

Revitalizing Brazil's Shipbuilding Industry - A Case Study

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Abstract

This paper examines Estaliero Atlântico Sul (EAS), a shipyard which illustrates how rapidly-learned CAD/CAM/CAE 3D modeling software is playing an integral role in Brazil's shipbuilding revival.

1. Introduction

According to Lloyd's Register, in 1980 Brazil was the world's 2nd largest shipbuilding nation behind Japan. However, the industry collapsed in the following decades due to local economic factors such as hyperinflation, high interest rates and the ending of state subsidies. By 1999, no ships over 100 tons were being built and the industry had shrunk to only 2000 workers nationwide, *Paschoa (2010)*.

However, an amazing revival has occurred in the last decade in response to large deepwater offshore oil and gas discoveries. For political reasons, the Brazilian Government through its state-sponsored oil company Petrobras and its shipping subsidiary Transpetro have used these oil discoveries as a vehicle for job creation. Wherever possible the Brazilian government has required as many of the requisite vessels and oil rigs to be built within the country. This has resulted in a shipbuilding boom. Today, the industry has a national workforce of over 45,000 with approximately 80 booked orders for a variety of ships and rigs, *França (2009) and Paschoa (2010)*.

One of the most interesting stories involved in this revitalization is the meteoric rise of Estaliero Atlântico Sul (EAS), a new Brazilian shipyard which has received a substantial share of the new orders. This shipyard, with an order book of over \$3.4 billion USD, has been purpose-built to address the lack of modern shipbuilding capability within Brazil.

In order to capitalize on current opportunities, EAS has pursued an aggressive strategy of building the ships while the shipyard was still being built, *França (2009)*. This is all the more surprising since the shipyard is now the largest in Latin America with a total area of 1.65 million sq. m. *Paschoa (2010)*.

However, quickly constructing a shipyard of such size has not been the largest difficulty the company has faced. At a recent conference, Ângelo Bellelis, President of EAS, noted that his company has had challenges finding qualified labour. At full capacity, the shipyard will employ over 5000 workers, the majority of whom are locally trained and who lack any shipbuilding experience. The challenge of finding engineering staff has been even more acute. EAS has had to scour the country to find their team of 194 engineers, designers and draftsmen, *Bellelis (2009)*.

Based on this factor, EAS determined that its choice of CAD/CAM/CAE software would be critical to the success of its shipbuilding program. In order to ensure that the production design could be completed on schedule by a largely inexperienced workforce it was

determined that a stringent process was required to choose an appropriate 3D product modeling toolset.

The ShipConstructor software suite was selected as the center of a best-of-breed solution, largely due to the ease with which new users can become proficient in its use. As a result of the diligence applied in the selection process, EAS is already ahead of schedule on orders from Petrobras with good prospects for winning several more contracts.

2. Brazil’s Shipbuilding Industry

The recent growth of the Brazilian marine industry is astounding. The revival started in approximately 2000 with offshore platform construction for Petrobras and then continued at an accelerated pace in the second half of the decade in the wake of more oil discoveries in the Campos, Santos and Espirito Santo Basins.

Estimates vary widely regarding the ultimate size of Brazil’s petroleum resources but the proven reserves of oil are 12.8 billion barrels and the proven gas reserves are 365 billion cu. m. There are 29 sedimentary basins with oil and gas potential, comprising 7.5 million sq. km, with 2.4 million sq. km being offshore, *Paschoa (2010)*.

In order to develop and supply the petroleum industry, in 2006 Transpetro, the shipping subsidiary of Petrobras, selected shipyards to construct the first 26 ships in order to modernize and expand its fleet. In 2008, the Brazilian government launched the Petrobras Fleet and Support Vessel Modernization and Expansion Program which included orders for 146 support vessels, 40 survey/drill ships (12 already in construction by international shipyards and 28 to be constructed in Brazil), 23 tankers, and eight offshore rigs, *Paschoa (2010)*.

The need for more ships and rigs has led to a dramatic growth in employment as evidenced in the statistics provided by Brazil’s shipbuilding association, SINAVAL in Figure 1.

Year	Workers Employed in Brazilian Shipbuilding Industry
2000	1 910
2001	3 976
2002	6 493
2003	7 465
2004	12 651
2005	14 442
2006	19 600
2007	39 000
2008	40 277
2009	45 470

Fig. 1: Brazilian Shipbuilding Employment, 2000-2009. Source: SINAVAL, July via *França (2009)*.

3. Overview of EAS

In accordance with the Brazilian Government’s policy of supporting domestic control of the country’s shipbuilding industry, Estaliero Atlântico Sul is 80% owned by corporate Brazilian industrial groups (Camargo Correa and Queiroz Galvão) and 10% PJMR local shipbuilding

specialists. However, 10% of the ownership (worth \$22 M) is held by Korea's Samsung Heavy Industries (SHI) who is hoping to gain a share of the growing and lucrative Brazilian market, *França (2009)*.

The EAS strategy is to use the Petrobras/Transpetro orders as a launching pad to developing international competitiveness and to be productive within five years. To meet this challenging goal they began simultaneous steel processing and yard construction during the start-up phase of their projects.

The EAS shipyard was designed for a processing capability of 160 000 tons of steel per year with facilities to build ships up to 400 thousand tons and various types of offshore rigs, *França (2009)*. The shipyard has a drydock measuring 400 m in length and 73 m wide, a 400 m dock for construction and repair of ships and offshore rigs, with two 1,500-ton cranes and two 300-ton horizontal transport cranes. The property covers a total area of 1.65 million sq. m with a covered building area of 110, 000 sq. m, *Paschoa (2009)*.

The shipyard currently has an order book of \$3.4 billion USD for 14 Suezmax tankers, 8 Aframax tankers as well as the hull of a P55 semi-submersible platform, *França (2009)*.



Fig.2: Rendering of EAS Shipyard which is the largest in Latin America

4. Software Evaluation Criteria

The requirement for quickly training a new engineering team led EAS to create a specific set of criteria for the purchase of its 3D product modeling Computer Aided Design, Manufacturing and Engineering (CAD/CAM/CAE) toolset. At a conference in 2009, Ricardo Barcellos, Coordinator of Modeling for EAS, listed and explained criteria EAS used in their evaluation, *Barcellos (2009)*. To meet their needs, EAS believed the software had to:

1. Be shipbuilding-specific
2. Have seamless engineering to production integration
3. Be easily learned and used
4. Allow for working on the model in different offices at the same time

5. Shipbuilding-Specific Software

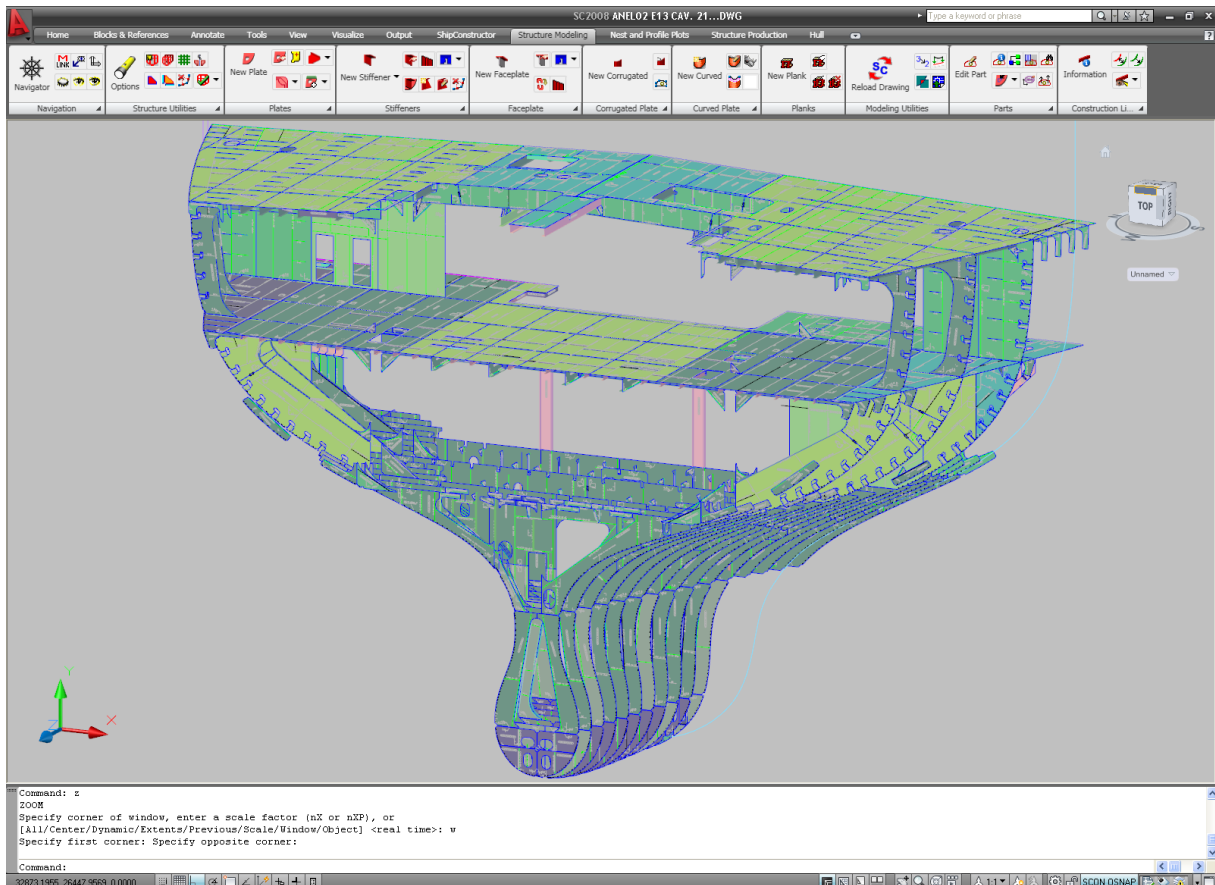


Fig.3: ShipConstructor Structure Module with AutoCAD interface and ribbon with shipbuilding-specific menus and tools.

EAS wanted a CAD/CAM/CAE software package that was specifically designed to fit the needs of shipbuilders. They saw that while some software packages were ideal for projects involving industrial plants or general 3D modeling tasks, they were actually weak when it came to modeling the complex structure of a ship.

EAS also realized that many different groups must interact during the design and construction of a vessel so it was important that they all be able to communicate using common terminology—the terminology of shipbuilding. This principle applied directly to how information was stored and displayed in the ship's 3D product model since the model is utilized throughout the shipbuilding process by various groups using different pieces of software for production automation and planning.

Unfortunately, some CAD/CAM/CAE programs define the product model's geometry and relationships in terms of parametric geometric elements rather than common marine-specific terms. This can confuse end-users who have little understanding of concepts having no real-world counterparts and that do not easily map onto the processes used in a shipyard.

Since EAS was building a modern shipyard designed to facilitate modern shipbuilding practices such as extensive pre-outfitting and design for production principles, they required a software capability that incorporated these principles directly into the 3D product model and facilitated the production of a vessel using these techniques. In addition they needed a software package that would allow seamless integration with shipbuilding production methods without requiring a high degree of production knowledge in the majority of their engineering staff. Only a shipbuilding-specific software package could fulfill all of these requirements.

6. Integration with Production

Due to the fact that EAS was working with an inexperienced staff, the company determined it was critical for the engineering information from the 3D model to be able to be easily transferred to production. Drawings had to be easily created and information for NC machine-cutting had to be accurately extracted.

This meant that the model had to be more than just a picture. Large amounts of detailed, shipbuilding-specific production output had to be able to be generated semi-automatically. With some software, especially those focused mainly on the 3D modeling tasks or those that are not dedicated to the shipbuilding industry, this is not possible so a significant amount of information for production must be created manually. This requires a high degree of expert knowledge and skill in the entire engineering department—things that were in relatively short supply in Brazil. Manual creation of production documentation would also have been costly, more prone to errors and much more time-consuming. This could have jeopardized the tight schedule EAS was facing in order to complete their first project.

By contrast, EAS saw that the ShipConstructor application allowed for the semi-automatic creation of accurate production output such as assembly drawings, arrangement drawings, spool drawings, plate nests and profile plots etc. because all relevant information is contained within a relational database.

The relational nature of the data also made possible interference checking, clash detection and other error-reduction features which helped speed up the process and improve the quality of work. These were especially important to EAS.

7. Speed to Proficiency

In order to be able to start work as soon as possible, EAS believed it was critical to be able to quickly train new workers on the CAD/CAM/CAE toolset. EAS could not afford to delay the engineering schedule while users gained a sufficient level of proficiency. The software had to be relatively intuitive so that work could start almost immediately.

EAS learned that with ShipConstructor this would be possible due to the way ShipConstructor is designed. ShipConstructor uses the widely-known AutoCAD software as a viewport into its SQL database. Users open AutoCAD directly and ShipConstructor provides a set of shipbuilding-specific menus and tools within the familiar AutoCAD interface. A consistent UI is maintained across several disciplines such as Structure, Piping and HVAC. All disciplines utilize AutoCAD as a viewport and workspace for interacting with the 3D model.

ShipConstructor works in the background via its patent-pending method for storing three dimensional geometry and attribute information within a Database Driven Relational Object Model. The database which stores the ship's 3D model is easily accessible for both importing and exporting to and from other best-of-breed programs which specialize in different aspects of the ship design and production process such as initial design, virtual reality visualization, document management and ERP.

EAS was able to find staff who already knew AutoCAD since it is a widely known design program used in most industries. These AutoCAD users were able to become productive in ShipConstructor after only a few weeks of training. The fact that new employees could quickly become proficient in the software was critical in a country where the industry was being built from the ground up and growing at a rapid rate.

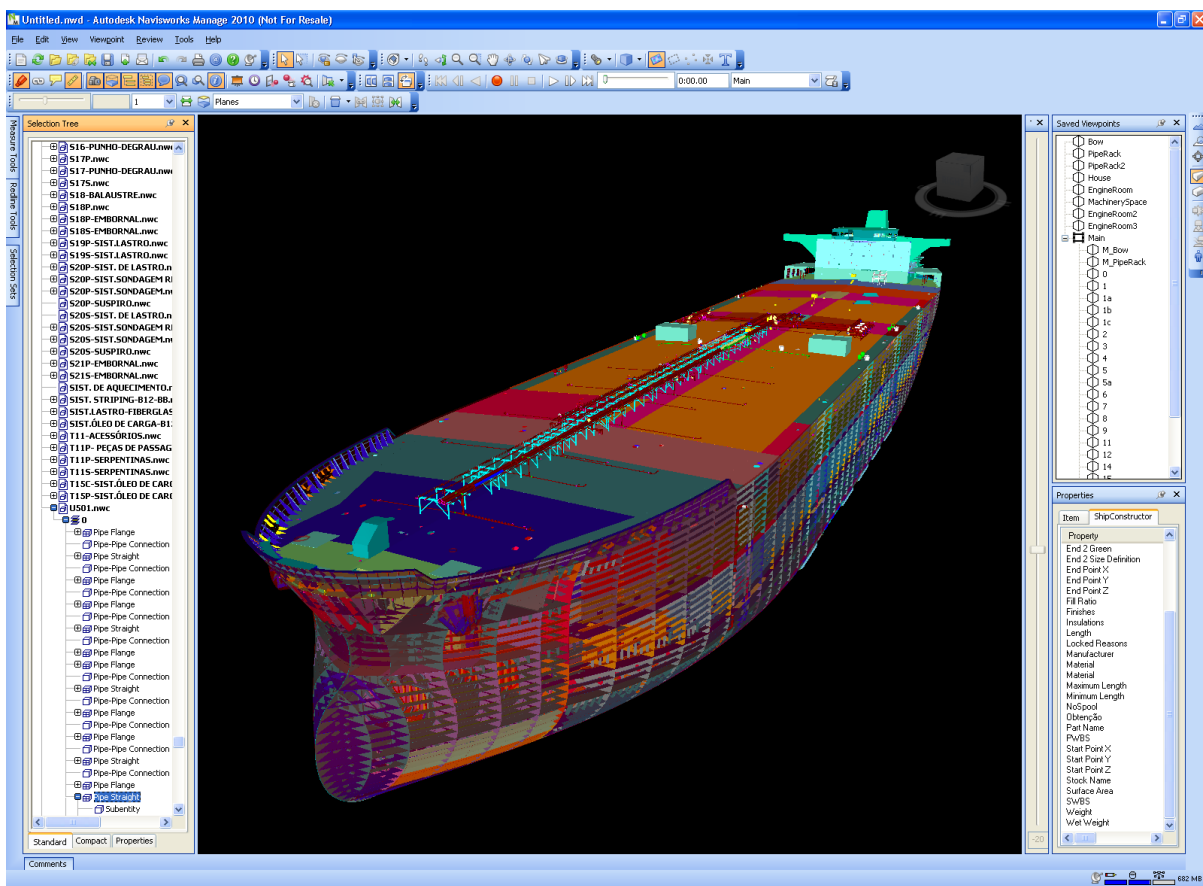


Fig.4: Completed Suezmax ShipConstructor 3D Model

8. Sharing the Model amongst Multiple Offices

EAS had a requirement that is becoming more and more prevalent in the global shipbuilding industry. EAS wished to split some of the production design and engineering work with another company. EAS had arranged for engineering firm CONSUNAV to handle the production engineering of distributed systems such as HVAC, Piping and Equipment while EAS was to be responsible for the structural detail design. That meant that both companies had to have access to the 3D model at the same time while separated by a distance of over 2000 kilometers.

Working on the model over a real time network or internet connection was not a viable option due to the vast distances involved as well as the lack of sufficiently robust and reliable infrastructure. However, trying to work on two different versions of the 3D product model would have resulted in an error-prone project management nightmare.

ShipConstructor fortunately provided a lightweight technological solution. ShipConstructor allows parts of the model to be “split off” and “sealed”. In other words CONSUNAV could work on some parts of the model, safe in the knowledge that EAS would not have the ability to overwrite those areas and vice versa. The split model could then be merged back together when required. This solution was critical in giving EAS staff in Recife the ability to work on the model simultaneously with the CONSUNAV staff in Rio de Janeiro.

9. Conclusion

Brazil is showing the world that a country’s shipbuilding industry can be brought back from the dead in a short period of time. However, the largest problem Brazil faces is the need to quickly train workers. The success of Estaliero Atlântico Sul has proven that a careful selection of technology can help address this challenge.

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