

Digital Prototyping: Questions and Answers

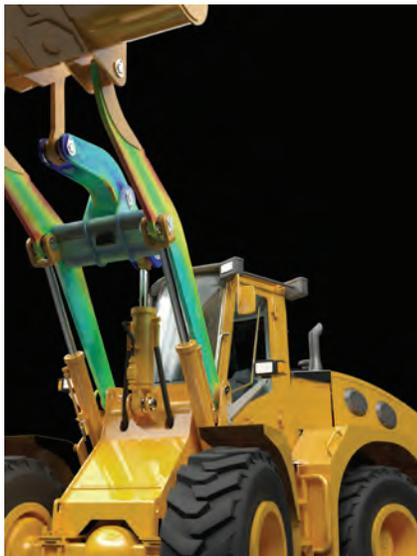
1. What is a digital prototype?

A digital prototype is a digital simulation of a product that can be used to test form, fit, and function. The digital prototype becomes more and more complete as all associated industrial, mechanical, and electrical design data are integrated. A complete digital prototype is a true digital representation of the entire end product, and can be used to visualize and simulate a product to reduce the necessity of building expensive physical prototypes.



2. What is Digital Prototyping?

Digital Prototyping gives conceptual design, engineering and manufacturing departments the ability to virtually explore a complete product before it becomes real. With Digital Prototyping manufacturers can design, visualize and simulate products from the conceptual design phase through the manufacturing process, boosting the level of communication with different stakeholders while getting more innovative products to market faster. By using a digital prototype, manufacturers can visualize and simulate the real-world performance of the design digitally, helping reduce their reliance on costly physical prototypes.



3. What are the pain points that Digital Prototyping addresses?

The manufacturing product development process today is dominated by islands of competency, each presenting its own technical challenges:

- In the conceptual design phase, industrial designers and engineers often use paper-based methods or digital formats that are incompatible with the digital information used in the engineering phase. A lack of digital data, compatible formats and automation keeps this island separate from engineering and manufacturing, and means that the conceptual design data must be recreated digitally downstream, resulting in lost time and money.
- In the engineering phase, mechanical and electrical engineers use different systems and formats, and a lack of automation makes it difficult to capture and rapidly respond to change requests from manufacturing. Another problem in the engineering phase is that with typical 3D CAD software, the geometric focus makes it difficult to create and use a digital prototype to validate and optimize products before they are built, making it necessary to build multiple costly physical prototypes.
- Manufacturing is at the downstream end of all the broken digital processes—the disconnection between the conceptual design phase, the engineering components, electrical and mechanical—and they receive this analog information in the form of drawings. The result is a heavy reliance on physical prototypes and the subsequent impacts on productivity and innovation.

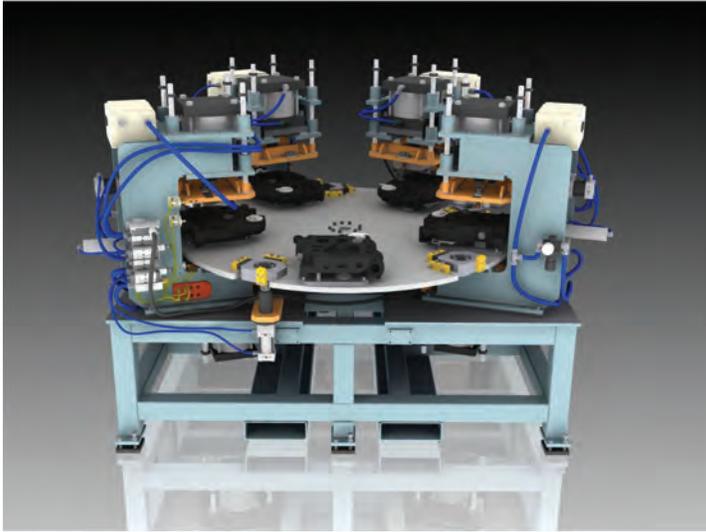
4. Hasn't the concept of Digital Prototyping been around for years?

Although there has been talk about the benefits of Digital Prototyping for years, the budget for the tools required to build and test a true digital prototype has been out of reach for most manufacturing companies. Digital Prototyping solutions are usually expensive, customized installations for large enterprises. Most out-of-the-box 3D modeling applications provide only part of the functionality needed to create a complete digital prototype.

Autodesk® Manufacturing

5. What is unique about the Autodesk approach to Digital Prototyping?

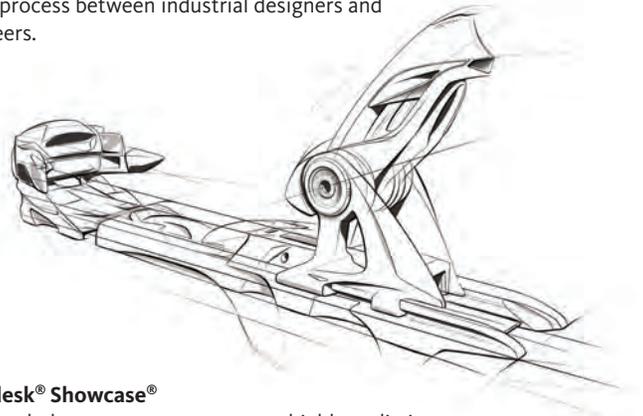
- **Attainable:** The Autodesk solution for Digital Prototyping provides the most straightforward and unproblematic path for mainstream manufacturers to create and maintain a single digital model. Ease of deployment and management of the technology allows design and manufacturing workgroups to quickly create and share a single digital model that can be used in all stages of production.
- **Scalable:** The Autodesk solution for Digital Prototyping is scalable, flexible, and easy to integrate into existing business processes. So manufacturers can realize the benefits of Digital Prototyping at their own pace, with minimal disruption to existing productive workflows.
- **Cost effective:** Autodesk Manufacturing is uniquely positioned to bring Digital Prototyping to a broader market by making it cost-effective for design and manufacturing workgroups. Autodesk has a proven track record of making powerful desktop technology available to companies of all sizes.



6. How do the Autodesk Manufacturing products and technology drive Digital Prototyping?

The Autodesk solution for Digital Prototyping brings together design data from all phases of the product development process to create a single digital model. This single digital model simulates the complete product and gives engineers the ability to better design, visualize and simulate their product with less reliance on costly physical prototypes – thereby improving time-to-market, and increasing competitive advantage. Autodesk provides the interoperable tools required to create a complete digital prototype from the conceptual phase of a project through manufacturing:

The **Autodesk® Alias®** product line enables users to work digitally from the start of a project with best-in-class industrial design tools. Users can capture ideas digitally from initial sketches through to 3D concept models and share those designs with the engineering team using a common file format—allowing a product's industrial design data to be incorporated into the digital prototype. Today, the look and feel of a machine or device is more important than ever for consumers, so housing and user interfaces must be shared early in the process between industrial designers and engineers.



Autodesk® Showcase®

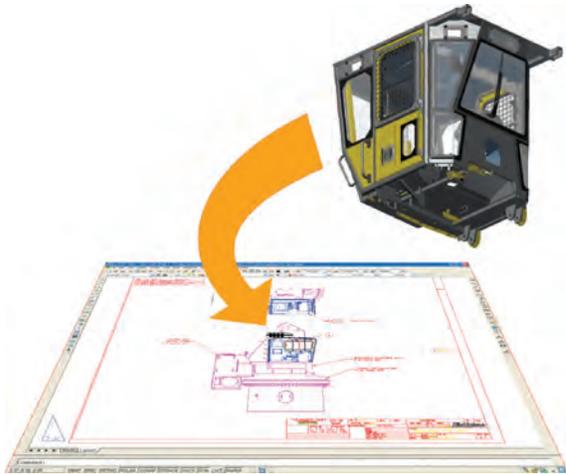
software helps users create accurate, highly realistic representations from 3D CAD data, enabling informed decision-making on digital prototypes. The unique Showcase environment facilitates the process of presenting and reviewing designs for important product decisions.



Autodesk® Manufacturing

Autodesk® Inventor® software is the foundation for Digital Prototyping. It enables engineers to produce accurate 3D models that can be used to design, visualize and simulate the product and its manufacturing processes before it is ever built. Digital Prototyping with Inventor® software helps design and manufacturing companies design better products, win more business and gain a competitive edge.

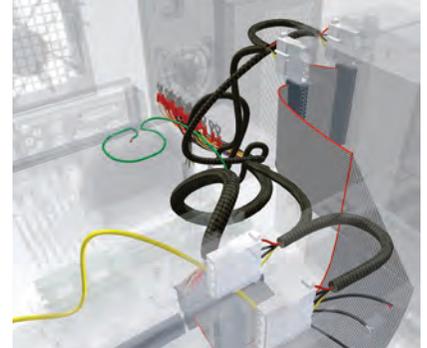
- **Functional Design:** Autodesk Inventor software products combine an intuitive 3D mechanical design environment for creating parts and assemblies with functional design tools that enable engineers to focus on a design's function, not geometry creation, and let the software drive the automatic creation of intelligent components such as plastic parts, steel frames, rotating machinery, tube and pipe runs, and electrical cable and wire harnesses. Reducing the geometry burden helps engineers spend more time rapidly building and refining digital prototypes that validate design functions and help optimize manufacturing costs.
- **DWG™ Interoperability:** Inventor provides direct read and write of native DWG files while maintaining full associativity to the 3D model without risking inaccurate translations. This gives engineers the freedom to safely reuse valuable 2D DWG files to build accurate 3D part models and then communicate insights gained from Digital Prototyping with partners and suppliers that rely on AutoCAD® software.



AutoCAD® Mechanical software, part of the AutoCAD family of products, is built for mechanical designers and drafters to improve the design experience by simplifying complex mechanical design work. Easily detail your production drawings using the Autodesk Inventor link, which automatically updates your 2D drawing when changes are made to the 3D model, reducing errors and saving hours of time. This workflow allows engineering departments to build digital prototypes while taking full advantage of the skills and expertise of the 2D drafting team.

AutoCAD® Electrical software passes electrical design intent information for cables and conductors directly to Autodesk Inventor software to automatically create a 3D harness design, adding valuable electrical controls design data to the digital prototype created in Inventor. Inventor users can pass wire-connectivity information to AutoCAD Electrical and automatically create the corresponding 2D schematics. The smooth integration between AutoCAD Electrical and Inventor software helps users create accurate 2D and 3D electrical designs in less time.

Autodesk® 3ds Max® software enables users to leverage engineering data to create advanced software rendered and animated visualizations of digital prototypes. 3ds Max contains a complete suite of CAD data preparation, modeling, effects and rendering tools to create the highest quality photorealistic and stylistic still and animated visualizations.



Autodesk's data management tools allow design workgroups to manage and track all the design components for a digital prototype, helping them to better reuse design data, manage bills of material, and promote early collaboration with manufacturing teams and clients. The **Autodesk® Vault** product line securely stores and manages engineering design data and related documents that make up the complete digital prototype. It automates the design revision and release processes and manages engineering bills of materials.

Autodesk® Navisworks® software for manufacturing enables manufacturing companies to visualize complete manufacturing facilities, industrial machinery, factory floor models and production lines in a single environment. Combine together CAD data from various design systems regardless of file format or size, for complete assembly visualization and optimization.

The Autodesk solution for Digital Prototyping includes **Autodesk® Moldflow®** injection molding simulation software, which helps companies to optimize their plastic part and injection mold designs and help ensure manufacturability, helping to shorten development times, reduce costs and avoid manufacturing defects.

7. What can customers do with the Autodesk solution for Digital Prototyping today?

Industrial designers use Alias products to digitally sketch design ideas and create 3D digital concept models for validation that then can be shared with the engineering team or manufacturing.

Engineers use Inventor to explore ideas with simple, functional representations that help generate a digital prototype. Inventor software delivers the best bidirectional interoperability between 2D and 3D mechanical and electrical design applications on the market. Integrated stress analysis and motion simulation help engineers optimize and validate complete designs digitally and confirm that customer requirements are met even before the product is built.

Manufacturing teams benefit from accessing the most current and accurate data (release drawings, models, and BOMs)—avoiding mistakes caused by using outdated documents. And, they can provide expertise earlier in the engineering process by using the digital prototype delivered using DWF™ technology to communicate, mark up, and measure designs—moving one step closer to true paperless manufacturing processes.



8. What are the business benefits of Digital Prototyping?

According to an independent study by the Aberdeen Group, best-in-class manufacturers use Digital Prototyping to build half the number of physical prototypes as the average manufacturer, get to market 58 days faster than average, experience 48 percent lower prototyping costs, and ultimately drive greater innovation in their products.* The Autodesk solution for Digital Prototyping helps customers achieve results like these.

9. How does the Autodesk solution for Digital Prototyping help get customers to best-in-class?

By giving customers the tools to develop a complete digital prototype, Autodesk helps them build fewer physical prototypes and ultimately get to market ahead of the competition with more innovative products. Autodesk's position is that moving to 3D is only the first step in creating a digital prototype. In today's increasingly competitive global market, being best-in-class means using technology to stay ahead of the competition and incorporating Digital Prototyping into the product development process gives manufacturers that edge. Autodesk provides this functionality through a complete, easy-to-learn set of design applications and a wide range of partners for consultation regarding what is needed to make Digital Prototyping a reality.

10. What is the market saying about

Digital Prototyping?

“To be best-in-class is not just about moving from 2D to 3D, but rather to push ahead to digital prototyping to answer questions about your product before you start to build it.”

—Start-IT

“IDC believes that with its new definition of digital prototyping, Autodesk is offering a product development solution to SMBs that will strengthen their competitiveness and give them the functional tools and processes required to achieve product excellence and profitability for years to come.”

—Gisela Wilson and Michael Fauscette, IDC

“One of the primary reasons manufacturers aim to capture more product information electronically is to digitally prototype their product. As a result, they can reduce physical prototyping and in turn, save time and development costs.”

—Aberdeen Group

“It [Autodesk] provides a comprehensive range of software solutions for the manufacturing industry including its flagship 3D design offering, Autodesk Inventor. The solutions redefine product design process by supporting and connecting all disciplines of product development, from industrial design to mechanical and electrical engineering, and manufacturing.”

—Design News

“The ability to not only visualize product development in 3D but also to simulate how that product would perform in the physical world are among the benefits assigned to digital prototyping. Research from consulting firm Aberdeen Group, in fact, shows that the use of digital prototypes for top-performing companies both reduces their product development costs and speeds up how quickly products get to market.”

—IndustryWeek

“The latest Autodesk manufacturing solutions redefine the product design process by supporting and natively connecting all of the disciplines involved in product development, from industrial design to mechanical and electrical engineering and manufacturing.”

—The Manufacturer

“The Digital Prototyping approach is now embraced by some important manufacturers who once promoted enterprise PLM, including Boeing. Its new 787 Dreamliner, like the 777 before it, was digitally designed, but the digital definition from engineering was pushed into manufacturing via new processes that replaced DCAC/MRM.”

—Nancy Rouse-Tally, Desktop Engineering

“Autodesk is doing what it has always been good at - taking a technology idea and giving it the top 80% of functionality at 20% of the price. Digital Prototyping is no different. It takes the idea of ‘expensive’ out of PLM and brings it down to all those other users.”

—Rachael Dalton-Taggart, PR, Marketing and the Business of CAD

“Before Inventor, it would typically take me 18 months to bring a new design to market,” Jason Faircloth, product manager and designer for Marin Bikes, Inc. says. “The finite-element and motion analysis software have enabled me to almost eliminate physical prototypes. With the software, it’s now nine months, and getting faster — and the product is better. This is our future.” The CAE capabilities of Inventor Professional enabled Faircloth to produce multiple “digital prototypes” so that the time-consuming process of physical prototyping was reduced or eliminated.”

—Desktop Engineering

