changes
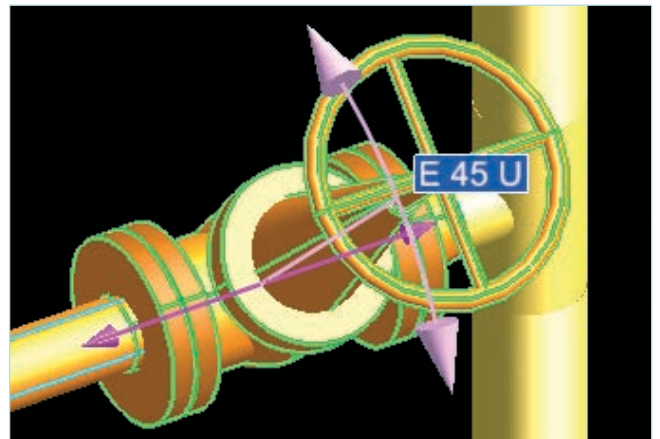
Design and modification is quick and easy, even for the novice user
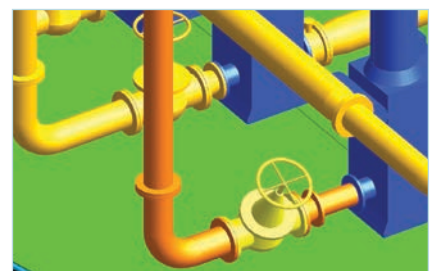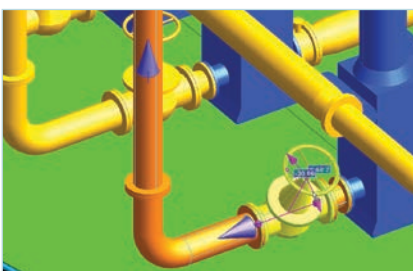
'Graphical handle' manipulation simplifies model changes

Equipment

- The Equipment functions build 3D models for all kinds of outfit items, from pumps and exchangers through to complex items such as main engines and compressors. They are used in all kinds of layout studies, arrangement drawings and connectivity or clash checks.

- Multiple graphical representations are available so that, for example, spaces required for access or maintenance activities can be visualised and clash checked during layout and design.

- To create an equipment item in the design, the relevant template is selected and the required parameters are defined.

- Equipment templates enable complex parameterised design configurations to be defined for quick and easy reuse, even across multiple projects.

- Alternatively, complex 3D models of equipment can be imported from vendors' 3D CAD systems, using AVEVA Mechanical Equipment Interface™. They can then be integrated in the 3D model of the ship and reused like library items for layout purposes or connection with systems.

- Equipment items include intelligent connection points, with relevant attributes, for the connection of associated piping, ducting, instrument and electrical systems.
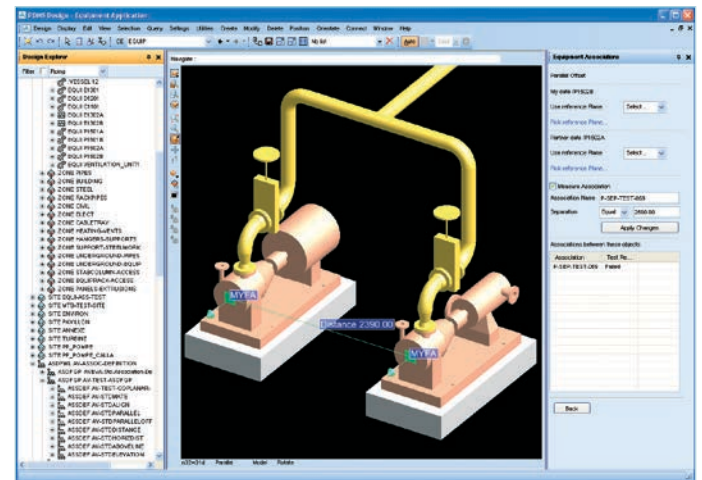

An example of association rules
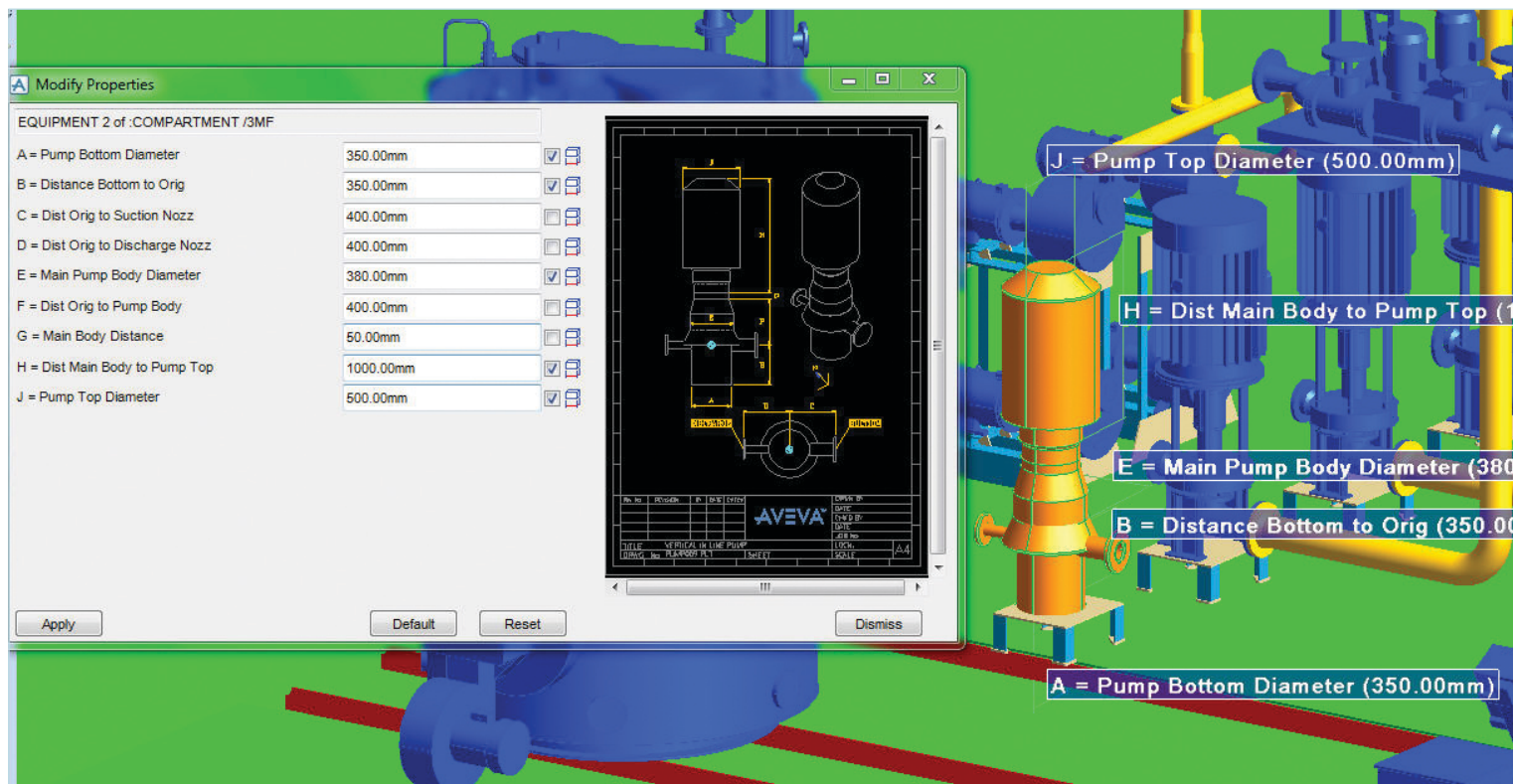
An equipment template

Key Features (continued)

Piping

▋ The Piping functions build a fully detailed model of all piping systems, based on component catalogues and engineering specifications. From the piping model, piping General Arrangement drawings, isometric drawings and bills of quantity are produced.

▋ A full range of automatically generated piping isometrics is available, as are pipe spool drawings. Extended configuration options are available to fit any relevant national, company or project requirement.

▋ AVEVA Outfitting integrates with AVEVA Outfitting Supports™ for the detail design of supports for piping, HVAC ducts and cable trays, and with specialist applications for pipe stress analysis via AVEVA Pipe Stress Interface™. Custom interfaces to flow calculation systems, wall thickness calculation and other third-party software can easily be created.

▋ The Automated Pipe Routing function enables a preliminary route and a first MTO to be created very quickly. Necessary associated items such as gaskets and flanges are automatically selected.

▋ The Quick Pipe Routing function enables the user to define the route of a pipe by using the mouse pointer to specify changes in direction, either by absolute position or relative to other model features. The route can be orthogonal or non-orthogonal, while easy-to-use tools enable the definition of sloping pipes. Components can be positioned explicitly or by using feature snapping. The route can be completed automatically where completion is predictable.

▋ To enable the piping design to be further developed, sophisticated modification capabilities include highly interactive graphical editing functions, together with functions to apply specification and pipe bore changes across the line, or to define and modify slopes.
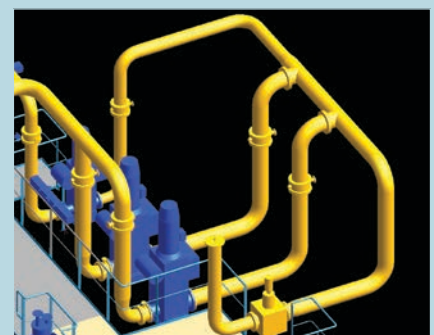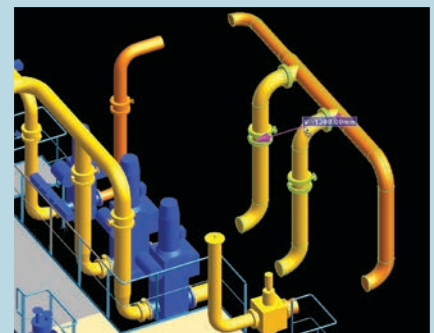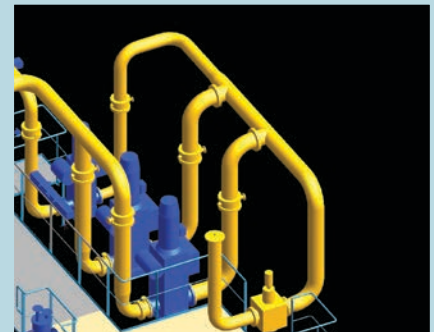
Design changes are executed easily
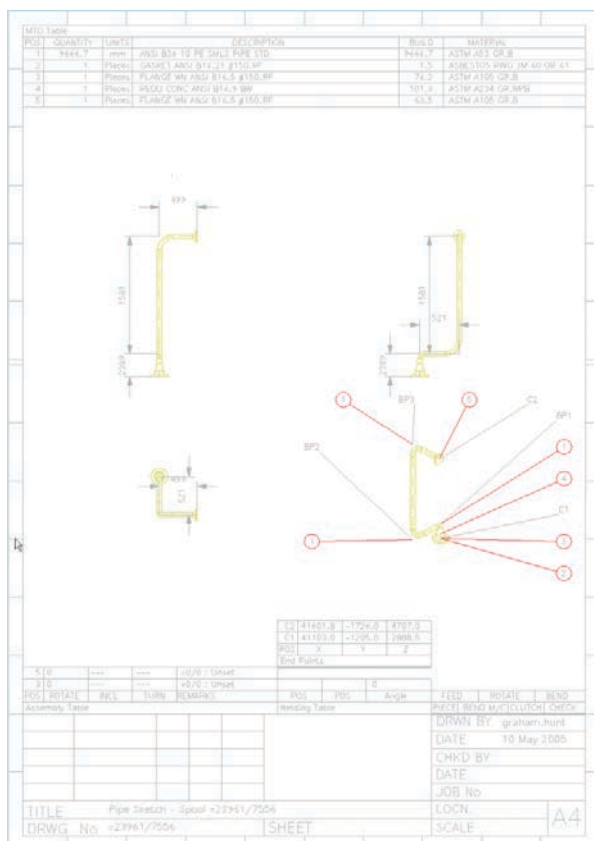
Pipe sketches are produced automatically
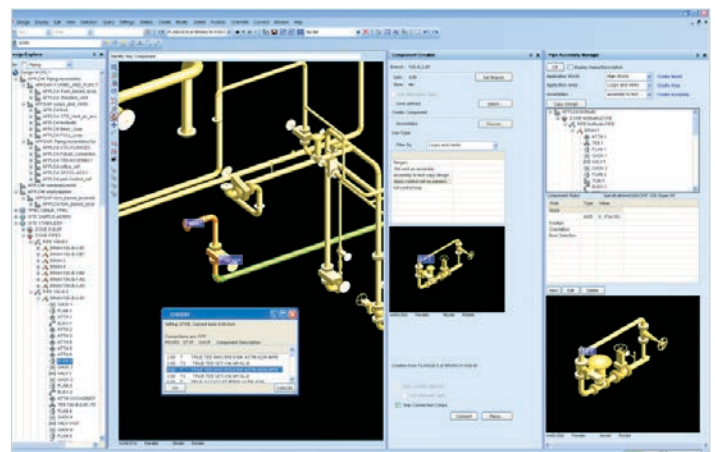
Regularly used pipe assemblies can be stored and reused throughout the design

HVAC and Ducting

- Piping assemblies, such as vents, drains or control sets, can be added to the design as entities. Existing configurations can be saved as assemblies for later reuse.

- AVEVA Outfitting also provides a number of capabilities for modelling non-standard pipe connections such as boss connections, and to generate production information for these assemblies.

- All drawings, including layouts and isometrics, have associative dimensions and intelligent annotations, and can therefore be updated automatically in line with design changes.

- Accurate MTO information can be generated on each sheet or drawing or via separate reports for any System, Line, Area, and so on.

- Pipe fabrication checks for bending and flange rotation can be carried out to ensure that the design easily fits the capabilities of the machines to be used for manufacture. Flange rotation checking ensures that bolt holes in mating flanges are correctly aligned.

- Intelligent rules, configured to the yard's individual pipe fabrication equipment, enable a designer to create high-quality, least-cost pipe runs quickly and efficiently.

- A comprehensive set of production checks is provided to ensure that bending, welding, painting and galvanising processes are easily achieved.

- Outfitting provides a specialist function for the design of all types of ducting.

- The function uses an engineering specification to select parametric components from a catalogue, enabling a full 3D model to be quickly built.

- A 'Fill' command automatically creates the straight parts of the route with the appropriate number of straight lengths.

- In-line equipment such as dampers, vanes, diffusers and hoods can all be included.

- The ducting model can be split into spool parts for manufacture and pre-assembly. Spool and isometric drawings can be produced automatically.
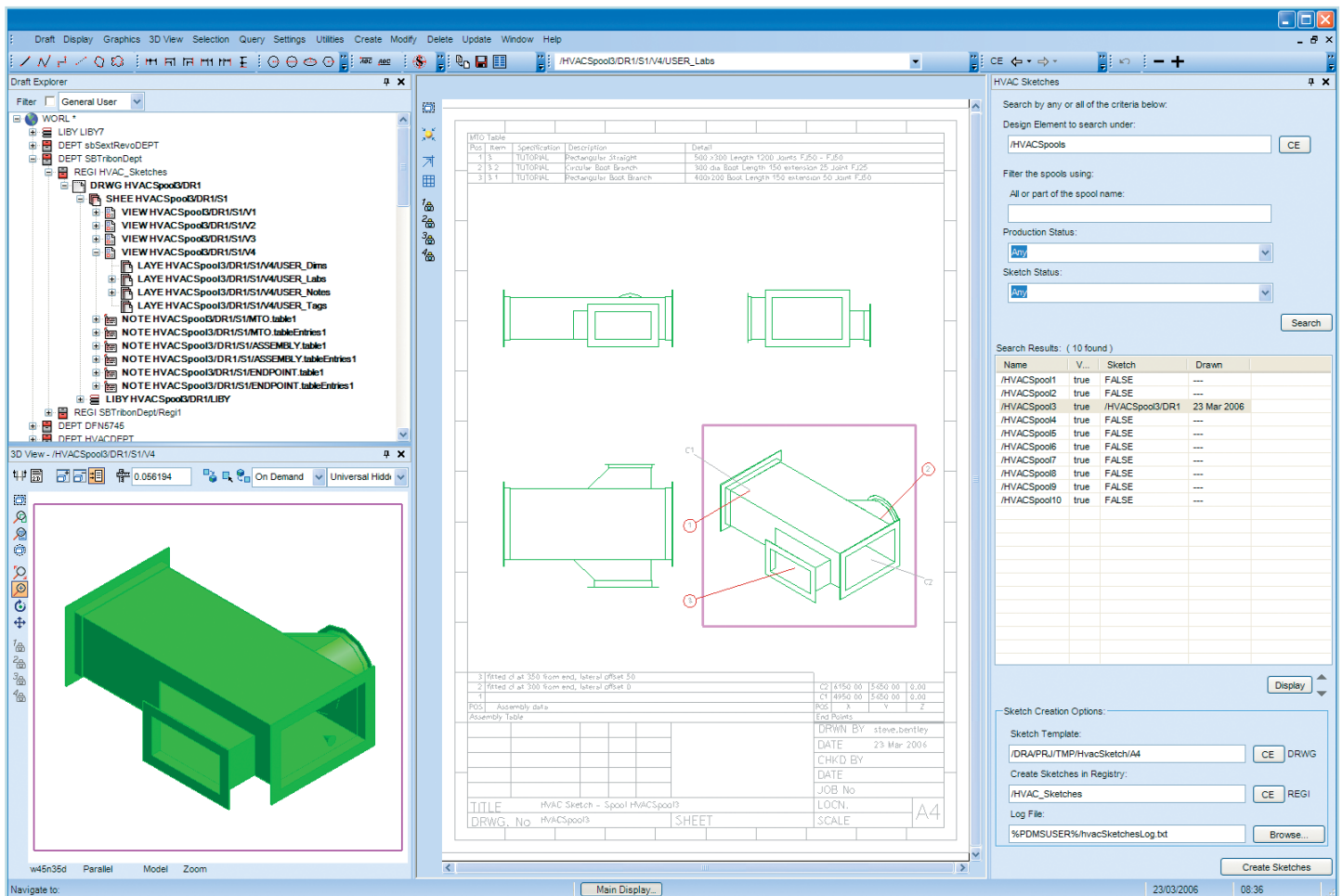

Ducting design and spool drawing

Key Features (continued)

Structural

- Outfitting contains a number of specialist functions for the design and detailing of miscellaneous steel structures found in marine projects. A wide range of layout, arrangement and detail component drawings can be produced, together with accurate weight and MTO information.

- The Beams and Columns function defines and maintains a fully connected nodal network of structural sections, including all joint and fitting details.

- Standard bracing configurations are available and can be customised as required.

- Curved, tapered and built-up beams are all available.

- The Panels and Plates function defines and maintains flat panels of any shape.

- Outfitting includes efficient tools to model the many small steel outfit items, such as equipment foundations, generally made from bent plates and negative extrusions.

- Just as for hull parts, direct generation of production information for such steel outfit items saves time and increases quality in production.

- The Walls and Floors function enables designers to define and maintain walls and floors of standard shapes.

- Fittings can be added to all types of beams, plates, walls, floors, and so on, to add items such as doors, windows, intelligent piping penetrations, stiffeners, lifting lugs and fire-proofing.

- The Access Platforms, Stairs and Ladders functionality enables designers to efficiently create and manipulate these commonly required items. Their models are built from a set of customer-definable parametric standards that include all details for each structure, such as handrails and kick plates. These structures can easily be modified as the design evolves, by adjusting the original parameters.

- Intelligent parametric penetrations can be defined, together with full details such as kick plates and coamings, and connected to the structure and the penetrating item (for example, pipe or duct) so that alignment and other checks can be carried out.

- Structural modelling makes extensive use of parameterised catalogues for components such as section profiles, joints and fittings. These catalogues can be added to by the user to suit particular project or other requirements.

- Profile catalogues cover the leading international and national profile standards, including angles, channels and I-beams.

- Joint catalogues contain standard types of joints, including cleats, end-plates and sniped end-preparations. Joint definitions are parameterised so that, if a section related to a joint is resized, the joint can be resized automatically.

- Fitting catalogues contain a selection of parameterised structural and industrial fittings, including lifting lugs, stiffeners, windows and doors.
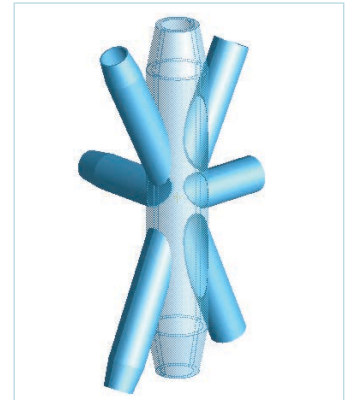
A complex joint

- A range of interfacing options is available to link to specialist analysis software and structural fabrication systems.

- AVEVA Outfitting is easily linked with AVEVA Bocad™ used for the detailed design and production engineering of complex structures. Bi-directional Compare & Update functions keep the user in control of modifications as the design progresses.
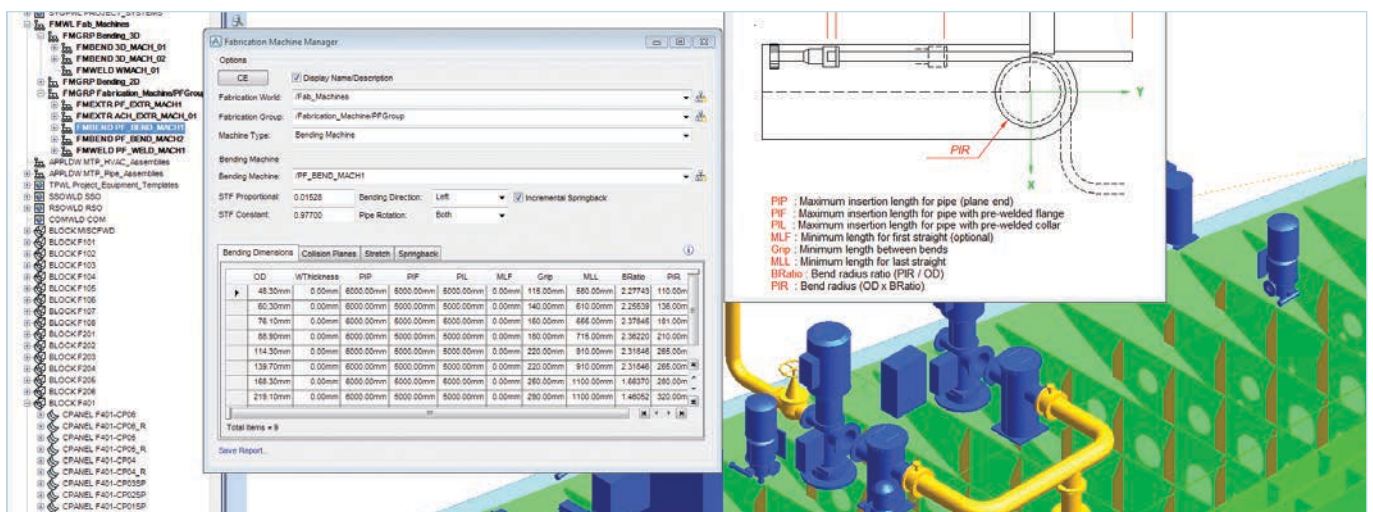

Example of pipe bending machine being configured

Electrical and Instrumentation

❚ Outfitting allows all electrical and instrument items, including electrical cabinets, transformers and switchgear, to be located in the 3D model for the purposes of design layout, visualisation, clash checking and the production of arrangement drawings.

❚ 3D models of electrical and offline instrument items can be created from parameterised templates.

❚ Valves and in-line instruments are selected from catalogues via engineering specifications. The workflow is fully integrated with piping design, enabling such items to be detailed as required, for example on piping isometrics.

❚ The Cable Tray function selects components from a catalogue via an engineering specification and creates the complete cable tray layout. A 'Fill' command automatically fills the straight parts of the route with the appropriate number of straight lengths.

❚ Cable tray isometric drawings can be automatically generated for manufacturing purposes.

❚ Outfitting integrates with AVEVA Cable Design™ for routing electrical and instrument cables in the design.

Drawings and Reports

❚ All drawings, including their annotations and dimensions, are produced directly from the model database, ensuring high levels of consistency between documents and design.

❚ Updates to drawings automatically include the latest design changes. Automatic change highlighting can be used to clearly show changes compared to the previous version.

❚ A comprehensive, flexible reporting module enables all types of reports and schedules to be produced direct from the model database. Users can customise their reports according to their needs and habits.

❚ Accurate MTO information is available across all disciplines, by item, unit, area, and so on.

❚ Reporting options include surface area, weight and centre of gravity.
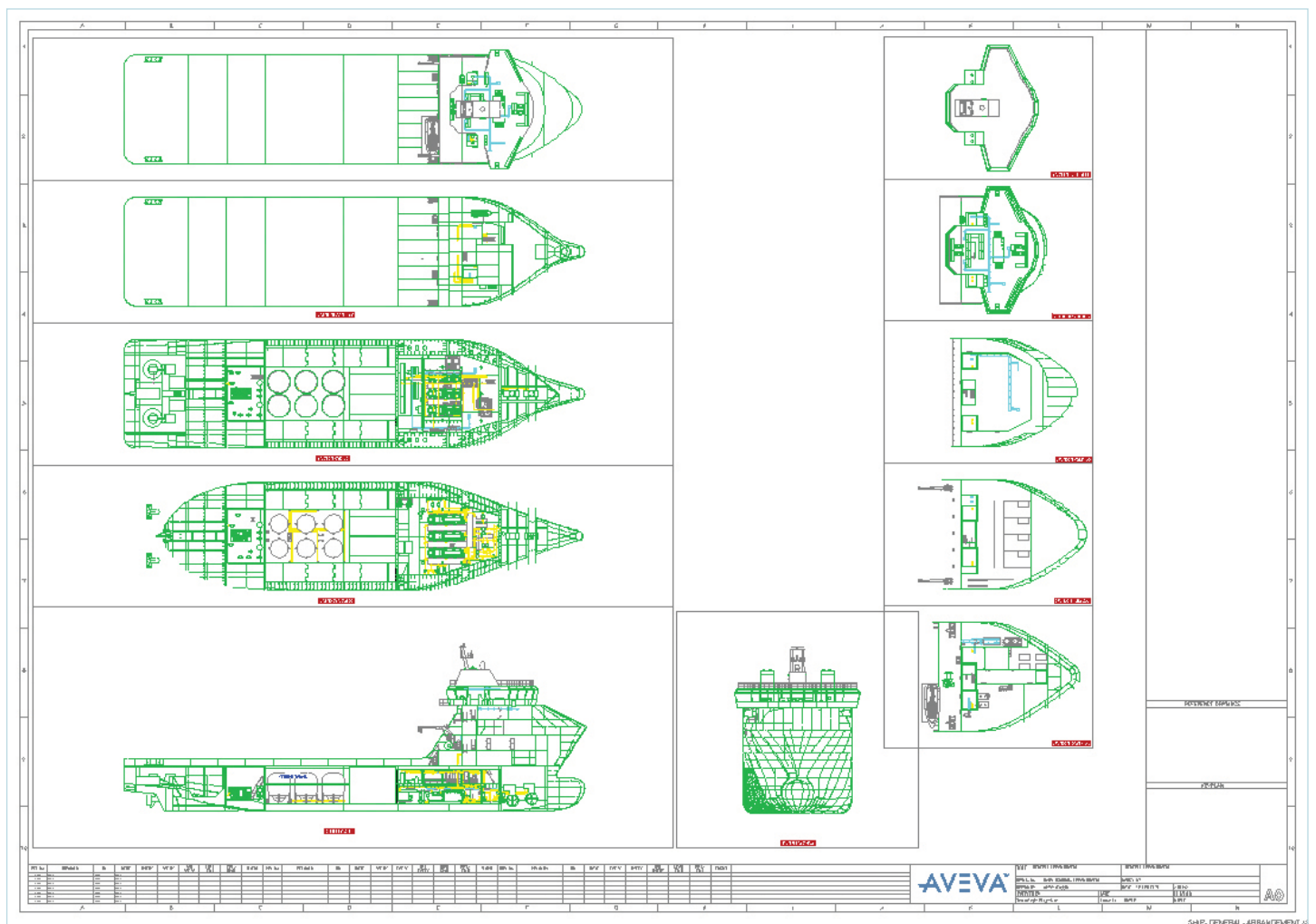
Example of a General Arrangement drawing of a ship

# Key Features (continued)

Catalogues & Specifications

▮ An extensive set of catalogues covering industry, national and international standards is available, including piping, structural steel, ducting, hangers, supports and cable trays.

▮ Each catalogue provides the parametric definition of all components in the required size ranges, ratings and types. So, for piping component connection types, physical and nominal size, wall thickness, flange offsets, material codes and bolt requirements are all stored.

▮ Engineering specifications control the way in which components from the catalogues may be used in the design.

▮ Standard catalogues can be defined once and shared across multiple projects.

▮ New catalogue items, for instance for project specials, can easily be created by the user without the need to use any programming language.

▮ Controlled changes to components and specifications are quick and easy. There are many functions to manage, control and apply such changes across the design.

Integration and interfacing

▮ A variety of interfaces to analysis systems, drafting systems and third-party design systems are available.

▮ A wide range of data exchange formats is supported, including DXF, DGN, SDNF and CSV.

Integration with AVEVA Engineer products

▮ AVEVA's Engineer products create schematics, diagrams, datasheets, engineering lists and indexes. AVEVA Outfitting integrates with all the products within this category, including AVEVA Diagrams™, AVEVA P&ID™, AVEVA Engineering™, AVEVA Electrical™ and AVEVA Instrumentation™.
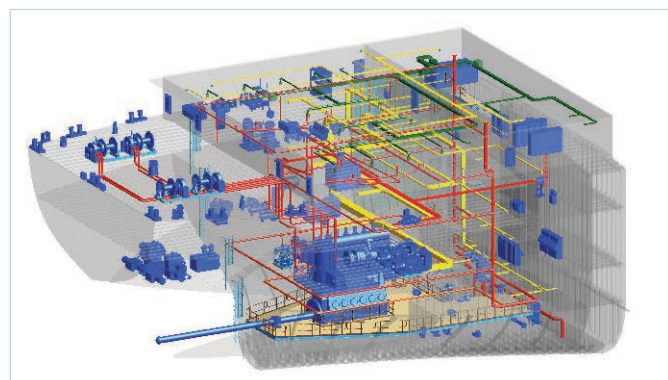
Localisation

▮ An extensive range of international character sets (Unicode) can be used for data, catalogues, drawings, reports and user interfaces, including many multi-byte (Asian) and single-byte (European) character sets.

▮ Feet/inches and metric units are available throughout.

▮ Units of measurement are made available throughout, enabling management of a wide range of engineering data, and efficient conversions.