

Integrating a New ECAD System with Service Publications

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ABSTRACT

Adoption of a new Electronic Systems Computer-Aided Design (ECAD) system for modeling electrical systems design by Product Engineering offers the promise of improved accuracy and productivity for Service Publication's authors to create wiring diagrams and to standardize their format; while improving the comprehension and functionality of those documents for service technicians. It is also potentially disruptive, requiring new workflows, processes, standards and lines of communication to be developed.

This paper describes how to structure and organize a project for effectively and efficiently bringing a new ECAD system for modeling electrical system design into Service Publications. It also provides insight into some lessons learned.

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INTRODUCTION

The following approach is one view of how one might select and integrate a new ECAD system within Service Information development and delivery process for Service Publications; assuming the project is not constrained by money, resources or time. Of course, this is never the situation. In real-life, exclusions and shortcuts are required in order to work within budgets, with available people resources, and to finish the project before the required completion date.

That said, there is merit in considering an ideal approach in order to identify elements to include and those that may be left-out of your "real" project.

Before continuing, remember: successful projects have three phases:

- Plan
- Prepare
- Perform

ENGINEERING'S BUSINESS CASE

Electrical systems and their children, electronic systems, are making ever larger contributions to the functionality and value of current and future products. Starting with relatively

"simple", legacy electrical systems: spark ignition, lights, horn, wipers, and heating & ventilating; electronic systems have significantly replaced electrical systems. Even traditional mechanical control components, such as cams, are being displaced by mechatronics, the hybrid of mechanical systems with electronic control. The increased functionality and control available via electronics are making these systems pervasive. Indeed electronics are becoming, or already are, critical for delivering ever greater product functionality and value to the customer.

Furthermore, the electronic and electrical content of vehicles is increasing due to the current trend of vehicle electrification. Indeed the continuing market and government pressures for ever greater fuel economy and lower emissions are driving the emergence of hybrid propulsion and the effective reappearance of electric on-road vehicles. Furthermore, the integration of personal electronic devices with vehicles for providing sophisticated, hands-free infotainment systems, the development of driver assist systems, and the coming autonomous vehicles are contributing to rapidly increasing electronic and electrical content.

In this author's opinion, as a Mechanical Engineer, it is becoming uncomfortably close to being true that in the near future the competitive difference and productivity of a

vehicle will not primarily come from the product's iron or hardware, it will come from its electronics and associated software!

Thus it makes sense that given the increased presence and importance of electronic and electrical systems in products that their design should be supported with ECAD systems that equal or exceed the functionality of the Mechanical Computer-Aided Design (MCAD) systems used to design the mechanical portion of the product.

Given the increasing size, complexity and sophistication of the electrical/electronic systems in current and future products, the ever shorter product development projects, and the demands for product higher quality using fewer experimental and developmental machines; it is clear that higher functionality ECAD systems need to be used.

Today's high-end ECAD systems claim to deliver error-free and accurate modeling of the product as well as:

- Generative design functionality to logically model complex controller enabled electrical systems including CAN
- Version tracking and enforcement
- Design validation
- Failure Mode Effects Analysis (FMEA) worksheets and reports generation
- Design reuse
- Component design centers of excellence
- Support for "follow the sun" engineering activity

All of the listed capabilities assist Product Engineering departments in achieving shorter design cycles and improved product quality.

With today's rapidly aging work-force and the frequent retirements of the "Baby-boomers", High-end ECAD systems may have additional benefits for Product Engineering departments. Some of those ECAD systems support capturing of "tribal knowledge" design rules before that experience walks out of the door for the last time. That can be critical to maintaining the product quality and characteristics customers expect of the brand. Furthermore, product quality may be improved if the ECAD system supports programmatic application or enforcement of those design rules.

Given the obvious importance of electrical and electronic systems to today's and tomorrow's products and the feature/benefits packages of today's high-end ECAD systems; Product Engineering departments have significant justification for upgrading from one or more simple, legacy ECAD systems and a potpourri of additional documentation and design validation tools.

SERVICE INFORMATION FOR PRODUCT SUPPORT AND SERVICE PUBLICATION'S BUSINESS CASE

Product Engineering is the original source for most of the Service Information published by companies. If the

associated product supporting Service Information published is to be accurate, available on-time; and authored inexpensively, efficiently, and quickly; then Service Information development processes within Service Publications must integrate Service Publication's authoring systems and processes with Product Engineering's ECAD system. If Product Engineering adopts a new ECAD system, then the developers of Service Information - Service Publications must also change to work with the new ECAD system as their source of information.

However, there are additional reasons for Service Information - Service Publications developers to embrace Product Engineering's adoption of a sophisticated ECAD system.

Accuracy of Schematics

Once Service Information - Service Publications integrates with at least one advanced ECAD system, the electrical schematics included in published Service Information may be directly linked to, or integrated with, Engineering's product model. This integration automates and streamlines communications between Product Engineers and Service Information - Service Publication's Authors; reducing the chance for the introduction of errors. As long as the product model is correct, the associated schematic diagrams should have no reason to be incorrect.

If the new ECAD system supports the concept of "inheritance", which at least one major CAD supplier refers to as "associativity", schematic diagrams developed from the product model should have the capability of being programmatically revised after the product model is updated. This functionality facilitates quick and reliable updating of schematics as the product design changes. This "inheritance" promises significantly reduced effort along with reduced cost to manage changes to the electrical/electronic design for updating the Service Information.

A high-end ECAD system's version tracking capability and programmatic generation of change notifications facilitate making certain Service Information is kept up-to-date and relevant to a specific product release. This further increases the perceived accuracy of Service Information for Product Support.

The synergy of the previously mentioned functionality may make it feasible to validate Service Information through using "standard" publications to support appropriate Product Engineering builds of the product. Because the elapsed time and person-hours used to update schematics via a high-end ECAD system may be greatly reduced, it might become practical to generate a draft of Service Information earlier in the Product Development Process. Instead of waiting to produce schematics until the product is nearly ready for production and living in dread of last-minute revisions of the product and mistakes in the documentation, Diagnostic Authors can seriously consider authoring schematics for supporting experimental and durability evaluation machines with early drafts of Service Information. Early testing of the