



Desktop Metal Shop: Introduction

An introduction to the capabilities of the Desktop Metal Shop metal 3D printing system.

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Introduction

The Desktop Metal Shop is a metal 3D printing solution by Desktop Metal which utilizes a binder jetting process. It is best suited for batch metal printing, and the parts are ready for prototyping, end-use or further post-processing through any traditional techniques. The parts produced are solid metal and have a consistent surface finish.

“It works a bit like inkjet document printing, but instead of jetting drops of ink onto paper, the print head jets microscopic binder droplets onto a fresh bed of metal powder. Once baked, this holds parts together long enough to excavate and sinter them into fully dense metal parts. “

Learn more about the capabilities and technology supporting the Desktop Metal Shop system.

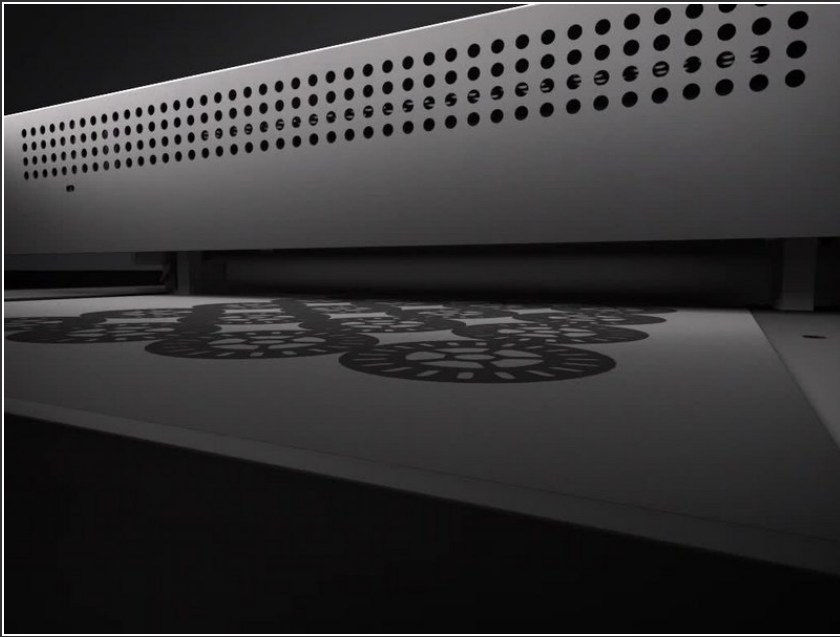
Images by: Terrapin Works and Desktop Metal

Step 1 — Advantages of the Desktop Metal Shop system



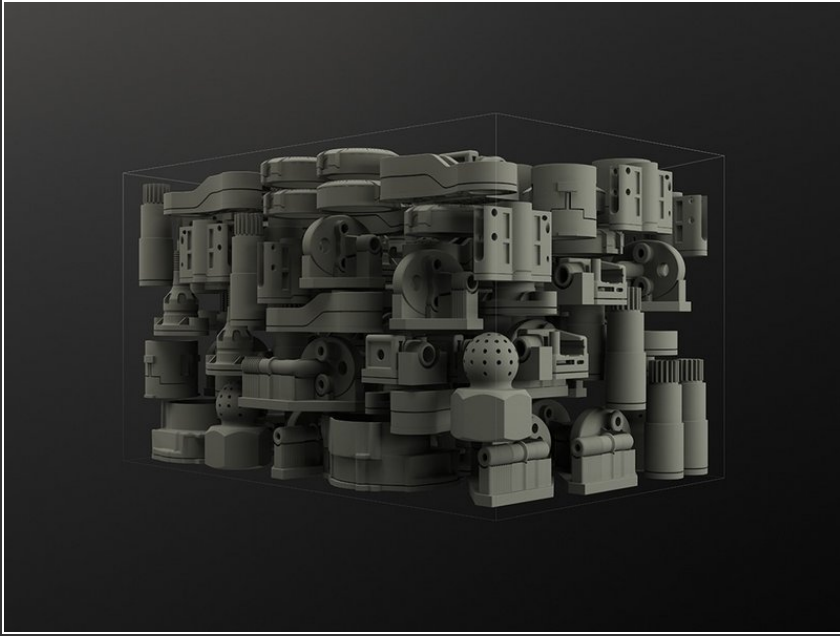
- The DMS system is a high volume metal 3D printing solution
- Fully solid metal parts, with high repeatability and good mechanical properties
- No post-sinter processing necessary - no support and easy to remove from the build area
- Lower cost than other, laser-based processes
- High accuracy and resolution

Step 2 — How Does DMS work?



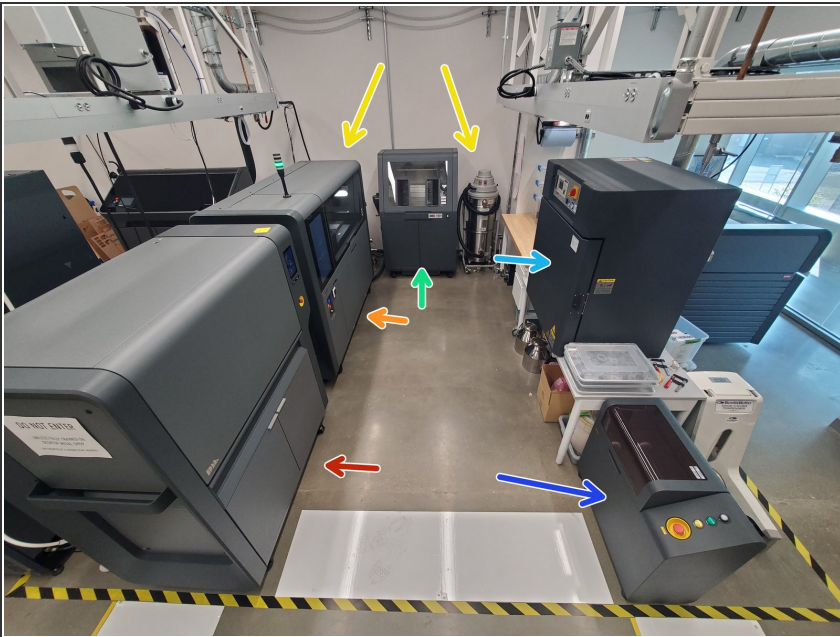
- DMS uses Binder Jetting, which is powder bed based process:
 - A piston and roller distribute a fine layer of powder in the build area
 - An COTS inkjet head deposits binding agent in the desired geometry using 70000 micronozzles
 - This process repeats several hundred (or thousand) times to define 3D geometry
- The entire build box is then cured in an oven to cure the parts to a "green" state
- The build box is excavated to remove the green parts from loose powder, and all loose powder is recycled back into the process
- The green parts are sintered at ~1400 C for several hours in order to fuse the green parts into solid stainless steel

Step 3 — Capabilities and Design Guides



- Design guidelines for the DMS system can be found on the [category page](#)
- 1600 dpi resolution in XY
- 40-100 micron resolution in Z
- 17-4 PH Stainless Steel part with maximum wall thickness of 1 inch
- Tunable layer parameters
- Dozens or hundreds of unique parts can be printed in a single batch

Step 4 — Machines Included in the DMS System



- DMS Furnace
- DMS Printer
- 2 Immersion, explosion-proof vacuums
- DMS Powder Station
- DMS Drying Oven
- DMS Blender

Step 5 — A Walkaround: DMS Furnace



- There are two utility cabinets on the furnace
 - The left utility cabinet holds gas canisters that could be used for the studio system, but is useless for the shop system
 - The right utility cabinet contains the binder trap and compressor (where oil can be filled)
- The furnace door can only be opened when the system is vented, by the up and down arrows on the side
- The touchscreen is on the front right, and can be used to perform all standard machine functions
- The e-stop is on the front right, and can be used to shutdown the machine during emergencies

Step 6 — A Walkaround: DMS Furnace



- There are two exhaust pipes which come out of the back of the furnace
 - These feed into tee-connectors, for condensate to collect in the clear plastic bottles
 - The condensate bottles should regularly be checked to see if they need to be emptied
 - The other end of the tee should feed into an external exhaust line
- There is a VCO type fitting connection for external gas on the back of the furnace
 - The external gas used is hydrogen balanced argon (3% hydrogen)
 - The gas pressure can be adjusted with the regulator and briefly loosening this fitting to allow gas to flow, or by running a **Purge Gas Line** operation on the furnace

Step 7 — A Look Inside: DMS Furnace



- The furnace operates using several powerful infrared heaters, which heat the retort in full vacuum
⚠ These heaters are fragile and expensive, DO NOT touch them
- The retort is made out of graphite, and serves to direct forming gas in laminar flow over the parts inside
- There is a steel bell which serves as the top part of the vacuum chamber, and must seal to the lower portion with the O-ring shown
- The O-ring shown should be maintained and kept clean, but should not be exposed to any fluids besides DI water when cleaning
- The white insulation is silica based - proper PPE should be worn whenever the chamber is open

Step 8 — A Walkaround: DMS Printer



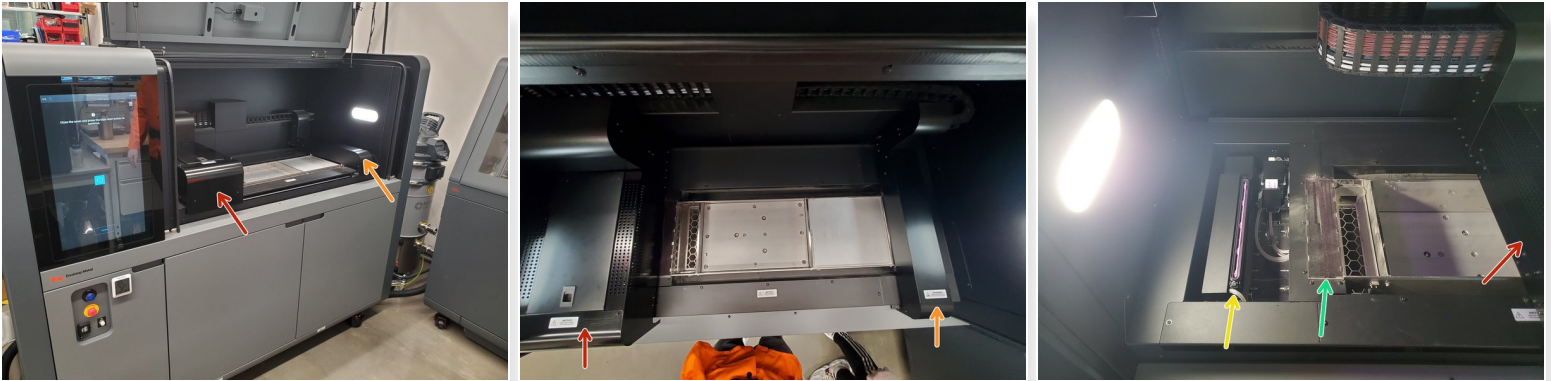
- There are three utility cabinets on the DMS printer
 - The left utility cabinet holds the binder cartridge and fines jar
 - The center utility cabinet holds the overflow keg
 - The right utility cabinet holds the waste overflow containers
- The touchscreen is the main interface with the machine
- E-stop, white power on button and blue reset button are located below the display

Step 9 — A Walkaround: DMS Printer



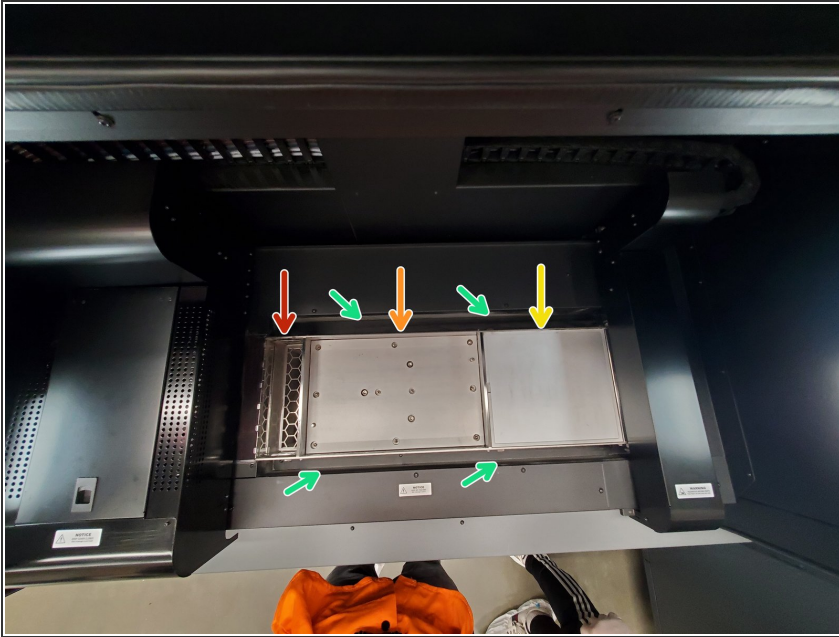
- The water inlet (for the humidifier) goes into the rear panel
- The small rear panel has to be removed to replace the tube or service the humidifier
- There is a water overflow which must go into an overflow bin
- The ethernet connection goes into the rear panel
- The power cord and main breaker for the machine are behind the electrical panel

Step 10 — A Look Inside: DMS Printer



- ① The print area is humidity controlled and should not be open without reason
 - Both carriages inside the printer area are disabled when the printer door is open
 - The left carriage is the printhead carriage
 - The right carriage is the spreader carriage
 - The printhead cap seals and increases the longevity of the printhead in between prints
 - The spit pad essentially catches excess binder that may be left near the printhead or on the printhead nozzles

Step 11 — A Look Inside: DMS Printer



- The powder overflow chute and tray directs and filters powder that is spread over the edge of the print area and allows it to fall into the overflow keg
- The build area is where powder is spread onto and binder jetted down on top of in order to create part geometry
- The powder piston holds metal that will be used during the print, incrementally raising and exposing more powder to the spreader carriage
- The area surrounding the print area and powder piston are used to control and catch any extra powder

Step 12 — A Note: DMS Vacuum(s)



- One vacuum is run throughout the entire print, and is powered by compressed air
 - ⚠ This vacuum **MUST** be grounded with the grounding clamp whenever in use
- The other vacuum is run during any other powder processing tasks, such as cleaning parts, cleaning the printer, or transferring powder (this one is powered with electricity)
- Both vacuums have a separable bottom, and the vacuum bags reside here
 - ⚠ The vacuum bags are immersed in water, which must be properly disposed

Step 13 — A Walkaround: DMS Powder Station



- The powder station is primarily used to excavate parts and participate in the post-print process
- There is a lower utility cabinet, which holds:
 - Blend keg
 - Waste jar
 - Sieving screen
 - Dosing chute

⚠ This area should be kept as clean as possible

Step 14 — A Walkaround: DMS Powder Station



- There is a cyclone separator on the side of the powder station, with a fines jar and vacuum inlet
 - ⓘ The vacuum and fines jar should always be installed when using the powder station
- The upper chamber of the powder station has brushes in the door for the operator
 - Always hit the door a few times and allow metal powder to settle before opening
- ⚠ The station should never be used to excavate parts with the door open
- The main interface on the powder station is the screen and arrow keys up front, and the white power button to the right

Step 15 — A Walkaround: DMS Drying Oven



- The handle of the drying oven turns counter clockwise to open
- ⚠ The drying oven should **NEVER** be opened without proper PPE
- The main interface is up front, and has several buttons to interact with the menus
- E-stop and power switch are to the right of the main interface
- The exhaust lever is at the back of the drying oven

Step 16 — A Walkaround: DMS Blender



- The blender has a single powered roller and an idler roller
- The lid also has an interlock, so it cannot be run with the lid opened
- There is a one button, status light and e-stop button on the right