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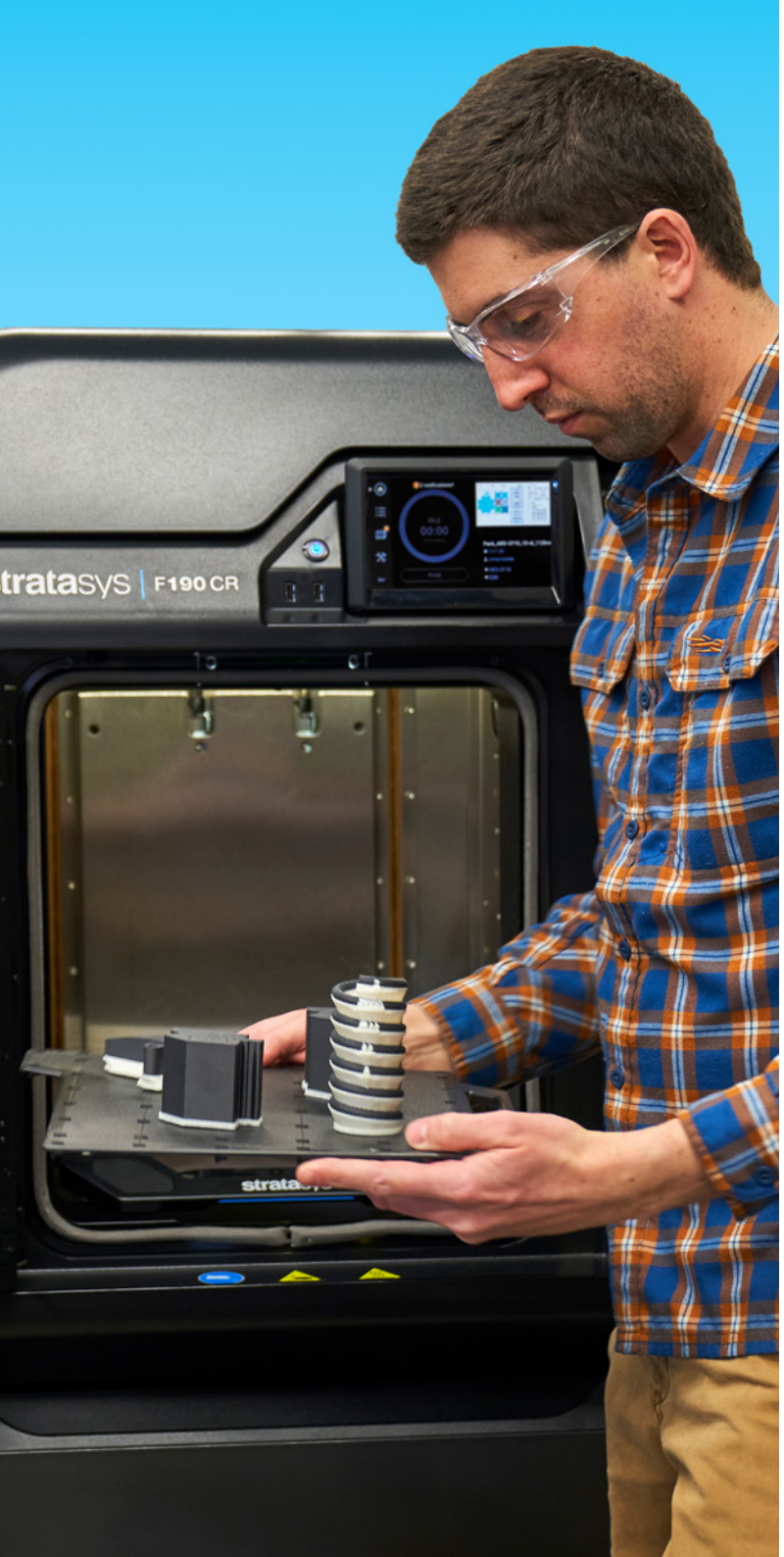
EBOOK
FDM

Rapid Prototyping
Reinvented

How F-Series Printers and GrabCAD Software Make Prototyping Easier Than Ever



It's no secret that businesses must quickly respond to changing customer and market demands to stay competitive. That's true for small design firms and large, established manufacturers. Getting a new product out before your competition helps you generate new revenue and maintain market leadership. But doing that isn't easy, particularly if you're competing on the same level as your competitors and using similar technology and processes.

In today's competitive marketplace, an effective solution is to change your product development methodology to incorporate additive manufacturing. It's a proven means to at least keep pace with competitors or, more preferably, gain a competitive advantage. It can drastically reduce new product development time while letting you optimize designs to ensure they're ready for market.

However, embracing this technology or broadening its use is often avoided for several legitimate reasons. Investing in professional 3D printers can be a significant financial hurdle, and companies may find it difficult to justify the cost. Some types of additive manufacturing require comprehensive knowledge of the process and equipment. That typically means hiring new employees and increasing the payroll. Even companies already using 3D printing for rapid prototyping face challenges in making the most of this technology. If the 3D printers aren't readily accessible to the users, the workflow is cumbersome and complicated, or the equipment is unreliable, benefits will be minimal from inefficient use.

Choosing to stay with the status quo using traditional rapid prototyping methods poses risks, too. In the race to quickly develop new products, chances for field failures increase because there is insufficient time and resources to vet and test more than a few design iterations adequately. It's simply too costly to develop multiple designs using the old methods, particularly if the process or portions are outsourced.

So, what simple, reliable, and efficient technology is available to help product developers become more competitive? The answer lies with the professional F-Series 3D printing platform designed to increase the efficiency and simplicity of the rapid prototyping process. Comprising the F170™, F370®, F190CR™, F370CR®, and F770™, these FDM® 3D printers provide solutions that help companies become more competitive through easier rapid prototyping adoption. These printers let businesses improve their existing prototyping methods easily and hassle-free.

But it's not just about the hardware. The GrabCAD® software suite provides the backbone of print operations, simplifying the workflow while supplying powerful tools to manage print outcomes. To understand the potency of this hardware and software combination, let's take a closer look at how F-Series printers with GrabCAD software address the typical challenges engineers, designers, and prototyping managers face in the product development process.

The Challenge: Slow Process

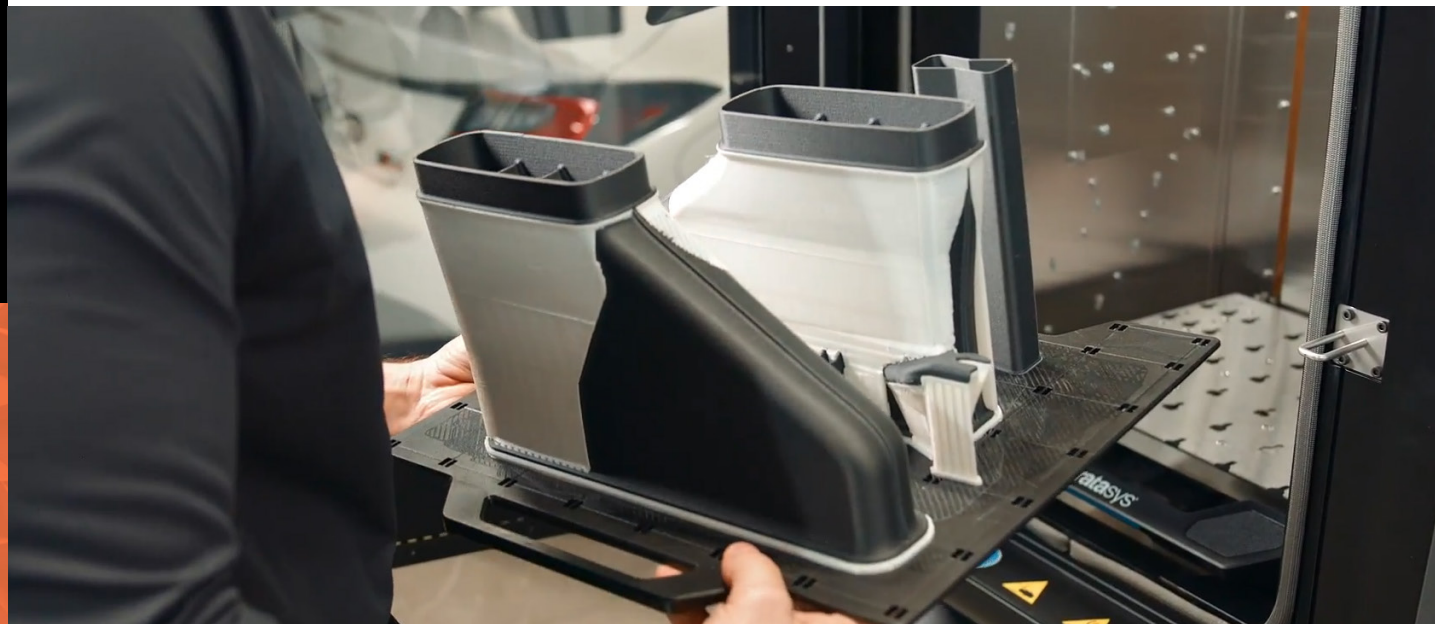
"It takes too long to develop new products, which increases the chance that our competitors will get to market first. This can negatively impact our ability to generate new revenue. We also don't have sufficient resources to fully test multiple design iterations, leading to a higher risk of field failures and declining revenue. We need a simple system that speeds up all facets of the rapid prototyping process."

How F-Series Printers Make Prototyping Faster

The hallmark of the F-Series printers is that they are designed to meet the needs of the total rapid prototyping process: concept verification, design validation, and functional testing. And they do it with economy and speed in a workgroup setting. Rather than using less-optimal materials, printers, or service bureaus for early iterations, F-Series printers can quickly create multiple designs for stakeholder reviews.

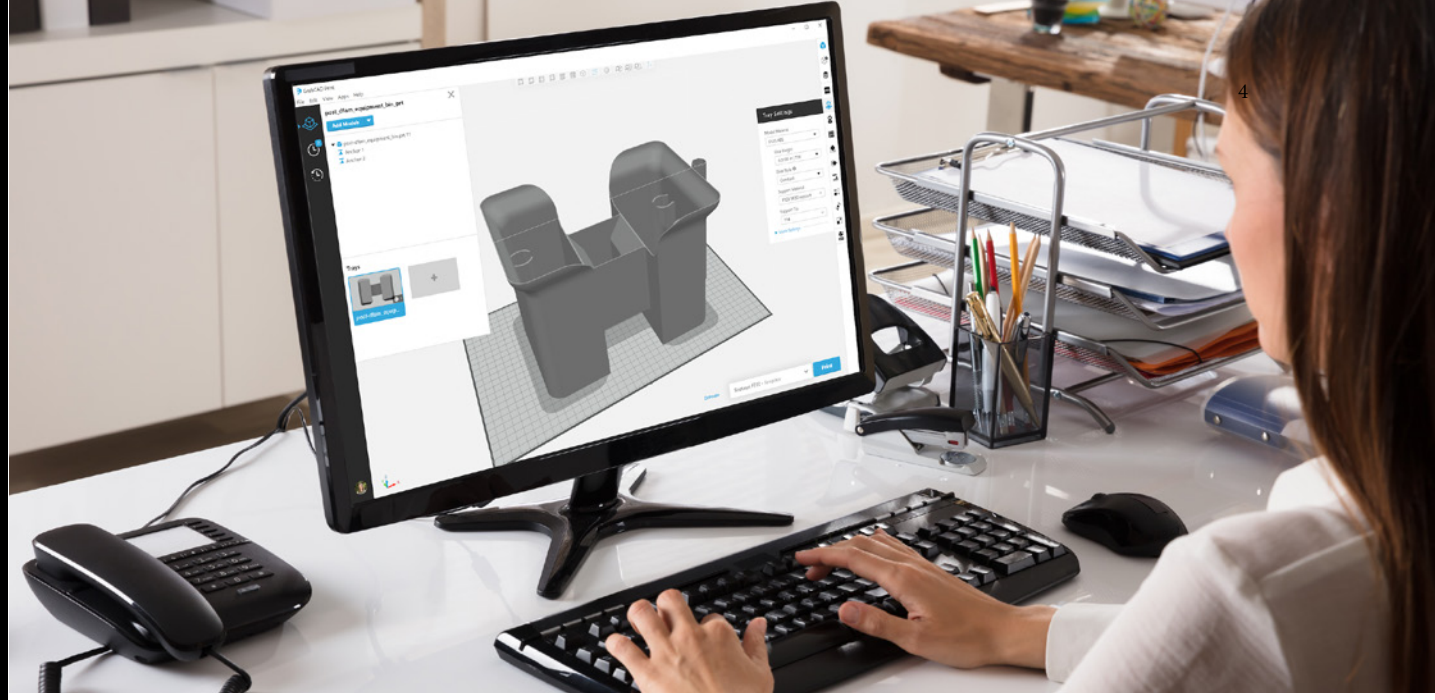
When you can fabricate prototypes quickly and easily, there's no need to farm out those tasks, regardless of whether you use 3D printing or traditional machining or molding. Outsourcing with either option usually means you're at the mercy of your suppliers' turn time, which can be days or weeks. In contrast, making prototypes with F-Series printers can happen in hours or overnight, drastically reducing the time it takes to go from CAD design to a physical part ready for evaluation.

Prototyping in-house with local 3D printers also protects your intellectual property. There's no risk that confidential design information will fall into competitors' hands through outside machine shops and service bureaus.



The Challenge: The Lack of Expertise

"We don't have the expertise to operate a 3D printer, nor the budget to hire additional specialists to work with them. We need a rapid prototyping technology that's easy to use and can be shared by multiple engineers in our group."



How the F-Series Printers Make Prototyping Easier

Some 3D printing platforms require trained individuals who are knowledgeable about printer operation, file manipulation, and troubleshooting. F-Series printers are designed for ease of use, from the initial setup through the design-to-print workflow. The printers employ a plug-and-play architecture with automatic setup and test functionality. Once they're powered up, they're ready to use. There's no need for a special technician dedicated to printer operation and maintenance.

Each printer is also Wi-Fi-ready, making the print function as easy as 2D printing from an office computer. Or, if Wi-Fi is unavailable, files can be printed via USB or Ethernet cable. Monitoring the progress of a print job is simple, thanks to the printer's built-in camera.

GrabCAD Print™ software is also a big part of making F-Series printing easy by simplifying the traditional print preparation workflow. It's formatted similarly to CAD software, which is familiar to designers and engineers. Once parts are designed, simply hit the "print" command to print the parts. You can start fast and learn on the smart default settings using tooltips and notifications. File sharing is also possible through GrabCAD Print, so design or engineering workgroup members can collaborate in the design process and share access to the 3D printer. You can check print status directly from your workstation with GrabCAD Print or through an app on your mobile device.

When you need more functionality than what's included with GrabCAD Print, there's GrabCAD Print Pro™. The Pro version offers valuable productivity-enhancing features that include:

- Thickness analysis to quickly determine if your part's geometry is below your printer's resolution
- Labeling capabilities that let you add custom embossing and debossing on your part's surface for identification
- An accuracy center that lets you improve your part's accuracy up to 10X in a single step
- Per-part-time and material-use estimations

GrabCAD Print Pro offers additional benefits beyond these listed here and is a powerful complement to the print capabilities of the F-Series printers.

The Challenge: Lack of Capacity

"Some of the parts we need to print exceed the build size of most of the available printers. We produce white goods, and many of our prototype parts are pretty large. The printers that are big enough exceed our budget and offer capabilities that we don't need nor can justify."

How F-Series Printers Make Large-Scale Printing Easily Accessible

The F770 printer was developed specifically for this challenge. It provides one of the largest build chambers among all Stratasys FDM printers, second only to the F900®. More importantly, it's designed to meet a very accessible price point using the same easy-to-use features of the other F-Series printers.

Premium 3D printers like the F900, which have high-temperature capability, the most material options, and the largest build chamber, are targeted for specific production-level use cases. In contrast, the F770 fills the niche for large-scale prototyping, using ABS and ASA materials, for applications that don't require the sophistication of premium printers. When size is a requirement but cost and high-performance polymers are not part of the equation, the F770 is the perfect fit.

The Challenge: The Lack of Options

"Our 3D printer uses only one type of material, but we'd like to develop prototypes using several different materials. Also, replacing empty material cartridges is cumbersome and time-consuming."

How F-Series Printers Make Prototyping More Versatile

The F-Series printers are designed with versatility in mind and can print with various materials, each tailored to meet specific requirements. PLA is an economical choice, providing the best option when you need fast model creation or need to print them in greater quantity. ASA, ABS, and PC-ABS are engineering-grade thermoplastics that offer flexibility when models and prototypes need differentiation, such as UV light resistance or high strength and durability. These materials can also be printed in Fast Draft mode. And when you need high-strength, rigid parts for functional testing, carbon fiber-filled polymers like ABS-CF10 and FDM® Nylon-CF10 give you that option.

To make material changes and replacements more straightforward, most F-Series printers use self-positioning filament spools designed for the fastest replacement of any FDM 3D printer in the marketplace. Changing or replenishing material takes no more than a minute to remove and replace the empty spool and feed the filament into the bay drive. Spools are located in an easily accessed drawer at the front of the printer.

The F770's material loading scheme differs slightly from its other F-Series counterparts, but the process is still relatively simple. F770 materials are contained in material coil boxes placed in an easily accessible material storage area beneath the printer's build chamber. Once the filament is fed into the port at the back of the printer, the printer handles the rest of the loading process automatically.

The Challenge: Too Much Downtime

"Our experience with the 3D printers we've purchased is that they haven't been reliable, resulting in more downtime than is reasonable. In short, they've been an unproductive investment."

How F-Series Printers Make Prototyping More Reliable

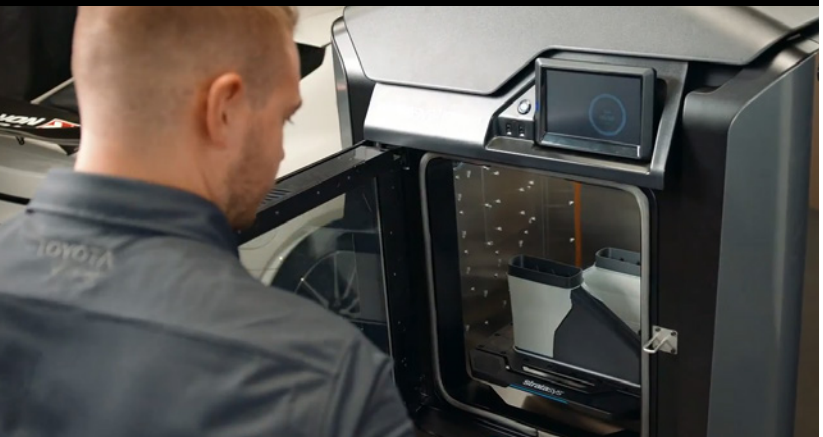
F-Series printers offer the most reliable FDM capability in the market, fulfilling one of their primary design requirements. It started with the deliberate decision to use industrial-quality components and design best practices from over 30 years of Stratasys FDM development. More importantly, engineers accomplished over 100,000+ hours of reliability testing to validate the reliability performance of these printers.

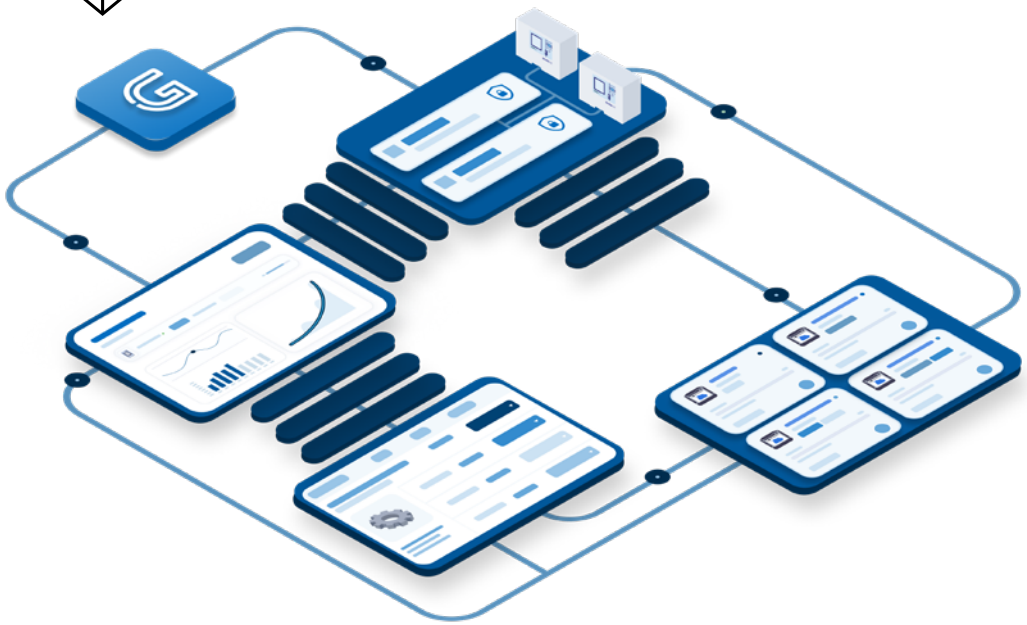
That testing paid dividends, as the F-Series boasts some of the highest reliability metrics among FDM printers. In an internal study among several FDM printer types[1], the F370 demonstrated a 95% job yield (print jobs completed vs. started) and a 99% part yield (successful parts achieved vs. total parts printed).

[1] Stratasys. (2022). A Characterization of the Repeatability and Performance of Stratasys Fused Deposition Modeling (FDM) Systems, from https://www.stratasys.com/en/resources/whitepapers/characterization-of-repeatability-and-performance/

The Challenge: Adding More Printers Just Adds More Workload

"We added several more 3D printers to address the increased demand for additive prototyping applications, but while our capacity has increased, so has our workload. Managing all the printers and print requests has become more work than we anticipated, and our productivity has stagnated."





How F-Series Printers Let You Easily Scale

Once an organization adopts 3D printing, its demand increases as people see the time and cost efficiencies it offers. That's when companies usually purchase additional printers to address the rising demand for print services. Unfortunately, the workload to manage print operations increases, becomes unmanageable, and output doesn't meet expectations. However, it's not a printer problem – it's a process problem. And one that's easily rectified.

The solution is found in GrabCAD Streamline Pro™, software that provides an easy answer to manage what can sometimes be a frustrating and time-consuming process. Streamline Pro essentially becomes the traffic cop at the intersection of all the activities associated with successfully operating multiple 3D printers. Streamline Pro is built specifically for Stratasys printers, optimizing the workflow. It helps you scale from one or two printers up to multiple printers, seamlessly managing the increased volume and complexity of print projects.

GrabCAD Streamline Pro complements GrabCAD Print software. GrabCAD Print and Print Pro focus on file preparation, whereas Streamline Pro targets workflow management. Together, they provide an end-to-end solution for Stratasys customers.

Point of Proof – Designing the F-Series With FDM Technology

Like all FDM printers, F-Series systems quickly, easily, and locally create models and prototypes directly from digital data for concept verification, design validation, and functional testing. That's a game-changing advantage in a competitive market where the winner is often decided by who gets to market first. It antiquates traditional methods of prototyping that rely on expensive and time-consuming modeling, machining, or injection molding.

As proof of this advantage, the F-Series printers were developed using the same time- and cost-saving FDM technology and capabilities they are designed to offer: faster concept validation and functional testing, resulting in a better product.

To provide faster print speeds and the capability for multiple materials, the F-Series printers required a new print head design. Stratasys engineers created numerous versions of the head and 3D printed them on other FDM printers. Over 20 design iterations were made, and 80 head housings were 3D printed during the design development and verification stage.

This seemingly repetitive process was necessary to refine the design to ensure accuracy and achieve a precise fit with mating parts. These parts were also used for functional testing, going beyond just concept and design validation, and were even used in some of the initial prototype printers. The capabilities of FDM thermoplastics provided the durability needed to mirror the engineering specifications required for the injection molded final head design.

Achieving this level of rigor in design qualification and testing without FDM technology would be exceptionally expensive and time-consuming. Estimates for injection mold tools to make prototype head units were approximately $10,000 each. Producing molds for 20 design prototypes would be exorbitantly expensive, not to mention the lengthy lead time required to produce them.

The ability to quickly create multiple design iterations helped distill the best configuration for the print head and gave engineers substantial data from which to derive statistically significant test results. Numerous design iterations helped unmask potential flaws that less rigorous methods may not have detected until post-production, risking product callbacks and other quality problems.

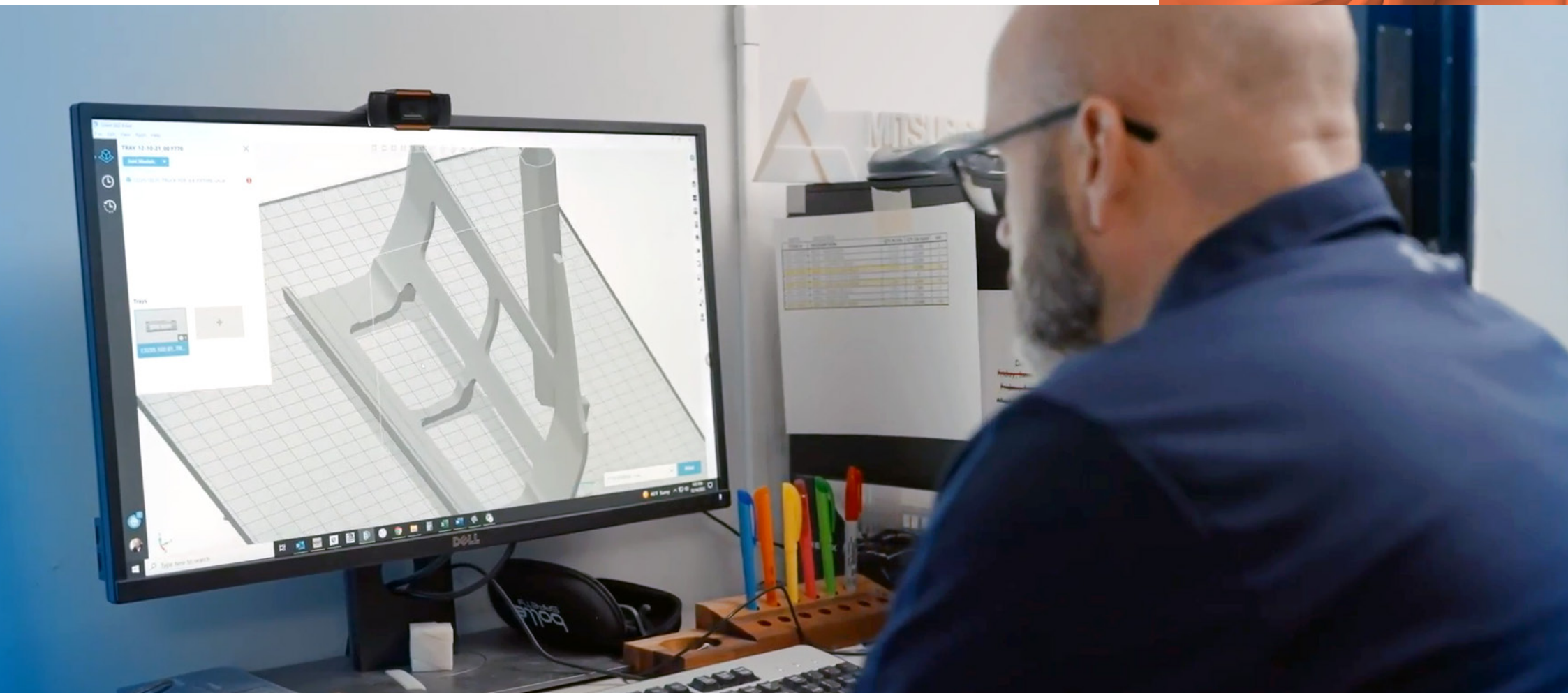
In total, engineers 3D printed over 1000 parts for 15 different components in the F-Series design verification phase. Without the FDM process, these prototypes would have been made with formed sheet metal, CNC machining, and injection molding, requiring substantial time and cost outlay for this level of design rigor. The capability to 3D print and test many different designs produced the best configuration to prove the reliability of the final product in the shortest amount of time.

Additionally, all of this development took place within the security of Stratasys facilities. This minimized the risk of confidential intellectual property falling into the wrong hands, a possibility when prototyping is outsourced.

The preceding story simply shows this: just as FDM technology was used to speed up the development of the F-Series printers, these printers can achieve similar wins for your prototyping and product development applications. But they'll do it even better, thanks to more powerful GrabCAD software and the design intent to make the RP process simpler and more capable.

Made by the Name You Can Trust

There's value in establishing your rapid prototyping infrastructure on proven technology produced by a company with market tenure. 3D printer manufacturers lacking this experience may be here today but gone tomorrow, cutting off access to spare parts, materials, and support. The Stratasys F-Series is a professional 3D printing platform based on over 30 years of Stratasys experience developing and supporting 3D printers, materials, and customer solutions.



Make the Next Step

If you're in the business of designing and developing new products, F-Series printers, and GrabCAD software offer the straightest path to a positive impact on your bottom line. They enable your designers and engineers to move rapidly from design concept through part verification to functional prototype in a fraction of the time, compared with traditional prototyping methods. That gets your product to market faster and reduces post-production quality problems. It also increases your chances of beating the competition.

This printer hardware and software combination are designed for ease of use and shorter, streamlined workflows that give your team the capability, reliability, and simplicity they need in a rapid prototyping platform to iterate, refine, and perfect designs. They can do that in an office environment with clean, quiet, safety-certified 3D printers.

How would your company benefit if you could cut your product development time by half or more compared with how long it takes today? How much more efficient would your design and engineering workgroups be with accessible, reliable 3D printers and a simple CAD-to-print workflow?

With Stratasys F-Series printers and GrabCAD software, there's never been a better opportunity to use FDM technology to improve your prototyping operations. Contact a Stratasys representative today and take the next step to smarter prototyping.

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