



Air France Industries: creating a virtual tool to plan in advance for real-world defects

1. Organisations involved

Air France KLM

2. Description of the case

2.1. Introduction

Air France KLM operates in three main businesses: passenger transport, freight transport, and servicing and maintenance services under the name Air France Industries.

Air France Industries is made up of a number of distinct organisations, one of which is the so-called "Engine" facility that focuses on the servicing of turbojets for the Air France KLM fleet and other customers.

As new commercial jumbo jets such as the A380 enter the aircraft market and jet engines become increasingly large, maintenance workshops must meet these new demands by increasing their handling capacity.

In 2004 Air France Industries reorganised one of its maintenance workshops at Orly airport, part of its Engines business.

Engine servicing takes place in three stages:

- One unit (unit 2) is responsible for initial engine dismounting to remove several modules.
- Other units (unit 3, unit 4, unit 5 and unit 7) are responsible for dismantling the modules into parts, then re-assembling them after treatment. Each unit is specialised in a particular type of module for all types of engines.
- Finally, one unit is responsible for cleaning the modules (chemical and mechanical scrubbing), inspecting them (non-destructive testing by ultrasonic or eddy current methods, for example) and then restoring them to those units in charge of reassembly.

Air France Industries took advantage of an opportunity to re-vamp one of these engine maintenance workshops provided by the moving of a department from the Orly site to Villeneuve-le-Roi, freeing up a significant work space. It was also necessary to replace industrial equipment that had become obsolete.

This work was carried out as part of the "Prisme" programme for industrial rationalisation of existing engine areas, and the new workshop had to be able to receive jet engines 3.5 metres in diameter, whereas the equipment had previously been designed for engines 2.2 metres in diameter.

At the same time, certain production units that had been on different sites now had to be grouped together coherently on this one site. All this involved the installation of larger machines, enlarging the traffic aisles and setting up suitable lifting and handling equipment. The area available was 8000 sq. m broken down into 70 units, each unit consisting of 20 to 30 office items, machines, handling equipment, and so forth.

As part of this reorganisation, risk prevention and safety questions were re-examined on site. Air France Industries wanted to limit the number of areas where pedestrians had to use the same pathways along which machinery was moved and so needed to reorganise the internal and external traffic plans.

To summarise in a few figures, the "Prisme" project represented:

- a budget of €20m;
- an area of 8000 sq. m to be reorganised;
- 1030 people involved in "Engine" operations, of which 700 were affected by the reorganisation;



- approximately 250 engines handled by the "Engine" workshop each year, each engine refurbishment taking about 60 days' work.

2.2. Aims

Air France Industries applied to the Ile-de-France regional health insurance fund (CRAMIF) for help with the project. It was proving difficult to assess the 2D drawings and identify any production, safety and ergonomics issues.

Moreover, Air France Industries wanted to involve all the personnel affected by the reorganisation in the process of designing this new workshop to enlist their support for the changes and enhance risk prevention.

The solution chosen by the partners involved in this project was the creation of a three-dimensional interactive computer model, and for this the partners asked for the help of the French national research and safety institute INRS.

The aim, then, was to make a tool that would make a 3D project visualization available to everyone involved and which would make group work possible.

2.3. Scope of the project

To carry out this project, the organisation called on the CRAMIF, which had already provided OSH services for chemical treatment equipment of Air France.

The INRS provided its support for the simulation project. The planned numerical simulation tool, consisting of software showing the future workshop viewable in 3D, had to fulfil two objectives: to enlist the support of employees for the changes by providing them with a detailed view of their future work area which 2D drawings did not allow, and to identify any safety, ergonomic or production issues before the changes were made.

The INRS therefore developed a tool specific to the needs of Air France Industries. Using in-house computer modelling expertise, a preliminary model was produced to help establish the specifications. The idea was to show that such a tool was feasible, offering a realistic representation of the space and performing well when it was used by planning groups and individual workers.

The difficulty was to produce a model that would be as realistic as possible, showing the maximum data, while at the same time remaining fluid in its operation and easy to work with. To this end, objects were to be composed of simple shapes (cubes, spheres, cylinders) wherever possible.

The design work began with:

- Identification of the objects to be simulated with the help of a representative from each of the 3 units
- Metric and photographic identification of these objects
- Collection of available drawings of the building, of planned changes to the building, and the machines chosen for the new locations
- Translation of the 2D drawing into a 3D model incorporating the objects
- Validation of the model and its interactions with the managers of each of the 3 units
- Finally, deployment of the model.

An interactive three-dimensional simulation was created. This required the modelling of:

- a building;
- 50 specific machines;
- 40 handling devices (trolleys, pallet jacks, etc.);
- 50 items of furniture (benches, cabinets, racks, etc.).

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These models made it possible to form 70 units each consisting of 20 to 30 items.

For the simulation to work, a number of technical constraints had to be considered. The simulation was based on elaborated structures for the various constraints. Production of this model required two months' work and the cost of the simulation was €20,000.

The INRS used experience drawn from the computer gaming universe to produce this collaborative tool. Each employee had to be able to access it at his work station. Working on a tool of this scale was a first for the INRS, and was very instructive.

Following this preliminary stage, production of the finished model was handed over to an outside service provider. The simulation was recorded on CDs that were then distributed to the workshop employees.

Everyone was thus able to take a virtual tour of their future work area. Feedback showed the model was well-received by the personnel.

One month after distribution of the CDs, meetings were organised by each processing unit to gather comments. This information was summarised and analysed by a project monitoring group.

2.4. Results and evaluation

Before the beginning of the Prisme project, a large number of staff had reservations about the project and the large scale changes it involved.

The virtual model was a great help in furthering understanding of the project. The ease with which the model could be used enabled everyone to visualize themselves in their future working environment. By comparison with hard-copy drawings, the 3D model gave a better understanding of the new layout and helped highlight inconsistencies.

Being able to view movements within the workshop made it possible to detect and correct certain ergonomics and safety problems in the proposed layout of the premises, such as a poorly located column and doors opening in the wrong direction.

The main difficulties identified concerned traffic lanes and difficult access to certain work stations because storage areas nearby for bulky parts were not large enough.

However, the decision to use a computer model was taken at a late stage in the project and limited the benefits that could have been derived from it. Air France Industries nevertheless regard the experience as positive and it plans to introduce the use of this type of simulation for all future projects.

Working conditions at the re-designed premises have been improved, in particular in safer circulation around the premises and safer access to work areas for maintenance workers.

The model will continue to be used by the Safety Manager – while the actual layout mirrors the simulation - to train new recruits about the operation of the workshop and raise awareness about possible risks.

2.5. Contact information

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2.6. *Transferability*

This method is applicable to all types of industry and all activities in any country.

In the future, Air France Industries plans to use the same approach in its future projects.

Moreover, this collaboration proved profitable for the partners brought in to assist Air France Industries and led to further thinking on the subject at the INRS. A three-year study is now in progress using similar tools in the bakery trade, in cooperation with the "Institut National de la Boulangerie-Pâtisserie" (National Bread and Cake Baking Institute).