

Implementing the Engineering Collaboration Hub

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This article presents an approach to Engineering Collaboration in the Aerospace Industry using international standards for information sharing and process integration. It presents the challenges experienced by the industry and the approach used by Volvo Aero Corporation to address them. Areas covered include an Engineering Hub concept based on a secure, standardized collaboration platform and a shared, standardized Engineering Change process.

Volvo Aero Corporation is providing a number of key components to all major engine OEM's in the industry. Their strategy is to specialize in design and manufacturing of large but light weight engine components, thereby contributing to the reduction of weight of engines and hence the reduction of fuel consumption and emissions, a matter that has become a crucial factor of competition.

Volvo Aero is currently working in more than 20 different engine programs with a large number of partners: both OEM's and suppliers of manufacturing and design. Efficient collaboration is a key factor for success. As described in their Best Partner vision, Volvo Aero aims to excel in this area. In order to achieve efficiency, Volvo Aero cannot use different tools and processes for each engine program. This means that the "Best Partner"-vision drives the development of new ways of collaboration and the need for a well-functioning collaborative platform.

In addition, a typical lifespan for an aircraft engine exceeds 30 years and information about the engine must be available to numerous partners during this long period of time.

This situation requires efficient and standardized collaboration tools and processes to be developed and implemented not only within the individual companies like Volvo Aero but within the industry as a whole.

The Vivace project and the VEC-Hub Concept

One key initiative in collaboration recently performed by the Industry was the Vivace project, an EU project with 63 partners from the Aerospace industry. The overall objectives for the project were to:

- Achieve a 5% cost reduction in aircraft development
- Contribution to a 30% lead-time reduction in engine development
- Contribution to a 50% cost reduction in engine development

Volvo Aero, as well as Eurostep, was one of the key partners in the project and participated in several work packages, one of the most important ones being the Collaboration work package. The objective was to specify and demonstrate an efficient collaboration platform for engine development. The result from this work package was the VEC-Hub (Virtual Enterprise Collaboration Hub) concept which defines a collaboration platform supporting product information and process sharing through the use of

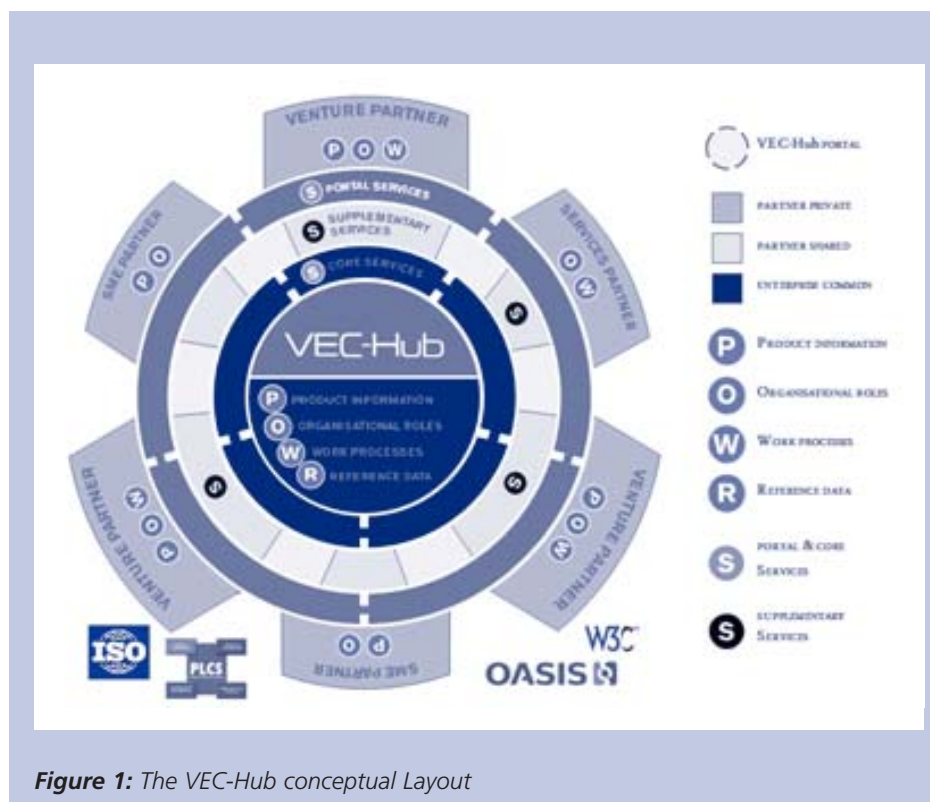


Figure 1: The VEC-Hub conceptual Layout

services in a Service Oriented Architecture (SOA). See figure 1.

The idea is to define an environment where product information and work processes related to a collaboration can be shared in an efficient and safe way that protects IPR.

The VEC-Hub concept is characterized by:

- The notion of sharing information rather than sending
- The use of available information and interface standards
- Making information and processes available as services in a SOA

Realizing the VEC-Hub concept at Volvo Aero

The VEC-Hub concept is seen as a key part in the realization of Volvo Aero's Best partner vision. A pre-study was performed in 2007, and the implementation of the concept has already started. The approach chosen by Volvo Aero is to implement the concept step by step, and thereby improving the efficiency of ongoing projects.

Process mapping

The key in all kinds of collaboration is the Engineering Change Management (ECM) Process, since all development implies changes to the documentation. Volvo Aero as well as their partners have all well defined internal ECM processes. However, these processes are not identical nor do they cover close interaction with partner processes. To enable the processes to "talk" to each other there is a need for a shared engineering change (EC) process where the partner in-house processes can "meet" and be integrated (see figure 2).

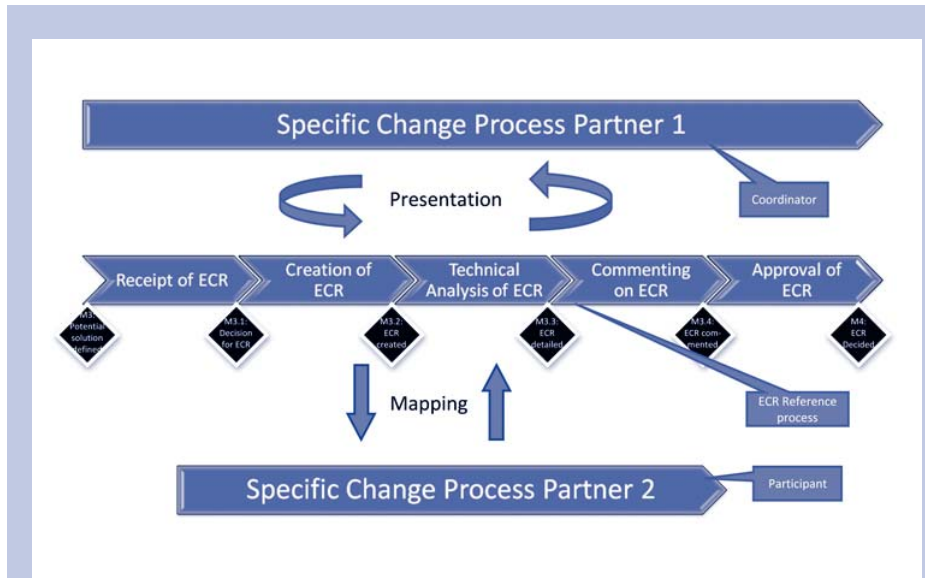


Figure 2: Each partner involved in a collaboration maps their in-house processes into a shared collaborative process, here the VDA4965 ECR reference process is depicted

The VDA4965 reference processes can be used as a tool to identify and map a partner's in-house EC process into a collaborative scenario. By doing that, the involvement of additional partners in the collaboration is facilitated, since each in-house process only map to the reference process. The approach in the Volvo Aero pre-study was to identify all possible process interaction points and the related information. An example is shown in figure 3.

The activity resulted in 15 use-cases covering the internal process. This internal ECM process was then mapped to a standardized reference process, in this case the VDA4965/SASIG ECM process.

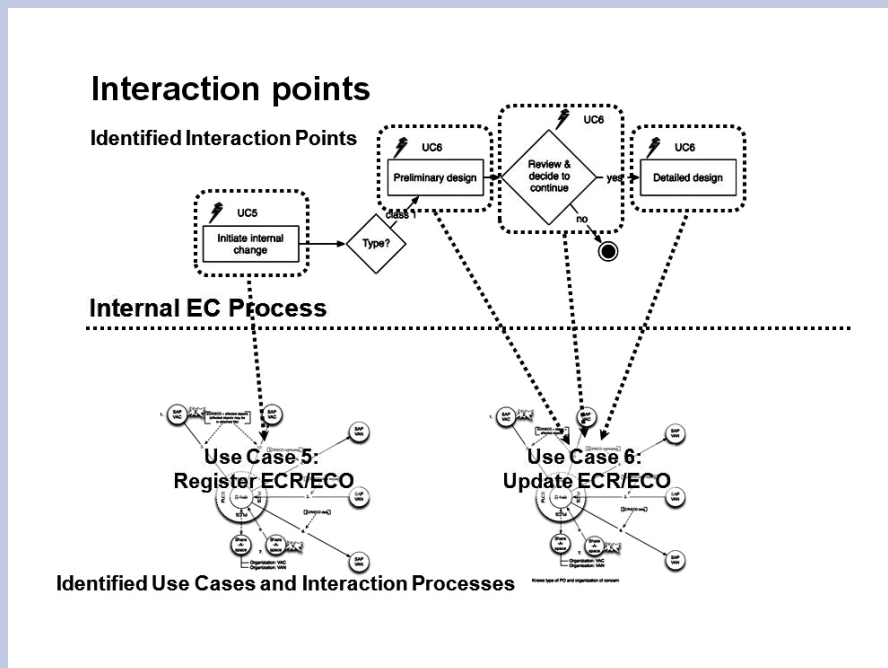


Figure 3: Identification of interaction points and related Use-Cases

A Step by Step implementation

The selected case to start the implementation with included one of Volvo Aero's manufacturing suppliers and the management of manufacturing information. The following information was involved in this collaboration case:

- Drawings
- Manufacturing specifications
- Engineering changes notes
- Purchase orders

The process scope for this first case was limited to released information (Released ECO). The systems used by the supplier are SAP and Teamcenter. Volvo Aero uses SAP and Teamcenter Engineering.

Characteristics of the As-Is situation could be summarized as:

- Notifications of changes are done using e-mail or phone
- Files are exchanged using e-mail and shared on a common disk
- Structural and part related information is communicated in documents

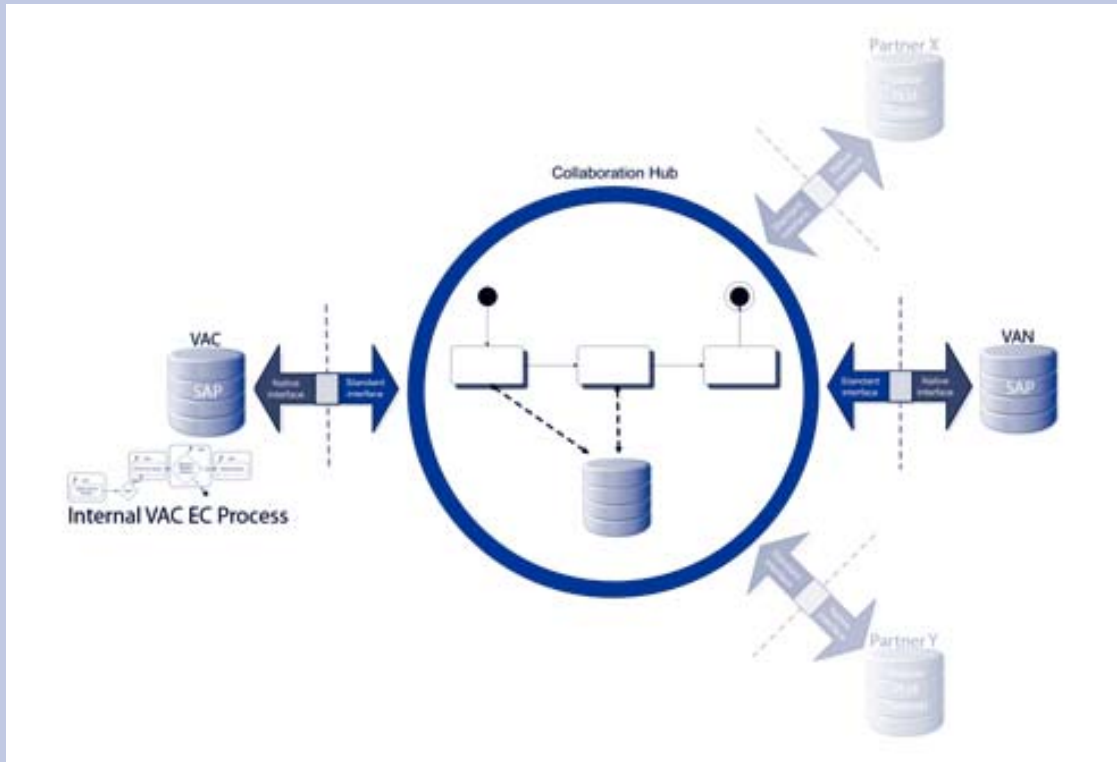


Figure 4: The company internal PLM-systems are integrated with the Collaboration Hub through adapters using the native interface. The information in the collaboration Hub is exposed through a standardized interface like PLCS webservices or PLM webservices

- Drawings and other documents are not always digitalized which makes electronic collaboration impossible.
- Data entering into the supplier system is done manually
- Current interaction is based on the current internal process at VAC

All these activities require extensive manual hands-on to uphold control and traceability, and thus the risk of introducing errors inherent in manual data entry.

The Implementation

In comparison with direct integration, such as a portal, an external client solution or a point-to-point integration, the VEC-hub benefits include:

- Improved security, since partners will not have access to the internal system and the complete set of information
 - Easy integration, the hub exposes the information in a standardized format enabling the partners a standardized interface (PLCS/PLM Webservices)
 - Process separation allows each partner to use the most efficient process and still collaborate efficiently
- The implementation approach is shown in figure 4.

The development of a solution for this first step included the following activities and deliveries:

- The adapter between Volvo Aero's SAP system and the Hub (SAP to STEP) uses SAP/XI to produce OMG PLM services messages. Detailed specification and development were

done by Volvo Information Technology in cooperation with Eurostep AB.

- The Engineering Hub itself, including secure information storage and process orchestration, was developed by Eurostep AB based on their Share-A-space server and Microsoft Biztalk.
- An interface to the manufacturers SAP system, initially browser based with a STEP reporting functionality, but later automated through existing webservices.
- Infrastructure, including different security solutions supporting the SAP to HUB communication, supplied and operated by Volvo Information Technology.

Expected To-Be situation

The To-Be interaction process based on the VEC-Hub concepts addresses the issues above by:

- Notifications of EC's are done automatically based on defined trigger points, and the receipt of notifications is logged, creating control and thereby supporting a high degree of traceability.
- Files are made available automatically in the Hub in a controlled way with full traceability and managed access right.
- Structural and part related information is made available in the hub as objects in standard format allowing search and select, avoiding time consuming and error prone document interpretation.
- Drawings and other documents are made available in an electronic format.
- Data entering into the supplier system may be automated

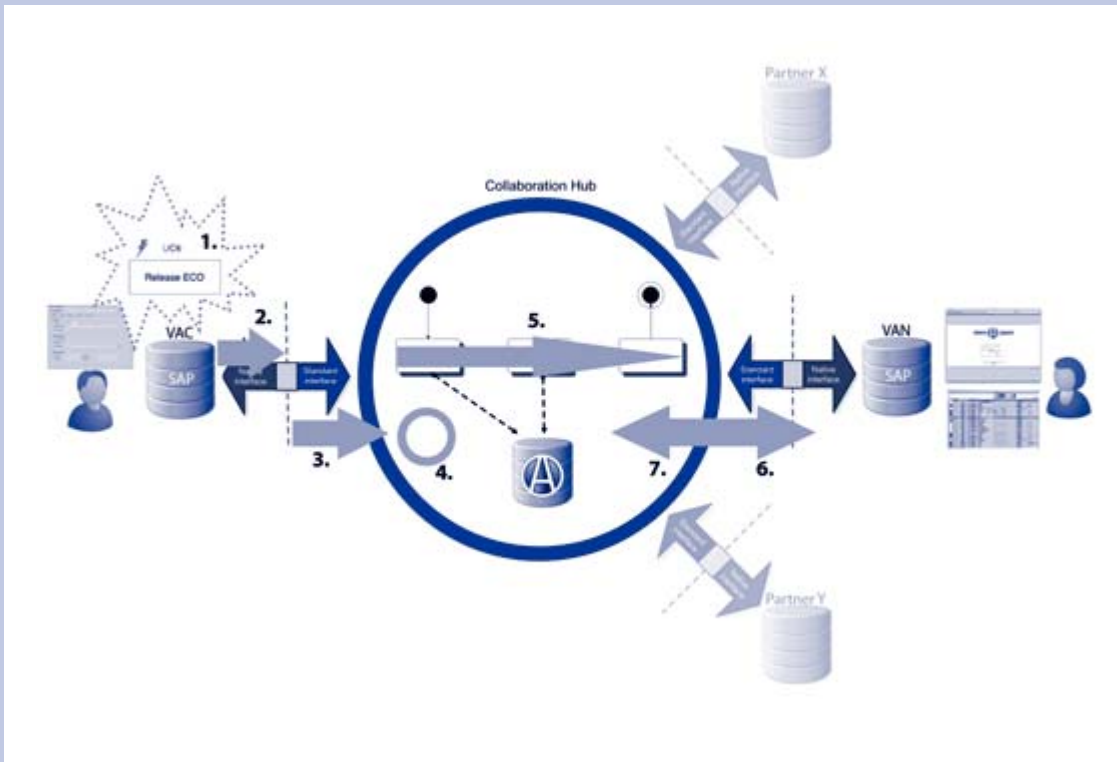


Figure 5: ECM interaction scenario

- Access to and interaction with the Engineering Hub is provided through a secure web-interface, supporting potential collaboration with partners anywhere in the world.

A typical use case scenario

Figure 5 demonstrates a simple ECO release scenario:

1. An ECO is released in SAP triggering an SAP/XI process as identified by an interaction point and its related use-case.
2. The required information is retrieved from SAP by the SAP/XI adapter.
3. The information is mapped into a PLM services message using XSLT and sent to the Hub
4. The message is received by the Hub and checked for completeness.
5. Then the message is executed in accordance with the defined process and the information is consolidated into the Share-A-space server using PLCS webservice
6. A notification is sent out to the persons defined in a distribution list. The notification will only be a message that new information is available, due to security reasons.
7. The new information is accessed by the receiver via a browser or using the webservice interface and controlled by the access control system in the Hub.

Summary and conclusion

The Engineering Hub approach contributes to Volvo Aero's Best partner vision by:

- Allowing users at Volvo Aero and partner companies to work in internal systems, with internal processes
- Manage information in standardized format and way throughout the lifecycle of the product
- Supporting the reference ECM process separated from internal processes
- Making it easy to connect additional partners
- Supporting secure collaboration

Support for additional life cycle stages such as early design phases and additional processes like non-conformance management will be added during the next steps of the Volvo Aero roll-out of the VEC-Hub concept. ■

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