

7. FORAN-PLM Advanced Integration

1. Initial Design
2. Basic Design
3. Hull Structure
4. Machinery & Outfitting
5. Electrical Design
6. Drafting & Mechanical CAD
8. Virtual Reality
9. Change & Access Control

FORAN v8.0
The right shipbuilding CAD/CAM System

A complete integration considers all shipbuilding disciplines covered by the FORAN System as well as all the associated information for manufacturing and lifecycle



FORAN-PLM Advanced Integration is a solution that gives a strong communication of information, processes, systems and databases during the design, production and operation of ships.

Product Lifecycle Management (PLM) tools can be defined as the management of evolving and maturing product information throughout the lifecycle of a product. For medium and large shipyards developing complex vessels, the PLM system usually represents the formal central repository for product information disclosure.

While traditional CAD-PLM integration only considered document management and partial exchange of product structure, the FORAN-PLM integration enables a seamless integration and incorporates solutions to the most demanding requirements related to **alignment of BoM** between the different business systems.

The solution has been built taking in consideration the higher demands of large naval projects, in order to bring a state-of-the-art answer covering all stages of the vessel lifecycle, from the conceptual and basic design to the operation of the ship in all FORAN disciplines (Hull forms, General arrangement, Naval architecture, Hull structure, Machinery and outfitting and Electrical design).

Integration with the major PLM Systems in the market is currently available within the last version of FORAN, and it is being used in the development of large naval programs such as submarines, aircraft carriers, patrol vessels, landing vessels, etc.

Integration architecture

The integration is based on a **neutral framework**, built on standards such as web services, XML and CORBA, specifically developed to be as independent as possible from the specific characteristics of each PLM system.

The integration relies in two key processes to allow the bidirectional communication between the two systems: **publishing**, that means transferring data from FORAN to PLM, and **synchronization**, which means transferring data from PLM to FORAN.

From the data structure perspective, the integration is controlled by a set of tables on the FORAN Oracle database to allow the control of the following actions:

- Register all items and parts in the FORAN project published to the PLM, along with their PLM mastered data to be shared with FORAN
- Register all items and parts created initially in PLM allowing them to be incorporated into the FORAN project and then published onto PLM
- Control both the publishing and synchronization processes
- Mark items as locked from the PLM context to prevent modifications in the FORAN context

Integration scope

From an **administration perspective**, FORAN-PLM integration incorporates a utility to allow the mapping and configuration of the data model in the two systems, including **attributes manager** to configure which attributes will be shared between the two systems as well as which is the “master” system for each attribute. The PLM can be the single source of generation of items identifications.

As regards FORAN components (standard parts), the integration controls the **bidirectional transferring** of equipment components (mechanical and electrical), pipe/HVAC fittings components, cable tray components, types and sections of cables and transits types.

The integration comprises all entities, including equipment, hull structure, P&I diagrams, pipelines and duct lines (3D), auxiliary structures (seats)

and supports, electrical diagrams, cables and cable trays (3D), penetrations and welds.

From the **3D model** perspective, the publishing mechanism generates JT Open (the ISO standard format for viewing and sharing lightweight 3D product information) files with the geometry of each particular part.

In addition, the integration allows the publishing of the FORAN **build strategy** and incorporates a full set of functions to allow the direct use of the **PLM full document management functionality** (Download, Check-out, Search, etc.) from all FORAN modules generating documents.

Different options exist in FORAN to allow the locking of an entity because it has reached a certain maturity level. FORAN modules also provide additional scene visualization capabilities based on the maturity state of the entities in the scene.



Courtesy of Babcock International Group



Configuration Management and Applicability

Configuration Management in FORAN-PLM integration has been focused in the **Applicability** management (also known as hull Effectivity) in the context of a class project composed by several ships. Other important aspects of the Configuration Management like baselines, configuration

states and product structures are managed in the PLM system.

FORAN approach to Applicability is based on the concept of “**series**” project or “**class of vessels**” project that controls the common aspects of the series including:

- Standards
- Unique identification of the items in the series
- Applicability information
- Common locking management across all vessels of the series

Security markings

A new representation group (Secure) has been implemented to contain the geometry to be shown to no authorized users during reading process for each model object.

FORAN-PLM integration also contemplates the use of **access control** list as a combination between groups/users and authorization levels. The access control list of an item will be defined in the PLM and then transmitted to FORAN by means of synchronization mechanism for the equipment items and library’s models.

Change Management

Once the design reaches a certain degree of maturity, the **management of changes** becomes essential. In the case of FORAN, the process

is mastered by PLM that provides the Change Manager functionality to support the change process, including:

- Identifying the need for the change and definition
- Assessing the change impact
- Notifying participants involved in the change process
- Defining tasks to implement it
- Comparing before and after product configurations

Change Management in FORAN is controlled by ECN (Engineering Change Notice, in a design context) processes and FORAN deals with aspects like the identification, impact assessment, ECN viewer, development of tasks and comparison of product configuration.

Applicability can be defined for all FORAN entities of the project at different levels, including at item level in some cases (i.e. equipment). The applicability context of each item in the series project will be handled by means of a FORAN database table common to all the units in the project.

Once the applicability of an item has been defined or modified, the subsequent changes on that item (modifications or deletions) will take into account the new applicability values of the item so FORAN will automatically propagate the changes across all affected vessels of the series project.

FORAN also incorporates **tools to visualize** one or several vessels of the series as well as to perform comparisons.



Courtesy of Sanoyas

FORAN-PLM Advanced Integration Benefits

- Strong and complete integration between FORAN and different major PLM tools
- Scalable for large and complex projects specially in the naval field, with hundreds of users working simultaneously and high security restrictions
- The architecture of the solution is neutral and it is based in standards such as XML, web services and CORBA (Common Object Request Broker Architecture)
- All FORAN design disciplines are integrated and during all design stages, from concept design to manufacture and lifecycle
- FORAN-PLM Advanced Integration ensures the single source of data within the organization during the complete design, production and operation
- Proper answer to manage sister ships, one of the most challenging demands in the naval shipbuilding

