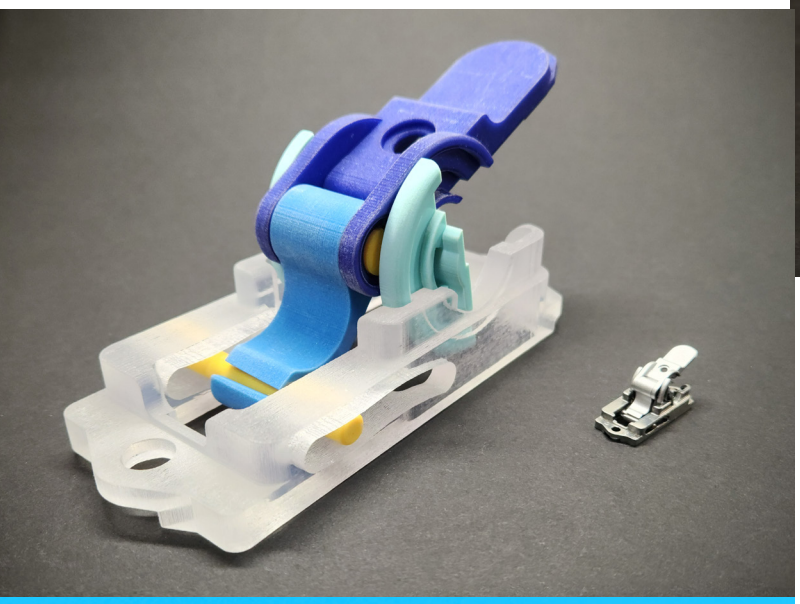
stratasys Microsoft

CASE STUDY
CONSUMER

# Shaping the Future: Microsoft's Journey with Advanced Rapid Prototyping




In the realm of technological innovation, the ability to quickly and accurately bring ideas to tangible reality is invaluable. This compilation of case studies showcases Microsoft's strategic use of advanced rapid prototyping, leveraging the versatility and precision of Stratasys 3D printing technologies. From sleek laptop designs to intricate components like kickstand hinges and Xbox controller buttons, each project highlights a unique aspect of prototyping that pushes the boundaries of form, function, and aesthetics. Moreover, the exploration into functional tooling with the shield can prototype exemplifies the depth of innovation possible when marrying creativity with cutting-edge 3D printing solutions. Dive into these narratives to discover how Microsoft is not just keeping pace with the future but actively shaping it through advanced rapid prototyping.

# How Stratasys PolyJet™ Technology Enabled Microsoft's "Fail Fast" Product Development Process

## Customer Profile

Located in Redmond, Washington—Microsoft's Advanced Prototyping Center (APC) is a 26,000 square foot prototyping facility sandwiched between the Industrial Design and Engineering groups. This team of highly passionate makers acts as the translator between concept and reality. Utilizing a multitude of manufacturing and prototyping tools, the APC focuses on efficiently creating solutions and prototypes to answer business questions. Following the mantra of "Fail Fast" the APC is responsible for quickly generating confidence in development decisions for Microsoft's designers, engineers, and partners. 3D printing plays an integral part in Microsoft's "Fail Fast" development process and Stratasys PolyJet™ models are a part of our daily routine.

## Challenge

The question is and always will be "how do we innovate faster?" Fueled by consumer demand and industry competition, hardware development cycles are continuously shortening. Product solutions, prototypes, and decisions need to be made at an accelerated pace to be competitive. In addition, product development increasingly demands higher accuracy to ensure design decisions are being made with greater confidence. In the prototyping world every step up in fidelity requires additional time and operations to move a model closer to being realized. Secondary operations such as paint and graphics need to be created and require accurate placement, fixturing or additional equipment, personnel, and time. Time that is often not available in the fast-paced decision making of hardware development.

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They say seeing is believing and in the world of prototyping the ability to create prototypes of our devices in color on the Stratasys J850 has been a game changer for our product development teams.

Edward Lehner

**Microsoft Senior Prototyping Manager**

A view of the Microsoft 3D Printing Lab for Rapid Prototyping

## Solution

Beyond the obvious benefits of 3D printing (speed and accuracy) the newer Stratasys J750™/J850™ Prime machines have allowed us to create prototypes that more accurately reflect the designer's intent. With the release of the VeroUltra™ and VeroVivid™ resins we can create true Pantone Validated colors with part thicknesses that were previously unachievable. Microsoft is one of few companies that color matches the product components. This is the reason the Surface Laptop metal chassis and Alcantara keyboard deck blend together seamlessly. The increase in color capability from the J750/850s allows us to create thinner and smaller parts with more realistic appearances. Features like part lines or differentiating materials became easier to explain through PolyJet technology. In addition, the resolution increased from 800dpi to 1600dpi, meaning prints can be created with full images or text perfectly aligned right off the printer. This fundamentally raised the bar for overnight 3D printed models. Suddenly there was an option for next-day 3D prints that could clearly and accurately represent a designer or engineer's intent without any additional secondary operations.

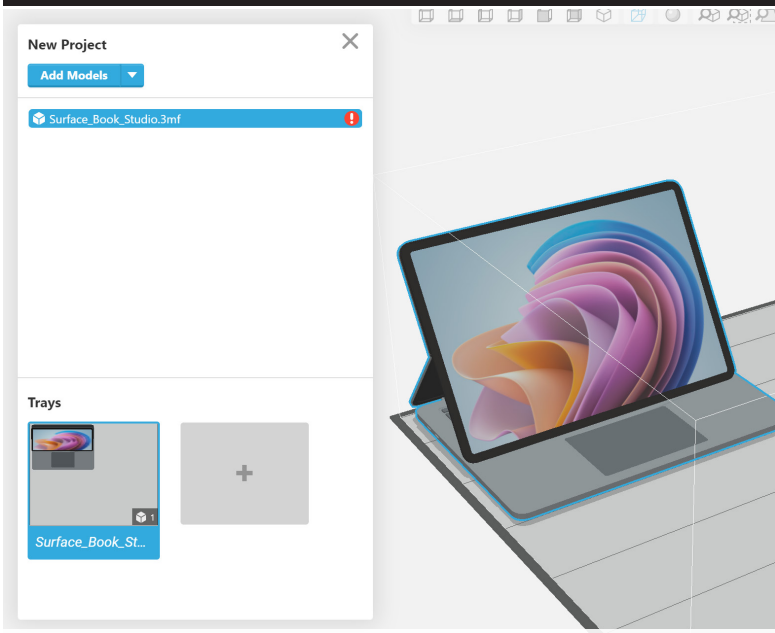
## Impact

A prototype is a highly efficient tool to tell a story – a way to communicate an idea and inspire progress. Anytime we can increase a models' fidelity quickly we increase our capability to make better informed decisions and at a greater pace. The additions of true Pantone Validated colors and of increased resolution have significantly impacted product development at Microsoft, accelerating our product making ability.

> The increased dimensional accuracy, coupled with full-color printing has made the Stratasys J850 our primary 3d printing tool for prototyping complex mechanical prototypes. Parts off the J850 require little to no post processing (sanding, painting etc.) making it possible to create multiple iterations at a much quicker pace compared to past methods.

Karsten Aagaard

**Microsoft Principal Model-Maker**




Preparing the print file with Stratasys GrabCAD™ Print Software


# Microsoft Engineers and Model-Makers Utilize PolyJet™ Technology to Redesign Surface Pro 9's Kickstand Hinge

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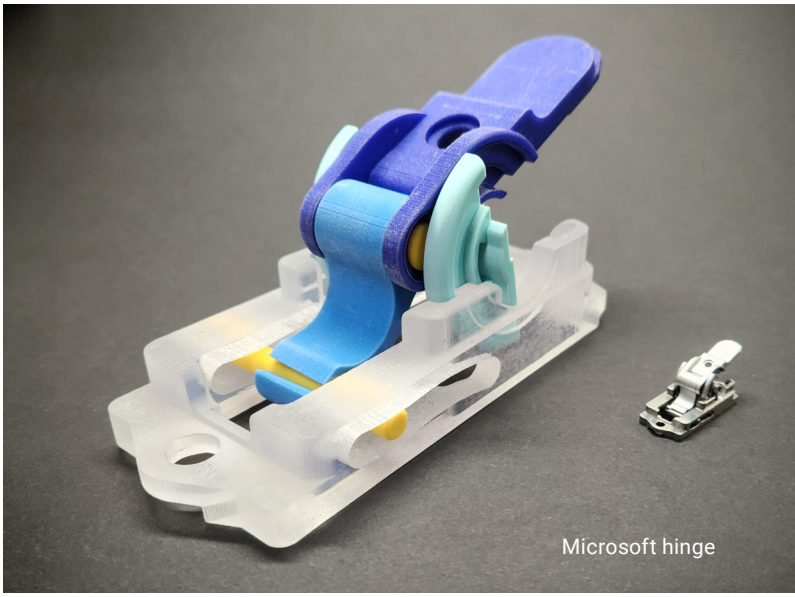
Microsoft hinge

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The primary objective has always been to identify the quickest and most efficient route towards validating a design solution. The J850 Prime has emerged as a leader in this domain, enabling a greater focus on the design aspect rather than the intricacies of fabrication.

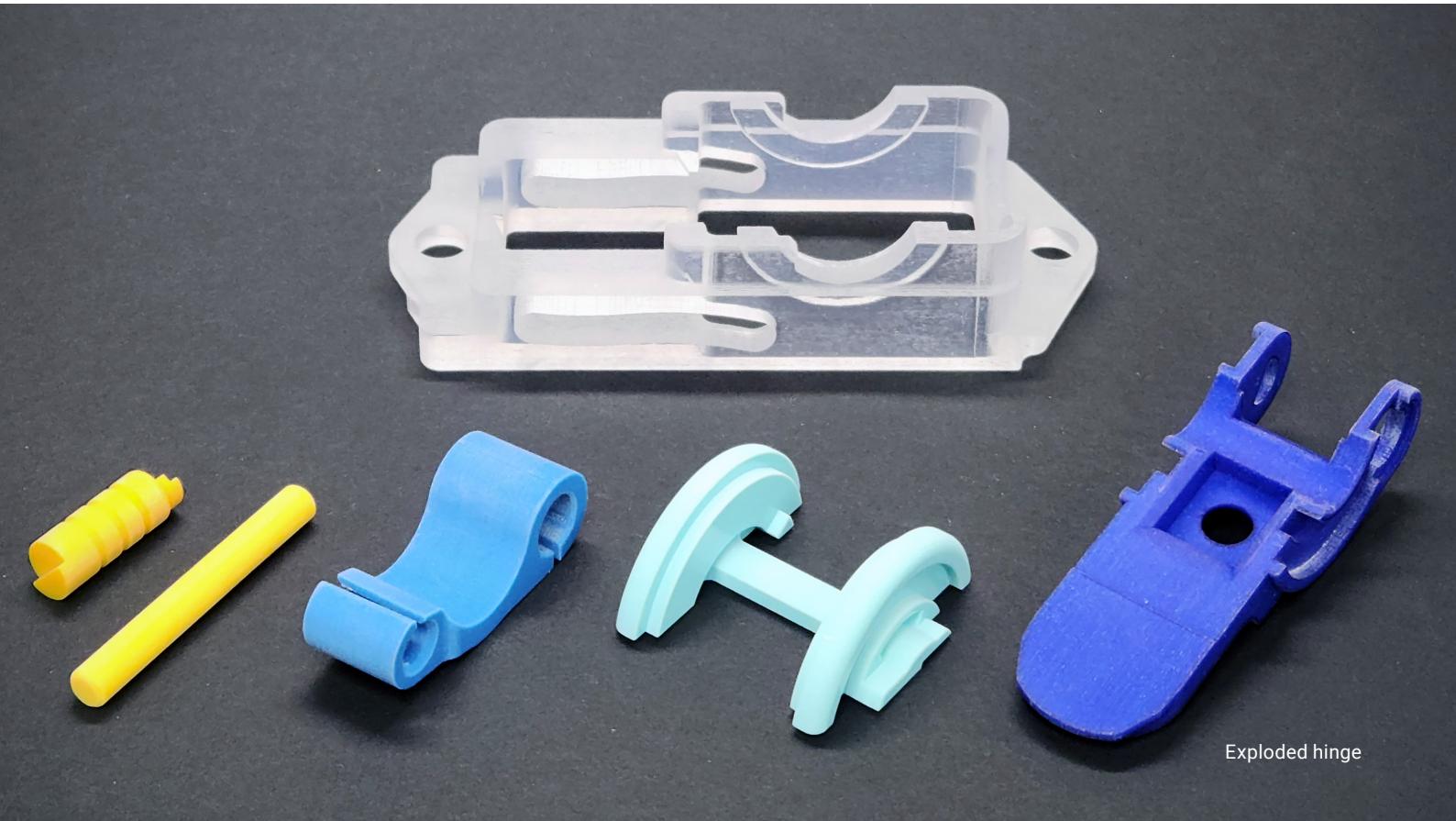
Mike Oldani
**Model-Maker, Microsoft**

## Challenge

Hardware development requires input from a wide range of subject matter experts to ensure the greatest chance of success for getting a product to market that fulfills the original design and engineering intent. The latest Surface Pro 9 is a fitting example of how different teams collaborate to engineer new and improved features for Microsoft devices, features like the easy to detach magnetic type-cover keyboards and the innovative refinement of the Surface Pro 9 kickstand hinges.

The kickstand is one of the iconic features of the Surface Pro 9. The hinges that attach the kickstand to the device play a crucial role in creating a premium user experience. Hinges need to be compact and lightweight, yet strong enough to support the device across a wide range of adjustable angles reliably with repeated usage. The latest iteration of the kickstand hinge was completely redesigned for Surface Pro 9 using fewer parts than previous versions, yet providing the same user experience, giving the users the ability to adjust the device to their preferred viewing angle. This smooth, almost infinite angle feature allows for great flexibility in various use settings, such as on a flight watching a movie, at home composing a Word doc, or creating art in and out of the studio using the Surface pen.

Developing a new Surface Pro hinge is an especially complex prototyping challenge due to the small size of the individual components which require precise engineering and access to tools that can produce parts with a high degree of accuracy. While traditional prototyping methods such as CNC machining or metal injection molding (MIM) can produce highly accurate parts, they are not efficient enough in terms of time and resources to quickly prototype and test multiple designs for these types of components, something that is crucial in today's product development landscape.



Exploded hinge

## Solution

In the past, prototyping complex mechanical designs required a significant amount of time and resources. With the introduction of the Stratasys J850™ Prime printers, this process has become much more efficient. The J850's advanced dimensional accuracy allows for quick iteration of even small mechanical parts, providing a faster and more efficient solution to prototyping complex mechanical designs. Microsoft engineers and model-makers collaborated to develop a unique prototyping method, digitally upscaling hinge assemblies, and then printing these larger-than-life units. The accuracy of the parts off the J850 system meant there is little to no post-processing needed for assembling the prototype, allowing for rapid validation of designs. The J850 printer has proven to be an invaluable tool in the product development process, enabling precise fit checks of complex mechanisms designs, and range of motion studies. Couple that with its fast-printing speed the J850 has helped remove the bottleneck in product development for the designers, engineers, and model makers.

## Business Impact

Surface devices are conceived from an idea, built many times over, and perfected before heading off for factory production. The J850 Prime has boosted confidence in the overall prototyping process expediting the turnaround time for precise parts, allowing engineers to become more deeply absorbed in the form and function of the design versus worrying about the details of a prototype construction. In the case of the Surface Pro 9's hinge, the ability to upscale and print components on the J850 has allowed for faster identification of potential failure points and enabled exploration of more innovative design paths, ultimately leading to a more premium user experience.

> "Part to part accuracy is crucial when developing mechanical features during product development. This ensures the prototype experience matches the design intent as closely as possible. Due to the vast improvement in accuracy from previous PolyJet printer generations, our mechanical engineers routinely ask that we print their parts exclusively on J850 technology.

Mark Honschke
**3D Print Lead, Microsoft**

Microsoft 3D Printing Lab

Microsoft

# Microsoft Leverages Advanced 3D Printing for Xbox Controller Prototyping

## Customer Profile

Located in Redmond, Washington—Building 87 or Microsoft's Advanced Prototyping Center (APC) behind a door labeled with the periodic Carbon element (one of the basic elemental building blocks), is a 26,000 square foot prototyping facility, home to a team of highly passionate makers that act as the translator, between concept and reality for both Industrial Designers and Engineers. Utilizing a multitude of manufacturing and prototyping tools, the APC focuses on efficiently creating solutions and prototypes to answer business questions. Following the mantra of "Fail Fast" the APC is responsible for quickly generating confidence in development decisions for Microsoft's designers, engineers, and partners. 3D printing plays an integral part in Microsoft's "Fail Fast" development process and Stratasys PolyJet™ models are a part of our daily routine.

> "The improvements we see with the GrabCAD software, such as the ability to apply advanced color/opacity techniques directly in the software has made the Stratasys J850 an even more powerful tool for hardware development at Microsoft

**Mark Honschke**

**Additive Prototyping Lead, Microsoft**

## Challenge

Since the first-generation, the ABXY buttons on the Xbox controller have been more than just functional keys for gaming. Their jewel-like appearance has been a visual delight for gamers that adds to the aesthetic appeal of the controller and makes it easier for gamers to identify and press. The first two generations of Xbox ABXY buttons were typically made up of two parts, the bottom-colored portion with the letter and a clear cap seamlessly built together in a process called over-molding. Subsequent generations increased the part count to three, a black base, a colored letter, and the clear cap, with future generations of these buttons increasing part count and surface treatments. Prototyping of this multi-material injection mold process was a challenge from the beginning that was made even more complicated by the fact that although, at first glance all the buttons look similar, each button is a unique shape above and below the surface of the case top. The traditional methods used to prototype ABXY buttons were slow. First, each layer of the button assembly was fabricated individually and then molds of the individual parts and a mold of the fully assembled button would then be produced. This initial part of the process could take days and was only the first step to a finished button. Second, in a process called over-molding, copies of the bottom of the button are inserted into the assembly mold and a clear resin was cast over the base, creating the one-piece letter “under glass” design. This process would then need to be repeated for all four buttons. Early 3D printing helped to speed up fabrication of the master parts, but it did nothing to eliminate the slow mold making process.

## Solution

The introduction of multi-material 3D printing drastically changed the process for prototyping ABXY buttons. With the first generation two-material 3D printing process, where typically a clear resin coupled with white or black was used, meant you could print button prototypes that more closely resembled the final product in a shorter period than the traditional methods. First generation 3D printers gave designers the ability to iterate button shapes very quickly, but the dual material limitation meant shape changes were the only element that could be prototyped. The advancement to PolyJet™ full-color multi-material printing, as on the Stratasys J850™ Prime, was the advancement that truly opened the possibilities for fabricating complicated ABXY button prototypes. The Stratasys J850 Prime 3D printer allows us to change the shape and color of objects within the prototype’s solid bodies in a single print. We can also add color variation and apply graphic textures to individual surfaces with even the smallest detail, and in the gaming world details matter.

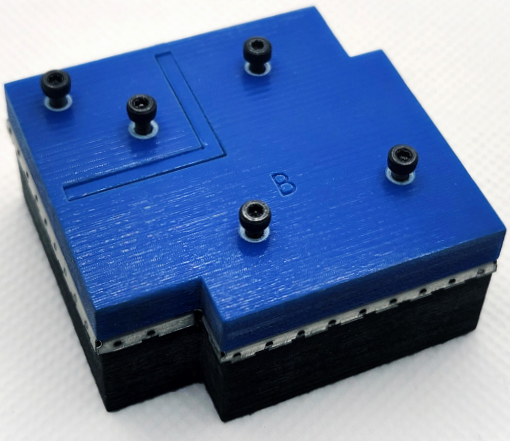
## Business Impact

In the world of console gaming, controllers are the most important accessory for gamers. They are an extension of the gamer, not only in the digital worlds but also IRL. As such, gamers want controllers that work seamlessly with their hardware that also reflect their personality, style, and preferences. Controllers that bring the “wow” factor with new colors, graphics and button treatments are hot commodities in a crowded market. Utilizing PolyJet™ full color 3D printing technology on the J850 Prime has allowed Xbox designers to iterate design details effortlessly. The speed, accuracy and large range of colors on the Stratasys J850 Prime has opened new worlds of creative possibility.

> “Stratasys’s polyJet technology’s color matching accuracy has reduced the time needed to prototype Xbox controller buttons, which has given us the capacity to explore more options, ensuring we produce an exciting array of products for the Xbox player community.

Erik Sijgers
**Model Maker, Microsoft**

Microsoft



# How Microsoft Optimized Tooling for Shield Metal Prototyping with Stratasys' PolyJet™ Technology

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> "The Stratasys J8 Series™ printers have given me a powerful tool to produce parts for both engineers and designers, a difficult gap to bridge for other 3D printing technologies

**Mark Honschke**
**Additive Prototyping Lead, Microsoft**

Press molds for sheet metal PCB shield cans

## Challenge: Shield Metal Prototyping

Shield cans are an essential part of modern electronic devices used to protect internal electronic components from electromagnetic and radio interference. Without these critical guards, electronic devices would be susceptible to external interferences which would cause operational issues from minor malfunctions to complete failure. As important as sheet metal components play for hardware historically prototyping them has been challenging and time-consuming. Traditional methods for prototyping shield cans have often impeded the iteration process, requiring a complete restart of the tooling whenever even simple design changes are needed. The time and money required by these older methods reduced the total number of iterations that could be accomplished during a development cycle. Sheet metal shield cans are typically made from thin metal materials like brass, nickel silver and stainless steel and, due to the thin geometries, directly 3D printing shield can prototypes is not practical. However, 3D printing the tooling form needed with PolyJet™ technology to use when producing the metal prototypes improves the lead time and has opened the use of unique geometries that would otherwise be impossible using traditional methods.

## Solution: 3D Printed Tooling

While 3D printing has been around for decades, its wide adoption for sheet metal prototyping has only recently emerged. In the past all 3D printing processes had limitations that curbed the range of useful geometries. Stratasys PolyJet™ technology has been the best option with the best balance between part quality, accuracy, and speed and the J850 Prime, renowned for its enhanced x/y accuracy, and multiple layer resolutions including a high 14-micron resolution, presents an exceptionally rapid method to produce sheet metal tooling with the precision necessary for prototyping extremely small features. The standard Vero materials, with their high compression strength, have been an amazing resin for sheet metal form prototyping. In addition, if higher flexural strength and heat deflection temperature parts are needed the J850 Prime, with its 7 material bays, has the capacity to run the Digital ABS Plus material without losing the ability to run full color parts. The dynamic features of the J850 Prime mean model makers spend less time designing around traditional manufacturing limitations and can focus on producing the best part for the need. Tooling with sharp corners, odd undercuts, or difficult surfaces to machine is no longer a concern. The time spent designing the molds is reduced, allowing engineers to embrace a new paradigm of rapid and frequent part iteration.

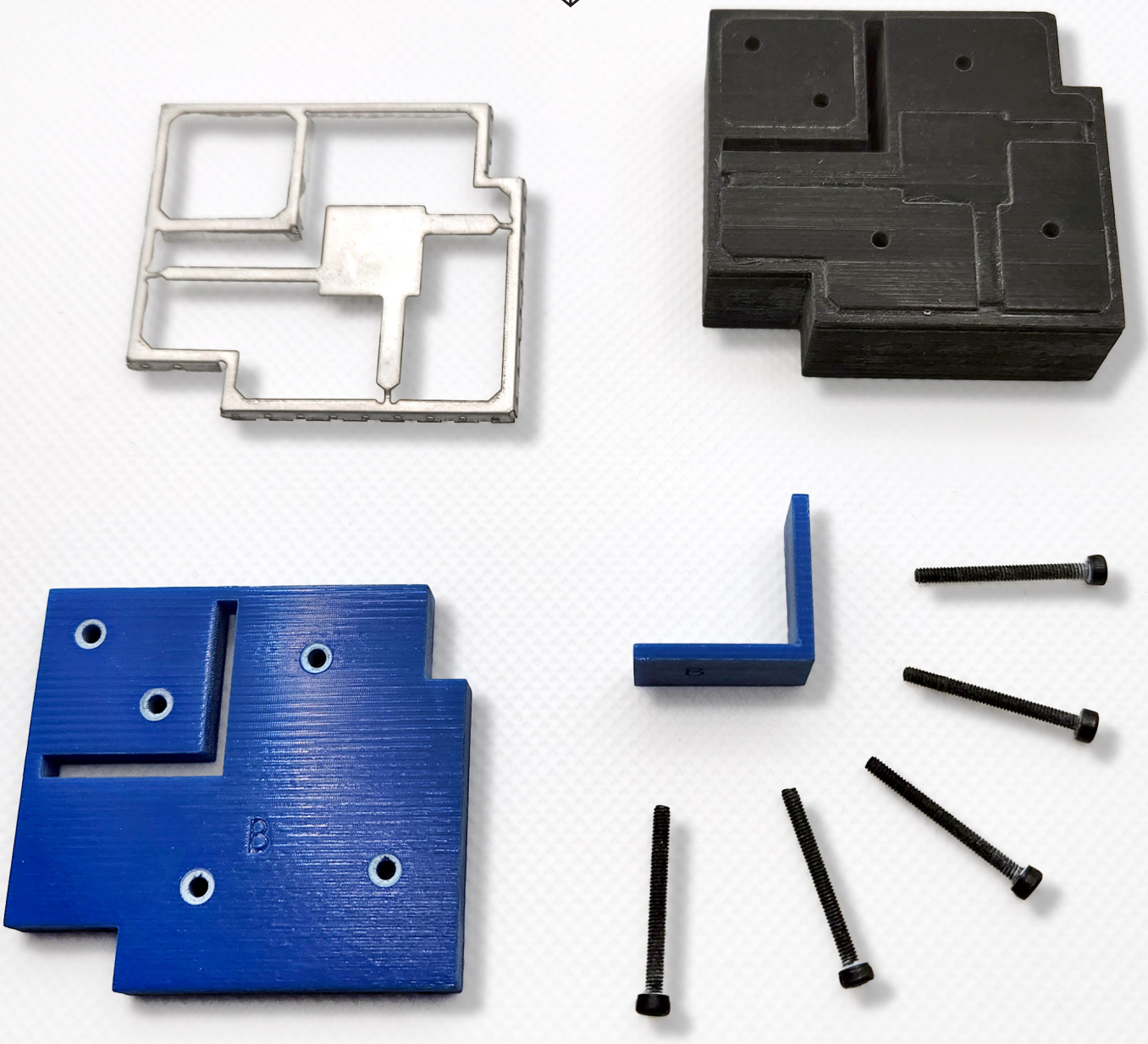
## Impact

In hardware development it is necessary to continue to find faster solutions for replacing traditional prototype processes with newer fabrication techniques using modern technology to enable continuous improvement. Shield can prototyping at Microsoft's Advanced Prototyping Center using the Stratasys J850 Prime has given our model-makers the capacity to supply engineers with highly accurate models swiftly, and with far fewer design limitations than the traditional techniques, significantly accelerating the development process and leading to more innovative product solutions.

> "While 3D printing has undoubtedly revolutionized hardware design, its transformative impact extends beyond mere part creation. Stepping back, we can appreciate its role in eliminating previously cumbersome processes involved in producing actual parts. The inclusion of printed tooling introduces a powerful dimension, amplifying efficiency and creativity in the development process.

Mike Oldani

**Model Maker, Microsoft**



Exploded view of press mold for shield can frame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