

## Innovation Reports

**3D-TESTBENCH**

(ITEA 2 ~ 06043)

3D virtual design environment speeds complex product development

**MULTIPOL**

(ITEA 2 ~ 07001)

Securing access across multiple domains

**UseNet**

(ITEA 2 ~ 06004)

Leading the way in ubiquitous machine-to-machine networking

**3D-TESTBENCH**

(ITEA 2 – 06043)

Andy De Mets, Barco  
Belgium

## 3D virtual design environment speeds complex product development

The 3D-TESTBENCH project has developed a virtual environment linking multiple engineering tools for collaboration in design analysis and validation of complex products. It provides a multi-disciplinary 3D display solution based on integrated automated workflows and knowledge-based engineering tools to enable virtual prototyping and testing – reducing design times markedly while providing notable cost savings. The individual building blocks are already being exploited, while the overall concept has been proven and is being developed further by the project partners.

Many disciplines are now involved in industrial product design. So it is necessary to operate at a higher level to review activities and catch problems such as those of integration early on. Even 10 to 15 years ago, a product could have been developed and built by relatively only a few people. Now many more people are involved because the complexity has increased and more disciplines, also non technical, have become part of the design and manufacturing phases.

3D-TESTBENCH has developed a test platform which allows all participants to visualise and validate a complete development or part of a development. The whole team can come together in one room to review the design on a 3D display with input from multiple desktop or laptop computers, moving from one

block to another in the development cycle. And this approach could possibly be extended in the future to enable collaboration between remote teams in plants say in China and Europe enabling both teams to have the same views of the project.

The initial idea was to bring semantics and ontological aspects related to documents and drawings within engineering processes. The original project proposer was unable to obtain funding, but global visualisation solution provider Barco was still keen to continue. Together with Vrije Universiteit Brussel (VUB), Barco oriented the project to more 3D scientific visualisation aspects, manipulating simulation models for engineering. The idea was to develop a virtual design environment consisting of multiple engineering design

tools to take the collaboration and design analysis to a new level and even further to improve the validation processes of complex products.

The two original partners were quickly joined by test and mechatronic simulation specialist LMS International in Belgium through its subsidiary NOESIS Solutions – now an independent spin-off company and leader in process integration and design optimisation – and aircraft wiring harness manufacturer Fokker Elmo and TU Delft in the Netherlands. While there was also interest from Germany and Spain, the funding for them was unfortunately unavailable. So, in the end, it was a small project with just five partners in two countries. This meant concentrating on proving the concept and its feasibility.

**COMPLEMENTARY EXPERTISE**

The five partners proved a good match as they were highly complementary with good individual expertise and each a leader in its own domains:

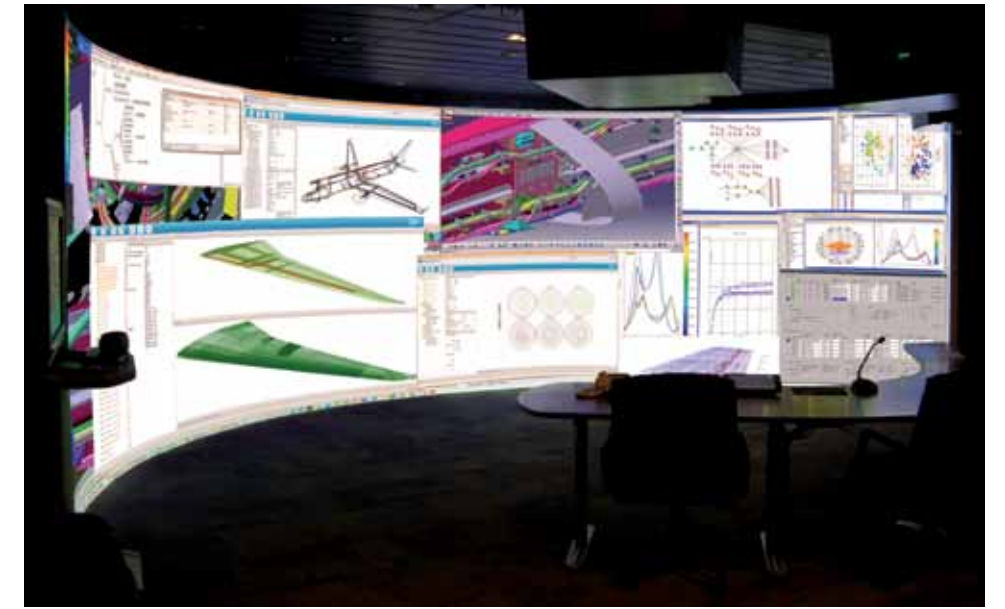
- Barco – an ITEA founding company – could supply the visualisation technology for the virtual environment, projection hardware and integration of the multiple user interfaces;
- NOESIS Solutions – as part of LMS – offered a workflow management framework to enable the integration and configuration of engineering tools or services;
- TU Delft specialised in modelling language, test formalism and knowledge-based engineering (KBE);
- VUB had particular expertise in analysis and visualisation software for modelling and inspection of coupled of computational fluid dynamics (CFD) and finite elements methods (FEM) numerical simulations; and
- Fokker Elmo could provide a real use case for wiring in aircraft to raise the level of design automation and improve the accessibility of tooling.

Integration of the multidisciplinary development process focused on two specific problems. The first was the need for a collaborative engineering environment with high-end visualisation technology and with workflow automation software to make it smart. The second involved the growing importance of knowledge-based engineering aspects to take software-based modelling and simulation to a new level.

One of the main aspects of the project was the use of computer resources to predict and provide a virtual experience of a product without the need to build it physically. 3D-TESTBENCH developed a solution using knowledge-based engineering to do just this – eliminating the need for expensive mock-up prototyping with real hardware. The result is achieved faster and cheaper in a collaborative environment with all the disciplines in one room.

The major emphasis in the project was the integration of mainly existing technologies – but with new twists. While there were no real individual breakthroughs, there were several important innovations such as:

- Integration of the engineering work flow from NOESIS;
- Development of desktop-sharing technologies that Barco intends use both internally and for new products;
- Creation of a domain-specific language to automate wiring harness design;
- Formalisation of design processes for knowledge-based engineering; and
- More ontology-based integration for future enhancements.

**PROOF OF CONCEPT**

The concept has been proven and many of the building blocks already commercialised but not yet the entire concept. However, Barco is intending to establish engineering design rooms internally using this approach and is continuing development. And all the partners are still in contact and working together to continue this approach to a higher level.

Less tangible benefits included:

- Prototyping with a reduction in hard prototyping effort and/or lead-time;
- Easy workflow management with the creation of a session structure as easy as using a Lego building block system;
- Automatic reporting of development/review for project leader; and
- A high speed and network-efficient desktop sharing system which meets industry expectations – such not having to switch plugs when viewing a series of presentations from different computers.

Use cases selected for the ITEA 2 project have already demonstrated these benefits in a real industrial environment. For example, Fokker Elmo has been able to automate the pin assignment for electrical connectors in an aircraft – a process which had to be done manually before. Savings of 2,300 hours of engineering labour resulted per aircraft programme. And savings of up to 1,600 hours of engineering labour per aircraft programme have resulted from automating wiring harness design.

Use of knowledge-based engineering in applications development is already providing savings of over

20% compared with traditional automation. And this will increase when the domain-specific language is extended

**EXPLOITING THE BUILDING BLOCKS**

Overall, the project was very successful with a series of building blocks that are already being commercialised in different markets. Barco's XDS desktop-sharing solutions make it possible to bring different sources – such as different laptops – together on one big screen. The advantage of this approach is that no special new software is required – the system just shows what is already on the PC. XDS systems are already being delivered to car manufacturers and the oil and gas industry – and are of interest to any company doing development work that needs to integrate multiple results.

NOESIS is also already marketing its OPTIMUS workflow management software and allowing the federation of many engineering disciplines to effectively support engineering collaboration. And the knowledge-based engineering solutions developed by TU Delft have led to a spin-off – KE-Works – which is supplying implementations to Fokker Elmo.

The outcome of this ITEA 2 project is well adapted to meet the growing need for multi-disciplinary collaboration as European engineers become more specialised and better equipped. VUB's new BRUFACE – Brussels Faculty of Engineering – initiative, to start in the 2011-2012 academic year, will help to overcome the multidisciplinary gaps between the different engineering domains.

**More information:** [www.3d-testbench.org](http://www.3d-testbench.org)