Teamcenter as an engine for visualising service requirements in the product development process

Summary

Because a service repair is particular to a given system or assembly but is impacted by all those that surround it, poor communication around requirements and parameters for service repairs routinely costs OEM's millions. By defining process tools that leveraged a client's existing Teamcenter Engineering Process Management, Teamcenter Systems Engineering and Requirements Management, and Teamcenter Visualization Mockup tools, CAD-IT delivered a step-change in how service and aftermarket requirements were represented and discussed within one household name OEM's product development community.

Introduction

The costs of ignoring the 'Voice of the Technician'

In any complex machine, service access and withdrawal strategies for maintenance or repair are dependent on the product package.

Most obviously, the design and package of a secured assembly will need to ensure that it can be removed with minimal disassembly of surrounding items, and that its retaining parts such as bolts, and connectors for associated parts like electrical harness, are orientated and positioned in a way that makes them accessible by hand and, where a tool is required, with a standard workshop tool.

Similarly other considerations may be need to be accounted for in terms of the assembly's removal: for example, designing out the possibility for a technician to be injured by contact with hot or sharp objects during the part's removal; or making consideration in the assembly's package for a possible need to retain fluids within it as it is removed from its assembled position.

During recall or repair campaigns, instances in which these simple criteria have been overlooked can very often deliver losses of many millions of dollars for a manufacturer. These losses could often have been avoided by better package design if, in the product development lifecycle itself, better management of requirements had provided a batter representation of the, “voice of the customer”, or the, “voice of the technician”, to the fraternity of engineers involved.

The Challenge with Service Repair Package Requirements

Even so, these costs are not infrequently incurred, and the kind of package oversights that cause them are, unfortunately, all too common. One reason for this is that manufacturers necessarily compartmentalise product development responsibility for engineers on a system-by-system or assembly-by-assembly basis. While this works well for manufacturing (where an engineer might liaise with a supplier as the sole manufacturer of the designated assembly), it works less well for service repairs because delivery of the actual comprehensive service solution is not limited to just the OEM engineer and his supplier: any access strategy relies on all of the surrounding components being designed and packaged with this same strategy in mind.

Working with a household-name OEM, CAD-IT engineers were tasked with helping find a resolution to this problem as an adjunct to our general involvement with the delineation of processes and tools to bring service-lifecycle knowhow into product development. They determined that the most cost effective approach would be to define and add process enhancements that would best capitalise upon the client’s existing PLM toolset, which included Teamcenter Engineering Process Management and Teamcenter Systems Engineering and Requirements Management.

Service CAD Geometry in Teamcenter

Because, as outlined above, a service repair can be impacted upon by a wide range of systems in the package, it was apparent that a method of providing the engineering community with a graphical geometric representation of service access space and other associated service requirements - a Service Swept Volume (‘SSV’) - would be the best approach. Created using Teamcenter Visualization Mockup, the SSV could be published to the Teamcenter PDM repository making it available and visible to the entire product engineering team. Other SSVs could be created by importing and positioning ergonomic manikin or standard workshop tools information.

Once stored in Teamcenter, SSV information could adopt a wide range of uses. Integrated into automated clash-detection routines it provided awareness to systems engineers and service engineers when revisions to designs impinged upon space identified as a requirement for service. As a part of the routine product package SSVs also served to keep service access a priority in routine engineering package reviews. And linking requirements information from Teamcenter Requirements Management to an SSV provided anyone capable of viewing the SSV information immediate access to its associated service requirements that represented the, ‘voice of the customer’, and, ‘the voice of the technician’.

The CAD-IT methodology so defined also identified ranges of parts and systems for which SSV representation in the package would be important, and the optimum times for this data to be introduced into the mix, complementing the progress of the evolving product layout and package.

Value for money and benefits

Value for money was readily delivered to the customer de facto, because SSV inclusion in the package prevented oversights that would have cost money to rectify later in the design cycle or even in the aftermarket cycle. As noted SSVs also fulfilled an ambassadorial role for serviceable design, advertising a service message which became a subject for discussion in forums such as clash results analyses and package meetings. This was further enhanced by connectivity between SSV information and service requirements, effectively providing a visual cue for service requirements information in the product package.

An additional benefit realised from the creation of SSVs within the service engineering team was the clash validation of the path planning-generated CAD SSV to ensure that critical parts were not omitted from the original solve environment.

Specific examples of design changes to improve serviceability driven by SSVs became manifold. One example included capturing the implications of a late change re-routing of solidly mounted air conditioning lines around an engine and which would otherwise have prevented the removal of critical emissions system components. In this case engineers were alerted to the late change via the clash detection process and were able to engage with the climate control team. This led to a new package that facilitated the removal of the emissions components without breaking into the air conditioning system. Another instance (using a drain path SSV in clash detection) delivered design changes to a subframe that would have collected engine oil as it was drained from a sump.

Perhaps the most important achievement with respect to SSVs and the benefits they deliver to CAD-IT's customers is not the simple fact of SSV creation in its own right, but the development of a process toolset that supports this activity and which touches upon engineering development for the full range of product systems.