



## FORAN: 45 years as a world reference

By Verónica Alonso

Of all of the technological innovations and concepts that have emerged from SENER in the last 46 years, perhaps none has had a greater global impact than the development of the FORAN System.

Shipbuilding today, conditioned by complex ship designs, demanding customers, financial pressures and changing scenarios, is constantly looking for new ways to efficiently design profitable vessels with no margin for error. In this global environment, with an increasing tendency to share the engineering by multiple agents, ships need to be designed for ease of integration.

Everything began in the 1960's with Manuel Sendagorta, then Director of SENER, and his interest in the mathematical representation of hull forms of vessels. The research studies begun by Sendagorta and his collaborators showed that the use of a mathematical formulation to represent ships' hulls, combined with the use of computers, could serve not only to describe existing forms but also to generate new ones. This is how they arrived at a general formula that could represent intrinsically faired forms, which was the departure point for the ANalytical FORms System or, as it came to be known, the FORAN System.

After mastering hull forms, FORAN was then developed as a tool for the integration of all ship design and production activities. SENER took advantage of this to provide its own projects to its customers with extraordinary speed. In 1969, the first license contract was signed with a naval shipbuilder and since then this has extended to over 130 companies and 27 countries.

FORAN is a computer System specifically developed for ship design and construction. The System has the backing of SENER's in-house ship design capabilities, with the resultant quality of the personnel associated with the System, of a very high standard and very responsive in all disciplines and a complete integration of the entire range of ship design disciplines.

With FORAN, the ship designers work concurrently within the context of the overall vessel, which is defined in every detail. The System employs a comprehensive 3D product model as the single source of all data relating to the design and construction of the ship. Associative or topological relationships between

components permit the on-line construction of the model, propagating automatically modifications made to all the related components.

The design is not oriented just to 3D modelling, because FORAN model contains also material definition, manufacturing data and production process. The shipyard-user can easily define its own standards, norms, specifications, libraries and formats. FORAN adapts the engineering work to the requirements of the most efficient production, providing directly from the 3D model workshop information with high levels of accuracy, quality and automation.

FORAN, conceived as a practical solution for real shipbuilding problems, has been continuously in the market since its inception in the sixties. It is being used in the shipbuilding industry for:

### • Forms, Naval Architecture and General Arrangement

Hull forms generation (including asymmetric and multi-hull vessels), hydrostatic, freeboard, floodable and permissible lengths, sectional areas, trim diagram, space definition, intact and damage stability (including deterministic and probabilistic calculations), user-configurable stability criteria, launching, floating and powering calculations, 2D/3D general arrangement and accommodation spaces organised by decks and compartments.

### • Hull Structure

FORAN permits a fast definition of a complete and accurate 3D model of the hull structure, including shell and deck plating, structural profile parts and internal structure from basic to detail design. The product model database allows FORAN to provide the production department with all the necessary information for hull fabrication, pre-assembling, mounting, material management, planning and quality control.

### • Outfitting

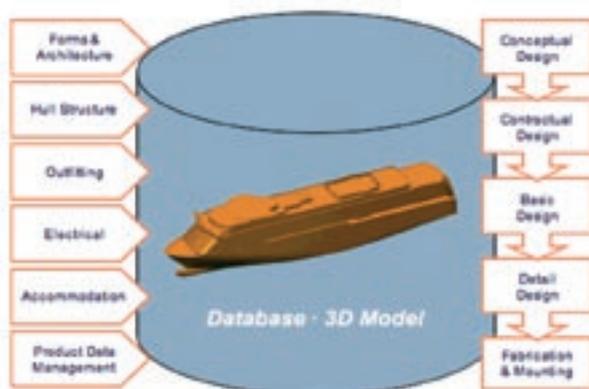
FORAN provides a single application with specific working modes for a complete and accurate definition of 2D diagrams and the outfitting 3D product model, including equipment, piping, HVAC and structural outfitting. It also provides the capability to make calculations and to obtain reports and drawings for coordination, fabrication and mounting.

### • Electrical

FORAN covers the electrical aspects of ship design and production, enabling the user to create diagrams, libraries of standards and components and catalogues of cables; model and arrange electrical equipment and trays; route cables; define cable terminations, I/O signals; make calculations; and generate complete reports.

### • Build Strategy

FORAN features a build strategy module that represents the ship breakdown, creating user-defined structured work packages tied to intermediate products for assembly and organising custom-made and highly accurate production and fabrication information.



#### • Drafting

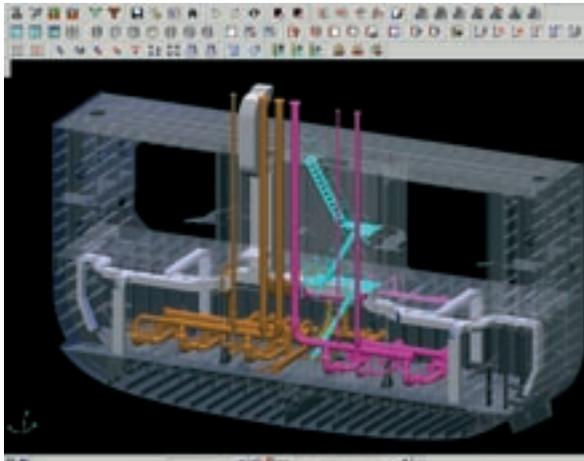
In all design disciplines FORAN includes tools for the seamless generation of 2D drawings associated to the 3D product model.

#### • Virtual Reality & Design Review

FORAN designs review tools to give users the possibility to walk through and fly around the 3D model in real time and to query the properties of the different ship components in an immersive experience.

#### • Design Change and Access Control

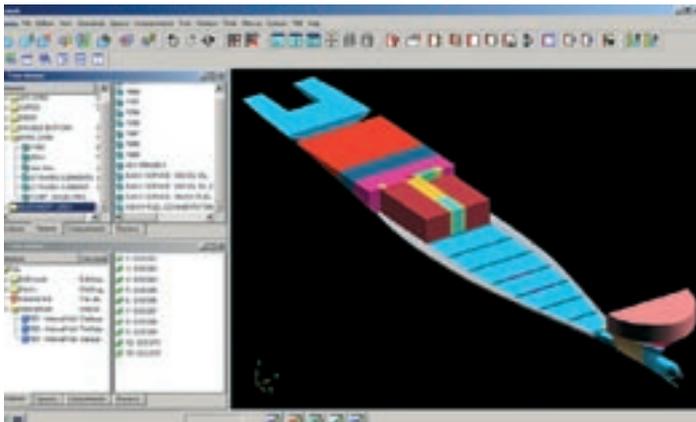
The latest FORAN module FCM is a powerful configuration tool used to organize the access rights of different levels of users to each area of the 3D model. It includes functions for the traceability of changes and the control of design maturity.



FORAN System screenshot.

#### FORAN: The future

SENER has recently launched the FORAN version V60R2.0 with many new features in all the areas of the System to reduce design man hours and to increase the design process performance.



FORAN System screenshot.



Courtesy of Navantia

F310 for the Norwegian Army.

New capabilities that improve the performance in detail design have been introduced to allow an easier work during the definition of the internal hull structure for a more automatic definition of entities.

FORAN outfitting also offers new specific design techniques related to pipes definition and tools to facilitate the design of auxiliary structures and supports taking into account the dismantling spaces. Other capabilities have been added to improve the complete HVAC design in a single working environment, fully integrated with the rest of disciplines.

SENER with a clearly defined strategy focused on innovation and customer requirements, is always looking ahead, and is continuously developing and improving all FORAN disciplines using state-of-the-art technologies. Now SENER is working in the next release of FORAN V60 R3.0 that will be launched at the end of 2008.

Thanks to this big effort, day by day the strategic objectives are achieved, to keep and consolidate the existing FORAN users and to improve the number of them taking advantage of the new opportunities in the market. The commercial effort is being moved to the Asian market (Japan, South Korea, India and China) with the corresponding technical and commercial local structures. To finish, it is expected to play special attention in shipyards dedicated to military shipbuilding sector. ■■