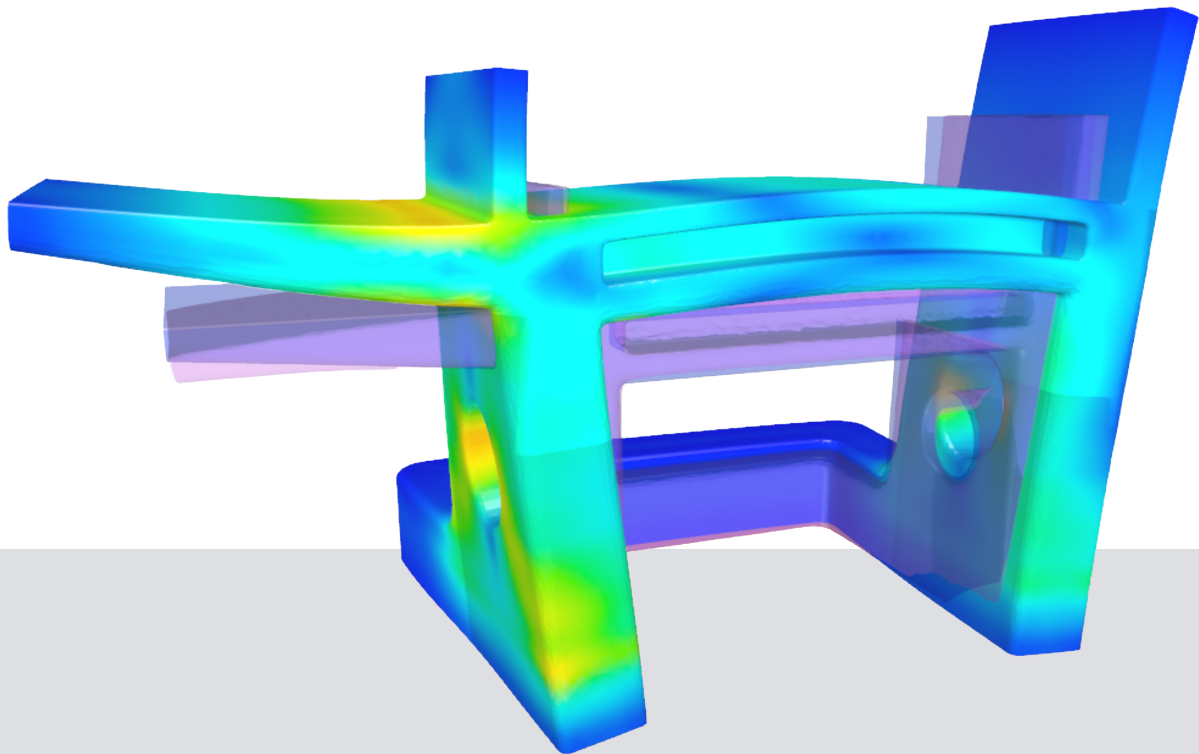


# Live Sinter™

## Powerful, multi-physics sintering simulation

Manufacturing preparation software for the successful production of powder metal sintered parts





# PRECISION METAL PART PRODUCTION FLEXIBILITY

Metal binder jet 3D prints fuse together during the sintering process to form a dense metal part. In the sintering furnace those parts shrink and experience significant forces that can lead to deformations. Our advanced simulation software team has worked to eliminate the trial and error required to achieve high-accuracy parts via powder metallurgy-based processes.

Live Sinter™ software is a powerful, multi-physics application that provides advanced simulation tools to predict and correct for errors when sintering to deliver final components with tight tolerances. Rather than 3D printing a part straight to have it warp out of specification, Live Sinter prints a negative offset that will sinter to meet dimensional tolerances with unique distortion compensation to help manufacturers not only reduce costs, but enable sintering to be successfully applied to a wider range of applications.

## **Simulation and distortion compensation**

Live Sinter performs simulation of the shrinkage and distortion of a metal part that takes place during sintering. The application models non-linear shrinkage, friction, elastic and plastic deformation, as well as density variations caused by powder spreading. Interactive simulations provide in-depth views of factors like stress, strain, and powder density. Negative offset models preserve the original design's intricate features with high-fidelity.

## **Manufacturing support**

Live Sinter accepts CAD data in STL, STEP, and Parasolid formats and allows users to select specific surfaces for material offsets to support downstream machining and post-processing operations. Shrinkage due to Hot Isostatic Pressing (HIP) heat treatment can also be compensated for with Live Sinter software.

## **Easy-to-use interface**

Live Sinter offers a user-friendly interface to work interactively with your parts. Compare the printer and sintering environments side-by-side, evaluate forces like stress or strain on the part, or analyze part deviation during sintering - or automate the process to run your preparation cycle hands-free with fast and accurate results.

## **Calibration**

Live Sinter™ uses a set of input parameters that define properties of the material, printer, and furnace. The software ships with a collection of sintering parameter files for different combinations of hardware and powders, as well as the capability for users to generate custom parameter files further tuned to their own environments.

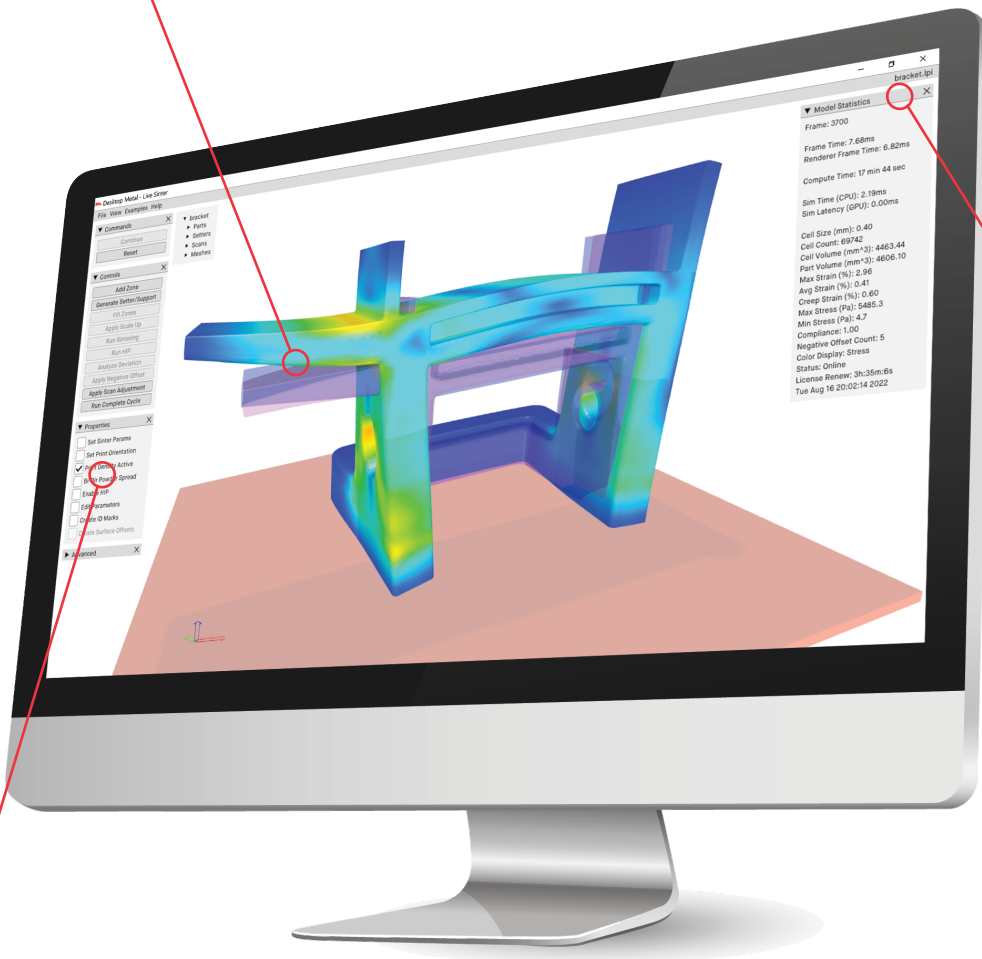
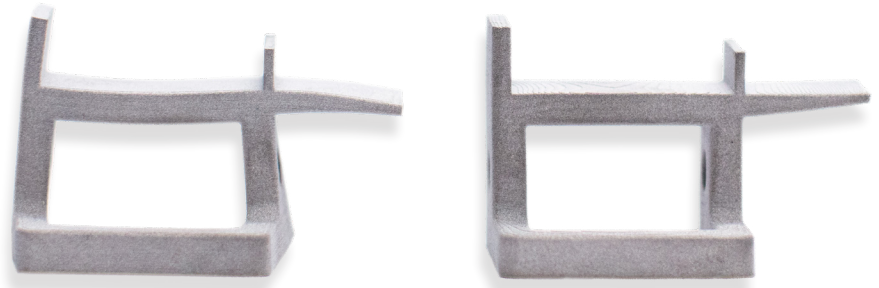
## **Support generation**

Live Sinter provides optional support generation optimized to significantly reduce material usage while enabling distortion compensation to occur where needed. Users interactively generate supports in a variety of sinter orientations while analyzing support volumes and stability characteristics as part of a trade-off analysis.

## **Scan-based adjustment**

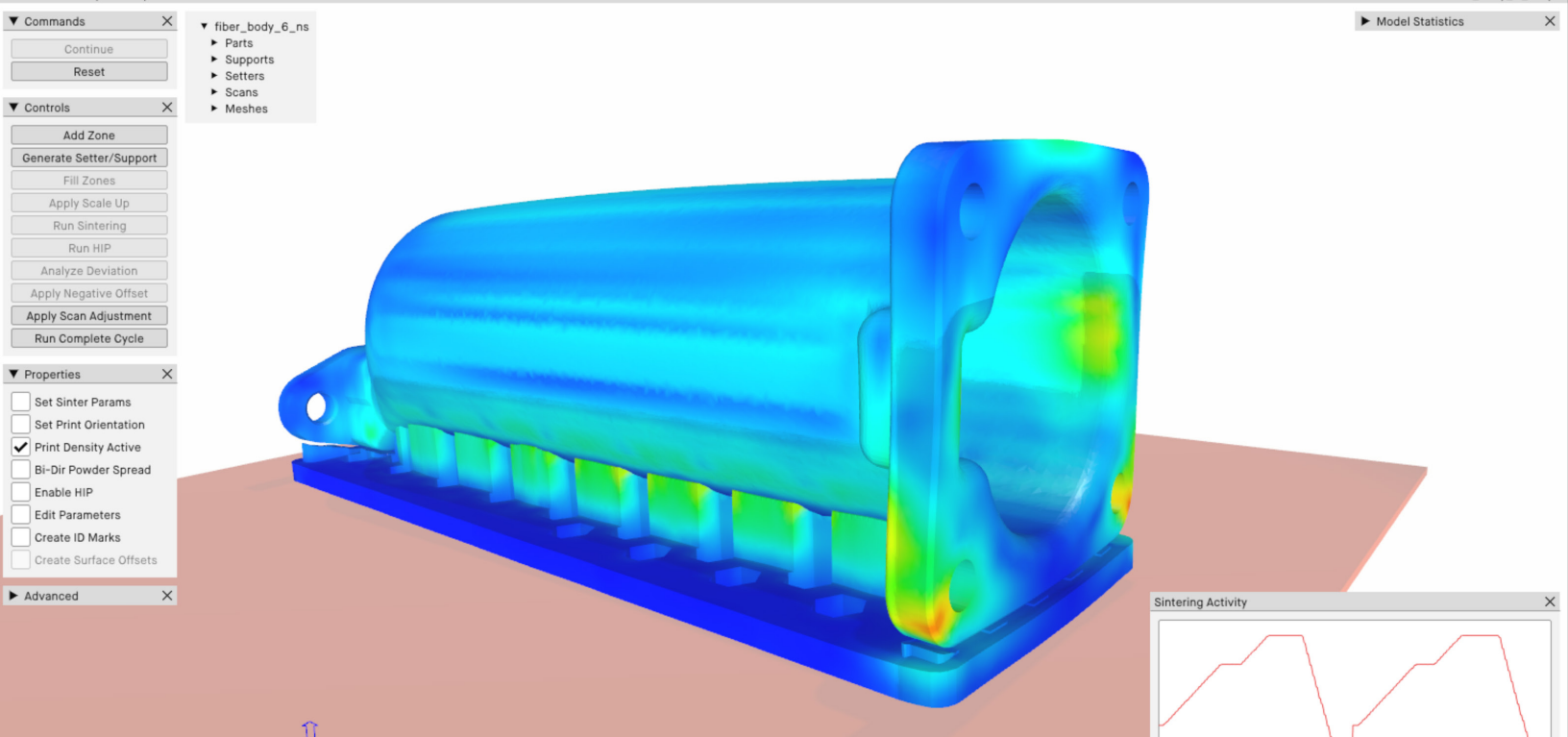
Live Sinter complements predictive sintering simulation with scan-based adjustments to fine tune negative offset models and correct for complex distortion effects. After scan-based adjustments, Live Sinter yields parts that consistently fall within 1% of target dimension, with as low as +/- 0.3% deviation, avoiding distortion, warping, and other common sintering challenges, as well as the cost and time associated with supports or setters.

Rather than fight the effects of gravity, friction, shrinkage and distortion, seen near right, Live Sinter software embraces nature and provides advanced simulation tools to predict and correct for errors with a negative offset geometry that prints and sinters to compensate for these effects, far right



Pre-loaded settings for a range of materials and 3D printing hardware

Most complete simulations take 15-30 minutes



# LIVE SINTER FEATURES

Desktop Metal Live Sinter was developed as a tool for engineers to predict sintering outcomes and improve upon dimensional accuracy when producing powdered metal parts with high quality. Below is an overview of the broad functionality of this powerful software.

## Simulation and Distortion Compensation

- Simulation of Non-Uniform Shrinkage, Friction, Gravity, Elastic and Plastic Deformation
- Built-in Dilatometer Profiles Plus Ability to Define Custom Time/Temp/Shrinkage Profiles
- Automatic Iterative Process for Simulation Followed by Negative Offset to Converge on Final Compensated Shape
- Non-Uniform Shrink Rates in XYZ
- Shrinkage Gradients for Shrinkage Variations Along Specific Axes
- Complex Setter Support (any imported geometry)
- Floating Setters and Inserts (non-shrinking geometry that moves with the part as it shrinks)
- Super-Fast Simulation Using GPU-Based Multi-Physics
- Interactive Mode for Analysis Plus Fully Automated Operation
- Ability to Force Flattening of Selected and Top and Bottom Surfaces
- Modeling and Compensation for Powder Spreading Density Variations
- High Fidelity Export of Compensated Geometry Preserving All Detailed Features
- Enable Multiple Parts on Single Support

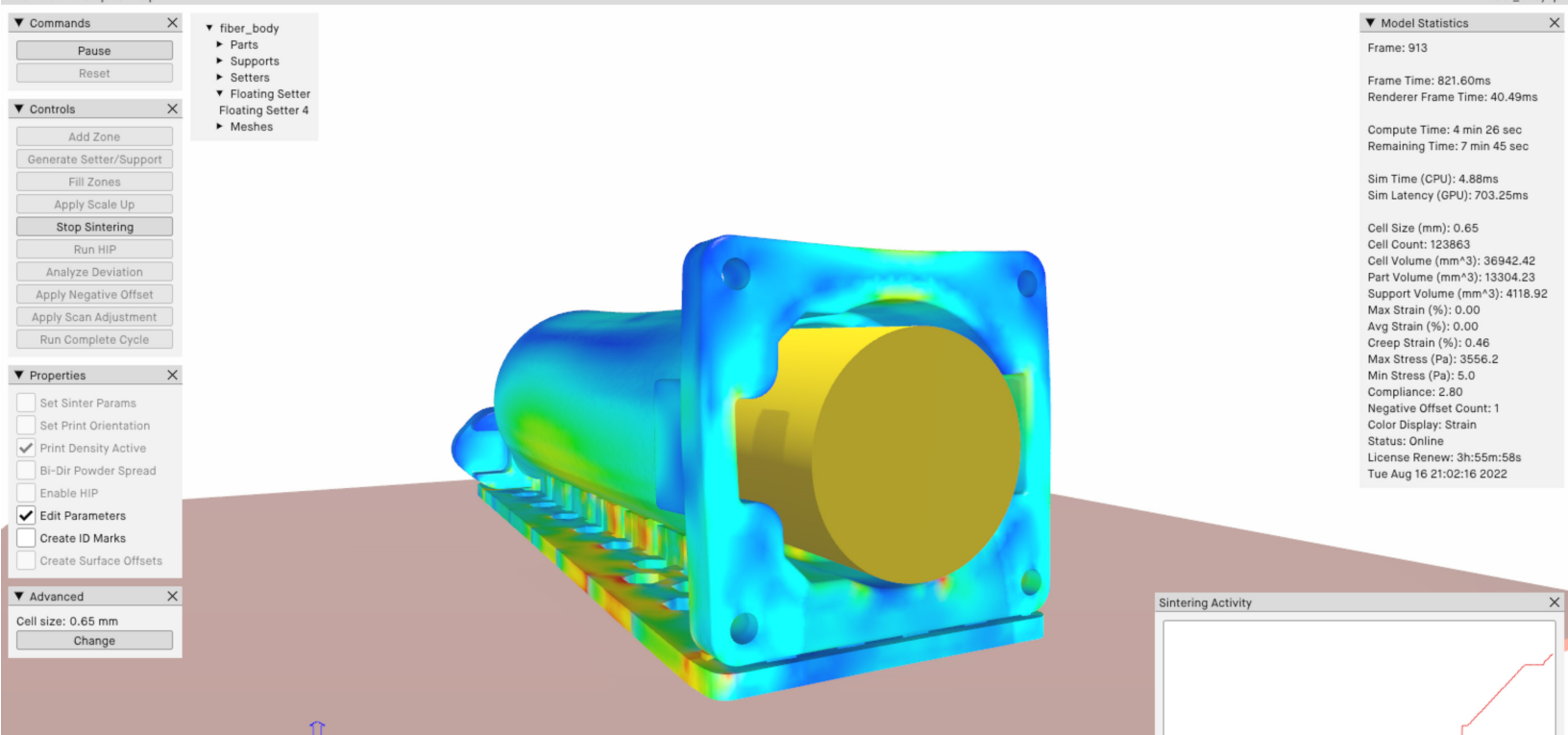
## Manufacturing Support

- Generate Offset Surfaces to Add Material on Meshes for Regions to Be Post-Machined

- Generate ID Marks for Indicating Sintering Placement
- Optional HIP Simulation Following Sintering for Complete Shrinkage Compensation
- Setup Printer Mode for Setting Print Orientation and Placing Part/Support in Print Box
- Printer Build Box Display with Database of Printers
- Set Print Orientation Different from Sinter Orientation
- Export Part/Support as Single or Multiple Files
- Automatic Separation of Part/Support in Print Direction for Clearance
- Import Complex Setter Geometry for Analysis in Designing Setters
- Registration of Parts on Complex Setters for Repeatable Sintering Behavior
- Use of Customized Parameter Files Specific to Customer Environments

## User Interface

- Perspective and Orthographic Views
- Cross Sectioning of Parts, Supports, Scans, Setters, and Compensated Geometry
- Opaque and Translucent Views
- On Screen Comparisons of Deformed Sintered versus Nominal Shapes Negative Offset versus Scaled-Up Shapes
- Queue Mechanism to Run Complete Cycle on a set of Models
- Deviation Analysis Heatmaps with Slider-Controlled Colors



- Part/Support Orientation Using Surface Alignment, Grab Handles, or Precise Text Entry
- Setup Print Orientation Different from Sinter Orientation
- Measurement Tool
- Color Display of Strain, Stress, Density Shells, Shrinkage Gradients, Tension/Compression Regions
- Display of Volumes of Negative Offset Support and Part Geometries for Cost Analysis
- Built-In Bug Reporting Upload Mechanism
- Trail File Mechanism for Recording and Playing Back Usage Scenarios
- Prediction of Time Remaining in Simulation
- Online Knowledge Base with Video Tutorials
- Configurable Light/Dark Background Styles
- Command-Line Support For Automated Scripting
- Automated Version Updating (new versions automatically download and install)
- Online Licensing Renewal with Optional Offline Operation

## Support Generation

- Fully Automatic Support Generation Based on Part Geometry
- Read STEP/STL/Parasolid Formats for Optional Imported Supports
- Automatic Unit Conversion
- Mesh Simplification Without Errors
- Mesh Cleanup (fragments and noise)
- Option to Explicitly Include and Exclude Selected Surfaces
- Automated Generation Based on Support Angles, Wall Offsets
- Options to Add Honeycomb and Radial Cut Patterns to Rafts and Risers
- Automatic Raft Thickness Specification Based on Volume/Mass
- Generation of Pillars For Extreme Lightweighting
- Automatic Raft Strengthening for Easier De-Powdering
- Automatic Smear Raft Generation
- Optional Export of Generated Support Geometry for Modification in External Systems

## Scan Adjustment

- Read STL, PLY, and Point Cloud Formats
- Automatic Fit of Scans to Part
- Scan Averaging of Multiple Scans From Different Build Locations into a Composite Scan
- Support for Missing Data Regions in Scans
- Volumetric Scan Adjustment Including Adjustment for Missing Internal Regions
- Split Scan Support for Parts that are Cut and Scanned on the Inside
- Deviation Analysis and Color Heatmap Showing Part and Scan Differences
- Automatic Adjustment of Support Geometry to Fit Part After Scan Adjustment
- Optional Solid Rendering of Scans
- Automatic Point Decimation For Super Large Scans
- Scale Adjustment Tool for Compensating to Caliper-Based Measurements
- Noise Elimination Preventing Scanned Part Noise From Affecting Scan Adjustments
- Ability to Scan Adjust Multiple Times For Increased Accuracy
- Scan Adjustment for Non-Sintered Parts

## Calibration System

- Fully Automatic Online Calibration System (Upload Scan(s) and Receive Custom Parameter Files in Minutes)
- Calibration Widget Shipped with Software for Customer Self-Calibration
- Machine-Learning Based Multi-Dimensional Regression Analysis against Eigenvector Decomposition of Uploaded Scans.
- Single Calibration Part Handles Print, Sinter, and Material Properties All At Once

 Watch a demo and learn more about Desktop Metal Live Sinter Software: [TeamDM.com/LiveSinterWebinar](https://TeamDM.com/LiveSinterWebinar)





# TECHNICAL SPECIFICATIONS

Operating System	Windows 10 Professional 64-bit PC / Laptop
RAM	32 GB
Storage	2.2 TB
CPU	At least 6 physical cores @ 3 ghz
GPU	Nvidia GTX 1070/80, RTX 2070/80, Quadro P5000/6000 or later
Additional requirements	Must have Nvidia Cuda 9.2 toolkit or later installed

*We use Live Sinter all the time now and it's a dramatic change. We simulate, print, scan, and reprint and it comes out perfect.*

Sean Harkins, President, AmPd Labs

*One of my biggest worries investing in this technology was the furnace and the frustration of failing that far into the process during sintering. Using Live Sinter, I'm blown away at our success with the sintering furnace. I don't have to use sintering supports anymore, so I don't have to charge for supports. I use Live Sinter for everything and it makes it more competitive.*

Neil Glazebrook, Vice President of 3D Solutions, ABCorp

*We've found Live Sinter to be an extremely valuable tool. The ability to print, scan, adjust, reprint, etc., has reduced our lead time by helping us yield product in spec faster than a traditional trial and error loop. The ability of the software to predictively deform products prior to first manufacturing or to take first-off parts and make adjustments have resulted in our customers getting to market faster with product so they can move on to their next development.*

Chris Aiello, Co-Founder, FreeFORM Technologies

 Watch a demo and learn more about Desktop Metal Live Sinter Software Solutions: [TeamDM.com/LiveSinterWebinar](https://TeamDM.com/LiveSinterWebinar)

# CUSTOMER SUCCESS STORIES

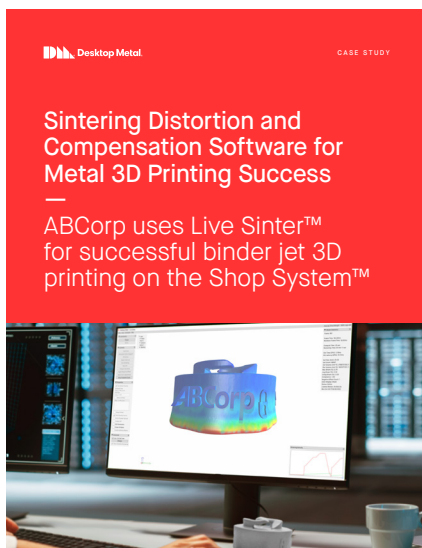


AMPD LABS

## Capitalizing on Opportunity with Additive Manufacturing

AmPd Labs recognized a demand for solutions to minimize production down times, including for traditionally cast or machined parts. 3D printing stainless steel on the Shop System allows the company to offer new manufacturing solutions with metal binder jetting and Live Sinter.

[TeamDM.com/AmPdLabs](https://TeamDM.com/AmPdLabs)



ABCORP

## Easy Adoption Success with the Shop System and Live Sinter

In addition to the easy-to-use Shop System, a key component to the out-of-the-box success of ABCORP's binder jetting operations is Live Sinter's advanced simulation to predict and correct for errors when sintering 3D printed parts.

[TeamDM.com/ABCORP](https://TeamDM.com/ABCORP)

Learn more about binder jetting and find more customer success stories at

[TeamDM.com/MetalSuccess](https://TeamDM.com/MetalSuccess)

# Additive Manufacturing 2.0

Metal | Polymer | Ceramic | Composite | Wood

Printer platforms



Desktop Health™



Materials



Applications and more



Desktop Labs

[DESKTOPMETAL.COM](https://www.desktopmetal.com)

Desktop Metal (NYSE:DM) is driving Additive Manufacturing 2.0, a new era of on-demand, digital mass production of industrial, medical, and consumer products. Our innovative 3D printers, materials, and software deliver the speed, cost, and part quality required for this transformation. We're the original inventors and world leaders of the 3D printing methods we believe will empower this shift, binder jetting and digital light processing. Today, our systems print metal, polymer, sand and other ceramics, as well as foam and recycled wood. Manufacturers use our technology worldwide to save time and money, reduce waste, increase flexibility, and produce designs that solve the world's toughest problems and enable once-impossible innovations. Learn more about Desktop Metal and our #TeamDM brands at DesktopMetal.com