# Cluster #1. Collaborative management of inspection results in power plant turbines

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## 1 Introduction

Tecnatom is an engineering company that provides services to a number of markets, including the nuclear energy, combined cycle and thermal, aircraft and aerospace, transport, and petrochemical markets. The company's main activity is performing inspection services and training operation personnel.

As part of the evaluation of the structural integrity of nuclear power plants' components and industrial facilities in general, Tecnatom performs inspections and tests based on applicable standards. **Once an inspection has been carried out, the results are recorded, transmitted and evaluated. When defects are detected, the flow of information becomes crucial because there are many actors involved**

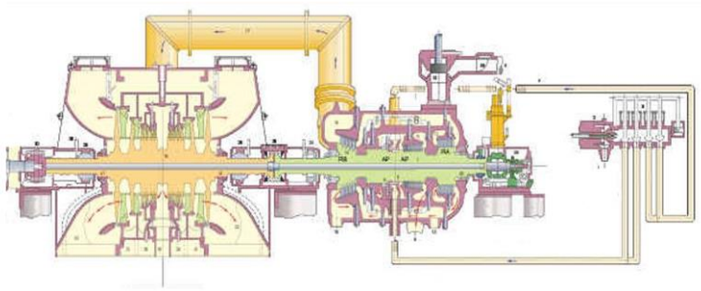

*Figure 1. Typical turbine-generator set scheme*

Within the UiW context, **this industrial case is centered on the power plant steam turbine, which are long-lasting, high-investment component**

## 2 Developed architecture

In this industrial case, actors, product and services were modeled based on the model-based systems engineering methodology defined within the context of the project Virtual Spacecraft Design (Rey, 2013). The model focuses on identifying the structure of any relevant information that the system has to store and manage to provide the needed functionalities. **The model considers separately the product, which involves the power plant turbine, and the service, which involves the inspection of the turbine for maintenance purposes.** Actors can also be classified into two categories: (1) those who approach the problem from the point of view of the product and (2) those who approach the problem from the point of view of the service.

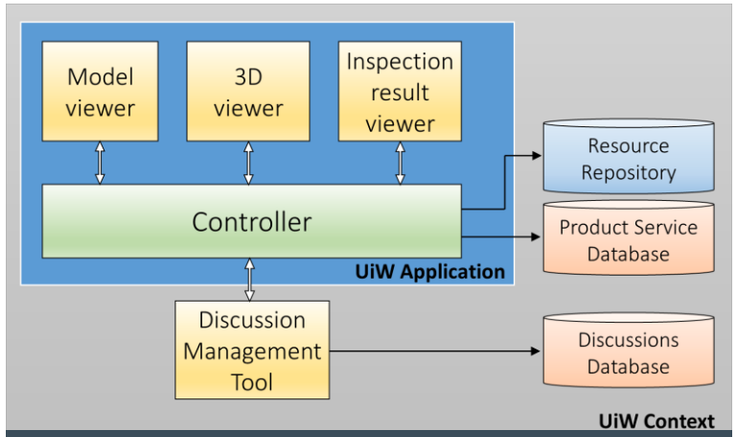


*Figure 2. Block architecture of the system.*

**A web application was developed using ASP**, whose architecture is shown in fig 2. This developed application includes a 3D viewer module, based on HOM3R (González-Toledo, 2016), which is integrated using WebGL.

## 3 3D Viewer

The implemented 3D viewer module graphically represents the 3D geometry of the turbine model. In addition, the application allows users to interact with the product by **navigating around** the turbine 3D model. To help the user with the **visualization of hidden** parts, some mechanisms have been implemented (Burns, 2011):

- Navigation around the 3D model. The user can navigate around the turbine model using the mouse and the keyboard. Camera movements follow ellipsoidal paths in order to adapt to long parts, making navigation natural.

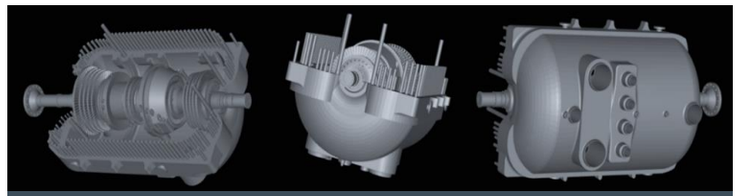

*Figure 3. Navigation around the product*

- Occlusion Management. As some parts are occluded by others, the system provides mechanisms to make them visible. without losing its spatial relationship with the other parts. Several mechanisms, as adaptive transparency or exploded views have been implemented.

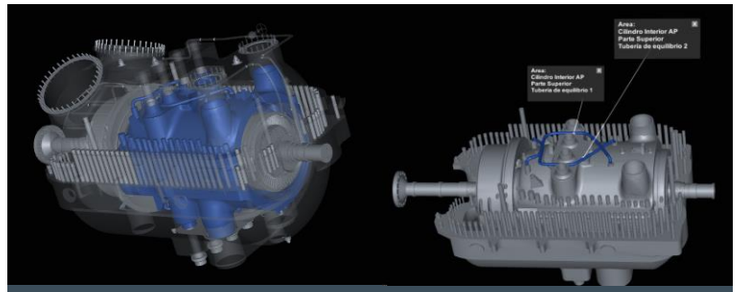

*Figure 4. Adaptive transparency and labeling.*

- Labeling. Together with the 3D model. Some mechanisms have been implemented to present the inspection result information in the 3D viewer. One of them consists in overlaying the turbine graphical model with labels.

## 4 References

Rey J., Modeling with VSEE: Definition of Guidelines and Exploitation of the Models. YGT Final Report. Virtual Spacecraft Design Project. European Space Agency, 2013.

González-Toledo, D. et al. HOM3R: A 3D Viewer for Complex Hierarchical Product Models, to be presented in EuroVR2016, Athens, Nov, 2016.

Burns, MS., Efficient and Comprehensible Visualization of Complex 3-D Scenes. PhD Thesis, Princeton University, 2011.

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