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Beyond Data Management: How Engineering Leaders are Turning Data into Insights

Why cloud-based product development platforms are replacing PDM and legacy CAD with a "single source of truth"

ptc

Contents

Introduction - Rethinking the Cowpath: Improving Data Management in Product Development page 03

- File-Based CAD Duplicates the Paper-and-Pen Product Design Process page 04

1. The Challenges of Managing File-Based CAD Data page 06

- Digitalization and Agility: A New Strategic Imperative for Data page 08
- Why Does Legacy File-Based CAD Slow Down the Product Development Process? page 09
  - *Access to Design Data* page 13
  - *Version Control Errors* page 15
  - *PDM/PLM Administrative Headaches* page 16
  - *Lack of Analytics and Project Visibility* page 18

2. Turning Data into Insights with Cloud-Based CAD page 20

- Access to Design Data: Anywhere, Anytime page 22
- Enabling Collaboration: A Single Source of Truth for Version Control page 23
- Streamlining and Expanding Work with External Partners page 24
- Eliminating the Serial Workflow and Downtime of External PDM Systems page 25
- Turning Data into Insights: The Right Information at the Right Time page 26

3. The Top 5 Onshape Features for Streamlining Design Data Management page 28

- 1. Release Management & Approval Workflow page 30
- 2. Real-Time Analytics page 31
- 3. Comprehensive Edit History page 32
- 4. Restore (Infinite Undo) page 33
- 5. Compare page 34

4. Chapter 4: Why Forward-Thinking Companies are Embracing Cloud-Based Data Management page 35

- *Garrett Motion* page 36
- *DHL* page 37
- *OceanGate* page 38
- *Kichler Lighting* page 39
- *Doris Dev* page 40
- *Loop Medical* page 41

5. How Onshape's Cloud-Native Product Development Platform Helps Boost Innovation page 42

INTRODUCTION

Rethinking the Cowpath: Improving Data Management in Product Development

Leading product firms today realize that how they manage data is critical for improving product features, innovating new products, delighting their customers and winning market share.

Companies are now recognizing that they must reassess legacy product development technology that severely limits their teams' ability to effectively collaborate and work remotely. Engineering and manufacturing teams are fundamentally reimagining the role of technology in their organizations and pivoting to a model that addresses the needs of end users at every stage of their product's journey.

Although installed file-based CAD platforms were innovative when they were launched over 30 years ago, these on-premise systems are woefully outdated today – even blocking teams from fulfilling their commitments to deliver innovative products when promised. As user and business demands have evolved, the capabilities of file-based CAD software have not advanced with them.

INTRODUCTION

RETHINKING THE COWPATH: IMPROVING DATA MANAGEMENT IN PRODUCT DEVELOPMENT

The truth is that in many ways, on-premise CAD software is really just a digitized version of the old-school analog "paper and pen" design process. Legacy CAD simply took the good, the bad, and the truly cumbersome aspects of data management and moved them from the drafting table to a computer. By keeping the same fundamental flaws as the paper-and-pen process, file-based CAD really just "paved over the cowpath."

The colorful expression "paving over the cowpath" originated in the notion that the winding asphalt streets of many old U.S. colonial cities like Boston followed the same serpentine routes that cows followed home from the pastures every evening. Contrast Boston's winding city streets with the meticulously planned geometric grid you see in Manhattan, for example. Although some modern city planners dispute the cowpath tale as the reason for Boston's confusing layout, the bovines remain a powerful and relevant business metaphor.

In the modern software world, "paving over the cowpath" means that a given solution has simply followed the existing methodology that came before it – without re-examining and exploring if there might be a better approach to solving a problem.

File-Based CAD Duplicates the Paper-and-Pen Product Design Process

When examining the origins of the data challenges that so many users of file-based CAD systems face today, the "paving the cowpath" analogy seems particularly apt. It is easy to see how traditional on-premise CAD evolved from its paper-and-pen predecessor. When product designs were sketched on paper, they were physically locked in a file cabinet. The digitized version of that are computer design files locked in a Product Data Management (PDM) system vault. Neither the paper file, nor the computer file is well suited for collaboration.

INTRODUCTION

RETHINKING THE COWPATH: IMPROVING DATA MANAGEMENT IN PRODUCT DEVELOPMENT

Just as sharing data between multiple users was never a core consideration for the design of the first drafting table, data management clearly was not a key concern when file-based CAD was created in the late 1980s. Devised before the internet, file-based CAD tethers users to a single dedicated workstation with design files fed back and forth from a server. There is no easy or efficient way for users to collaborate with other design team members. Just as paper-based files were couriered around offices and across town in the old days, "modern" file-based CAD requires users to undertake similarly awkward workarounds to share information.

As legacy CAD users send emails with design file attachments to multiple stakeholders, every additional design copy increases the potential for version control errors and costly manufacturing mistakes. This back-and-forth process of sending copies of design files to colleagues, receiving feedback and coordinating their edits into a master version is laborious, time-consuming and prone to errors.

The limitations of file-based CAD have only grown more apparent in recent years. In an era when anyone can hail a ride-sharing service, order dinner, or even book a vacation rental with a few taps on their cell phone, the slow, cumbersome, and error-prone design process of legacy CAD has become a clear anachronism. The bottom line is that today's designers and engineers expect cloud-based efficiency, convenience and functionality.

The global pandemic has only magnified these issues. Product development teams need cloud-based tools that enable anywhere, anytime remote access. They also need the ability for multiple engineers and stakeholders to collaborate in real time. Organizations can no longer tolerate the delays and limitations produced by siloed data trapped within individual departments.

The pandemic has also taught businesses today that they need to "expect the unexpected." In the face of accelerating change and the uncertainty of future potential Black Swan events, forward-thinking companies must take steps to improve their business agility and resilience.

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Chapter 1

The Challenges of Managing File-Based CAD Data

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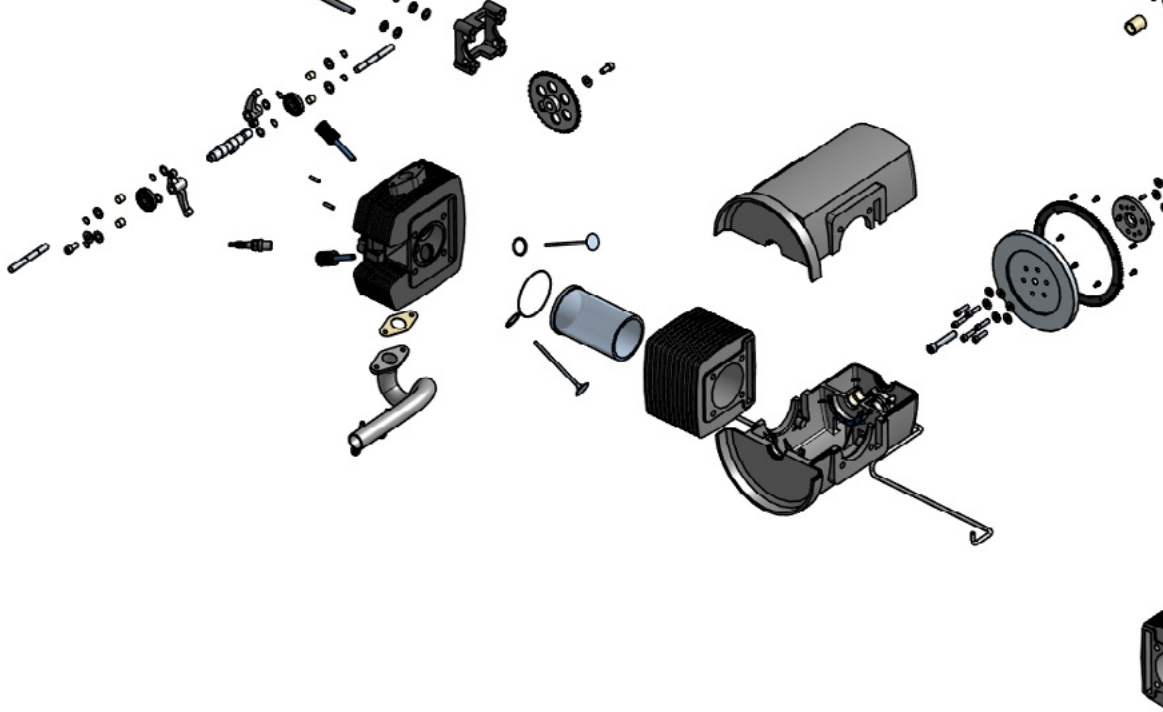


The Challenges of Managing File-Based CAD Data

The recent global pandemic has exposed cracks in legacy file-based CAD systems that were already there – and were already slowing down design processes well before a large portion of the white-collar workforce went remote.

The biggest reasons why installed on-premise product development tools slow teams down include:

1. *Designers and engineers are tethered to one licensed computer without convenient, anywhere access to their work;*
2. *CAD users have been unable to easily and quickly share the latest critical product design data across company departments for review and approval;* and
3. *Companies have been unable to easily share real-time design data with external suppliers, vendors and partners.*

Just as some firms still use outdated legacy business software because it has "always been that way," decades-old, file-based CAD is still the default option at many companies. But the sudden ramped-up technology challenges of remote work and collaboration have forced teams to re-evaluate their old processes.

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Digitalization and Agility: A New Strategic Imperative for Data

McKinsey and Company has written extensively on the business paradigm shift toward digital and cloud-based solutions. The firm has noted that a core aspect of this shift is the changing role of IT and technology in general – moving from a focus on "improving cost efficiencies" to one leveraging technology as a "strategic business tool" to drive productivity and results.

In a recent global survey of business leaders, McKinsey found that the shift to remote work by employees, reduced business travel, and changes to consumer habits and expectations have resulted in a significant acceleration of digitalization.

Fully 85% of companies surveyed indicated that they have either "somewhat" or "greatly" accelerated the implementation of technologies to "digitally enable employee interaction and collaboration, such as videoconferencing and filesharing."

These survey results indicate that the trend towards remote work and the urgency for digital transformation to address these new business needs are likely far-reaching and long-lasting.

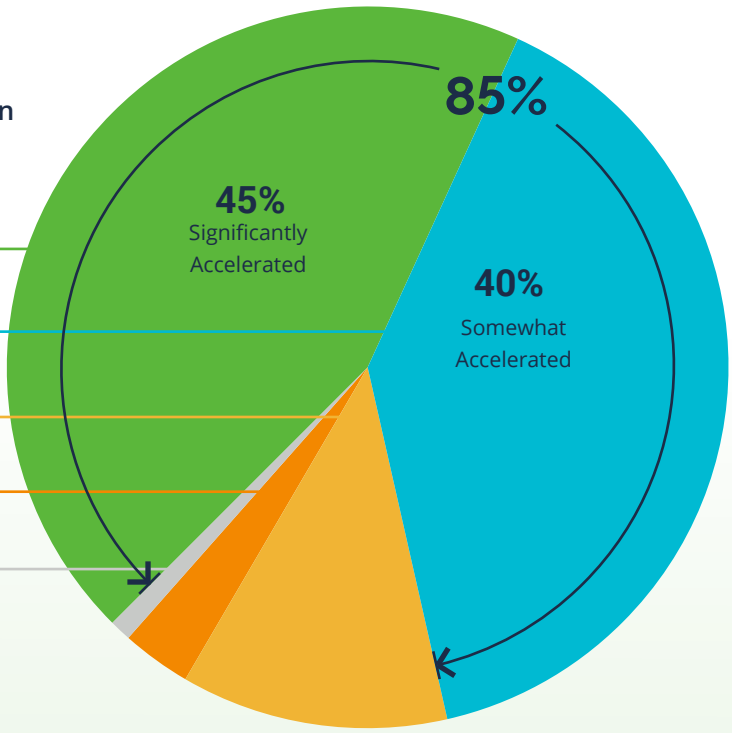
Acceleration of Digitization and Automation: Impact of the COVID-19 Crisis

85%

of business leaders surveyed have "significantly accelerated" or "somewhat accelerated" their digitization of employee interaction and collaboration

- **45%** Significantly Accelerated
- **40%** Somewhat Accelerated
- **12%** No change/not applicable/not adopted
- **3%** Somewhat decelerated
- **1%** Significantly decelerated

Note: Numbers do not add up to 100% due to rounding



Source: McKinsey Global Executives Survey, July 2020

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

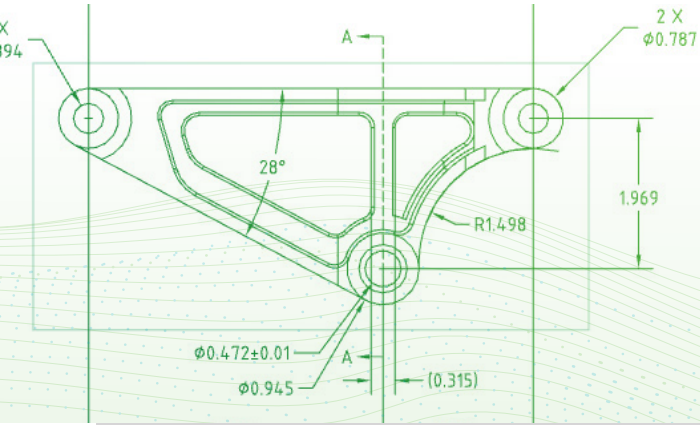
Why Does Legacy File-Based CAD Slow Down the Product Development Process?

A critical challenge facing today's users of on-premise, file-based CAD is version control. Because file-based CAD requires users to copy and send versions of the same document back and forth, it creates myriad opportunities for errors and mistakes.

The challenge is fairly intuitive. Whether you've been a student working on a term paper or a professional drafting a document for a client, you're undoubtedly familiar with the version control problems that arise whenever two or more people are collaborating on the same project. You send your original Document A to a colleague or supervisor for feedback, they leave comments in the margins and you create a revised Document B that you send back. The process goes through multiple iterations until you reach a final edit that everyone is happy with.

If you're sending your documents back and forth through email attachments, both parties need to follow strict naming conventions for all the various versions (Document A, B, C, D, etc.) or there is a risk of someone accidentally revising the wrong version they see on their desktop and missing out on important changes made earlier. Working on the wrong document creates a domino effect of people scrambling to figure out how to undo unintended missteps and get back on the right track.

The same dynamic, of course, applies to the engineering and manufacturing world. What's surprising is just how often it happens.



CHAPTER 1:

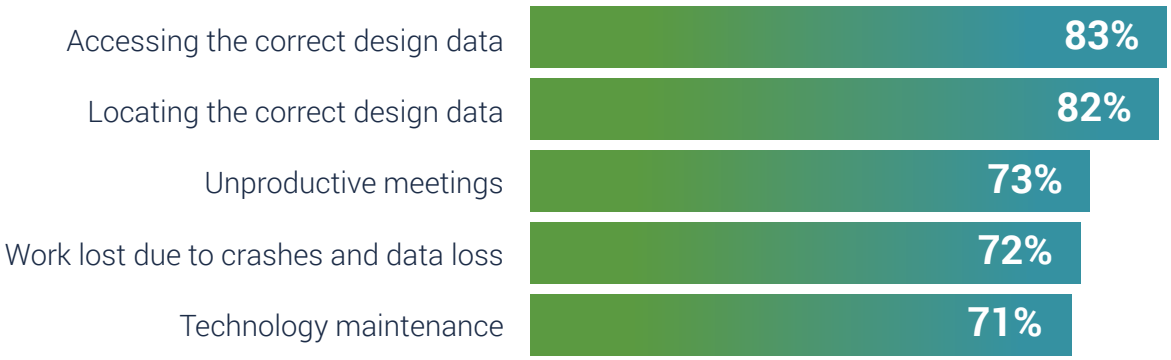
THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

In *The State of Product Development and Hardware Design 2020*, an Onshape-commissioned industry survey of nearly 1,000 engineering professionals worldwide, participants were asked to rate which productivity-killers were the most problematic at their company. To answer, respondents used a scale ranging from "not important at all" and "somewhat unimportant" to "somewhat important" and "very important."

REDUCING WASTED TIME

Q: How important is it to reduce time related to each of the following activities?

Percentage who said "somewhat important" or "very important"



Base: 980 respondents.

Source: The State of Product Development and Hardware Design 2020

These results are stunning. More than 4 out of 5 product development professionals report having trouble accessing the correct product design or even finding it in the first place. Working on the wrong version of a design can lead to costly manufacturing errors, frustrating rework, wasted materials and possible liability issues. But it's also stolen time that could have been devoted to the next project. Not being able to locate the design is equally frustrating and unproductive.

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

For file-based CAD users today, significant challenges to data management exist at virtually every stage of the product development process.

These include significant challenges for sharing data with the following groups:

- **Core Design and Engineering Teams:** Individual designers and engineers need to collaborate with one another to iterate and develop innovative product designs and efficiently keep track of design iterations.

- **Internal Company Stakeholders:** Designers must often share their product designs with an extended team of internal company stakeholders (non-CAD users) including operations, manufacturing, and sales, for early feedback and design reviews.

- **External Partners:** Companies are seeking to share finalized designs quickly and efficiently with external manufacturing suppliers and partners.

In each of these collaboration scenarios, here are the key reasons why legacy on-premise CAD software slows down the pace of product development:

Access to Design Data: Designers and engineers are increasingly working remotely. These users working in multiple locations cannot easily access each other's CAD designs. It is also difficult for the core design team to share real-time 3D product models with non-CAD users across the company, such as executives or the marketing team who need to provide critical feedback.

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Version Control Errors: When product designs go through multiple iterations, it is vital for everyone on the engineering and manufacturing teams to ensure that they are always working on the latest most up-to-date version of a design. Multiple copies of the same design files often lead to engineers accidentally working on the wrong iteration, which can result in data loss and costly manufacturing mistakes.

PDM/PLM Administrative Headaches: Product Data Management (PDM) and Product Lifecycle Management (PLM) systems prevent engineers from overwriting each other's work by forcing them to "check in" and "check out" design files from a vault. Only one person at a time can work on the design file, creating serial workflows instead of parallel ones.

Lack of Analytics/Visibility: Because file-based CAD users store their work on their individual hardware, it is not readily accessible or viewable anytime by supervisors, colleagues or other important design stakeholders. Learning the up-to-the-minute status of a design project often requires scheduling a design review or physically leaning over the project owner's shoulder.

Let's take a deeper look at the most common reasons why file-based legacy CAD causes needless delays in the design process.

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Access to Design Data

The global pandemic created immediate, and in some cases, lasting change for companies of all sizes. One of the most significant challenges for many firms was access to design data when entire teams were forced to shift to remote work away from their traditional offices. This posed an urgent need to find ways to access product design data while working remotely in order to stay productive. After working on the files at home, these users then had to make a return trip to the office parking lot to upload and check in their files in order to enable collaboration with colleagues.

For many designers and engineers thrust into this new paradigm of working from home, the change was disruptive. The lack of access to their office workstations meant delays as they sought workarounds to address their proiect deadlines and customer needs. In addition to the challenges of accessing design files, many were confronted with the absence of their in-office IT personnel whom they could call upon to troubleshoot problems in real time.

In fact, horror stories have emerged of the workarounds required for some users to access their design data. These workarounds include engineers having to place their PC in their car and drive to the parking lot of their office in order to connect to the office server to access and download time-sensitive CAD files. These users after working on the files at home, then had to make a return trip to the office parking lot to upload and checkin their files in order to enable collaboration with colleagues.

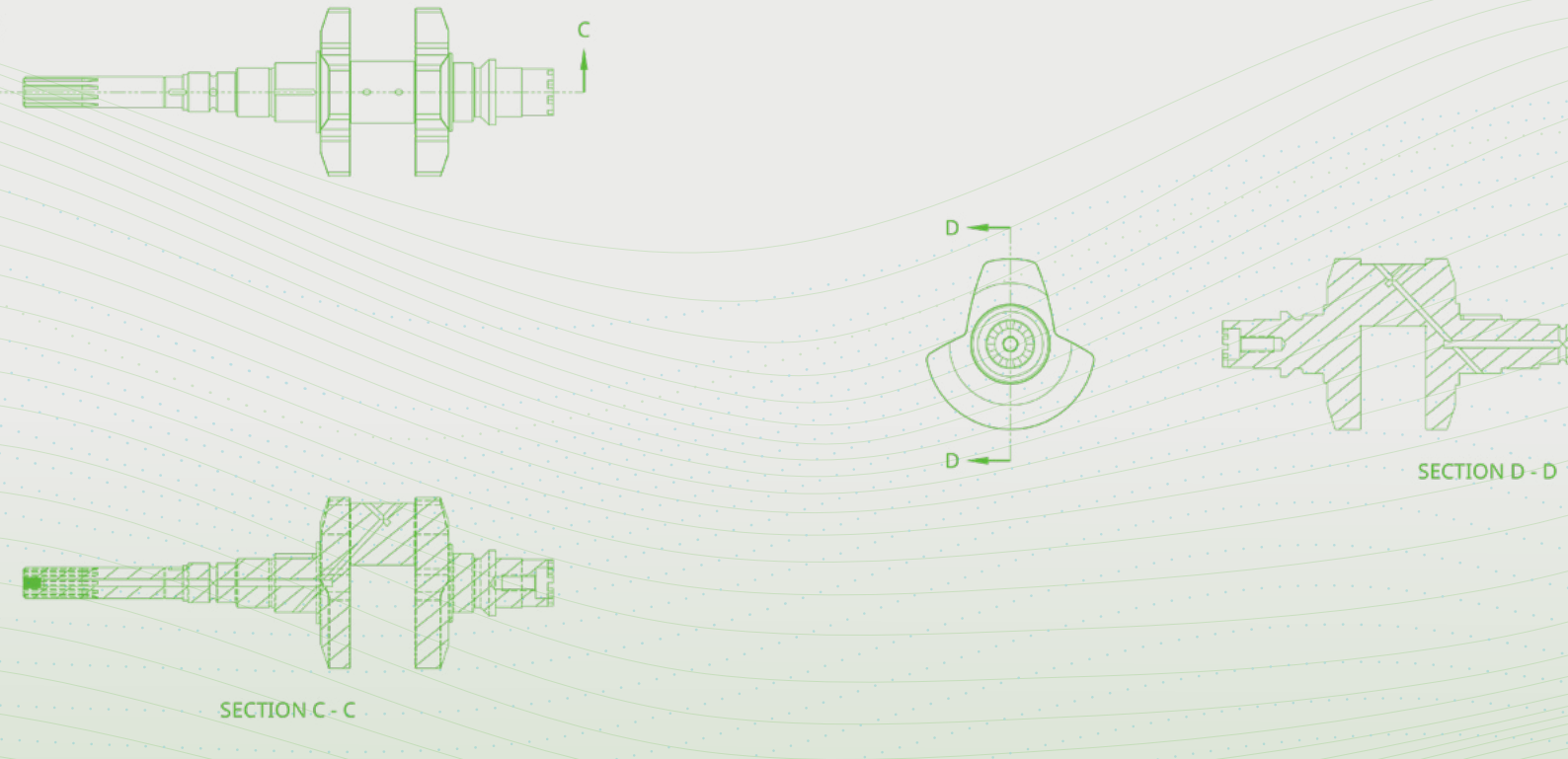
Although some firms took the extra step to set up dedicated VPN connections for individual employees, this option is cumbersome and expensive. The bottom line? While file-based CAD was clearly an improvement over paper-and-pencil product design, it was fundamentally built for in-office use. The technology has simply not kept up with the reality of the collaborative way that designers and engineers work today and the advancements of an internet-connected world.

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Looking to the future, companies are facing the reality that the increase in remote work is likely here to stay. Even when the pandemic abates and some office work resumes, many analysts are projecting that a complete return to full-time office work is unlikely. McKinsey and Company, in their recent "Future of Work" report, forecasts a hybrid home-office approach as the most likely scenario. These predictions correlate with actual worker preferences. A recent Fortune magazine survey found that only 9% of office workers who are still remote say they'd like to always work in the office in the future.

An additional 56% of those surveyed by Fortune prefer a hybrid model. Faced with a growing demand for remote productivity tools to support work from home, many product development leaders are recognizing that their file-based legacy CAD systems are undermining their future business goals.



CHAPTER 1:

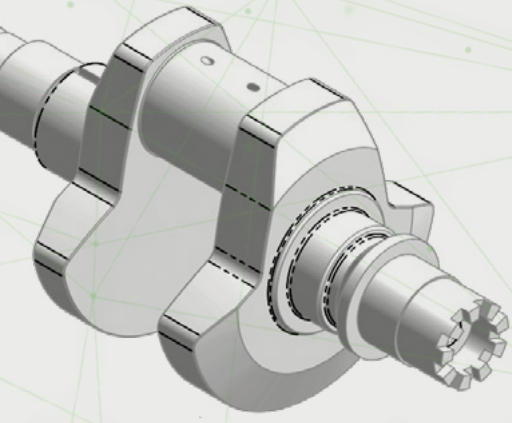
THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Version Control Errors

Another longstanding challenge faced by on-premise CAD users is the problem of "version control" for design files. At its core, file-based CAD was based on the premise of one user working on a single master design file. In many ways, this simply replicated the existing thinking that guided the original paper-and-pen design process. In those days, a user would make their edits to the master file, which was then protected tightly under lock and key in a file drawer. Following this same approach, file-based CAD requires users to make all edits to one file. Collaboration was not a key consideration in the original development of file-based CAD, so consequently many challenges remain for multiple users who wish to work together.

In order to share a project with a colleague, a user must first make a copy of their design file and then distribute that file – often through email or a file-sharing service such as Dropbox – to one or more collaborators. Upon receiving their copy, the colleague must then find a way to share their edits or suggestions with the file owner, again via email or Dropbox.

This back-and-forth process is cumbersome and inefficient. As one can imagine, reviewing, consolidating and synthesizing feedback from multiple stakeholders can create an enormous administrative challenge. Unfortunately, this tedious process often results in version control issues where key ideas can be missed or critical design elements can be lost or overwritten by accident.



CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

PDM/PLM Administrative Headaches

To address the version control challenges of file-based CAD, some organizations have turned to adding on external Product Data Management (PDM) or Product Lifecycle Management (PLM) solutions. Unfortunately, these solutions often create different, equally vexing problems of their own. Overall, the cumbersome nature of these systems add significant administrative time to their workload. Users must "check in and check out" design files like a digitized library book. For designers and engineers focused on solving engineering challenges, additional process-related steps are an unwelcome addition to their task list.

Perhaps the greatest challenge posed by PDM/PLM systems is tied to the approach of their underlying technology. In serving as a gatekeeper to data, to the exclusion of user needs, the technology inevitably creates downtime. Users must bide their time, waiting for co-workers to finish their work on a design file and return it to the system, before they can be granted access.

This outdated approach to data management is representative of an earlier era in technology. The forced serial editing process really is more akin to the traditional waterfall-based product development methodology than today's widely adopted agile approach to technology and product development.

For file-based CAD users, the extra wait time is more than an annoying inconvenience. Tight project timelines are jeopardized and productivity is sacrificed as users must sit idly as they wait to access a needed file. It is not difficult to envision the damage that this antiquated data management approach has on employee morale. As users face the challenges of meeting ever-tighter deadlines, it is inevitable for tension and stress to build up between team members.

CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

According to *The State of Product Development and Hardware Design 2020*, the industry's frustration with current PDM/PLM technology is loud and clear. The report found that more than 50% of file-based PDM/PLM users believe the systems slow down their overall design process.

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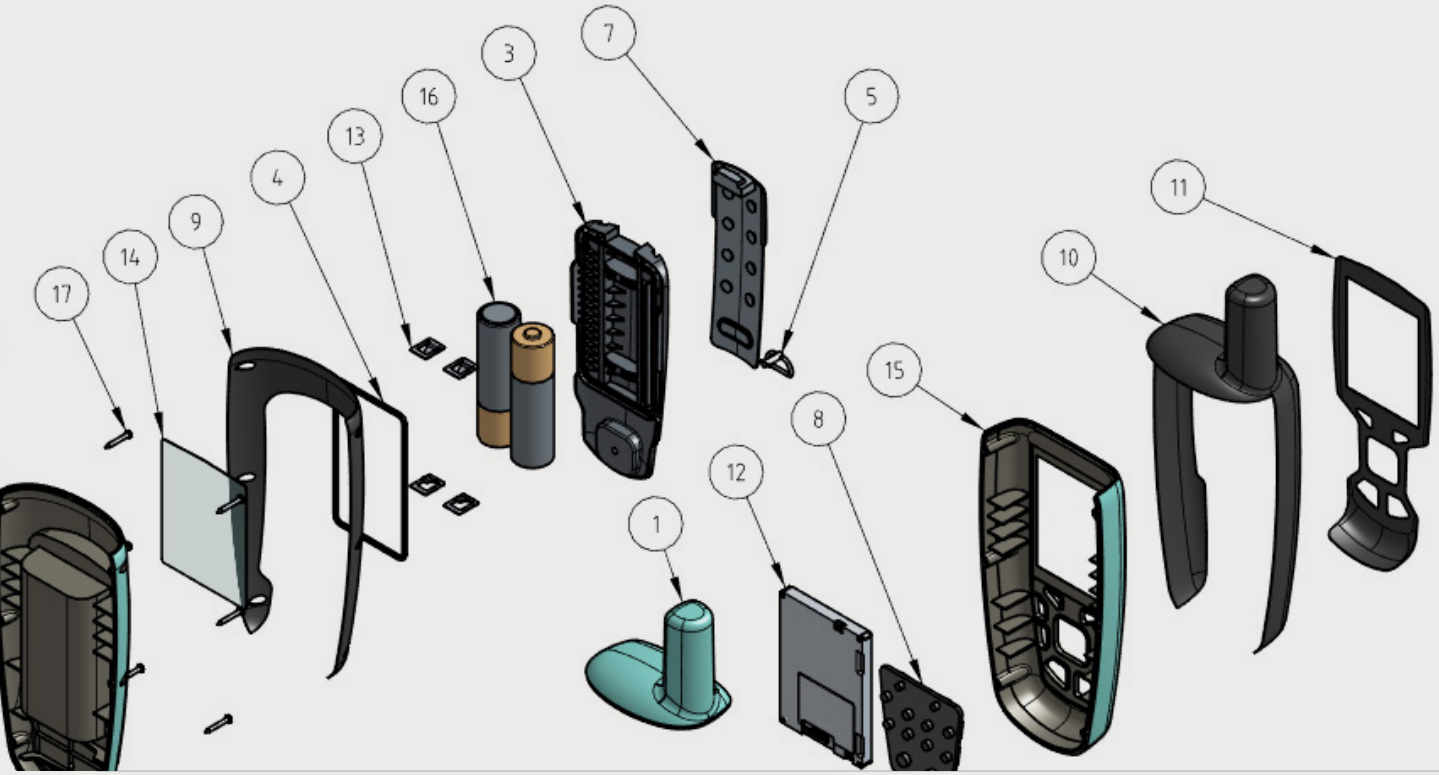
PDM/PLM users say the systems slow down their overall design process.



CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Lack of Analytics and Project Visibility

At a time when product designs are growing increasingly complex, and many firms are taking on the challenge of juggling multiple projects at once, the need for data and analytics in the lifecycle of a project is becoming increasingly important. Unfortunately, legacy file-based CAD simply doesn't provide the insight that today's teams require.

Take the example of a Director of Engineering seeking to understand what is going on with several design projects that are underway at once. With file-based CAD, it is virtually impossible for that individual to know with certainty, and in real time, what is going on with in-process designs. The reason for this is simple. The creators of file-based CAD, which was built around a single master document, never envisioned the need for real-time analytics or collaboration.

With legacy on-premise CAD, a project manager cannot see how much time an engineer is actually working on a design. When a user checks out a file, the status of that design file is invisible to anyone else. It is only after the user checks it back into the system that anyone can understand what work has been done. In effect, any actions taken on a design file for the entire length of time that the file is checked out is a black hole to colleagues and management.

In addition to the lack of visibility, this data management approach can also magnify errors and delays. In the scenario where a user might have selected a wrong part to incorporate in their design, a supervisor with real-time access could easily notice and course-correct with the user. However, with file-based CAD, the user who selected the wrong part might spend a week on it – whatever the interval is before the next check in of the file. The result is a small error has become a big error and wasted significant time.

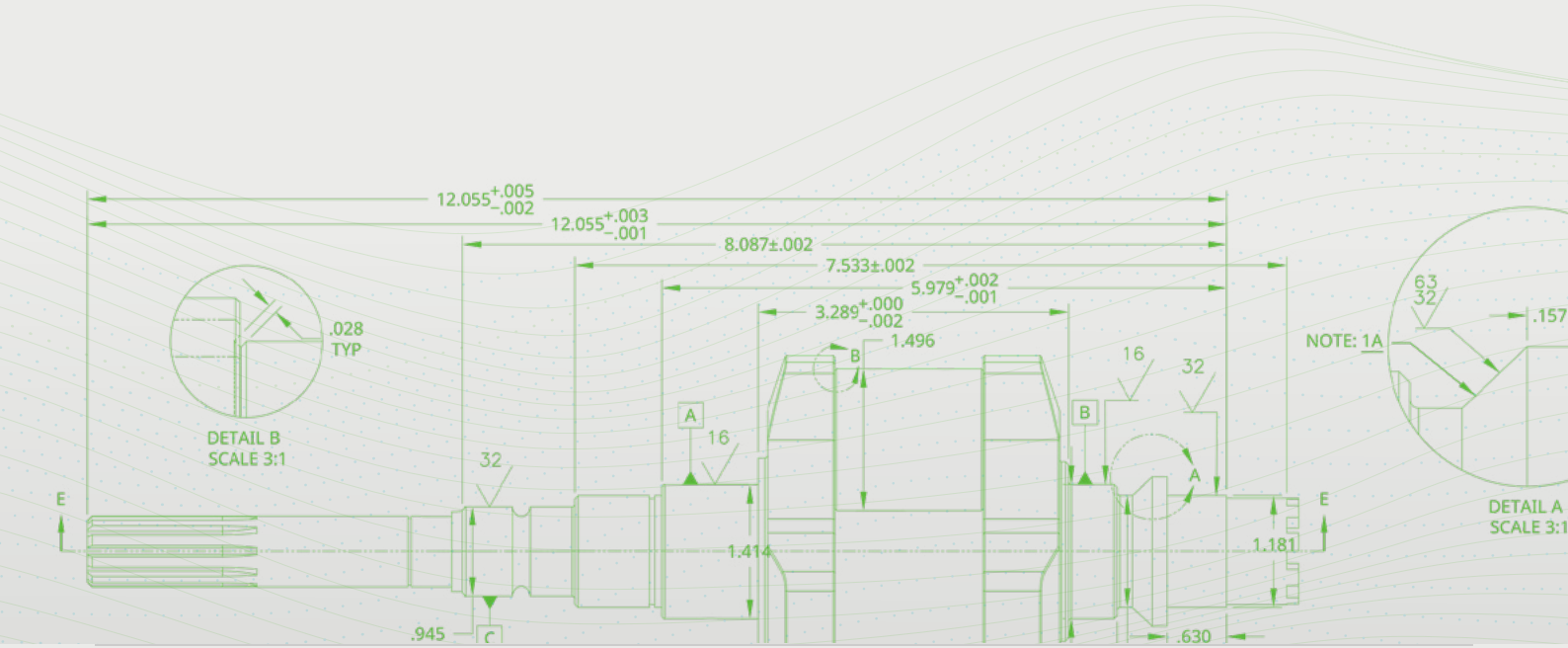
CHAPTER 1:

THE CHALLENGES OF MANAGING FILE-BASED CAD DATA

Similar to the workarounds to collaboration via email, there are workarounds for the lack of real-time visibility for file-based CAD. And like email, they are inefficient and suboptimal. In the case of analytics, many engineering leaders must require all of their team members to stop work for a period of time and check in all of their files at the same designated time. As one can imagine, these check-ins can be extremely disruptive to the designer or engineer's productivity.

Moreover, these mandatory check-ins only provide a limited period of time where there is insight into the actual status of a design. In this small window when no one is working, a manager can understand a "snapshot" of the status of an ongoing project. Once a design is checked out again and teams are working, the progress and status of a design are again unknown for those remaining 32 to 40 (or more) hours of design time during the week.

For those managers with an extended or even global design team, the challenges of obtaining real-time data and analytics are even more pronounced. Increasingly, product development leaders need to have the analytics to better manage individuals, understand the current status of projects, and remove obstacles as needed.



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Chapter 2

Turning Data into Insights with Cloud-Based CAD

Turning Data into Insights with Cloud-Based CAD

The impact of a global pandemic and the fundamental changes to how firms are operating today – including the shift to remote work for many previously office-based employees – has led organizations to reassess their technology needs. Increasingly, leaders are realizing that they must re-align existing tools to become more digital and agile.

For many product development firms, their existing software solutions have evolved over time – even on a department-by-department basis. Little thought has been given to the need to share data across silos. With the increasing need to share data insights in real time throughout the product development lifecycle, companies are refocusing on how they approach data management.

In Chapter 1, we outlined the numerous challenges that users of legacy file-based CAD face everyday. These include most notably:

- The lack of remote access for users;
- Delays and errors often created through serial copying and version control;
- The expense and administrative hassles of checking in and checking out design files with add-on PDM/PLM systems; and
- The virtually complete absence of real-time insights and analytics.

Product development leaders are now seeking new ways to improve operational efficiency and product quality. They are increasingly looking to the capabilities provided by digital and cloud-based solutions to address the most critical challenges.

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Let's take a closer look at how cloud-based CAD addresses the biggest blockers slowing down many of today's engineering teams. Specifically, we'll look at the approach of PTC's **Onshape**, a cloud product development platform that combines a robust CAD system with built-in data management, simultaneous collaboration tools and real-time business analytics.

CHAPTER 2:

TURNING DATA INTO INSIGHTS WITH CLOUD-BASED CAD

Access to Design Data: Anywhere, Anytime

To address the significant challenge of enabling anywhere, anytime remote access for employees and contractors, companies are seeking new technology that delivers secure and reliable access to product designs and enables teams to stay productive. Cloud-based solutions are already used in nearly every facet of corporate life today – ranging from customer and sales CRM and project management to human resources software. The principal benefit is the simple intuitive access and availability of data, regardless of where users are located.

For product development, the cloud-based Onshape platform provides unprecedented CAD accessibility with a secure, reliable way for users to create, collaborate and share design documents from any web-enabled device. In addition, Onshape is especially well suited to boost cross-departmental collaboration when it is most critical – at the earliest stages of product development when it is most possible to explore alternative ideas.

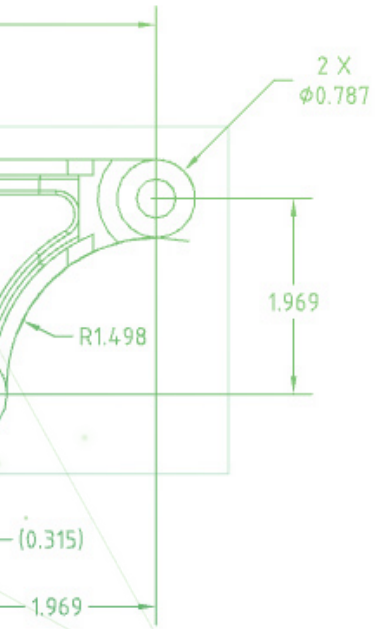
Designers and engineers want to stop wasting time hunting for the correct version of their design files and data. With Onshape, there is no more searching. The latest version of a design is always in the same secure cloud workspace which all members of the team (with permissions) have instant access. Onshape enables users to access their designs from any location and on any computer, tablet or phone (iOS and Android).

CHAPTER 2:

TURNING DATA INTO INSIGHTS WITH CLOUD-BASED CAD

Enabling Collaboration: A Single Source of Truth for Version Control

In addition to unhindered access, cloud-based CAD enables teams to work together better, period. Onshape allows multiple designers and engineers to simultaneously work together on the same product design. CAD users are no longer faced with the challenge of managing multiple versions of the same design document, risking costly manufacturing errors and unrecoverable lost time.



Onshape's single source of truth frees engineers to focus on improving the quality of their design work rather than overcoming administrative hassles. Working together on a common design document, users can see their colleagues' ideas play out in real time and experiment with alternative concepts more readily. Key CAD collaboration features built into Onshape, such as Branching and Merging, allow teams to take more creative risks without having to recreate their main design.

Relying on a single source of truth, Onshape facilitates quick and streamlined feedback between the core design team and non-CAD users across the organization (such as Sales, Marketing or Customer Success) or with outside clients or partners. To solicit feedback on a CAD model, users need only to share a permission-based web link. Stakeholders can more easily participate in time-sensitive design reviews and approvals. No longer are teams held hostage to the delays and inaccuracies of missed emails and lost attachments. And because users can run Onshape from any web-connected device, there's no longer a need for expensive, dedicated CAD workstations to access product designs.

Perhaps the biggest benefit of working from a single source of truth is peace of mind. Onshape's comprehensive Edit History tracks who made what design change and when, empowering the team to instantly revert back to any earlier stage of the CAD model if desired. With unlimited "undo" and "redo" built into the system, users can rest assured that their work will never be overwritten or lost.

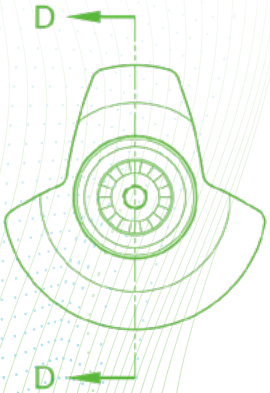
CHAPTER 2:

TURNING DATA INTO INSIGHTS WITH CLOUD-BASED CAD

Streamlining and Expanding Work with External Partners

For product development firms, the quarantines and travel restrictions associated with the global pandemic has required a re-examination of existing relationships with suppliers and manufacturing partners.

The takeaway for many firms is that they must take steps to improve their breadth and depth of relationships to ensure business continuity during any similar future crisis. In some cases, they are seeking to ensure that time-sensitive data can be shared securely and easily without the need for travel. In other cases, firms are seeking to expand and diversify their partner network to ensure they can transfer or increase manufacturing capacity should the need arise. In all cases, it's clear that their legacy file-based CAD technology is struggling to meet these challenges.



With traditional file-based CAD, once a design file is sent by email, thumb drive or a file-sharing service like Dropbox, the intellectual property can then be forwarded to anyone else – with no record of it being sent or transfered. In contrast, Onshape's Sharing feature provides secure, limited and revocable access only to trusted stakeholders selected by the user. In addition, any downloads of the design document are logged and reviewable throughout the life of the document. The result is a more secure, trusted process.

With file-based CAD, product managers often feel the need to travel on-site to their manufacturing partner to ensure that all facets of a design are understood prior to tooling being cut. This extra quality control precaution is not unwarranted. Version control issues can arise frequently with on-premise CAD systems. Last-minute design changes are quite common and if a manufacturing partner misses these changes, producing the earlier outdated design can result in enormous cost in time and materials.

CHAPTER 2:

TURNING DATA INTO INSIGHTS WITH CLOUD-BASED CAD

Working off Onshape's single source of truth eliminates the risk of version control issues and costly manufacturing errors. Because there is only a single real-time master document, there is improved clarity and less possibility of confusion across teams.

Planning for supply chain contingencies, Onshape also enables users to more easily expand their network of suppliers and manufacturing partners. The ability to securely and confidently share the exact same design with multiple manufacturing partners in the bidding process means added flexibility in time-sensitive situations. By streamlining collaboration and communication with external partners, Onshape is helping companies become more agile and resilient to unexpected changes.

Eliminating the Serial Workflow and Downtime of External PDM Systems

With a cloud-based architecture and integrated data management, Onshape allows engineers to spend less time on administrative tasks so they can devote more time improving the quality of their designs.

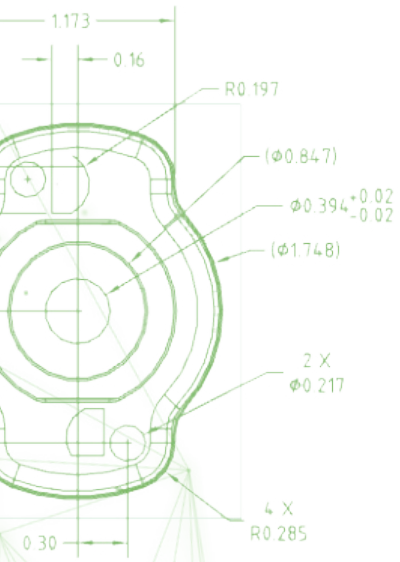
Onshape frees users from the need to send multiple design files to stakeholders and wrestle with subsequent version control issues. The cloud-based platform also eliminates the need for expensive and cumbersome "add-on" Product Data Management (PDM) systems.

Many firms seek out PDM systems because they are frustrated with the version control problems created by file-based CAD. However, the challenge with these systems is that they were designed to gate access in the same exact way as the old paper-and-pen processes. Instead of a physical locked file cabinet drawer, PDM puts a virtual lock on files following a strict check-in and check-out system. Once a colleague checks out a file, no one else can work on it until he or she checks it back into the vault. This forced serial workflow results in additional downtime for those waiting on files to be returned.

Certainly, an engineer could switch to another project while he or she is waiting, but the bottom line is that the overall pace of progress is being slowed down. The most logical approach to accelerate any project is a parallel workflow where multiple people can be working on the same design at the same time.

While PDM systems do achieve their stated purpose of preventing colleagues from overwriting each other's work, they also create organizational blind spots. Managers and product team leaders have zero visibility into the progress of design files while they are checked out of the system.

Cloud-based Onshape's single source of truth makes purchasing an add-on PDM system unnecessary. Built-in version control lets users access time-sensitive design documents whenever they need it. Executives and project managers have 24/7 visibility into the progress of a design, no longer having to wait for formal scheduled design reviews. And there is no danger of colleagues overwriting each other's work. Whenever one engineer makes a design change, everyone else on the team can instantly see it. A comprehensive Edit History tracks who made what change and when for the entire life of the project.



Turning Data into Insights: The Right Information at the Right Time

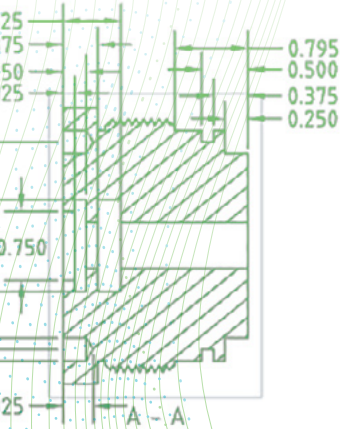
Whether you're a CIO at a multinational company or the owner of a small or mid-sized business, your biggest data management question is seldom about not having **enough data**. Rather, it's usually about whether or not you are looking at the **right data at the right time**. Companies need both real-time and historical data to optimize product development processes, improve product design, and accelerate time to market.

CHAPTER 2:

TURNING DATA INTO INSIGHTS WITH CLOUD-BASED CAD

With legacy file-based CAD systems, there is usually not enough of the right data available when needed. On-premise CAD systems create a dynamic where individual engineers are often working alone on their own downloaded designs. Without cloud-based sharing of a common document, these files are autonomous islands of data confined to each workstation. So if teams can't even see each other's data, how are they supposed to distill timely insights from it?

When collaborating in Onshape, individuals and teams always know exactly where a project stands in real time, so there are fewer last-minute surprises and bottlenecks. Team leaders can support individuals with insights and best practices as they are applicable – and allocate resources with a clear understanding of what work has already been accomplished and what issues are likely to arise in the future.



At a time when remote work with distributed teams and extended contractors is becoming increasingly common, Onshape provides product development companies the data tools they need to support their employees. Leaders can now use real-time data to manage capacity and remove obstacles to keep projects on track. This level of insight into the real-time progress of a project improves consistency and reduces errors. For example, a manager using Onshape might detect if an engineer is using the wrong component in their in-process design. In turn, they could rectify the problem early before it results in a waterfall of wasted time and effort.

The real-time visibility enabled by the cloud means that managers never need to guess about the status of their projects again.

The last area in which Onshape's built-in data management provides invaluable insights comes **after a project is completed**. Using the platform's integrated business analytics, managers can review exactly how many hours were spent by each team member on a given project and plan for future work accordingly. Onshape's comprehensive Edit History – chronicling every change in the design document – enables team leaders to examine opportunities for improvement and identify best practices.

Enabling the conditions for real continuous improvement, Onshape helps companies achieve faster times to market, improved product quality, and better control over product development lifecycles and critical deadlines.

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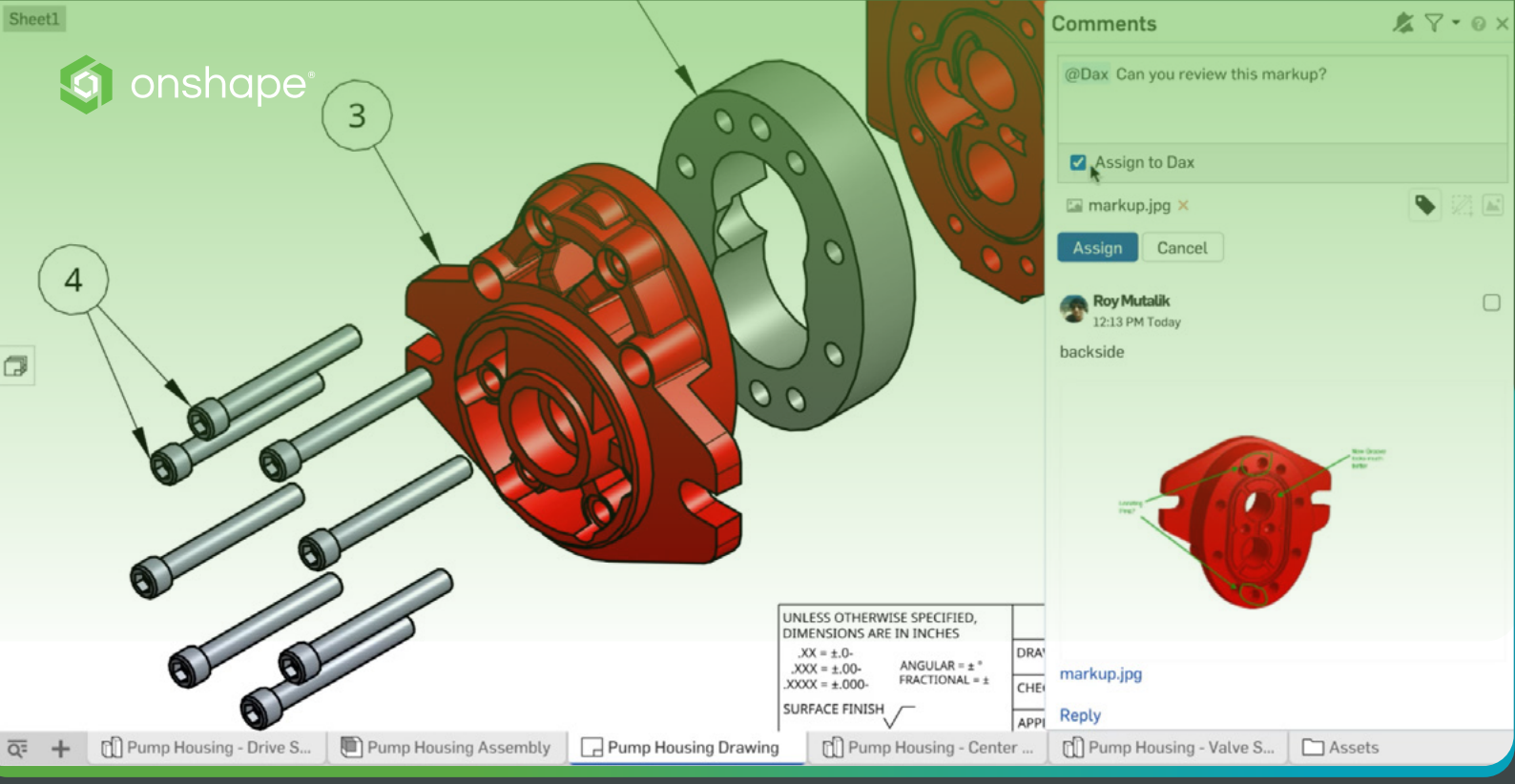
Chapter 3

The Top 5 Onshape Features for Streamlining Design Data Management



The Top 5 Onshape Features for Streamlining Design Data Management

Onshape's unique cloud database architecture delivers an unprecedented level of freedom for CAD users – including anywhere, anytime access and the ability for multiple people to simultaneously work together on the same design with the confidence they are always working on the latest version.

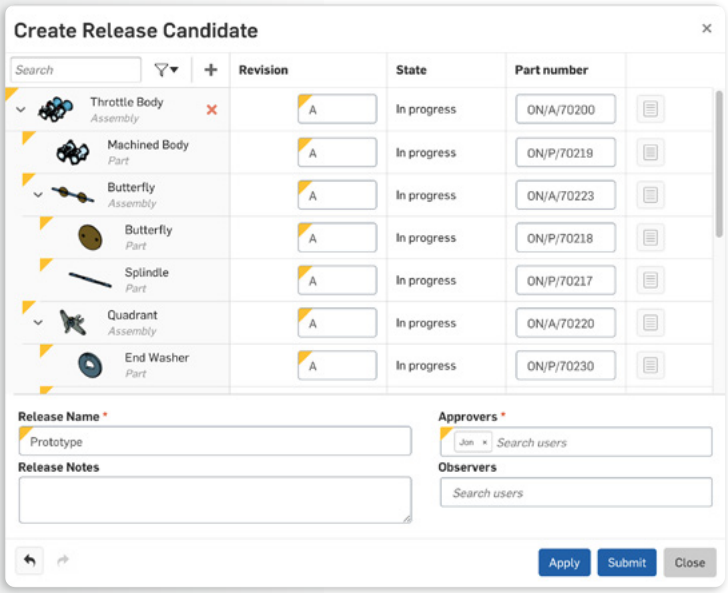
When engineering teams aren't devoting significant mindshare to naming and organizing their files, they can focus more on what's truly important – creating innovative products and design improvements.

Let's take a look at the most productive Onshape data management features built around a single source of truth.

1 Release Management & Approval Workflow

Release management and approval workflow capabilities in Onshape optimize efficiency and ensure faster time to market. The process of creating releases in file-based CAD comes with inordinate data challenges. These challenges include locating, validating, organizing and archiving hundreds – and sometimes even thousands – of individual design files.

Even with an external PDM system in place, creating a release can take several days and slow down engineering work – or even bring it to a complete halt. Because of Onshape's cloud-based architecture, there are no blockers or waiting for colleagues to "check in and check out" designs. Onshape users can continue working, even while a release candidate is created and being approved.



Onshape's release process takes just minutes instead of hours, and it allows engineers to go back and reference all the contents of any release at any time. Users can create a proposed release for any combination of parts, assemblies, configurations and other assets as a single release.

Once a release is defined, a simple, intuitive task view enables designated approvers to explore release contents in the appropriate context and then quickly approve or reject without interfering with other current activity.

Automatic notifications instantly let all users know when a new release is created, ensuring that all team members stay on the same page and continue progress. Onshape's release management is fully integrated into the modeling environment – a stark contrast to external PDM systems that add another layer of complexity. While they are modeling, Onshape users can always tell which parts and assemblies are released and what the latest release is. There are no strange file-naming conventions or calls to the PDM administrator required.

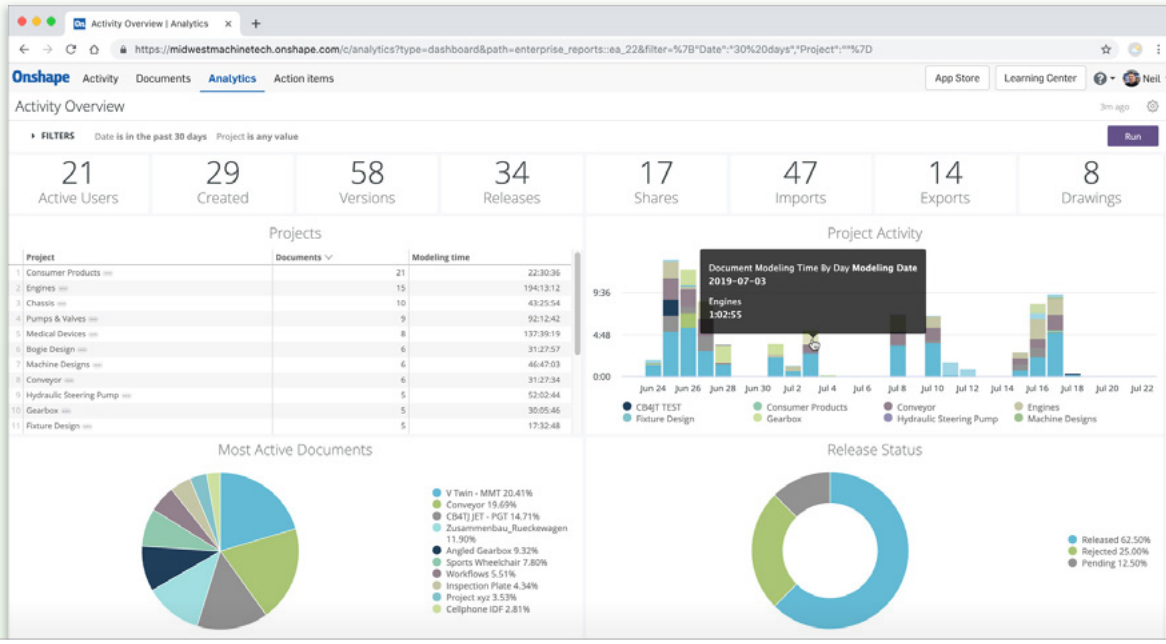
2

Real-Time Analytics

Onshape's real-time analytics provide a comprehensive overview of project data with easy-to-read tables and charts that enable users to review all design activity, review document access and manage projects and resources better.

The Activity Overview dashboard gives a comprehensive overview of data broken down by employees or external suppliers. It enables managers to see the total number of hours spent on each project per day and per user, which engineers are actively working on which projects, how many release candidates are pending approval, and which documents have been worked on the most.

From a process optimization perspective, these powerful insights give managers the ability to understand what is happening in the life of a project and to take appropriate action when it is most needed. This means that managers can now make more informed decisions based on data, not hunches or anecdotes. As a result, they can take steps to identify issues before they become problems, overcome bottlenecks, and allocate the appropriate resources to improve operational efficiency and accelerate time to market.

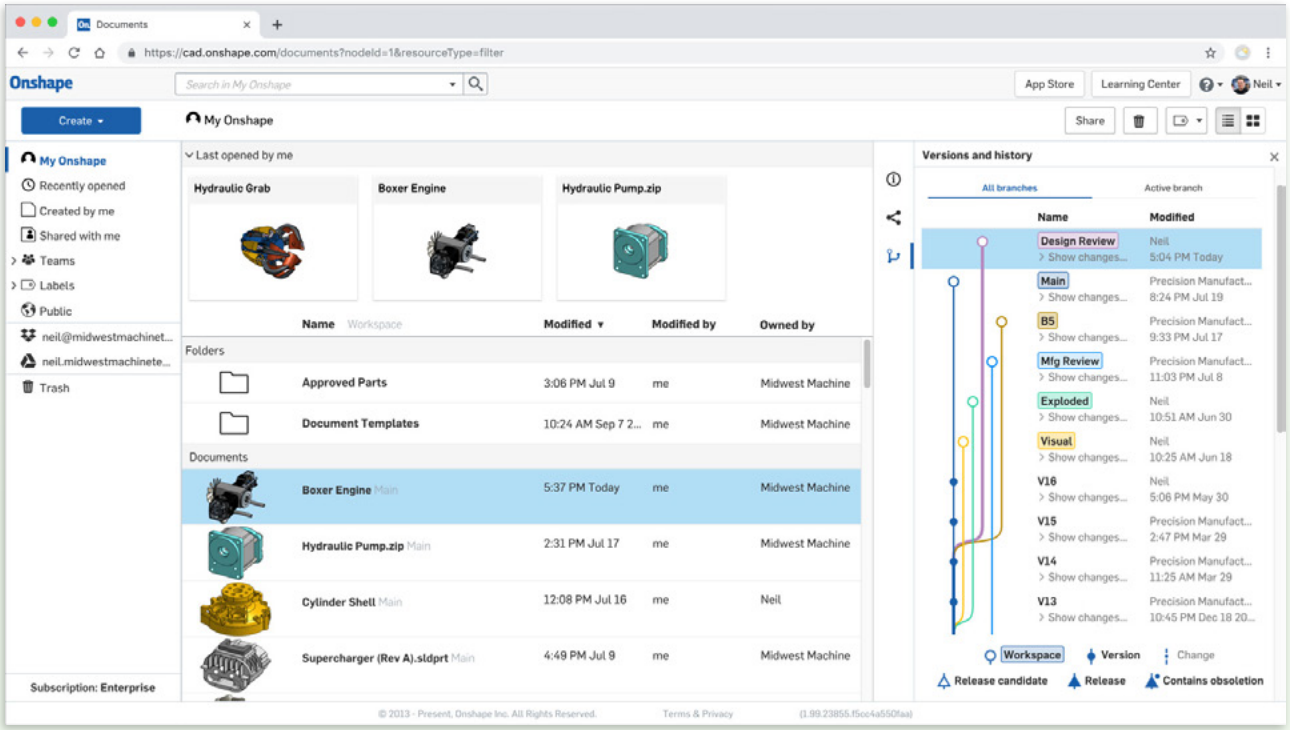


3

Comprehensive Edit History

As any designer or engineer will tell you, the creative process is seldom linear. The journey to a great design often requires experimentation, iteration, and multiple starts and stops. With Onshape's unlimited "undo" and "redo," users can now easily move forward or backward to any stage in the editing process. Closely related to Branching and Merging, the Edit History feature provides a comprehensive list of all changes made to the design document.

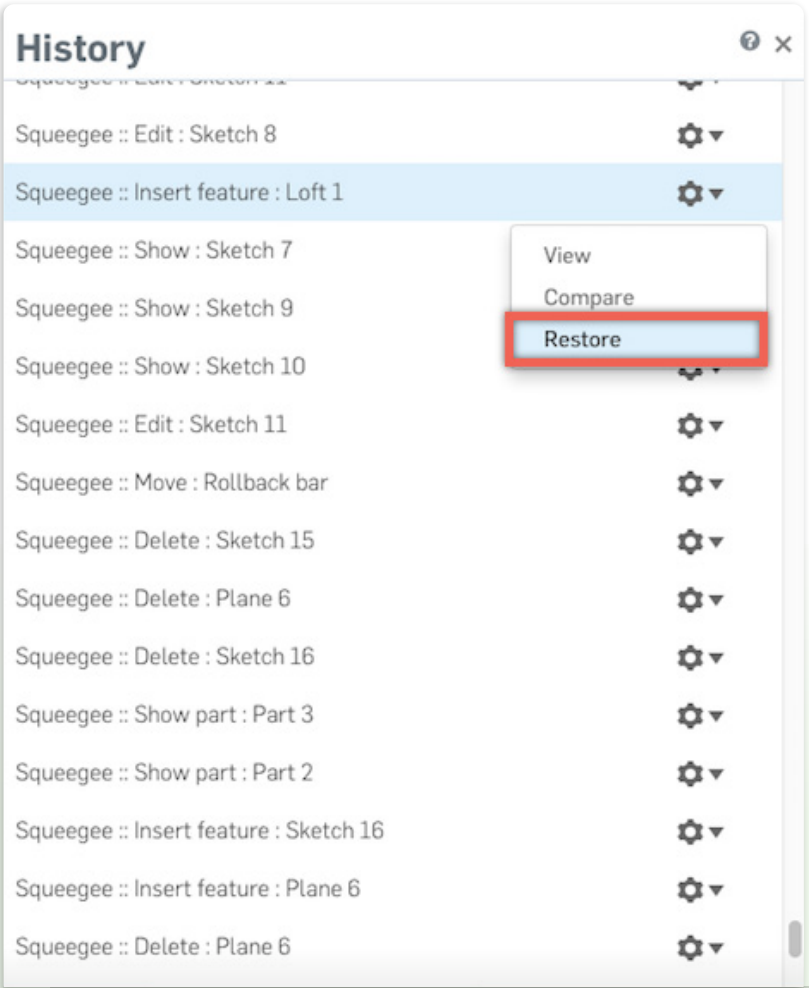
The feature enhances team collaboration by letting members work together and make edits and revisions without fear of losing earlier work. With clear visibility into all design changes, users can review, modify and undo edits as needed. The Edit History's audit trail is unalterable and is never erased, offering a reassuring always-available documentation of the life of a design project. Users can now design more boldly, take more creative risks and try new ideas – all with the confidence that they can easily go back to an earlier version if needed.



4 Restore (Infinite Undo)

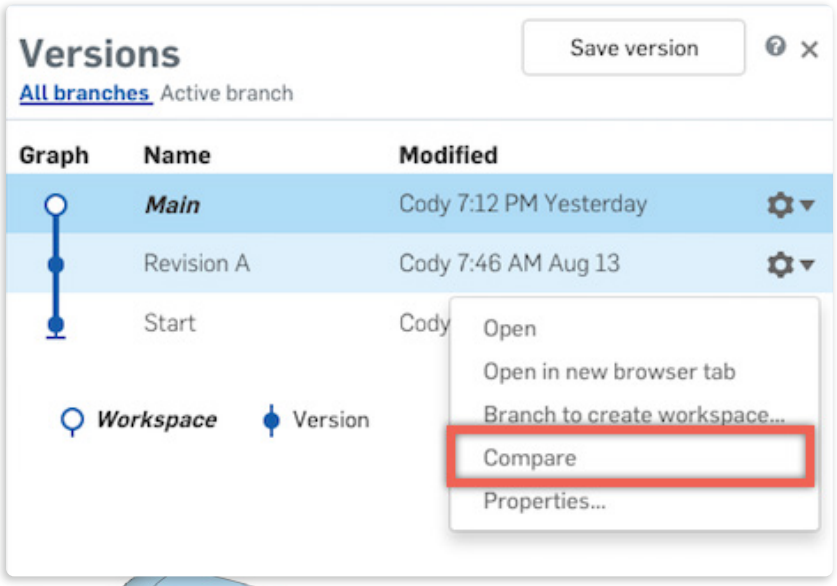
Related to Onshape's comprehensive Edit History, the Restore feature enables users to essentially go back in time and undo any design change. This ability to undo any error allows users to take creative risks with the confidence that they can be reversed later.

This ability to experiment without hesitation is an essential element of developing new design ideas. In contrast, users of legacy file-based CAD systems are accustomed to being limited to only a finite number of steps they can "undo." For many on-premise CAD systems, users are restricted to "undoing" only 5 or 10 steps backwards.

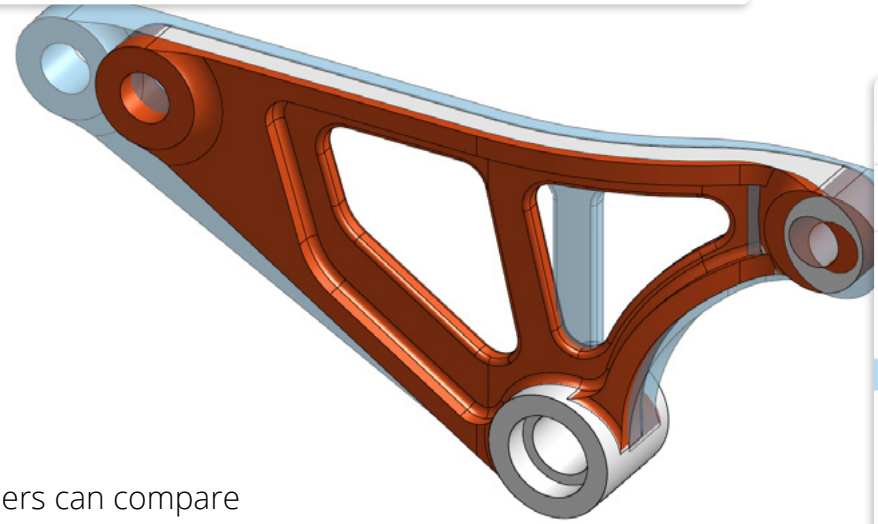


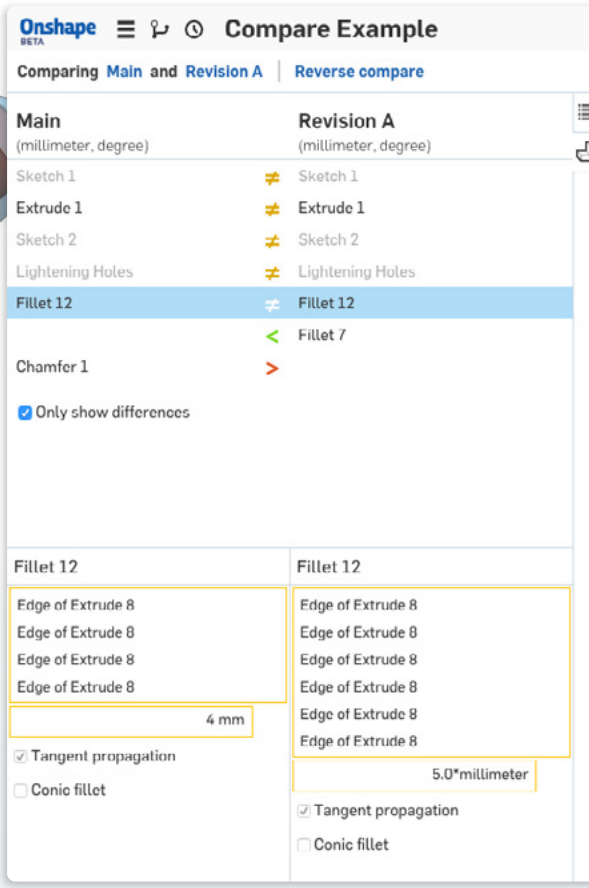
Needless to say, this limitation can discourage users from trying new things out of fear that they can't reverse direction and will be left with a partially finished or broken design. With the Restore function in Onshape, designers and engineers can work unconstrained, pushing the envelope on novel approaches with the confidence that they can return to any prior stage of the design anytime.

5 Compare



An important aspect of product design and data management is the challenge of understanding what changes have occurred in a given design over time. Onshape's Compare feature allows users to quickly and easily see these changes through both a written list and visual references.





Users can compare changes between versions, workspaces or even moments in the Edit History of a part or assembly. Users can see not only the changes in the graphics, but also the specific differences in the CAD features used between the two versions being compared.

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Chapter 4

Why Forward-Thinking Companies are Embracing Cloud-Based Data Management

Garrett Motion

ROLLE, SWITZERLAND

AUTOMOTIVE

Garrett Motion is the market leader in turbocharger technologies in every region of the world and across all vehicle classes and engine types.

The multinational company depends on Onshape's real-time data management to share the latest up-to-the-minute product designs between their five R&D centers, 11 close-to-customer engineering facilities and 13 manufacturing sites worldwide.

"Onshape changed the way we work by going from a functional team of 200 dedicated design engineers to more than 700 people who are using (our product models) across the engineering community, the manufacturing community, and with our suppliers," says **Chris Meade, Garrett's Senior Director of Design Engineering**. "All working around that same single source of truth is something we never could have accomplished with our legacy systems."

Before switching to cloud-based Onshape, 95 percent of Garrett's global engineering team had been working in on-premise, file-based CATIA. Meade acknowledges that getting experienced engineers to give up a platform they had already invested years in is not an easy task.

"You have to recognize from the beginning that it's not fundamentally about a tool change. It's really about human change management," he says. "Getting the people engaged. Getting them to understand what are the benefits, where is the future for us, how does it transform the way that we work?"

"Learning how to go from CAD system A to CAD system B is easy, but bringing the people with you, especially when your organization is spread out all over the place with different viewpoints and different ways of working, that's really the heart of it," Meade adds.

To learn more about how Garrett Motion improved their product development process, watch this Enterprise panel discussion from Onshape Live 2021.

DHL

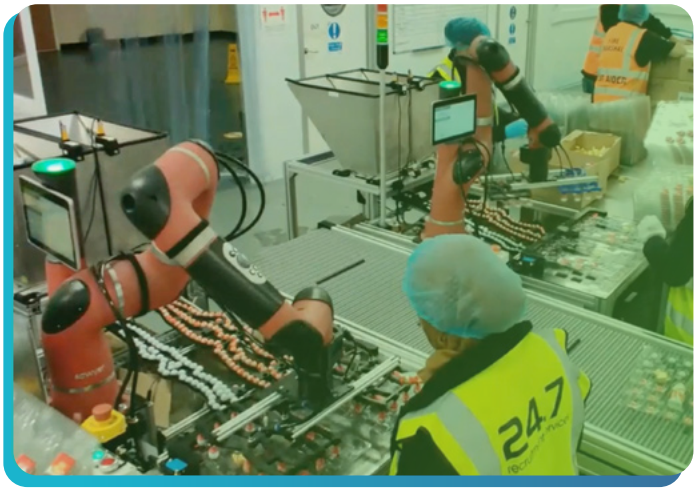
COVENTRY, ENGLAND

ROBOTICS AND AUTOMATION

DHL is the world's leading logistics company with 380,000 employees worldwide serving more than 220 countries and territories. While most consumers associate DHL with package delivery – they deliver more than 1.5 billion parcels annually – the company is also a leader in large-scale contract packaging for other companies.

DHL's Digital Manufacturing Group is an internal R&D unit focusing on creating custom low-cost, highly flexible and agile robotic systems to serve the logistics market. The team's engineers are charged with developing automation systems that address increasing labor costs and decreasing labor availability.

To help design and build their automated packaging equipment and 3D-printed modular conveyor belts, DHL relies on Onshape's built-in data management and real-time collaboration tools.



Onshape's comprehensive Edit History permanently tracks all changes in the evolution of a product design, allowing engineering teams to instantly revert back to any prior stage of development. The audit trail allows users to experiment with new ideas without fear of having to recreate the original design if they go down a nonviable path.

"With a click of a button, you can go weeks back or months back to an earlier version," says **DHL product development engineer George Walsh**. "It's like time traveling."

"Onshape removes the need for you to manage your own versions. With traditional CAD, you've got a file and you have to make sure that you're really strict and disciplined with your naming convention," adds **Redland Sanders, Technical Director of DHL's Digital Manufacturing Group**.

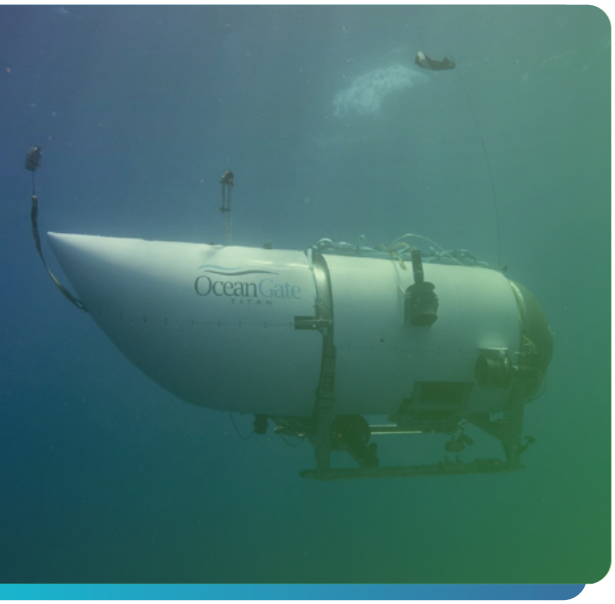
"That's now baked in and integrated into the design process. You've always got that full chronology, and that's massive."

To learn more about how DHL improved their product development process, watch this digital manufacturing webinar

OceanGate

SEATTLE, WASHINGTON

SUBMERSIBLE VEHICLES/SCIENTIFIC RESEARCH



OceanGate, a Seattle-based company which designs and manufactures submersible vehicles for deep sea exploration and adventure travel, is now moving ahead with plans to bring "citizen explorers" to survey the Titanic wreck site in the summer of 2021. The company has been collaborating with NASA's Marshall Space Flight Center in Huntsville, Alabama, to develop and manufacture a new aerospace-grade carbon fiber hull for its 5-person explorer subs.

OceanGate's core engineering team includes four engineers based in their Seattle office and another five contractors spread between four other states. Using cloud-based Onshape, the engineers can not only work on the same design simultaneously, but they can also refer to a comprehensive Edit History that tracks who made what change and when. Using this history, the team can instantly revert back to any prior stage of the design if desired.

"Onshape is really collaborative," says **Dan Scoville, OceanGate's Director of Engineering and Marine Operations**. "It's also valuable for getting quick feedback from our CEO. We can both be in the model and he can say what he likes, what he doesn't like, bring up issues and offer suggestions."

Scoville recently told the National Association of Manufacturers that he estimates that using a Software-as-a-Service design platform saves his company $60,000 to $70,000 a year in administrative costs. He attributes the savings to the reduced IT overhead of not having to maintain servers or have a full-time person managing a Product Data Management (PDM) system for version control.

"Onshape has the best version control system I've ever used on a CAD package," Scoville says. "It's extremely simple to use and will streamline your workflow. It will increase collaboration and decrease the need for IT support and infrastructure."

When the engineering team doesn't have to worry about spending time on administrative tasks, they can devote more time to what they love to do most (and were hired to do) – designing innovative products.

To learn more about how OceanGate improved their product development process, watch this video *from the National Association of Manufacturers.*

KICHLER

KICHLER LIGHTING

CLEVELAND, OHIO

CONSUMER PRODUCTS

Kichler Lighting is a global leader in fashion-forward and energy-efficient residential lighting solutions. The company's products include indoor and outdoor decorative lighting, interior lighting systems, landscape lighting, and ceiling fans.

For Kichler, the need to address data management issues between its distributed design and manufacturing teams was one of the primary reasons for switching to cloud-based Onshape.

"Our legacy systems were all file-based, of course, and on top of that, they were 2D systems. So we were sending drawings back and forth with our suppliers and our manufacturing partners all over the world. It was just a cumbersome process that didn't allow for very rich collaboration," says **Mehul Gala, Senior Product Development Engineer at Kichler**.

"On top of that, we would lose our revision control to some degree. We would end up at factories sometimes where we, the engineers, were on revision C, but our team in China would be on revision D and then our suppliers would be on revision E somehow. That caused a lot of confusion," he adds. "So (with Onshape) there was a lot of opportunity just around that single source of truth to get all the key players involved on the same page."

Gala also notes that Onshape makes it much easier to share product models with important internal company stakeholders who normally would not have access to CAD.

"We've been more deliberate about pulling in people earlier than we have in the past – and I think that's a function of the ability to enable non-CAD users to see designs and give feedback earlier in the process," he says. "So we have folks like our customer care team looking at products and giving feedback. And then not only that, they're helping customers that have issues with the product as well. They're able to retrieve information like they never have before."

To learn more about how Kichler Lighting improved their product development process, watch this Enterprise panel discussion from Onshape Live 2021

DORIS DEV

NEW YORK/HONG KONG

CONSUMER PRODUCTS

To learn more about how Doris Dev improved their product development process, read this blog.

Doris Dev is an on-demand, full-suite product development agency based in New York City with a dedicated sourcing and manufacturing team in Hong Kong. The firm can lead product development projects from idea to market, including industrial design, mechanical and electrical engineering, sourcing, manufacturing, compliance and fulfillment.

The company also creates its own brands of consumer products, including most recently the Canopy humidifier – billed as the "World's Cleanest Humidifier" because of its resistance to mold.

Doris Dev relies on cloud-based Onshape for enabling its core engineering team to share early product designs with internal stakeholders across the company and incorporate their feedback into new iterations faster.

"In Onshape, we are able to quickly make design changes with input from multiple designers at the same time because we're all able to share design documents," says **Lucas Lappe, Head of Product**. "We're all able to preview the designs with nine technical team members and the marketing and branding teams who can see the product and provide feedback without ever needing a CAD license or the ability to download a CAD file and open it up."

Doris Dev also credits Onshape for improving communication between its core design team and their clients, allowing them to monitor the progress of a project 24/7.

"What we're able to do with Onshape is give our clients a living link. They can watch us work and see all the changes we're making," says Lappe. "We do this freely because we want all of our clients to see how good, bad and messy the development process can be sometimes. We believe the more information they have, the better they're going to understand us and the better clients they're going to be."

"In the Onshape Document, our clients can make comments when they see something they don't like, and we can say, 'Hey, okay. Do you want to make this change? Here's what happens when we make this change, and here's why we can or can't make that change to the design.' And they're able to see all that in real time," Lappe adds.

LOOP MEDICAL

LAUSANNE, SWITZERLAND

MEDICAL DEVICES

Loop Medical is an R&D firm developing a new minimally invasive device to extract blood from capillaries just below the skin versus conventional methods that collect blood from the vein. Funded by the Bill and Melinda Gates Foundation, the breakthrough technology is aimed at simplifying blood diagnostic testing at health care facilities around the world – typically in developing nations where medical resources and standards are subpar. The company's research also focuses on reducing the spread of infectious diseases through used contaminated needles.

Loop Medical relies on cloud-based Onshape to speed up collaboration between its engineering teams in Switzerland, Germany and France.

"Before Onshape, sharing design files used to be very frustrating because partners would always be working on a different version of the CAD system and we couldn't open up each other's work without having long email conversations or using Google Drive. Communication was very inefficient," says **Loop founder Arthur Queval**.

"Onshape's workflow is really smooth and it's much easier to share our work and move on to the next task," Queval adds. "As the CEO, I can always see the status of a design and comment or address problems in real time."

To learn more about how Loop Medical improved their product development process, read this case study.

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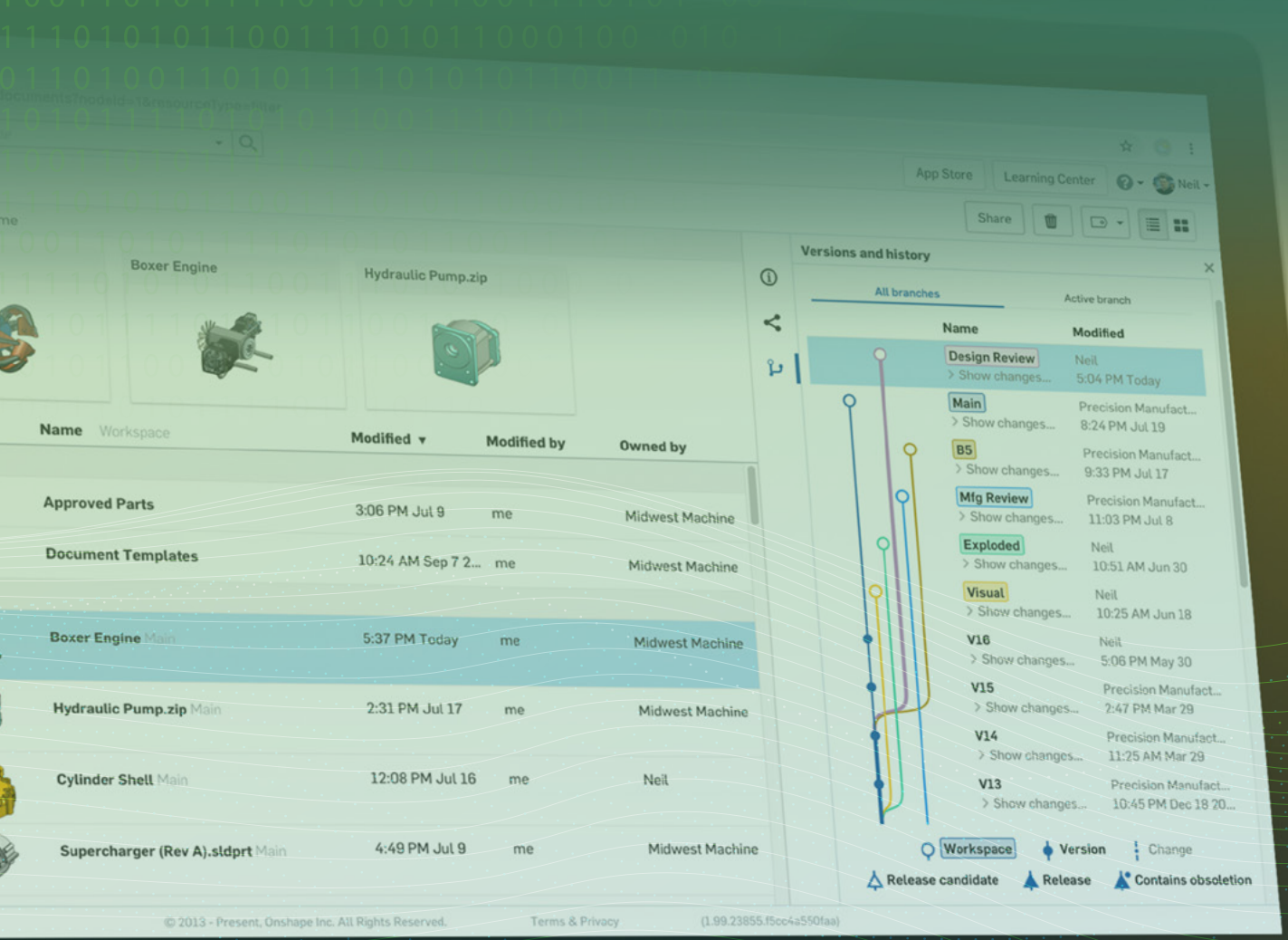
Chapter 5

How Onshape's Cloud-Based Product Development Platform Transforms Data into Insights



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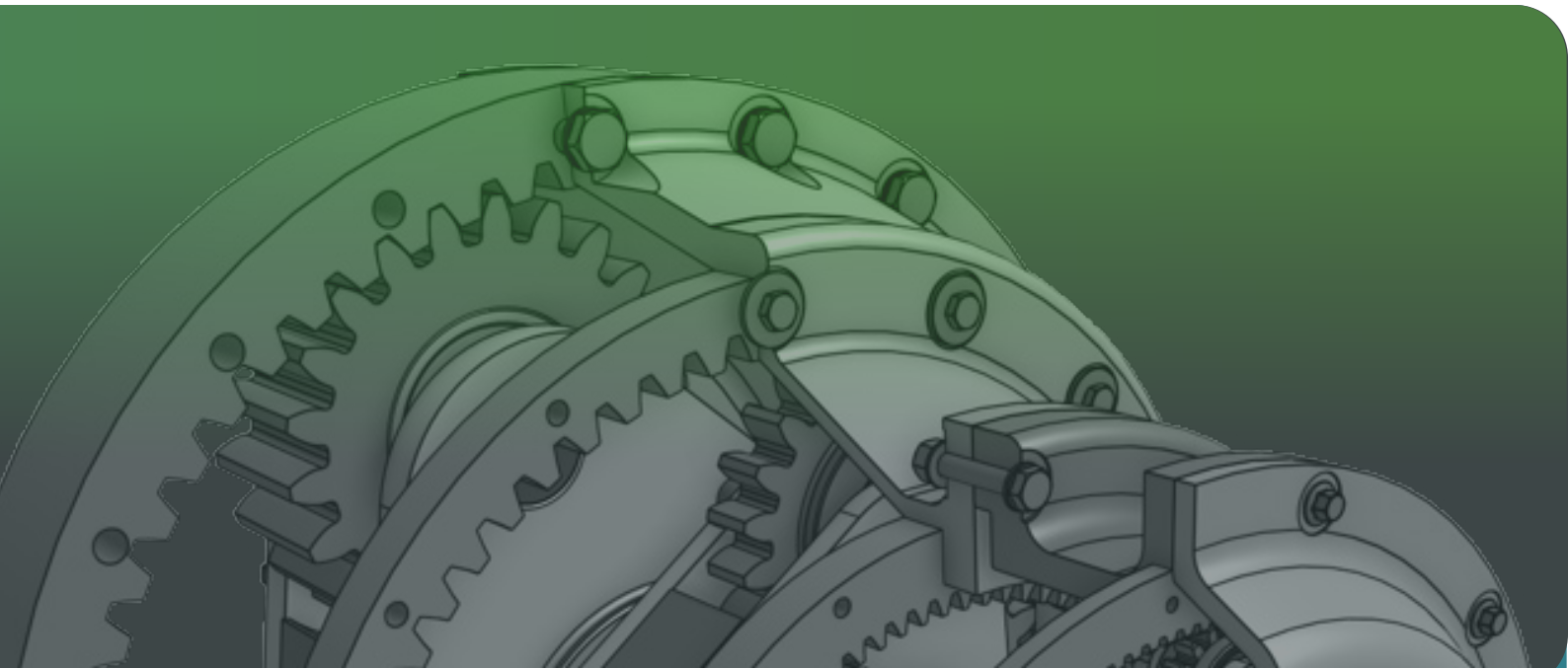
How Onshape's Cloud-Based Product Development Platform Transforms Data into Insights

Product development is now undergoing a major transformation. The new demands of competition and unexpected Black Swan events like the COVID-19 pandemic have fundamentally changed how companies need to manage data. There is a shift from thinking about data as a fungible commodity that can be siloed within departments to instead regarding data as a source of insights that can help optimize and accelerate processes across an organization.

Many product development teams are finding that their existing file-based CAD software – with limitations on access, sharing, collaboration and analytics – are impeding their progress. They realize that they cannot accept the high TCO, maintenance costs, and lack of agility imposed by these archaic systems. Faced with the new reality of remote work, today's product leaders are turning to cloud-based platforms to enable the collaboration and teamwork necessary to maintain a competitive edge.



Digital and cloud-based solutions are now driving all aspects of product development, from concept to approvals. This dynamic shift is a re-imagination of the way that data can be shared across the organization. Cloud CAD and data management improves the ways that engineers work together to concept new designs, the way that product teams share designs with internal stakeholders (executives, sales, operations, etc.), and streamlines how designs are shared with external manufacturing partners around the globe.

Onshape is a next-generation Software-as-a-Service (SaaS) product development platform that helps businesses of all sizes modernize and accelerate their design and manufacturing processes.

The cloud-native platform is the only all-in-one system that combines a robust CAD system with real-time collaboration and data management, workflows, admin tools, and an API with more than 50 engineering applications. Onshape helps extended design teams work together faster from any location and helps executives make better decisions with real-time business analytics and unprecedented visibility into their company's operations.

Here's a quick look at why Onshape is uniquely architected to help boost product development collaboration:

Onshape Empowers Workers with Remote Access

Onshape empowers designers and engineers with the freedom to work remotely from any location. Users can stay productive and work on their CAD models from any device – computer, tablet or phone – using an internet browser or mobile app (iOS or Android).

Onshape users don't have to worry about rushing back to the office to make time-sensitive design changes or to respond to customers. Businesses can accelerate their time-to-market as individuals have the ability to communicate, collaborate and create in real time.

With the "anywhere" connectivity of the Onshape platform, managers no longer need to wait for formal scheduled design reviews. Instead, they can stay up-to-date on the progress of their teams 24/7 – reviewing, approving and even releasing products to manufacturing from the convenience of a mobile phone if needed.

Onshape Harnesses Teamwork as the Path to Innovation

Onshape uniquely provides team members with real-time, simultaneous access to shared 3D CAD models – users frequently compare the SaaS platform to the "Google Docs of CAD."

Because there is always only one "single source of truth," users no longer face the administrative hassles of copying files and grappling with version control issues. Onshape allows teams to work in parallel versus serially, eliminating needless downtime. Users can stay productive working on shared Documents instead of waiting on colleagues to check in and check out files.

Designers and engineers can now work free from the fear of lost work due to crashes or overwriting files. Onshape also encourages the creative risks that fuel innovation. Engineers can experiment with new ideas in alternative branches, later merging the best elements into the final product. A comprehensive "Edit History" tracks who made what change and when, allowing users to instantly revert back to any prior stage of the design if needed.

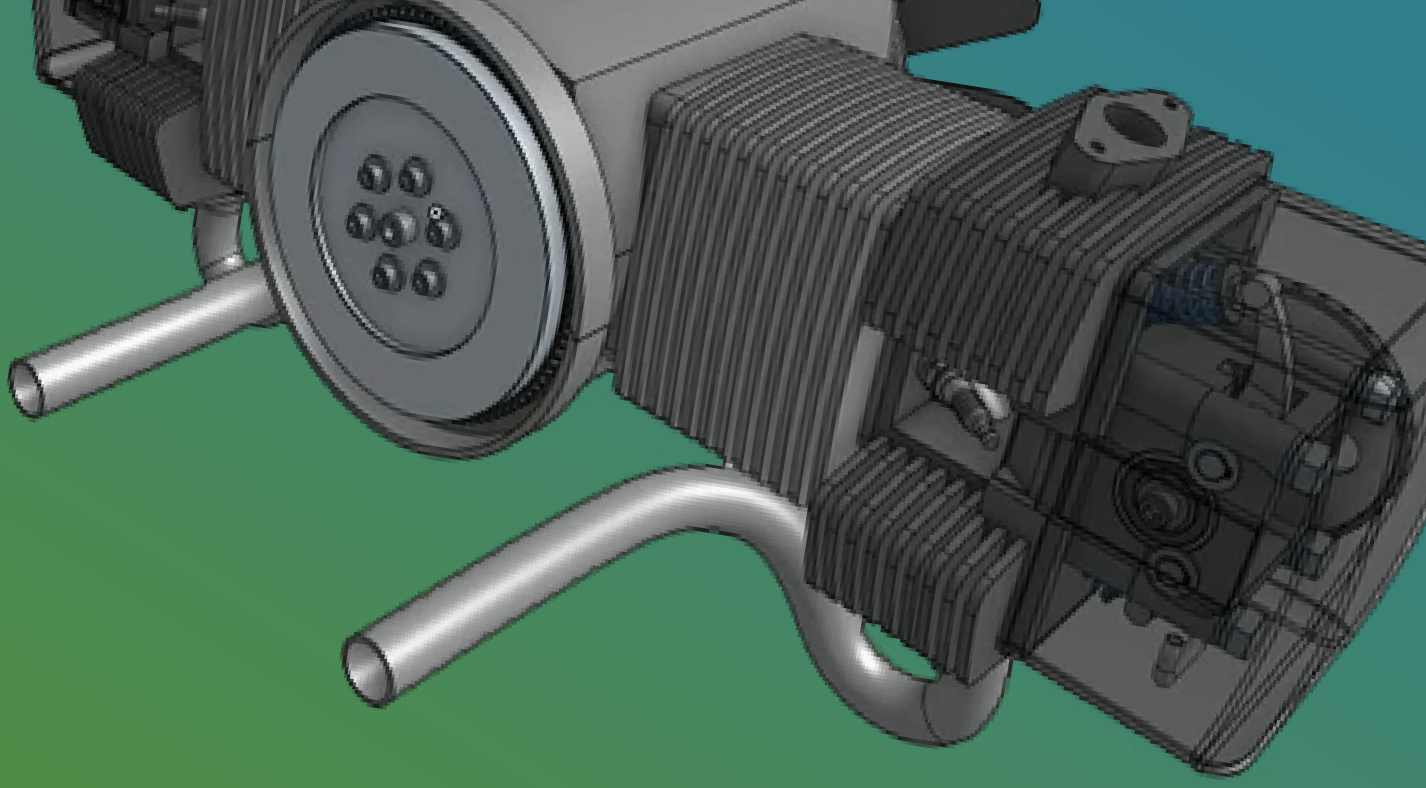
Onshape Turns Data into Insights to Improve Operational Efficiencies

With integrated data management and analytics, the Onshape platform allows organizations unprecedented access to time-sensitive information during the product development process. It accelerates time-to-market by turning data into actionable insights, allowing managers to better identify and address process inefficiencies, bottlenecks and other barriers in the product lifecycle.

Onshape's real-time business analytics helps executives decide how to best deploy personnel across ongoing projects to where resources are needed the most, ensuring product development stays on track and that critical customer commitments are met. Furthermore, Onshape helps organizations create uniform, efficient and replicable "best practices" for their teams to follow on every project.

Onshape Helps Businesses of All Sizes Prepare for "What's Next"

As product development organizations recover from the challenges of the pandemic and seek to position themselves to succeed in the future, they are recognizing the critical role that cloud-based technology will play. Today, the Onshape platform is enabling leading firms to ensure seamless remote access, improved collaboration, and improved product innovation. In addition, Onshape is helping these leaders ensure that their organizations stay flexible, agile and resilient, in order to address future challenges and "What's Next."



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Onshape is the only Software-as-a-Service (SaaS) product development platform that combines powerful CAD tools with real-time data management, collaboration, and business analytics. Executives and managers can get up-to-the-minute progress reports on a project's status and built-in version control prevents costly delays and manufacturing errors.

Sign up for a free Onshape Professional Trial and experience the benefits of cloud-native product design today!

GET STARTED

Onshape.com

Onshape is a PTC Business.