



Lines Development

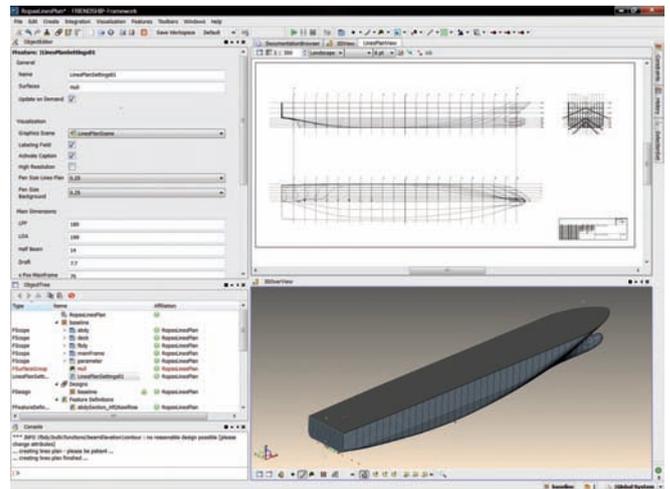
First-class design

Economic operation asks for maximum efficiency and optimal design. Form follows function – this has never been truer than for the design of functional surfaces. Ship hulls, rudders, appendages, bow thrusters and propellers can sustain operational safety, reliability and economic viability only when developed to the requirements. An optimal surface design is the key to profitable life-cycle consumption – the *FRIENDSHIP-Framework* is the engineering tool to meet the challenge. FRIENDSHIP SYSTEMS' world leading engineering software for the simulation-driven design of functional surfaces will guide you to first-class product development to deliver continuously profitable operation for your customer.

Efficiency on record: Lines Development

Optimal design starts with first-class lines development. Conventional modeling is often felt time-consuming – very rightfully so, compared to the faster design process you will experience within the *FRIENDSHIP-Framework*. Based on very few parameters, lines development within the Computer Aided Engineering (CAE) system is convenient, time-saving and truly elegant. Partially and fully parametric modeling techniques are provided in a hands-on approach developed and constantly furthered by practitioners. You only need very few parameters to design lines and shapes meeting the complex tasks of hydro and aerodynamic flow performance. Corresponding to the holistic design approach, geometric modeling is followed by systematic variation.

Hundreds of design variants are consulted in overnight studies – a practical, straightforward and time-saving process. The tight coupling of external programs and codes is strongly supported by the *FRIENDSHIP-Framework* which makes it deployable for diverse domains and calculations. Wave resistance calculations, for instance, are exercised within the software system using coupled flow codes.



The formal optimization of the most favorable design variants meeting your preferences is facilitated through numerical simulation. Simulation-driven engineering speeds up the whole design process remarkably, quickly leading you to supreme results.

Better lines – better products – better performance

Engineering with the *FRIENDSHIP-Framework* will put you a decisive step ahead. As market leader in simulation-driven design in the marine industry, FRIENDSHIP SYSTEMS provides you with excellent hands-on technology and practical support for engineering efficient products. Benefit from the advanced technology, e.g. B-spline technique, image technology, meta surfaces, feature definitions etc. Apply rudders, bow thrusters and appendages to your ship design simply using and adjusting the feature geometries provided in the *FRIENDSHIP-Framework* – easily set up and customized to your needs and preferences. Use the numerous advanced design options, develop best-in-class products, secure your advanced market position.

How you benefit

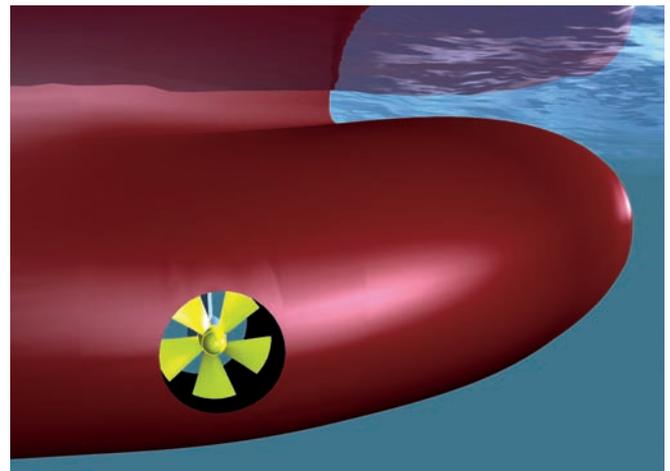
Engineering optimal products with the *FRIENDSHIP-Framework* is quite simply profitable because of

- Progressive engineering with cutting-edge technology
- Holistic design environment based on hands-on expertise
- Automated variation and selection of most favorable designs, which sharpen the focus on supreme models
- Less model testing at reduced risk of time and cost associated with changes and modifications
- Faster processes: time and cost-saving design approach
- Faster market access with better products
- Optimal design contributing to better environmental performance meeting present and future regulations

First-class design takes you a decisive step ahead – meeting future challenges in market regulations and competition. Applying the *FRIENDSHIP-Framework* means arriving at optimal functionality and maximum efficiency in less time and less cost.

Case study: Forebody of a Fast Monohull

This case study should illustrate how a ship hull surface can be easily modeled by means of fully-parametric techniques. The shape is completely defined by problem specific descriptors, widely known and common in the field of interest. With little need for abstraction naval architects can directly transform their knowledge and experience into a hull form description.



The design starts with a collection of basic parameters like length, beam and draft. As a next step a set of basic curves is created. These curves represent the spatial, mostly longitudinal, distribution of parameter values, which can be of positional, differential or integral nature. Typical positional information includes curves like flat of bottom, flat of side and centerplane curve. Differential information is given by tangent or curvature distributions and the sectional area curve yields integral values. Local parameters like specified values, tangent angles and fullness coefficients control the shape of these curves. Special curve types like the fairness optimized F-spline facilitate this task. Finally, the hull surface is created from the sum of this input using the meta surface technology, a novel development by FRIENDSHIP SYSTEMS. Different section topologies, not necessarily constant x sections, are set up as feature definitions and linked to the parametric input, defining how this input should be processed. The shape of each infinite surface cross section within a range of definition is then known. With this methodology a complete mathematical description of the complex free form surface is obtained. No need for interpolation, smooth basic curves and sections yield a smooth surface with no further need for manual fairing. What is more, this surface description is now completely dependent on parameters, so that the generation of variants, most importantly within a subsequent optimization, is easy, straightforward and robust. By adapting the parameters future generations of ships can be created or existing designs with similar topology can be remodeled using the same parametric description. Reusability is the key to further time and cost savings in the design process.

The *FRIENDSHIP-Framework*. Better Products. Faster Processes. Higher Profits.

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