The Gien Project Implementation - "Naval Architecture Integrated Management"

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ABSTRACT

Since the beginning of the Marlin's Field development, on the 90's, the Campos Basin oil production has been increasing at high rate. As a result, there was a boost of production units operated by Petrobras. Due to projects and operation complexity and the large number of contractor companies, problems related to data management on Naval Architecture were observed. Furthemore, due to fleet enlargement, difficulties regarding modifications on SPUs (Stationary Production Units) were also observed. Bearing this scenario in mind, it was decided to create a data management project to deal with the Naval Architecture aspects of offshore projects. Such management, in addition to its capacity to deal with the aforementioned problems, would provide assistance on emergency events.

The GIEN (Naval Architecture Integrated Management) project implementation was based on SPUs documentation revision, the development of a follow-up tool to manage modifications carried on onboard, the upload of all data on a single homepage, the emergency services rendered by a SALVAGE company and the engineering support provided by Classification Societies technical divisions.

This paper describes in an abridged form, the present situation of the GIEN project on Petrobras. Resources used and improvement gains derived from such implementation are also studied.

Keywords: *at least 3 suitable keywords for indexing purposes*

1. REVIEW

From 1990, PETROBRAS production fleet had a considerable growth. On 2000 the number of Units had doubled from 1990, as can be shown on Figure 1.

Moreover, an aging process was observed on operating units.

Continuous work carried on to comply with new rules, production plant upgrades, modifications to performance enhancement, and new projects data had turned difficult the management based on the former structure

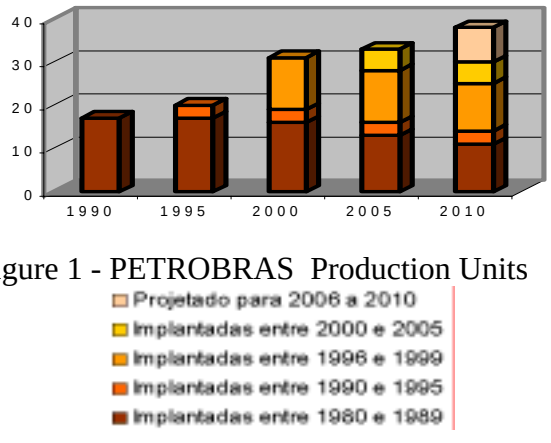

Figure 1 - PETROBRAS Production Units

Furthermore, the registry of some accident events that had occurred on that time and the great need of naval architecture support in order to take decision on emergency events

may explain the decision taken to develop the GIEN - Naval Architecture Integrated Management.

Regarding the accidents events, engineering analysis had shown to be very useful to support decisions. However, such analysis took a long time to be processed, a time that could be saved if a structure ready to provide feedback were available.

Some accidents events may be presented, for example, when tugboats had collided rig's columns, as shown on Figure 2.

Figure 2 – Semi submersible unit's column hit by a tugboat.

The GIEN project aims to gather engineer tool and the data that may be necessary to perform an immediate analysis. Project encompasses class continuance, modifications management and engineering response/support on emergency events.

This paper introduces GIEN's functions, organization and main activities.

2. PROJECT STRUCTURE

The GIEN project is basically formed by technical branches (TB) and by PETROBRAS engineers working on operations divisions, and company's headquarters

Technical branches (TB) are formed by engineering company/divisions of Classification Societies, such as ABS, BV and DNV, employing dedicated engineers and technicians working on the project under total or partial commitment.

The advantage to have a structure associated to Classification Societies is to rely on their expertise, an easier communication and support on the pursuit of engineering solutions.

Petrobras has a dedicated in-home team to perform response and support activities.

Labor - Structure

Each TB provides:

2 engineers on duty (24 x 365).

Offices:

- Fax and voice lines
- Notebook running numeric analysis software and their applicable models
- Priority documentation hardcopies
- Daily back-up of models and check of loading conditions as informed by Petrobras.

PETROBRAS team also works on a 24x365 duty basis, with a dedicated technician skilled to set in motion the entire project structure

3. MAIN ACTIVITIES

Among project activities, the following ones may be highlighted

- Technical documentation update and

filing:

a. *"as built"* drawings revision/issuance.
b. Operations Manual Revision.
c. SOPEP (Marpol) manual update.
d. Active documentation control.
e. Salvage Kit issuance (pls refer to item 4.1)

- Engineering analysis in order to assess Unit's global integrity

In order to make available the necessary tools to perform a quick analysis, numeric models were prepared for each unit. Data is uploaded on project homepage and divided on modules, as explained hereinafter.

- Engineering services applied to modifications project/implementation

A Lotus Notes based service used by PETROBRAS prior to any onboard alteration project, to submit a query to the Technical Branch related to class impact and rules requirements to be complied with. Thus, the answer issued by the TB allows the performance of the intended work according to Classification Society standards. Such system, besides its capacity to prevent the execution of modifications that do not meet such standards, also provides a better control over modifications carried on the Units.

- Check list and inspection plans:
- To be used on annual periodic surveys, intermediate surveys and class renewal surveys.
- Courses Preparation:
- Courses preparation encompassing class and statutory requirements. Emphasis is given to electric, structure and piping subjects.
- Emergency situation response:

a. Numeric models updated on a permanent basis, allowing Units assessment in case of an emergency event.
b. On duty engineers and infrastructure, as explained on item 2.
c. Units' daily loading conditions uploaded on the web page and filled.
d. Availability of engineering priority documentation.
e. On duty Maritime Salvage Center.
f. Kit Salvage (4.1).

4. GIEN MODULES

GIEN's structure, as aforementioned, has been divided on modules accessed by a homepage on Petrobras' intranet.

Every module provides data related to technical personal in charge on Petrobras and on the Technical Branches. Below it follows a summary of the main products in each module.

4.1 Emergency Module

This module aims to gather critical data to an emergency event response, and is formed by the following items:

Kit Salvage Unit's drawing package, as updated by data collected on board, in order to provide immediate data required on contingent operations on an emergency event.

SOPEP This plan is developed based on Rule 26 requirements of the Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto. The plan includes every data and operational instructions required by IMO's document "Guidelines for the development of shipboard oil pollution emergency plans".

This plan aims to set forth procedures required to a fast and efficient response to control an oil spill and/or the impact on the environment.

Emergency Manual This document aims to introduce the Emergency Service Response.

It contains contact procedures and emergency response flowchart, on duty team and their tasks, FAX transmitting forms and

sketches, reference documents, stability on damages cases analysis, structural damages cases and a response model.

Based on data collected and information available, the duty team is capable to issue a technical analysis related to corrective actions, using numeric model, whenever necessary and its personal expertise,

SSTAB Model SSTAB is a static stability simulator employing a geometric model to assess floating stability systems, such as Semi-submersible Units or F(P)SOs. The simulator is the result of a partnership between Petrobras and the Brazilian Catholic University (PUC).

A net generator called MG, produces the geometric model. This software exports to hydrodynamics analysis software and even to structural ones.

This software analyses stability criteria, as defined by IMO (International Maritime Organization), DNV (Det Norske Veritas), ABS (American Bureau of Shipping) and NMD 1992.

The dependable results achieved on the analysis performed, when compared to other well know softwares, even those used by Classification Societies, encourages its use on board of every Petrobras Unit. Thus, it would be the certified software to be used on loading conditions assessment, stability, bending momentum and shear stress.

This software success may be also evidenced by its adoption as the stability analysis standard software by the Technical Branches.

Report Stability A spreadsheet designed to generate a daily load report of every tank and cargo onboard. On emergency events, this spreadsheet may be used to feed loading conditions depicted on the numeric models to be used on Unit's actual condition simulation.

Every unit has its own report pattern, causing to support technicians to be familiar to each of every one. Some units employ the SSTAB software, saving the loading file on the page, and doing so, they speed the process. On the coming years it is expected that every Unit employ this mechanism, eliminating the inconvenience of reports based on different standards

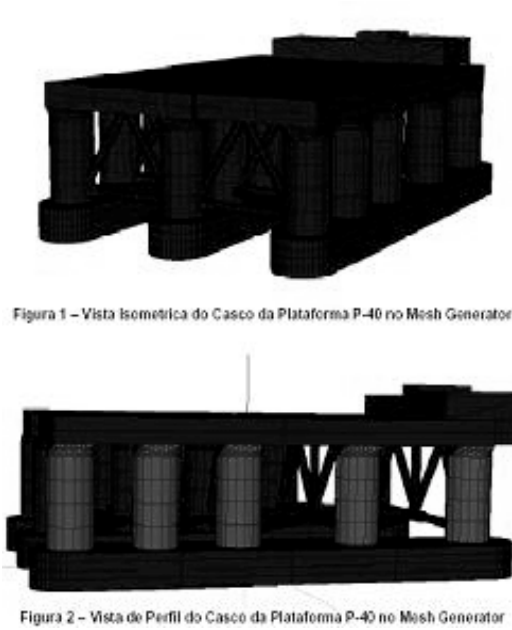

Figure 3 – Semi-submersible Unit SSTAB model example.

4.2 Structure Module

This item is related to Units structural model, life span to fatigue analysis and building steel specs.

Structural Model Structural models are base on actual data. In order to achieve this, a thorough updating work was a performed on technical drawing.

This model allows Unit's primary structure integrity evaluation.

Structural models are built based on finite elements as adopted by Classification Societies.

This model allows hull stress monitoring, buckling analysis related to ship's beam (FPSO) and primary elements (Semis e Jack up), as well as primary connections fatigue check.

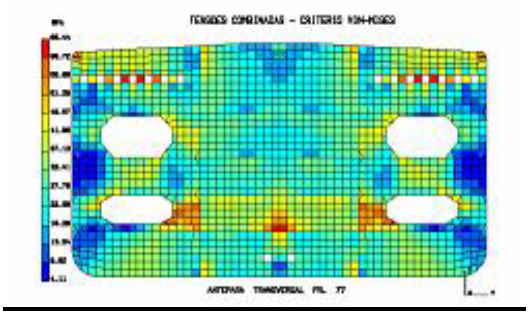

Figure 4– FPSO Unit structural model example.

Fatigue Life Analysis This report aims to indicate structure's critical areas in terms of fatigue, in order to set priorities to the joints to be inspected on class surveys.

Building steel specs Lists every type of steel used on the construction

4.3 Stability Moule

On the beginning, this module was based on calculation software adopted by the Classification Societies. As the SSTAB program became comprehensive and reliable, there was no need to run two models for the same purpose. Presently, a model executed on PETROBRAS' software is used both module, Emergency and Stability.

This module presents a Sounding Table, Capacity Plan and Free Board and Tanks Hydrostatic Characteristics (volume, crossed and longitudinal inertia momentum and tanks and areas centers).

4.4 Mooring Module

This module is related to the entire model of the mooring system, risers lines, fixed offsets rosette used on project's extreme conditions.

Some numeric models have already been used on line rupture cases. Such work have shown that with the GIEN implementation, is possible to achieve quicker responses on replacement of broken lines.

Throughout Units project several tests were carried on test tanks and wind tunnels. The GIEN project is recovering such data in order to attain more reliable coefficients on mooring models.

4.5 Hydrodynamic Module

The hydrodynamic model generates data to structural and mooring models.

Like the mooring model, it is important to recover, or even to carry another experimental test, in order to achieve the most reliable numeric coefficients.

This module generates:

- RAO curves to six degrees of freedom (DOF).
- STR (Short Term Response) curves.
- RAO curves combined to two preset points.
- Besides the aforementioned data, this page is expected to consolidate every information related to PETROBRAS naval architecture activities

5. MARITIME SALVAGE CENTER – SALVAGE

In order to complete the Naval Architecture subjects integration structure, the GIEN was integrated to the Maritime Salvage activity

SALVAGE is a service intended to render assistance to ships under distress, and is formed by the following resources:

- 24 hs on duty Salvage Master;
- warehouse fitted with several salvage operations equipment;

Figure 5 – Salvage Center Equipment

- a damage control kit onboard of every Unit;

Figure 6 –Damage control kit on board of Units

- Access to Units data through GIEN's web page.

Figure 7 – GIEN's web page

6. CONCLUSION

On the upcoming years, the GIEN project shall undergo an evolution process. The project cannot be considered concluded, since new requirements arise every day, and more and more, it is observed that the tools developed may be used on other unplanned activities

In addition, Petrobras is expanding its floating units fleet, resulting in a permanent data acquisition and numeric modeling always on progress to the new units.

During project term, its impact and success was confirmed by

- 7.364 controlled drawings, where 3.049 as-built;
- 25 ready to use Salvage Kits;
- 27 ready to use Emergency Manuals;
- 27 ready to use and calibrated Stability and Emergency Response;
- 22 ready to use and calibrated Displacement Models;
- 22 ready to use and calibrated Structure Models;
- 13 ready to use and calibrated Mooring Models;
- 592 modification processes under Classification Societies supervision
- 155 engineering analysis carried on by the Technical Branches;
- 24 hs on duty Maritime Salvage Center;
- 24 hs ERS service availability on the Technical Branches;
- 24 hs GIEN web page to consolidated every naval data related to UEP's;
- Simulations that have proved a major time reduction on emergency event response
- Naval data easy research

7. CREDITS

Author would like to demonstrate their appreciation to PETROBRAS and the Technical Branches for their support on this project

8. REFERENCES

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principles to GIEN’s numeric models

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BT-ABS SSTAB Modeling Report– ABS.