

The MOLOG Project

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Image courtesy of EDF

Three-dimensional (3D) computer-aided design is already well established for the layout design of new plant in the process and power industries. This layout design can be checked for engineering data consistency and volumetric clashes between adjacent engineering components, thus achieving high quality design. No attempt is made to model the physical assembly of the plant.

However, the engineer planning maintenance of an operational plant cannot ignore assembly and disassembly of significant engineering components. He may also need to model the transitory movement of such engineering components (freight) and the maintenance vehicles and cranes (handling devices) that transport them to ensure their routing path is obstruction-free.

In confined spaces with complex engineering components such routing paths can be complicated. An example might be the replacement of a large heat exchanger unit within a nuclear power station. An existing unit (350 tonnes, 20m high – see picture) will need to be disassembled and removed from the reactor containment vessel before being replaced by the new unit.

This extraction and re-installation of such a unit needs to be carried out safely within the nuclear environment and without fear of damaging adjacent plant. It also needs to take place as fast as possible as each single day of power station non-operation can cost up to £1 million in lost revenue.

Moreover, planning all movements of engineering components and maintenance vehicles associated with interrelated maintenance activities in a complex restricted environment is crucial in many industrial domains where 3D space needs to be managed as a critical resource.

Currently such routing paths for engineering maintenance are designed manually. However, many such motion planning problems cannot be worked out with mental visualisation or mock-up representations. 3D CAD has the potential to improve both motion planning and project planning

of complex maintenance activities to bring the high quality of 3D CAD design to improve the maintenance efficiency of operating plant.

Cadcentre is addressing this industry need for improved engineering IT support of the operational phase of the engineering lifecycle by participating in a collaborative research and development (R&D) project. The MOLOG (MOtion for LOGistics) R&D project has been initiated to create a collaborative 3D integration environment to facilitate kinematic behaviour of engineering components and associated maintenance vehicles, their automated motion planning and the corresponding management of interrelated maintenance activities.

MOLOG is a three-year R&D project which started early in 1999 and is supported by the European Union. Electricité de France (EDF) is the engineering end user who will gain practical benefit from the project as a plant owner/operator. The University of Utrecht in Holland and the Toulouse-based French research organisation LAAS-CNRS are two European academic institutes who are providing leading edge motion planning algorithms and technology to the project. In co-operation with the three other partners Cadcentre has designed the unifying integration environment as a motion planning API based on appropriate object-oriented class libraries. A provisional MOLOG implementation based on PDMS has been developed to facilitate initial integration testing and pilot demonstrators.

A number of simple kinematic engineering scenarios have already been successfully demonstrated. These include:

- A bridge crane carrying a load which avoids obstructions in a very simple 3D model
- A polar crane moving a load within the PDMS stabiliser plant 3D model
- A forklift truck in the PDMS stabiliser plant 3D model following a complex route path calculated in the partners motion planning software to avoid obstructions

The user interface (UI) of the MOLOG implementation is being developed by EDF following a survey carried out to establish best practice amongst its maintenance engineers. Interactive motion planning scenario description and selection of both maintenance vehicles and engineering components as freight are available to the maintenance engineer as well as interactive visualisation of specified routing paths and computed trajectories.

Having designed and verified successful 3D integration with kinematic behaviour in the first year and a half, MOLOG's next step is to progress to real engineering maintenance situations for rest of the project. Over the next year and a half the activities are expected to include:

- Extending the engineering user interface to cover more real tasks in maintenance project planning
- Increasing the complexity of the 3D plant model
- Extending the number of engineering transportation vehicles and devices supported
- Implementing the motion planning API in the forthcoming generic PDMS Toolbox API
- Enabling calculation of obstruction-free route paths at good interactive rates
- Optimising the quality of route paths, e.g. smoother, more realistic
- Greater control of the motion of maintenance vehicles and routing constraints

Although MOLOG is an R&D project, it wishes to produce as practical a solution as possible to deliver substantial benefits to real engineers. Thus the project would like other interested PDMS users to participate and contribute real engineering maintenance scenarios, including non-nuclear ones, for testing in the MOLOG environment. Interested users can contact the MOLOG project through Neil McPhater, Business Integration Manager, at Cadcentre in Cambridge. More information on the MOLOG project as a whole can be obtained by visiting the website at: www.laas.fr/molog

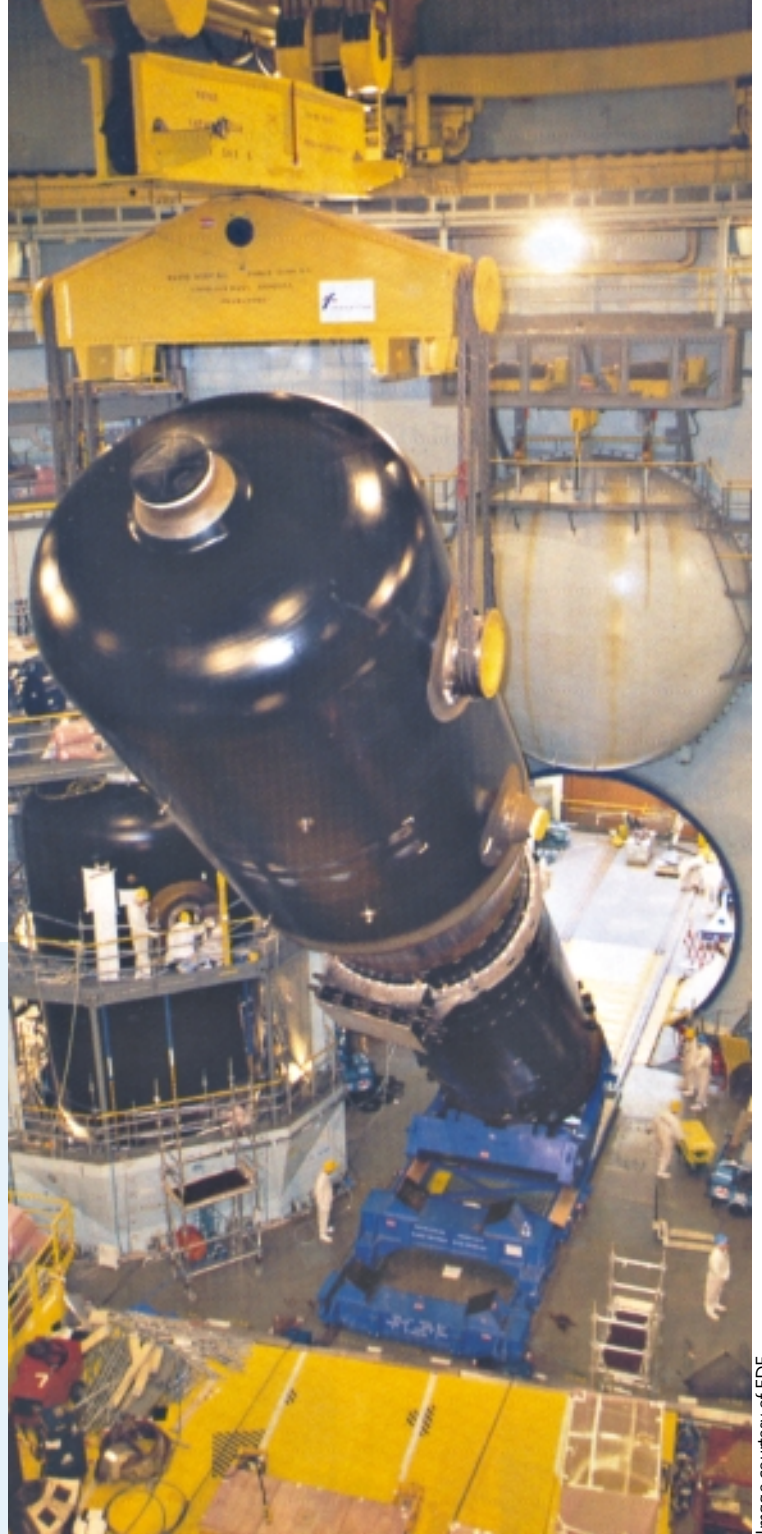


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