MULTIPHYSICS SIMULATION PLATFORMS SUPERCHARGE INDUSTRIAL DESIGN

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Report Highlights

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Shortened product development cycles is a key pressure affecting 72% of industrial designers.

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Limited development resources are a key challenge for 44% of industrial designers.

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Multiphysics simulation platform users perform 11% to 29% better than non-simulation users in time-to-market, cost, and quality.

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Industrial multiphysics simulation platform users improved their product development time by 13% while non-simulation users experienced 8% longer development times.

This report explores the growing importance of multiphysics engineering simulation platforms in the automotive, industrial, and aerospace & defense industries (abbreviated as "*industrial*"), including the business and product benefits enjoyed by multiphysics simulation users in these industries.

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The strength of a simulation tool lies in its ability to emulate the real world in all its moving parts. For advanced solutions, this demands a "multiphysics" simulation platform.

In the automotive, industrial, and aerospace & defense industries, engineering simulation is more important than ever, and a single simulation platform that leverages multiphysics capabilities produces better results.

Why multiphysics? Because the strength of a simulation tool lies in its ability to emulate the real world in all its moving parts. For advanced solutions, this means coupling different physical models or simultaneous physical phenomenon together using a multiphysics simulation solution (for example, modeling thermal, structural, fluid dynamics, and electromagnetic attributes of a product).

Now, in addition to its engineering strengths, new Aberdeen Group analysis in automotive, industrial, and aerospace & defense uncovers the business benefits of multiphysics simulation platforms, including time-to-market, cost, and quality advantages.

Unique Pressures Impact Industrial Engineering Design

The unique pressures of automotive, industrial, and aerospace & defense innovation flow from the demand for constant change from customers, competitors, and the overall market. Against a backdrop of shortened product development cycles, customers want more functionality (quality, reliability, "smart" features), less environmental impact (regulation compliant, safer, environmentally friendly) and the economic appeal of lower cost (Figure 1).

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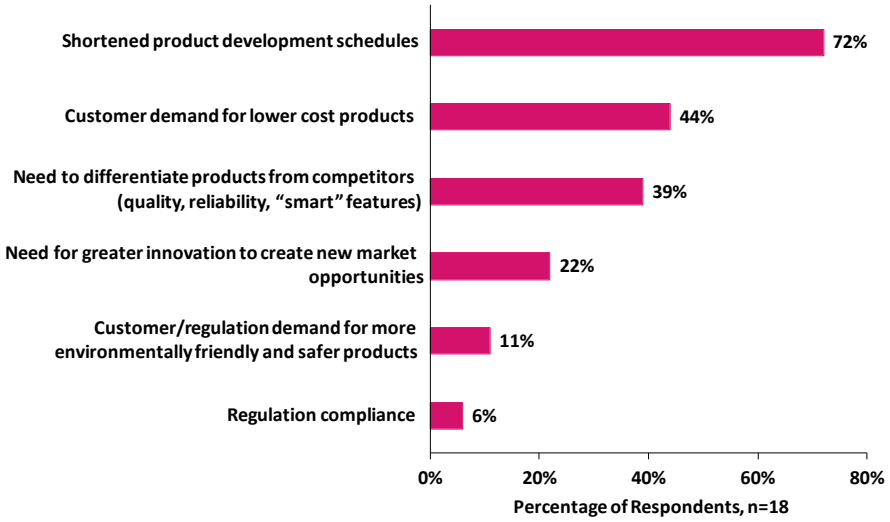
Figure 1: Pressures Driving Industrial Design

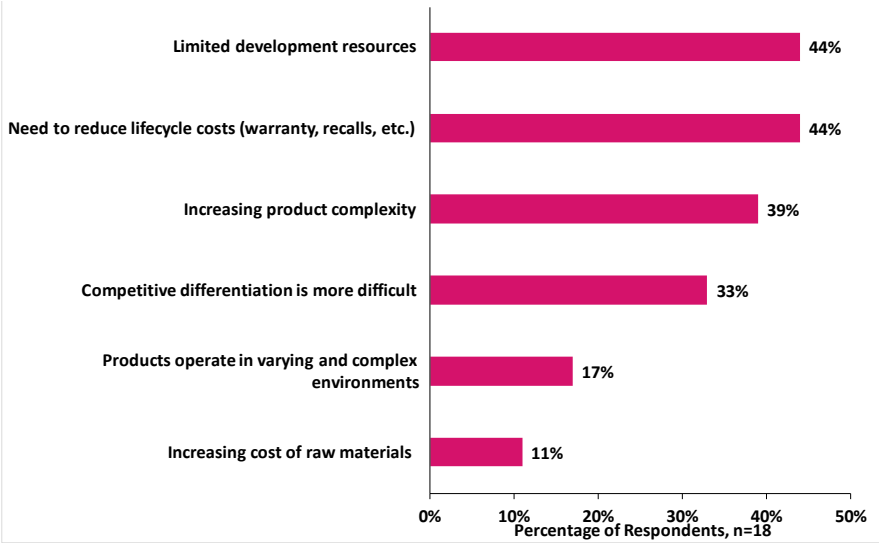


Source: Aberdeen Group, March 2017

Unique Challenges Impact Industrial Engineering Design

Competitive differentiation is more difficult in a sea of lookalike products, and rising product complexity makes it critical to get the design right the first time. New products operating in varying and complex IoT environments are just around the corner. Wrap it all in a pressing environment of limited development resources and it's easy to see why designing for automotive, industrial, and aerospace & defense today requires pinpoint accuracy, leaving little room for error (Figure 2).

Figure 2: Challenges Driving Industrial Design



Source: Aberdeen Group, March 2017

Simulation Platforms Conquer Industrial Pressures & Challenges

In this highly competitive environment, engineering simulation is more crucial than ever for success across key business initiatives. Engineering simulation meets this need in three ways. First, simulation is faster than physical prototyping, and results in faster time to market; second, simulation is less expensive than physical prototyping, and cuts cost; and third, simulation provides deeper insights into underlying physics, ultimately boosting product quality.

With simulation, hundreds of design and operating scenarios can be evaluated in the time and cost needed for just one physical test. This maximizes the chance for design success before committing scarce development resources.

Simulation platforms leverage common and compatible data models, and yield systems-level insights that could not be attained before, freeing up designers to explore and prototype new

products digitally before committing to a physical version. Three attributes define a simulation platform:

1. Comprehensive simulation including systems and multiphysics. Multiphysics capabilities may include thermal, structural, fluid dynamics, and electromagnetic modeling for a product.

2. Scalable solutions for process and data management from desktop to cloud.

3. An extensible ecosystem of partners and customized apps.

A recent study uncovered that Leaders, who are 24% more likely to deploy multiphysics simulation platforms, are seeing significant advantages in time-to-market, cost, and quality (Figure 3).

Figure 3: Business Benefits of Multiphysics Simulation Platforms

Base: Automotive/Industrial/Aerospace-Defense Respondents

	Multiphysics Simulation Platform Users	Non-Multiphysics Simulation Users
Product Launch Date Target	72%	65%
Product Cost Target	71%	55%
Quality Target	79%	70%

Source: Aberdeen Group, March 2017

In a competitive industrial environment where the pressure to innovate is relentless, simulation platforms shorten time-to-market, cut cost, and boost quality.

Industrial multiphysics simulation platform users say the business payoff comes in three areas:

- **Time-to-Market.** 72% of products currently meet product launch date targets for multiphysics simulation platform users, versus only 65% of products for non-simulation users. This is 11% better for multiphysics simulation platform users.
- **Cost.** 71% of products currently meet product cost targets for multiphysical simulation platform users, versus only 55% of products for non-multiphysics simulation users. This is a 29% better result for multiphysics simulation platform users.
- **Quality.** 79% of products currently meet quality targets for multiphysics simulation platform users, versus only 70% of products for non-multiphysics simulation users. This is a 13% better result for multiphysics simulation platform users.

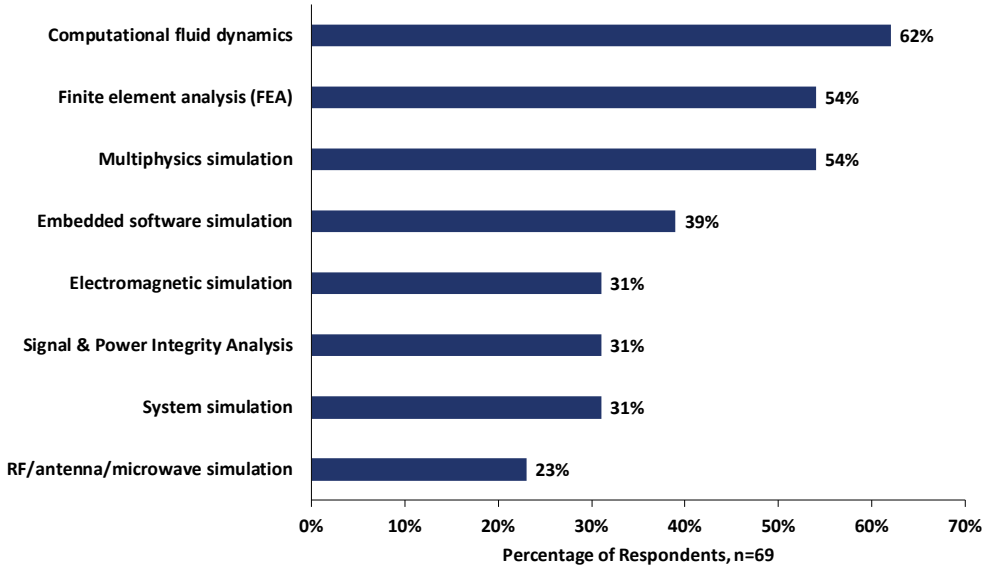
Moreover, year-over-year, multiphysics simulation platform users in automotive, industrial, and aerospace & defense improved their development times by 13%, while non-multiphysics simulation users experienced 8% longer development times.

As the research clearly shows, multiphysics simulation platforms are the best tool for shortening time-to-market, reducing cost, and boosting quality. Beyond these important attributes, simulation platforms optimize automotive engineering workflows in three important ways:

- **Digital Exploration.** A single simulation platform provides a risk-free, low-cost environment that allows designers to explore hundreds, if not thousands, of iterations of the same design.
- **Digital Prototyping.** The strength of a simulation platform lies in its ability to emulate the real world in each of its moving parts on a single, integrated base-of-operations. For example, a detailed virtual prototype might simulate thermal, structural, fluid dynamics, and electromagnetic attributes of the new product. Research shows that these and other new simulation areas are at the heart of future modeling investments by Best-in-Class companies.
- **Digital Twin.** Predicting what will happen when you operate a product is key. For example, in the automotive industry, there are potential digital twin/digital operation use cases abound: engine & powertrain; aerodynamics & thermal management; HMIs & infotainment; electronics & power electronics; body & chassis; brakes & steering; battery & power systems; electric machines; and ADAS & autonomous driving systems.

Lastly, confirming the popularity of multiphysics simulation platforms, Aberdeen Group Research shows that various areas of multiphysics simulation are among the hottest computer modeling growth areas (Figure 4).

Figure 4: Computer Modeling Investments by Best-in-Class Firms



Source: Aberdeen Group, March 2017

Future Perfect: The Road to Industrial Design Success

In a highly competitive environment, multiphysics engineering simulation is more crucial than ever for product success. Multiphysics simulation leverages common and compatible data models, and yields systems-level insights that could not be attained before, freeing up designers to explore and prototype new products digitally before committing to a physical version.

Plus, as Aberdeen Group research now clearly shows, a multiphysics simulation platform is the best tool for reducing time-to-market, lowering cost, and boosting quality.

As engineering simulation becomes pervasive throughout conceptualization, design, and virtual prototyping of products, the road forward requires an approach that simulates products as they exist in the real world. A multiphysics simulation approach "future-proofs" industrial product designs by allowing increasingly

realistic simulation of all engineering aspects of the product. And while a user may not model all these phenomena today, a multiphysics approach (that keeps your options open) is a wise move indeed.

Every good craftsperson knows the importance of "choosing the right tool for the right job." By reducing time to market, lowering cost, and boosting quality, multiphysics simulation has earned the right to this title.

For more information on this or other research topics, please visit www.aberdeen.com.

Related Research

Simulation-Integrated Product Development: Achieving More with Less; June 2016

Utilizing Simulation to Drive Innovation and Top Line Growth; January 2016

The Democratization of Simulation in a Multiphysics World; July 2016

Design for Manufacturing in Automotive; September 2016

Design for Manufacturing in Aerospace and Defense; September 2016

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