

AEROSPACE & DEFENSE  
**THE VOICE OF THE CUSTOMER**

Profitable Innovation Through Requirements Management,  
Traceability and Process Integration



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## **EXECUTIVE SUMMARY**

Aerospace and Defense companies delivering complex products in competitive markets must overcome many challenges to manage requirements throughout the product lifecycle. Among the most difficult challenges are integrating complex systems engineering processes, promoting collaboration among multiple engineering disciplines, and enabling the sharing of intellectual property among globally dispersed teams.

Companies seeking a way to efficiently manage product requirements can leverage a comprehensive product lifecycle management (PLM) solution to:

- Effectively reuse intellectual property to reduce
- Time to market
- Increase innovation
- Improve overall traceability of the requirements throughout the product lifecycle

Companies must avoid the inefficiencies in managing product requirements that result in costly product development headaches ranging from rework to customer dissatisfaction and rising development costs. Research shows that early requirements management improves time-to-market and helps manage costs. Requirements management allows organizations to capture the “voice of the customer” and translate that information into new products – improving their overall global requirements process.

Two essential areas of focus that enable companies to best leverage requirements management are process integration and traceability. Process integration eliminates communication barriers by creating a collaborative environment for sharing ideas, requirements and data throughout the product lifecycle. Increased innovation, in turn, fosters ideas that improve products and new product introductions. In addition, continuous traceability – from capturing the customer needs to product definition – makes a significant difference in project cycle times and cost reductions.

This paper will highlight the criteria needed for a comprehensive requirements management solution that incorporates PLM to offer customers a scaleable enterprise grade solution. This collaborative approach is designed to bring together people, processes, data and systems to deliver products to market faster and more efficiently.

## **REQUIREMENTS MANAGEMENT IS KEY TO THE RIGHT PRODUCT-TO-MARKET**

Requirements management is the consistent, prioritized, and monitored approach for administering and controlling the information that helps an enterprise develop the ‘right product for the right market at the right time.’ The challenge for most enterprises is not capturing customer requirements (needs). The true challenge is the need for continuous communication, change management and traceability (enforcement) of customer requirements throughout the development cycle.

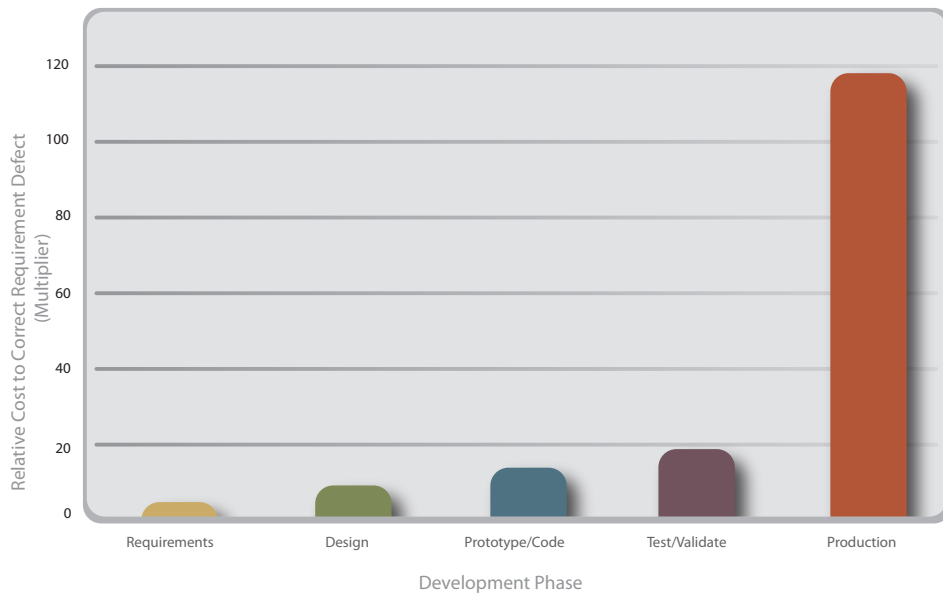
### **Effective Requirements Management Lowers Product Development Costs**

Poor requirements definition in the early stages of a product is a major factor in rising development costs. Requirements errors specifically can account for 70% to 85% of rework costs<sup>1</sup>. For example, product rework can:

- Represent about 40% of a development organization’s total spend – with a significant effort focused on correcting requirements defects<sup>2</sup>
- Consume 30% to 50% of total product development costs<sup>3</sup> while requirements errors specifically account for 70% to 85% of rework costs<sup>4</sup>

As Figure 1 illustrates, correcting requirements errors after a product is released can cost over 100 times more than anticipated. Best-in-class companies have learned to make the requirements definition visible early in the product development lifecycle.

In a typical product development lifecycle, eliciting, authoring, analyzing, and managing requirements represents about 10% of a project’s resources. A recent study demonstrated that the most successful projects spend roughly 28% of their resources on requirements<sup>5</sup>. This research also shows that early requirements management improves time-to-market and helps keep costs on target.



**Figure 1.** Correcting errors after a product is released can cost over 100 times more than if the problems are found early in the product development process. Best-in-class companies have learned to make the requirements definition visible early in the product development lifecycle.

### Challenges of Effective Requirements Management

Today, most standalone requirements management solutions fall short after the initial requirements capture and analysis. Many companies use groupware applications and manual processes to manage product requirements. These manual processes are slow and prone to error. Groupware solutions create “information silos” which are not integrated with downstream processes directly. Project teams must spend costly manual person-hours to ensure traceability, driving up product overhead costs.

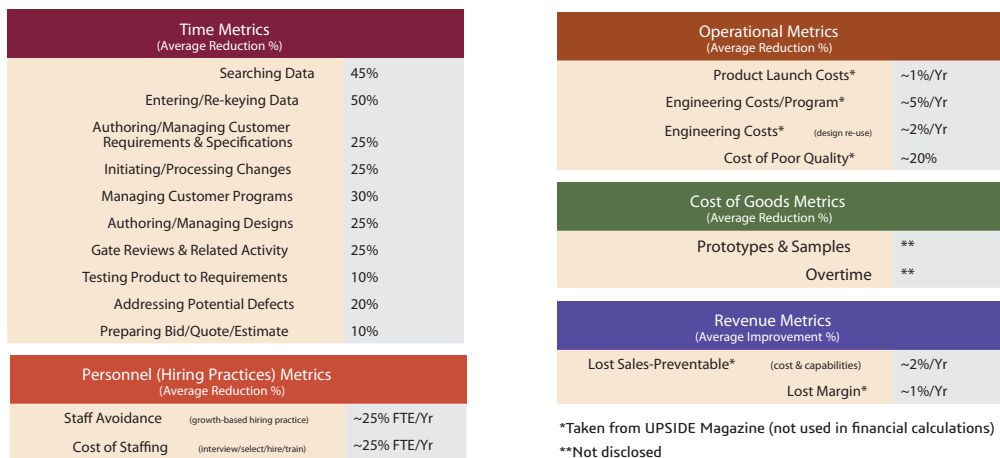
Requirements management, as part of a PLM solution, vastly improves decision support by linking business functions and key areas of product development, providing:

- Global collaboration via a common platform that fosters innovation by bridging the gap across all disciplines to share requirements, design and product launch data;
- Effective traceability allowing direct links to product line planning, systems design (features/options), designed product definitions (Engineering Bill of Material [EBOM] releases), and use-case testing (prototype and test); and
- Automated governance (rules) to enforce validation at each development state (e.g., system engineering, design, prototype, and test), ensuring that all requirements are met.

## Downstream Process Integration and Traceability

Integration of requirements with downstream processes removes “information silos.” This collaborative environment leverages shared ideas and data throughout the product development cycle. A common, shared view of customer needs drives innovation, whether an evolutionary change in existing products or a revolutionary new product. Collaboration also supports continuous improvement of products and business processes. Typically today 61% of a company’s profits are generated from new innovative products (i.e. new ideas, radical concepts) and 86% from product extensions of current product lines<sup>6</sup>. Requirements management packs a powerful punch. Companies can create product concepts and requirements, evolve product lines (roadmap), determine engineering feasibility and establish early product quality and manufacturing criteria, ensuring they are aiming at the correct target.

The business impact of having requirements management processes within a PLM platform include shorten cycle times, lower product and quality costs and the ability to take advantage of tight market windows.



**Figure 2.**

Case study results of a facilitated tier-1 automotive electronics manufacturer that realized product development cycle improvements with requirements traceability.

## Business Case Study

Dassault Systèmes and an aerospace manufacturer undertook a business assessment to improve its product development lifecycle. The results revealed several areas for process re-engineering to reduce the number of data handoffs between departments, roles and systems. Working with Dassault Systèmes, system integrator Deloitte focused on requirements management and product design. Some of the improvements targeted:

- Consolidate and simplify the IT architecture to reduce legacy systems and total cost of ownership
- Create a single enterprise innovation platform for all business units (e.g., sales, engineering, operations)
- Reduce 25 bill of material (BOM) resources to one
- Facilitate requirements management and traceability
- Secure data protection and loss prevention
- Reduce new hire headcount

## Requirements Manager

ENOVIA's Requirements Manager enables global development organizations to drive consistency in a shared environment when capturing customer, regulatory standards and market-driven requirements. Requirements can be defined and decomposed into a hierarchy, and fulfilled through the design, implementation and testing of final products to provide traceability throughout product development. The benefits of Requirements Manager are further extended when used with other ENOVIA® and CATIA® roles to define complex products, including their functional and logical aspects. In addition, as requirements are linked to program and project management activities, full traceability is established throughout the entire development process ensuring that the products that are developed meet original market goals.

In summary, ENOVIA Requirements Manager enables companies to improve efficiencies and effectiveness of their requirements management process by enabling the following capabilities:

- Fully manage the requirements lifecycle from the initial authoring to fulfillment with a product launch
- Maintain requirements traceability back to the original customer and marketing (source) documents
- Improve configuration of requirements to reduce development costs and project schedule slippage by establishing baselines agreed to by all stakeholders
- Enhance sharing and communication of requirements to cross functional organizations resulting in less rework, missed objectives, and missed deadlines
- Support optimal design architecture definition by enabling trade-off analysis that balances functionality, performance, and cost

## WHY DASSAULT SYSTÈMES?

Dassault Systèmes, the **3DEXPERIENCE**® Company, provides business and people with virtual universes to imagine sustainable innovations. Its world-leading solutions transform the way products are designed, produced and supported. Dassault Systèmes' collaborative solutions foster social innovation, expanding possibilities for the virtual world to improve the real world. The group brings value to over 210,000 customers of all sizes, in all industries, in more than 140 countries.

### 3DEXPERIENCE Platform

The **3DEXPERIENCE** platform is a business experience platform. It provides software solutions for every organization in your company — from engineering to marketing to sales — that help you in your value creation process to create differentiating consumer experiences. With a single, easy-to-use interface, it powers Industry Solution Experiences — based on 3D design, analysis, simulation and intelligence software in a collaborative, interactive environment. It is available on premise or via public or private cloud.

ENOVIA traceable requirements uses the **3DEXPERIENCE** platform to bring these benefits to users:

### Global Collaborative Innovation

Everyone with a stake in the product has the ability to participate in the development lifecycle—from sharing new ideas that reflect customer needs to product validation.

### Lifelike Experience

Leveraging Industry Solution Experiences from Dassault Systèmes, users can collaborate in an immersive online 3D environment.

### A Single PLM Platform for Intellectual Property Management

All deliverables related to the requirement process (e.g. product designs, definition, and validation) are stored and managed in a single enterprise platform eliminating translation and communication errors.

## Online Collaboration and Innovation

Internet access for all stakeholders to access and read requirements means increased requirements reuse (and all associated deliverables), enabling improved time-to-market and lower development costs.

## Ready to Use PLM Business Processes

Immediate value is possible with the use of out-of-the-box processes to capture, organize and publish requirements with the ability to trace those requirements to designs and validation throughout the development lifecycle.

## Strategic Requirements Management

In the Experience Economy, customers take a more proactive role in communicating their requirements and preferences for the products that they ultimately purchase. This phenomenon requires the ability to manage customer requirements not as an afterthought, but as an inherent part of the product development process. The ENOVIA requirements-driven systems engineering approach to developing products, with the customers' desired experiences in mind, is visible to all stakeholders involved.

## Reference Materials

1. Leffingwell 1997, "Calculating the Return on Investment from More Effective Requirements Management"
2. Grady, Robert B. 1999. "An Economic Release Decision Model: Insights into Software Project Management"
3. Boehm and Papaccio 1988, "Understanding and Controlling Software Costs, IEEE Transactions on Software Engineering"
4. Leffingwell 1997, "Calculating the Return on Investment from More Effective Requirements Management"
5. Hofmann and Lehner 2001, "Requirements Engineering as a Success Factor in Software Projects"
6. Kim, Chan & Mauborgne, Renee 2005, "Blue Ocean Strategy – How to create uncontested market space and make competition irrelevant"

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## Our 3DEXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

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