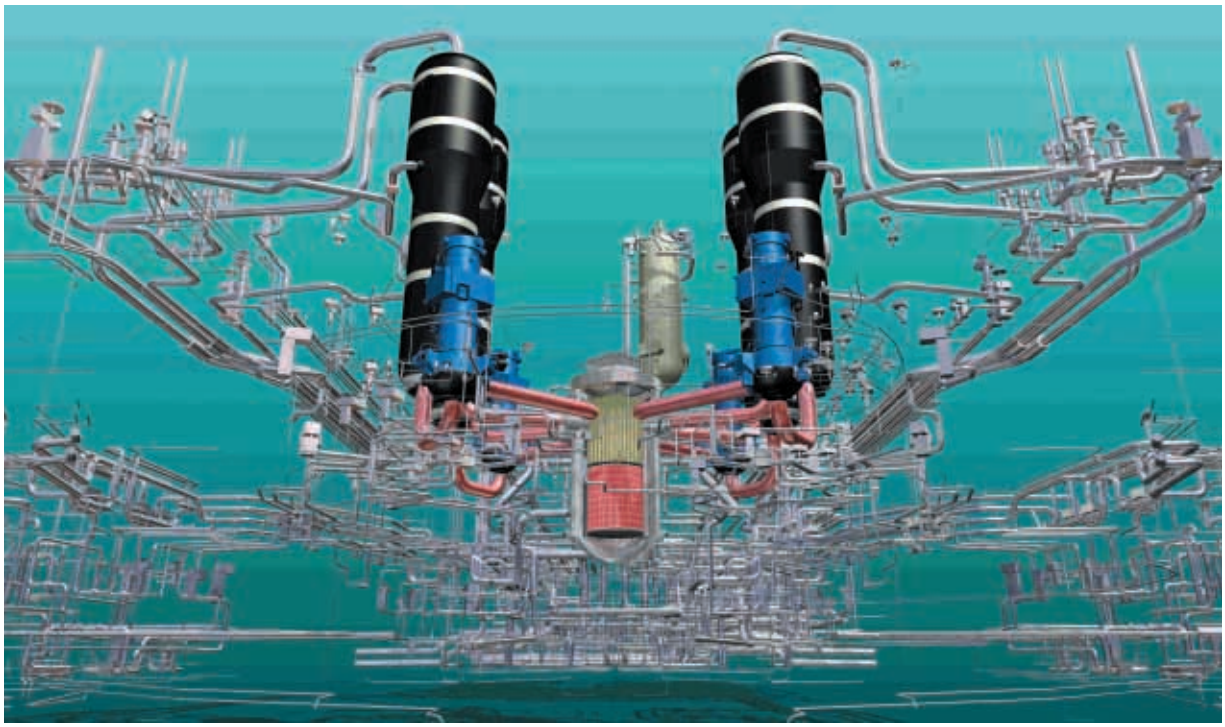
A system designed to last for life and beyond

The EPR project in Finland requires an IT infrastructure capable of supporting all phases – from engineering to execution, to final data handover to the operator.



At the start of the development of the European Pressurized Water Reactor (EPR), in 1993, the subsidiary company of Framatome and Siemens, NPI (Nuclear Power International), started the IT project "CAPE" in order to define the IT environment for the plant. At that time, no software solution was available on the market that was able to meet even a fraction of the project requirements. Therefore, an integrated tool infrastructure was created on the basis of proprietary programmes.

For 3D design, PDMS from the former CAD Centre – now known as Aveva – was selected. However, more than a decade was to pass before another nuclear power project was to be announced in Europe. This led to several key elements of the CAPE suite not being developed and not being adapted to modern hardware.

While the Olkiluoto 3 bid invitation of the Finnish nuclear power operator Teollidsuuden Voima Oy (TVO) was being processed, it quickly became apparent that the input required for the modernisation of many of these tools would have been too high. Therefore, an evaluation phase followed in 2003. As was to be expected, the software market for plant engineering and construction had developed rapidly. Moreover, TVO's requirement definitions were very ambitious for the IT sector as well: a so-called information management system (IMS) was to control development and construction as well as for operation after commissioning.

Framatome ANP (formed by the merger of Framatome and the nuclear division of Siemens) met this proposal with its own concept of a separate IMS for development and construction, where data would be available in open structures. The operator was to create an 'operation and maintenance management system' (OMS), customised to its specific requirements with continuous data import from the IMS during the last project phase. Instead of an instant and complete handover, continual data transfer between EPC (engineering-procurement-construction) and O/O (owner-operator) takes place. In this way, TVO can use elements of its existing OMS for this plant, if so desired.

Framatome ANP considered its own requirements for an integrated IT environment for complex new construction projects in its market analysis, the very detailed specifications of the operator and the best practice references of partners and entities accompanying the market. Investigated models, such as 'Powrtrack' by Black & Veatch employed by competitor General Electrics were not found to be worth emulating. Due to the central management in such a 'mother of all data' system, a closed architecture of

this type forces all concerned parties to use this system – with all consequences with regard to loss of flexibility and the input required for support and maintenance of a proprietary system.

Finally, the investigation yielded concrete results as to what the system was to look like. Frank-Peter Ritsche, who was at that time head of project logistics for Olkiluoto at Framatome ANP's Erlangen site, and his team searched for a modular system with central data management. The system was to consist of several compact databases on one hand, and of intelligent links and interfaces that were to eliminate data redundancy on the other.

In the end, the decision was made to use Aveva's Vantage software suite. The reasons for this decision were direct transfer of existing 3D data in PDMS format and the higher productivity of the in-house system designers with the respective Aveva module.

THREE PILLARS

The Olkiluoto project, however, demanded more functionality.

The corporate-wide implementation of the corporate electronic document management system (COEDM) – Documentum – was accelerated. This system has in the meantime been deployed to manage the entire documentation generated, as well as the internal workflows. Two other systems, along with Documentum, make up the IMS sector management tools: Primavera Enterprise P3E, a time management software, whose predecessor has been employed in-house for a long time; and SAP R/3 for commercial management.

The second sector, 'specific design tools', is made up of a series of specialised calculation and development tools. Among these are some further developments of the CAPE project.

The third sector, 'design coordinating tools', is covered by three Vantage products:

- Vantage VPRM as the material management system.
- Vantage VPE for system technology design.
- VPD, including PDMS, as the 3D design tool.

The actual system design, that is the definition of system functions in a system diagram, is initially created in the VPE module P&ID. Once the system diagram is released, the data is available in the VPE database, the VPE workbench (for processing by the engineers for components and assemblies), and for electrical design. An object broadly defined as a pump in the system diagram, with a defined flow rate and certain other basic parameters, will now become a concrete device to be complemented by further devices, like the driving electric motor, the connections and other parameters.

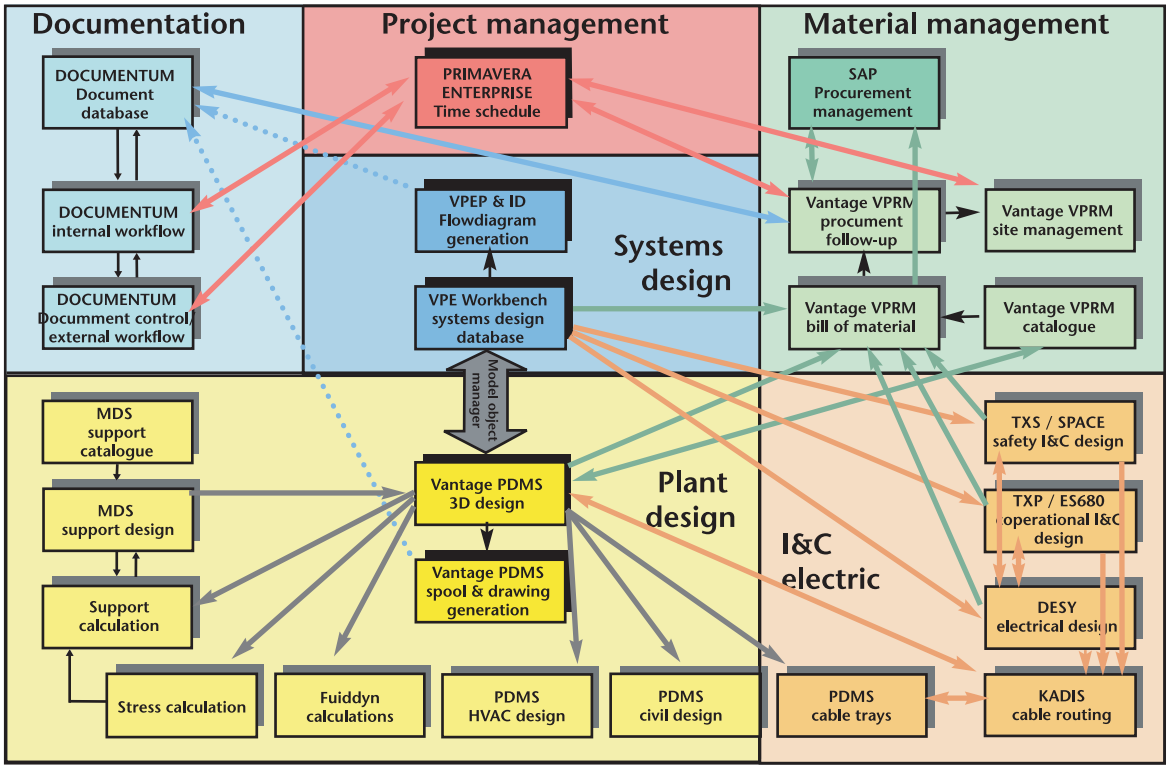
The datasheet generated in the VPE workbench is the basis for the order process, which is planned and monitored by the material management module VPRM. In parallel, the data is transferred to VPD via the model object manager (MOM). There, the component is inserted into the 3D model. At the same time the pipeline setup is introduced into the 3D model. Here as well, the data is aligned with VPE workbench data via MOM and material excerpts are handed over to VPRM.

STEP BY STEP

This multi-step process enables working with low resolution initial data, a prerequisite for simultaneous engineering processes. In this way, subsystems can be planned using the 3D tool on the basis of the system diagram – even if component data has not yet been released.

Ritsche said: "Due to the special quality requirements in nuclear technology, many pipelines with large diameters have to be made of special steel. Delivery may sometimes take several years and it is therefore important to have a concept of the quantities required early on in a project in order to enable suppliers to start production of semi-finished materials parallel to detailed design."

As all IMS modules are databased, the interconnection of components is simple. Aveva does not employ a singular 'mother of all data' system, but several databases, linked by intelligent



The Framatome ANP information management system. Most interfaces can be covered by standard software of the major suppliers

workflows. The system checks every change in one database for its implications and it checks whether the user is permitted to actuate this change at all. "Poor change management costs money, a lot of money," Ritsche said.

Engineering changes are passed on to the executing companies by material management before the steel is welded. The fact that four locations are involved in the development (two German sites, Offenbach and Erlangen, and two French sites near Paris, La Defense and Montrouge) complicates matters. Because of this, the databases of all sites involved have to be kept up to date as well.

Ritsche pointed out: "Data inconsistency as such is nothing objectionable. It is a standard phenomenon of parallel engineering processes – the task is to manage it as part of a controlled workflow."

If the system developer inserts an additional device into the system diagram, this device cannot instantly become part of the 3D model. The 3D developer must receive information from the system that this change requires replication in the 3D model. Conversely, the system developer must be informed if 3D planning shows that an additional drainage is required. A person in charge is defined for each individual piece of data. This person must decide whether a change to the data is to be permitted, or this person is requested to actuate the change. Mapping of 2D and 3D is handled by the Aveva module MOM.

A TIGHT SCHEDULE

The decision to choose the Aveva system was made in the summer of 2003. Half a year later (18 December 2003), the contract for Olkiluoto 3 was signed. Then the engineering division started 3D design based on the NPI data. The total time until power plant handover is 64 months, starting on 1 January 2004 and ending on 1 May 2009.

Early in 2004, the first requests to suppliers were made. Currently the system diagrams are complete and the workbench is loaded with the actual parameters of the component data. This created the basis for further detail engineering of the electrical design, instrumentation and control in the respective design tools connected via interfaces. About 20 system technicians work with VPE and more than 60 members of staff work with the database generated from the system diagram. About 200 workstations are available for PDMS modelling.

Looking at the handover of plant and data, Ritsche noted: "Sales of engineering tools is not our core business." That is why he relies on applications available on the market. "At the end of the project we hand over all databases to the customer in their original format." TVO then has the option to either continue working with the same tool as the EPC, or to develop a proprietary solution. The widespread use of PDMS and the other applications makes the handover of data manageable.

The customer is free to call for plant modification bids. As many engineering and construction companies use PDMS, they will be able to implement modifications and to provide the data required for updating OMS. The operator maintains its freedom to choose a different system partner.

Turning away from proprietary applications ensures that tools will remain up-to-date and that they will be developed further. Aveva, too, took a big step forward with this project. It was the first time that the complete software portfolio was employed for a project of this size and to such a degree of interconnection. Since the decisive elements of such a comprehensive solution needed to be introduced within the space of a year, it is important that Aveva's Vantage is less complicated and more pre-configured than its competitors.

This infrastructure, in terms of tools as well as in terms of required skills for efficient operation, provides the basis for fulfilling the individual expectations of the customer. Ritsche emphasised that the project is strategically important – not only because it represents the first-ever implementation of the EPR, but also because the IT infrastructure can be directly applied to further projects.

Based on an article first published in CADplus magazine and information supplied by Framatome ANP and Aveva. All images courtesy Framatome ANP