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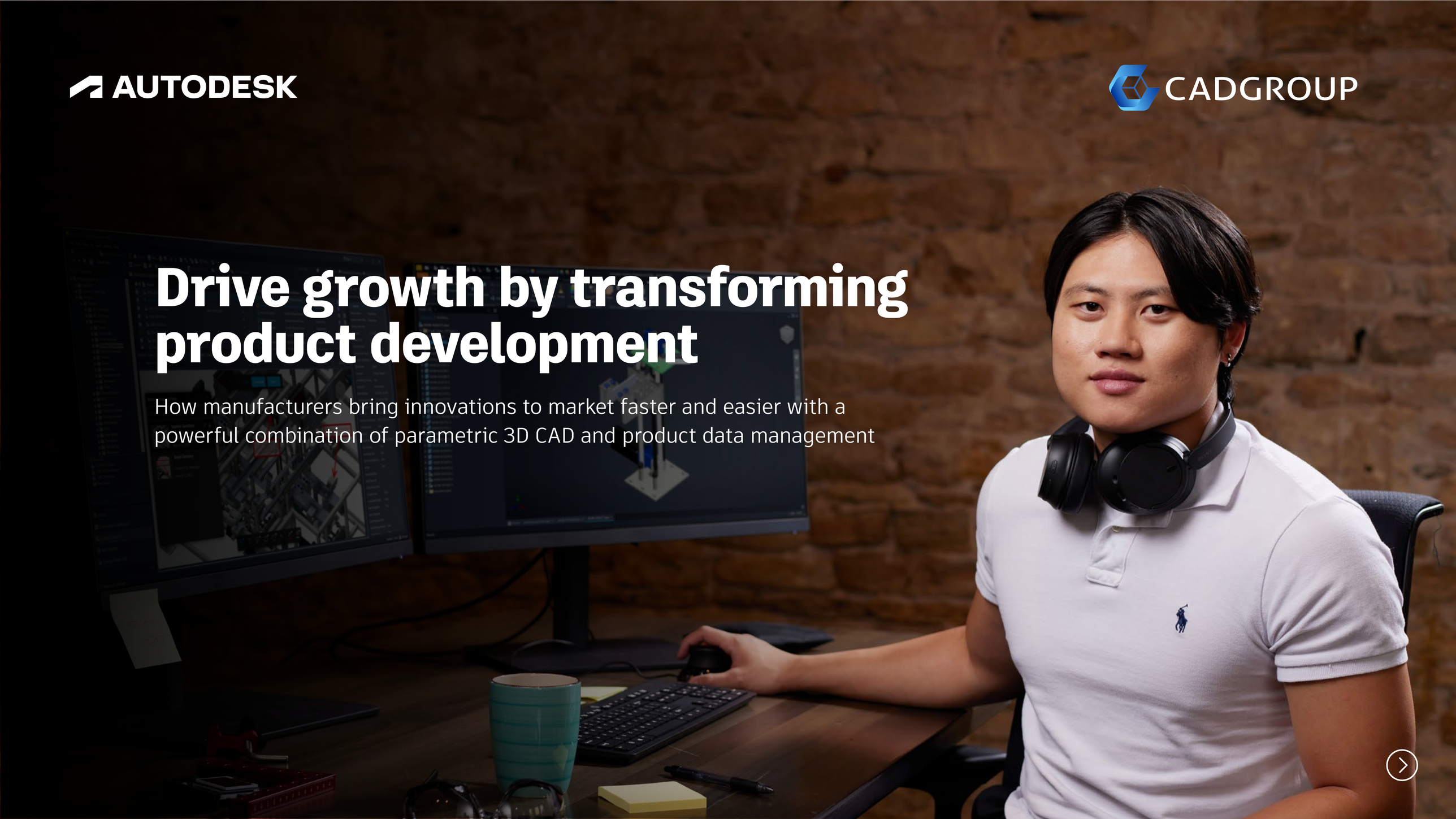
Drive growth by transforming product development

How manufacturers bring innovations to market faster and easier with a powerful combination of parametric 3D CAD and product data management



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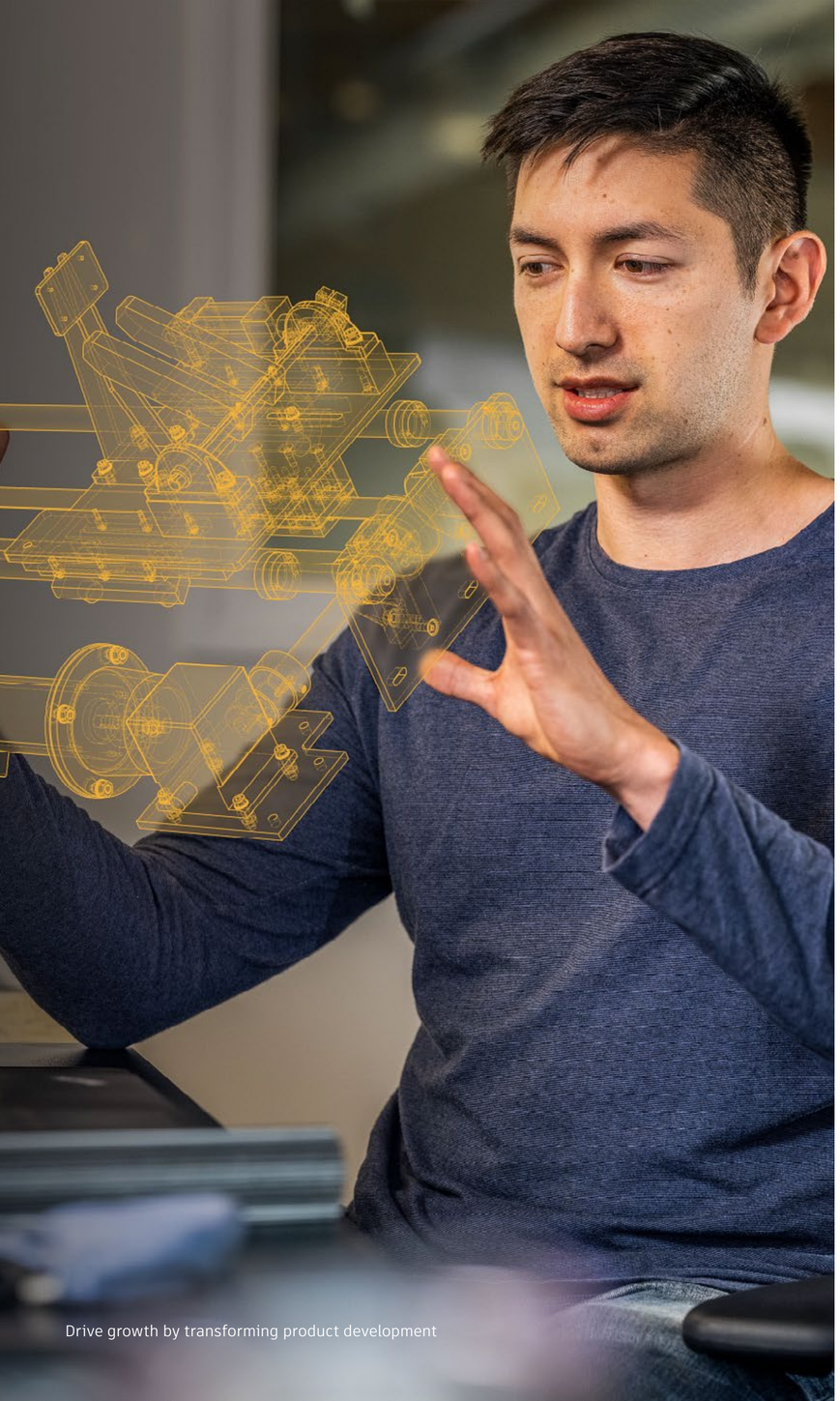

Gain new levels of agility, efficiency, and coordination

Customer requirements, competitive pressures, and new technologies are making manufactured products more complex. But there are still only 24 hours in a day and seven days in a week.

That means manufacturers must do more with less. Make processes more efficient. Free up data trapped in silos. Reduce the risk of errors and inconsistencies. And eliminate the need for coordination meetings. In other words, you need more agility than traditional processes allow.

Agility is essential. Agility enables manufacturers to solve familiar problems in new ways, increase product quality with less effort, ramp up innovation without sacrificing the schedule, and adapt to unanticipated events with less disruption.

Overall, agility is what helps manufacturers meet rapidly changing customer needs and bring new products to market before the competition.

So how can manufacturers bring more agility to all of the processes in the product development cycle? As we will see in this e-book, the answer is a combination of parametric 3D CAD and product data management that eliminates many of the most common barriers to finishing projects on time and on budget.

Modernizing product development

Automating product development processes will save the time you need to address your most pressing challenges. Becoming more modern does not mean doing everything differently. Becoming more modern is really about changing your approach in order to reduce errors, eliminate unnecessary steps, and become more efficient overall. Agility is really about modernizing product development.

Modernizing your product development approach means taking advantage of all the capabilities available to you. Two of the most important ones are parametric 3D CAD and product data management (PDM).

In short, parametric 3D CAD lets you establish design intent within the model and collaborate on designs in real-time, reducing delays and errors caused by passing files back and forth. PDM software automatically tracks changes, so everyone knows they are working on the correct version of the CAD model and an audit trail is maintained without any additional effort.

Ultimately, these tools create a fully modernized product development process that allows you to:

Focus on design while accelerating the steps from engineering to manufacturing

Visualize concepts and simulate how they will perform in the real world

Quickly find and reuse existing data so you don’t have to start from scratch

Track changes, revisions, and design history automatically as you work

Collaborate with your team and external partners, suppliers, and customers

Free up resources by automating repetitive processes

Modernizing the product development process delivers four benefits that are critical for every manufacturer, regardless of the industries you serve: streamlined collaboration, development agility, increased efficiency, and design continuity.

Streamline collaboration

Together, parametric 3D CAD and CAD-integrated PDM software make it easier for teams, functions, and departments to work together toward the same goal. Without these solutions, there is a risk of product data sitting in disconnected silos. When one team needs data from another, it requires a great deal of time to request and receive it. There are many ways for this exchange to fail, too.

Most manufacturing teams will be familiar with the problem of duplicated effort—when you discover too late that the work you just finished had already been done by another team. Even worse is the ripple effect that occurs when one team makes a decision about a product's geometry, function, or material that affects all the other teams involved—but the other teams are not made aware.

When 3D CAD and PDM software are implemented together, collaboration becomes seamless. You can share, track, and manage all product data in a central, secure system that scales with your business so teams can collaborate efficiently. This significantly reduces the risk of decisions made with incomplete information and duplicate effort, saving all the time that would normally be spent dealing with the consequences of these problems.

"You're not able to make mistakes or forget small valves or o-rings if all parts are stored within Vault."

Lune Riezebos, Application Specialist in Service Delivery, GEA

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Increase development agility

Every product design must change eventually. After a change from engineering, manufacturing, procurement, or the customer, it is very easy for discrepancies to infiltrate a 2D drawing. Even a small revision in a 2D drawing, for example, can warrant updates for a variety of views, parts, and subassemblies, often leading to broken links and manual work that goes beyond CAD files. If these discrepancies reach manufacturing, delays can occur while drawings are corrected and reissued.

With 3D CAD, the geometry of the model is controlled by parameters and equations. As a result, any modifications update in the model immediately without the need for time-consuming manual revisions. You make the design change once and it proliferates throughout all of the associated files, including drawings, renderings, FEA simulations, NC toolpaths, bills of material, and many others.

In much the same way, PDM software improves agility. When every team has centralized access to accurate product data, every step in the development process can happen faster without the bottlenecks of the conventional “waterfall” approach. With a much lower risk of error and higher productivity, there will be fewer design iterations and shorter time to market.

“Being able to manage our items and files related to each item is extremely valuable.”

Kipp Sakunduak, General Manager, Prairie Machine,
Rokion parent company

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Increase efficiency

A parametric 3D CAD model can generate a bill of materials (BOM) automatically to accelerate procurement and other downstream processes. Each object in a 3D model is a virtual representation of a real object, so the model can be used to calculate volume, weight, and center of gravity. These properties can also help calculate quantities of materials for manufacturing, components to order from a supplier, shipping information, or installation planning. With a 2D CAD model, these processes are done manually, which makes them both time-consuming and error-prone.

A PDM solution also drives efficiency, enabling manufacturers to bring all collaborators together in a secure system to share native files and design updates while maintaining access permission control, versioning, and traceability. One of the benefits of this approach is greater supply chain efficiency.

Product data determines inventory requirements, so improving the availability of this data makes it easier to ensure that your suppliers and customers have access to the latest data. It also supports just in time (JIT/JIS) efforts that reduce the need for on-site inventory management. Plus, it gives manufacturers greater ability to meet demand for more highly customized products.

> “It’s a continuous focus on making things as easy as possible for our fabricators and other customers, getting that customer intimacy as close as possible, and delivering the best possible solution.”
>
> Dimitri Van Nuland, Head of Development, Reynaers Aluminium

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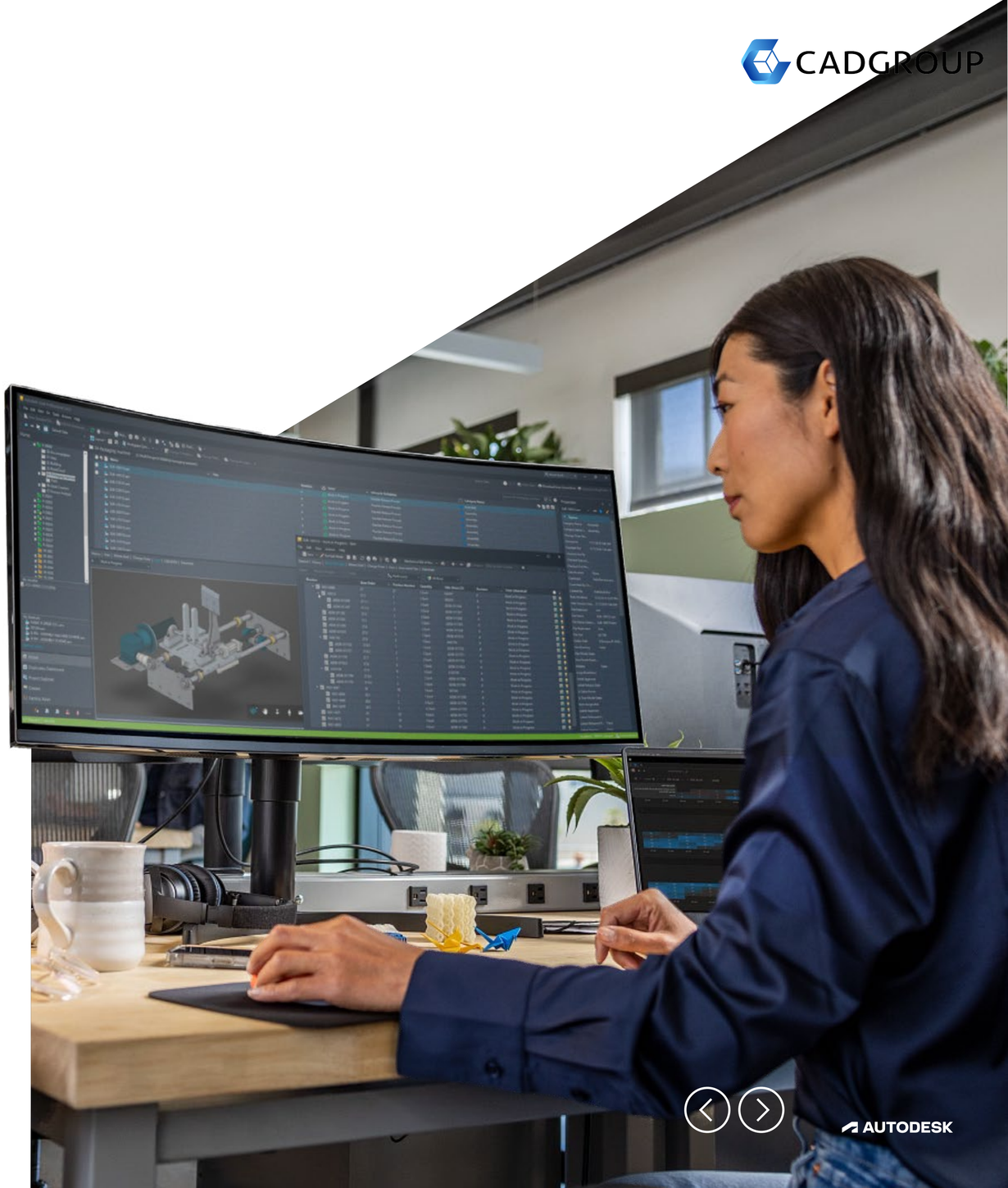
Facilitate design continuity

Parametric modeling with 3D CAD allows you to establish engineering intent and create relationships between geometric features. This means the shape of your model changes as soon as a dimension value is modified.

With 2D modeling, it is very difficult to maintain parametric relationships among 2D drawing views. This has two effects.

First, engineers may hold off drafting a design until all accurate dimensions are available. With parametric 3D CAD, however, you can start designing before accurate dimensions are available, safe in the knowledge that you can apply them later without the risk of creating inconsistencies.

Second, engineers working in 2D must spend a significant amount of time manually modifying drawing views and directly editing each geometric feature that must be updated any time a design change is required. Parametric 3D CAD eliminates all of these steps, creating a much more straightforward approach that reduces the risk of errors and rework.



The good news is that you do not have to abandon 2D in order to take full advantage of parametric 3D CAD models. Rather, you can continue to repurpose legacy 2D data from AutoCAD, which integrates directly with Autodesk Inventor for 3D CAD, allowing you to transition at your own pace.

PDM improves continuity too, enabling you to quickly find the right version of any design. This is important because in 3D CAD models, each part is a separate file and many people can be working on different parts of the same design concurrently.

To eliminate the risk of any work being lost, PDM uses a “check-in/check-out” process where individual files can be reserved. Others can reference the file as read-only until the reservation is released. Overall, this minimizes the time teams spend checking on their files and maximizes the time they spend on design and engineering.

“Before using Vault, we wasted 30% of our engineering time waiting for data files to open, save, or close. Now we are able to open the data we need in seconds. The wait time is almost zero.”

Ben Holmes, Digital Design Manager, NOV FGS

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The case for parametric 3D CAD

Making the transition from 2D CAD to 3D CAD gives manufacturers access to a wide range of capabilities that streamline the design process. Let's take a closer look at four important reasons to consider adding 3D CAD: performance, acceleration, simulation, and integration.

Performance

By adding 3D CAD to your toolbox, you have access to far more capabilities. Whether you are creating a single part or a massive assembly, 3D CAD software solutions like Autodesk Inventor lets you intuitively model and document your products with professional-grade 3D design capabilities and additional workflows that help you work more efficiently.

Inventor, for example, offers a powerful blend of flexible modeling methods that can be used individually or in combination, including:

Parametric modeling
techniques so the model behaves as you would expect when changes are made

Direct editing
for quick changes that will not disrupt the existing design intent

Freeform modeling
to improve aesthetics and ergonomic features

Inventor is also more powerful because it offers specialized modeling tools that automate design:

Sheet metal tools
that quickly create features and deliver an accurate flat pattern to the laser cutter

Welded frame generator
that creates a 3D model as you specify the skeletal structure and cross section of choice for each member

Tube and pipe assemblies
that automatically route rigid pipes, bent tubes, and flexible hoses

Automatic drawing creation
that links a model view to a drawing view, including 3D annotations

Acceleration

An automated approach to design provides a systematic way to capture and re-use engineering knowledge and intent, which greatly reduces repetitive efforts and accelerates future tasks.

Think of your parametric 3D CAD model as a “digital prototype” of the design that can be used to visualize, analyze, and communicate a design far more effectively than a 2D drawing.

This digital prototype can be used for visual inspection of the design, as well as finite element analysis (FEA) or computational fluid dynamics (CFD) to predict its performance with fewer physical prototypes. All the data required for procurement and manufacturing is contained within the model. The parametric 3D CAD model also makes your job easier if the design changes, or you want to design a family of similar models, or you want to start a design by reusing an old one.

Plus, built-in rules-based design technology can easily define logic without complex programming. You can use calculators to determine the appropriate sizing based on loading or other requirements.

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With iLogic technology in Inventor, you can take this idea even further. This capability automates processes for similar designs, such as parts or assemblies that vary in size or have slightly different components. Instead of redrawing these in every model, you simply create engineering rules that automate steps based on selections made in a form. iLogic can be used to replace components in an assembly or update text blocks within an associated drawing, among many other tasks.

iLogic automation also streamlines the creation of configurators. iLogic rules can dictate stock material dimensions, safe loads, or aesthetics such as finish and color. The design intent is contained within the configurator so sales teams and others outside engineering can configure a model without any risk of selecting options that can't be manufactured.

These capabilities not only help you get designs to manufacturing faster, they help you create accurate quotes, have more time to innovate, and win more business.

FS-Elliott needed to increase consistency and accuracy when modeling complex impellers, the critical component in their centrifugal air compressors. By creating an automation program using iLogic, FS-Elliott reduced the time to model an impeller from a couple of days to about 15 minutes.

FS-Elliott, Air compressor manufacturer

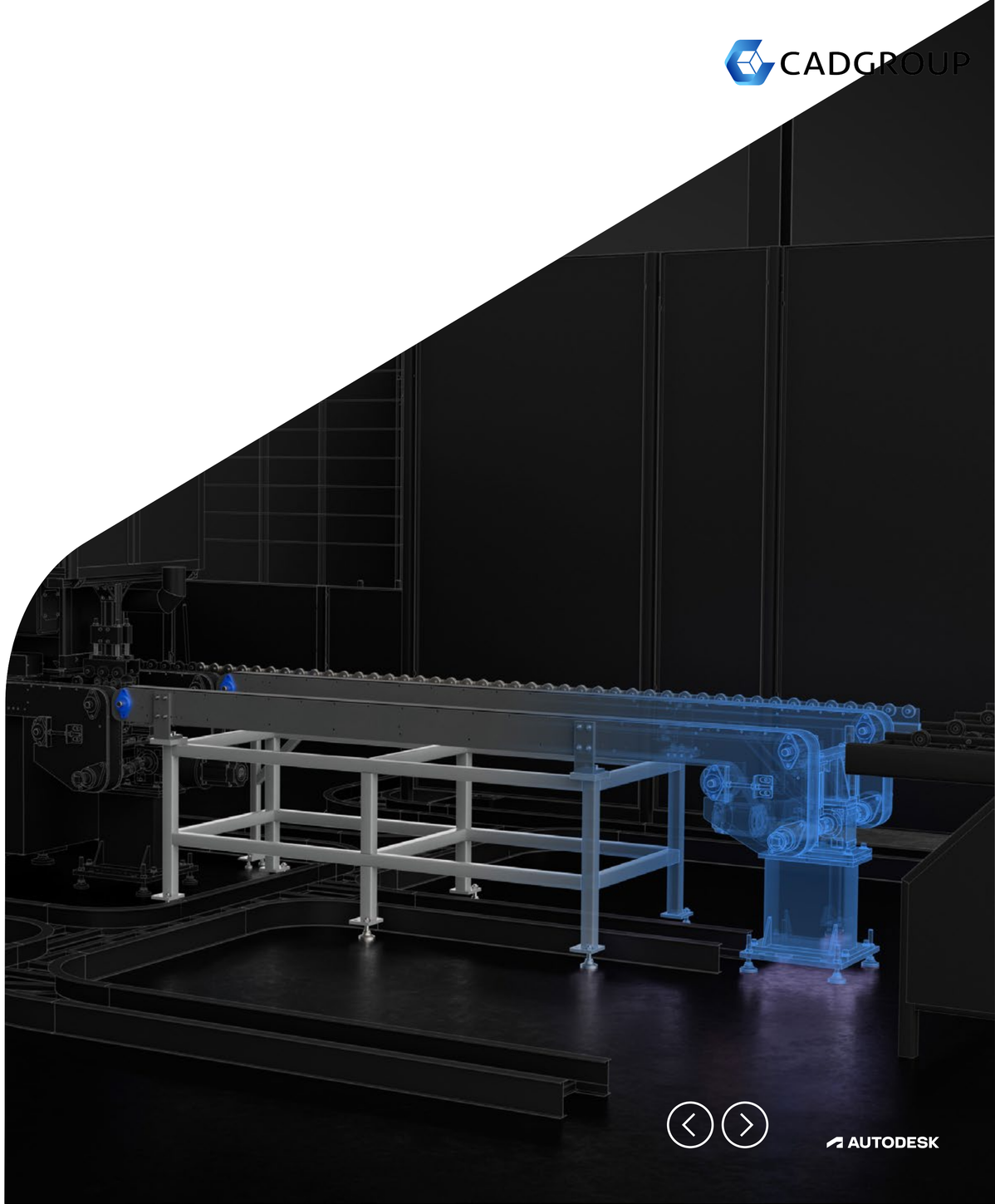
Learn more

Simulation

One of the best reasons to choose 3D CAD is the ability to test product designs virtually before building a physical model. Simulation lets you optimize designs based on multiple factors:

- Stress and deflection results identify areas of concern for product safety
- Nonlinear material models provide more accurate test results for products not made of metal
- Fatigue studies help estimate how long a product design will last
- Buckling studies reveal areas that may lose stiffness and cause catastrophic failure
- Thermal simulations highlight areas that may overheat
- Advanced vibration tests show whether your product will shake too much under vibration

All of these studies save time and minimize the number of iterations required to achieve an optimal product design. After you make a change to your design, you can simply run the study again at any point and review the new results.



Integration

Another way 3D CAD improves product performance and reduces time to market is by creating stronger connections between design and manufacturing. These connections ultimately reduce the risk of back-and-forth or miscommunication when the final design moves into production. For example:

- Tolerance stack-up analysis reports mechanical fit and performance based on dimensional tolerances
- Nesting tools suggest optimal nesting for flat design components
- CAM features allow manufacturing engineers to work from the exact same model as designers, eliminating the need for manual G-code programming for 2½ to 5-axis machining
- Advanced rendering capabilities help communicate design intent or prepare marketing content

It is also important to remember that all of these tools operate within the same 3D CAD environment. In other words, there is no need to learn different applications or interfaces. All of this ultimately saves time and helps streamline product development.

Technica International is a designer of automated product handling systems. They dramatically improved efficiency and productivity on any given project from 50% to 1600% after implementing the integrated 3D CAD and PDM solutions from Autodesk.

Technica International, Automated product handling systems designer

Learn more

The benefits of product data management

Product data management (PDM) is essential for a fully modernized product development process that uses parametric 3D CAD modeling. CAD-integrated PDM helps track and control all of the information used throughout all of the separate workflows required to bring a product from the initial moment of inspiration to the finished result.

Many of the challenges manufacturers face are those that PDM solves. These include spending too much time finding the right information, wasting excess time searching for data, the inability to reuse data effectively, and working with inaccurate or outdated data.

Finding a specific design file should be simple. But in operations that lack PDM, that file might be in any number of drives, workstations, shared folders, or even attached to an email. In addition, without a centralized system for managing engineering change orders and BOM data, it can be difficult to trace the history of design changes and why they were made.

Faster product development

CAD-integrated PDM solutions, including Autodesk Vault Professional, reduce time and resources spent on information control. Specifically, Vault delivers three important benefits: faster product development, less tedious tasks, and easier review cycles.

Vault PDM integrates with Autodesk Inventor and other CAD systems to keep everyone working from a central source of organized data. This helps accelerate product development by enabling better collaboration and streamlining workflows across engineering and manufacturing. For example, Vault PDM allows manufacturers to:

- Automate design and engineering processes
- Increase process standardization
- Create engineering BOMs
- Quickly find and reuse data
- Control what people can access and edit
- Track changes, revisions, and design history automatically

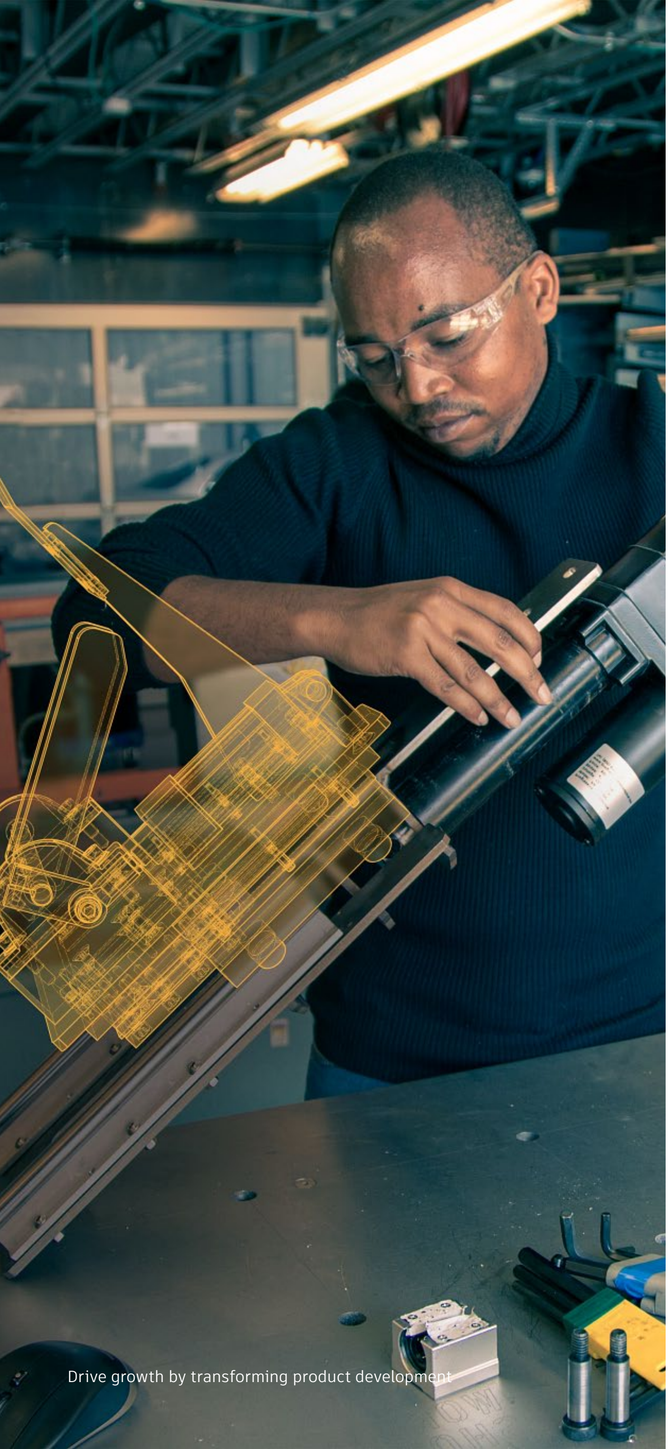
Fewer repetitive, manual tasks

Vault PDM uses a similar approach to automation as Inventor, giving designers the ability to focus their time and attention where it belongs: on design.

Here's a simple example. Instead of requiring engineers to spend time generating PDFs of in-process designs for others to review, Vault generates these PDFs automatically.

Vault also helps automate the change order process. It automatically maintains a full audit trail of all revisions and design history. As a result, decision-makers can run a report at any time to track the progress of any change order—instead of scheduling time-consuming coordination meetings. If there is ever a question about which engineer made which change, Vault has the answer instantly.

Another way Vault eliminates manual work is with Task Automation. Many manufacturers manually create PDFs of released designs to share with others in engineering, purchasing, manufacturing or partners outside the organization. The automation engine within Vault eliminates the need for this, as well as other repetitive tasks like batch plotting, data transfer, and file type conversion.



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Easier reviews

Vault is specifically designed to simplify and speed up review cycles. Whenever a product design is approaching a milestone and requires approval, the Shared Views capability allows you to quickly render a file for sharing with a secure link.

Keep in mind, this view is not the actual file and does not contain any intellectual property. It is a view of the design that allows others to provide feedback and can't be changed or downloaded.

The secure view itself is accessible only with a browser, so there is no additional application for viewers to install, whether they are a customer, supplier, design subcontractor, or other stakeholder. In other words, you can quickly share the product design with approved reviewers with no need for file transfer or translation. Reviewers can start adding feedback immediately. The end result is a faster review cycle with less lag time in between rounds.

Rokion makes electric vehicles with a distinct level of performance, reliability, and safety. To manage the process smoothly and bring products to market as efficiently as possible, Rokion relies on the Autodesk Product Design & Manufacturing Collection, including Vault.

Rokion, Heavy-duty electric vehicle manufacturer

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Soil Machine Dynamics is a leader in subsea excavation using ROVs. The company uses Vault to manage and track product designs as well as securely share and collaborate with their Asia offices and to push BOM information to the ERP system.

Soil Machine Dynamics, Subsea excavation

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Conclusion

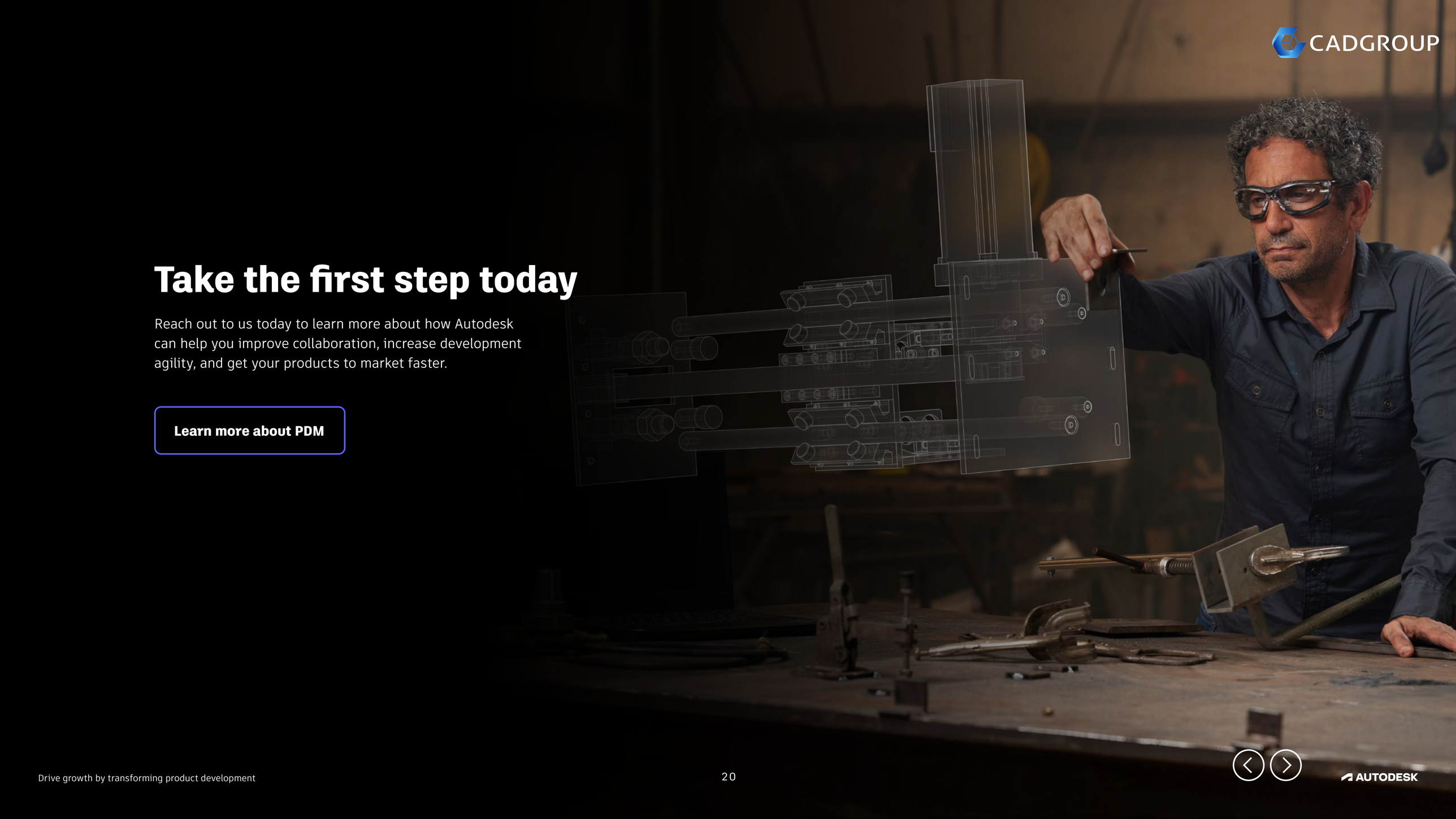
Making the strategic decision to modernize product development with a combination of 3D CAD and PDM solutions will equip manufacturers to transform productivity.

Pressure on manufacturers to bring complex products to market more efficiently is only increasing. That means manufacturers need to make every part of the operation more agile and productive, eliminate redundant processes, streamline workflows, and collaborate more easily.

Together, 3D CAD and PDM solutions make all of this possible. Parametric 3D CAD enables manufacturers to develop products faster while exploring a wider range of options. At the same time, CAD-integrated PDM helps you maintain control of project data in a way that frees time for strategic, innovative thinking, improves collaboration across teams, and accelerates product development. It allows you to manage design and engineering processes efficiently by centralizing product-related data in a secure location that is easily accessible to all stakeholders.

Ultimately, 3D CAD and PDM modernize the product development process, empowering your engineers to put their minds to work on the high-value tasks that drive business growth. The end result is nothing less than a transformation of your engineering power and productivity.

Take the first step today

Reach out to us today to learn more about how Autodesk can help you improve collaboration, increase development agility, and get your products to market faster.

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