AVEVA Initial Design is an integrated suite of advanced, yet cost-effective and practical ship-design tools developed for naval architects and design engineers. The application is best used as the front end of the complete, integrated AVEVA Marine solution, but it can also be used on its own for the conceptual parts of the design.

Initial Design is a tool for rapid definition and analysis during the contract and the structural design phases of a project. Its close integration with other AVEVA Marine applications ensures smooth and rapid design development on projects taken into basic and detailed design.

### Business Benefits

- **Rapid concept development.** Advanced mathematical modelling and analysis techniques including full surface topology enable quick design evaluation.
- **Flexible application capable of configuration to suit customer needs; means that users can work in the most efficient way that suits them.**
- **Graphical user interface that provides an intuitive way of working that helps achieve high productivity quickly.**
- **Fully integrated with hull and outfitting design, reduces error and the need to re-create data.**

### Geometry

**Lines** is a hull fairing tool which can be used to create virtually any form of marine vehicle, including multi-hulls, chined and asymmetrical hulls. The hull form is initially represented as a loosely-connected mesh of curves that is used to semi-automatically create a surface comprised of B-spline patches and bounded planes with tangential (C1) continuity.

Advanced mathematical techniques are incorporated for automatic curve fairing and surface smoothing. The quality of the surface can be assessed using isophotes to visualise fairness and continuity.
**Geometry (continued)**

**Lines** can be used for rapid hull form creation in preliminary design, or for full production fairing.

**Features include:**
- Interactive point and curve editing.
- Traditional 2D or advanced 3D fairing.
- Automatic curve fairing and data reduction.
- Special handling of waterline endings and frame feet.
- Hull form hydrostatics.
- Sectional area curve distortions and scaling.
- Deck creation with gunwale definition.
- Lines plans and loftbooks.
- Surface generation with automatic smoothing and manual editing.
- Assessment of surface fairness.

**Surface** is principally used to model features of the main hull and its appendages, such as rudders, anchor pockets and thruster tunnels.

**Features include:**
- Interactive point and curve editing.
- Traditional 2D or advanced 3D fairing.
- Automatic curve fairing and data reduction.
- Special handling of waterline endings and frame feet.
- Hull form hydrostatics.
- Surface operations – subtract, unite, solid intersection, intersect, imprint, join, combine, blend, scale, move, rotate, align, reflect, copy, concatenate, control point editing.
- 2D operations – join, trim, cross, offset, fillet.
- Visualisation – principal curvature, curvature tufts, Gaussian, isophotes, transparency, lights.
- Lines plans and loftbooks.

**Compartment** facilitates the quick definition of transverse and longitudinal bulkheads, decks, compartments and superstructure.

All features are stored topologically and can be rapidly regenerated to accommodate design changes with minimum effort. Functional descriptions can be assigned to bulkheads and decks, to enable automatic generation of steel in Hull Structural Design.

Analysis tools are incorporated for calculation of mass properties with facilities for preliminary weight analysis. Compartment also provides automatic generation of container bays.

**Features include:**
- Creation of transverse and longitudinal bulkheads, decks and compartments with topological referencing.
- Non-planar bulkhead/deck options including cranked, corrugated, upper and lower stools.
- Creation of compartments from bulkhead, deck and hull form boundaries, or from merging of compartments by addition and subtraction.
- Creation of internal structures from operations (subtraction, intersection, etc.) on primitives (plane, block, pyramid, cylinder, cone, sphere, toroids).
- Calculation of mass properties – volume, surface area, LCG, TCG, VCG.
- Preliminary weights and centres of gravity analysis.
- Automatic container bay arrangements.
- Integration of internal surfaces (transverses, longitudinals and decks) throughout AVEVA Marine for early structural steel design and full topological modelling.
Hydrostatics

The Hydrostatics module provides a comprehensive toolkit of naval architectural assessment routines, including the calculation of hydrostatics, tank calibrations, trim tables, loading conditions, loading and discharging sequences, intact and damage stability, critical KGs, longitudinal strength, inclining experiment, freeboard, floodable length, tonnage and launching.

Particularly sophisticated routines are included for damage stability assessment, using both deterministic and probabilistic methodology, as well as more specialised calculations covering grain stability, water on deck, and so on. The latest SOLAS probabilistic stability regulations for both passenger and cargo ships are incorporated.

Comprehensive graphical and tabular output is available throughout, in a form directly applicable to obtaining both owner and regulatory approval for a new design, and for use in standard documentation such as tender responses, stability booklets and damage stability assessments.

A significant feature of the analysis module is that the overall process is, itself, report format oriented. Reports can also be exported in HTML or XML format to enable further customisation by the user.

Features include:
- General particulars.
- Tankplan and loading diagram.
- Definition of openings, strength limits, etc.
- Lightweight definition.
- Container arrangement.
- Visibility check.
- Tank calibrations.
- Grain calibrations and permissible grain moments.
- Hydrostatics, cross curves, sectional area curves and deadweight scale.
- Trim tables.
- Intact and damaged stability with critical KGs.
- Probabilistic stability assessment according to SOLAS old and new regulations.
- Continuous flooding simulation.
- Loading conditions with stability and longitudinal strength.
- Tonnage measurement, freeboard, floodable length and equipment number.
- Static and dynamic launching calculations.
- Inclining experiment analysis.

Hydrodynamics

The Hydrodynamics module consists of a wide range of analysis tools for the prediction of the hydrodynamic performance of vessels.

Powering

A range of methods based on widely-employed standard regression analysis methods can be used to estimate powering for single- and twin-screw vessels. Actual resistance results from towing tank experiments can be substituted for the empirical estimates.

Features include:
- Propeller optimisation.
- Resistance calculations.
- Ship powering characteristics.
- Use of resistance ratios from model tests.

Manoeuvring

The manoeuvring characteristics of ships in deep or shallow water, under even keel or trimmed conditions, can be assessed. This analysis can rapidly estimate the effect of changes in ship conditions, and takes into account nonlinear coupling effects of hull forces and moments developed by the rudder.

Features include:
- Crash stop calculation.
- Zig-zag manoeuvre.
- Turning manoeuvre.
- Reverse spiral calculation.

Seakeeping

Seakeeping is analysed using standard strip theory. Added mass and damping coefficients are calculated and combined with wave excitation forces to calculate the vessel’s responses in regular and irregular seas. Responses at any location along the vessel may be calculated and combined to provide subjective motions, deck wetness, propeller emergence and slamming. Short-term irregular response can be extended to long-term performance prediction when combined with seakeeping criteria and wave statistics provided by third parties.

Features include:
- Sectional hydrodynamic coefficients.
- Regular wave responses (RAOs)
- Added resistance due to waves and dynamic loads.
- Short-term, irregular vessel responses (RMSs).
- Long-term seakeeping performance predictions.

Dynamic Positioning

The Dynamic Positioning module makes it possible to design the thruster system of any vessel which requires a station-keeping capability with three or more thrust units.

Features include:
- Thruster requirements for a given environment.
- Environment calculation, including a rosette of holding capability.
- Environmental Regularity Number (ERN) calculation.
**AVEVA Hull Structural Design**

**AVEVA Hull Structural Design** is licensed separately from **Initial Design**. **Hull Structural Design** is used for the preliminary geometry definition and arrangement of the principal structural members of a vessel, and provides the framework for associated design guidance. **Hull Structural Design** is used for the production of classification drawings, steel material estimates, weld lengths and weights and centres of gravity reports.

**Hull Structural Design** supports XML-based interfaces to classification societies’ software packages for rules checking and structural analysis. General FEM-based strength analysis software packages are also supported by these interfaces.

**Summary of Process Coverage**

The table shows the modules within **Initial Design** and their purpose within the process.

Although it is a separate product, **Hull Structural Design** is also shown in the table, in order to provide a complete picture of the early design activities covered by the AVEVA Marine solution.

<table>
<thead>
<tr>
<th>Process</th>
<th>Geometry</th>
<th>Hydrostatics</th>
<th>Hydrodynamics</th>
<th>Hull Structural Design</th>
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<tr>
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