

**COLIBRIUM  
ADDITIVE**  
a GE Aerospace company

# Binder Jet

Customer-centric innovation



# How is Colibrium Additive's Binder Jet technology unique?

**Binder & Printer capability** – The Binder Jet Line was meticulously designed and tested for scaled throughput, high uptime, lower costs, and safe production with minimal powder interaction and high-quality

- ✓ Green strength: Higher strength enables excellent feature fidelity / details, higher yield and allows for automation of production processes
  - Superior green and intermediate state (debind / sinter) properties enable less cracking and distortion of parts during sintering
- ✓ Material properties: Capable of producing material properties that conform to the rigorous requirements of highly regulated industries, like aerospace and automotive
- ✓ Larger parts: Ability to print, depowder and sinter large complex parts (as well as smaller ones)
- ✓ Scale: Uniquely designed following environmental, regulatory and safety best practices, to provide a solution that can scale into multi-machine installations on a true factory floor

**Dimensional Accuracy** – Distortion management and control to simulate and compensate geometries, coupled with printing accuracy and limited variation throughout the build box for accurate final, sintered parts.

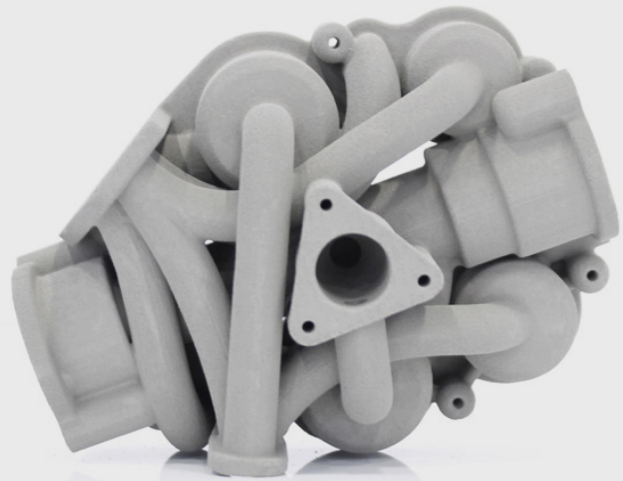
**Consulting** – Leverage our AddWorks team for consultancy across Additive part design, industrialization and more to help drive the value of Additive technology (inclusive of other modalities) across your products.

**Experience** – Colibrium Additive's vast experience with metal additive production provides unique expertise for helping customers avoid pitfalls and get to production faster.



Engineered for scaled manufacturing of quality parts, with end-to-end process in mind...  
not just a machine, but a production system.

# How Colibrium's Binder Jet Line addresses four critical business objectives:



## 1. Quality

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- Achieve repeatable and reliable printing of complex small to large parts
- Print throughout the build box (in x, y and z directions) with no noticeable trend in property variation
- Depowder intricate parts without having to manage them too delicately, enabled by high green strength
- Sinter parts within the desired tolerances
- Develop high-quality parts faster using distortion simulation, management and control

## 3. Scale

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- Achieve high productivity with automation-ready technology designed for a factory floor
- Minimize operator contact with machines and powders
- Print full build boxes of parts in ~1 day
- Integrate into factory cells for smooth operations
- Remove a complete build and start a new one in less than 1 ½ hours

## 2. Cost

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- Enable low-cost, high-volume part production
- Compete with or beat casting costs, with additive design benefits
- Take advantage of cheaper raw material powder and faster print speeds than other modalities
- Spend less on raw material by recycling unused powder
- Introduce new applications and innovations difficult or impossible to manufacture with other methods

## 4. Safety

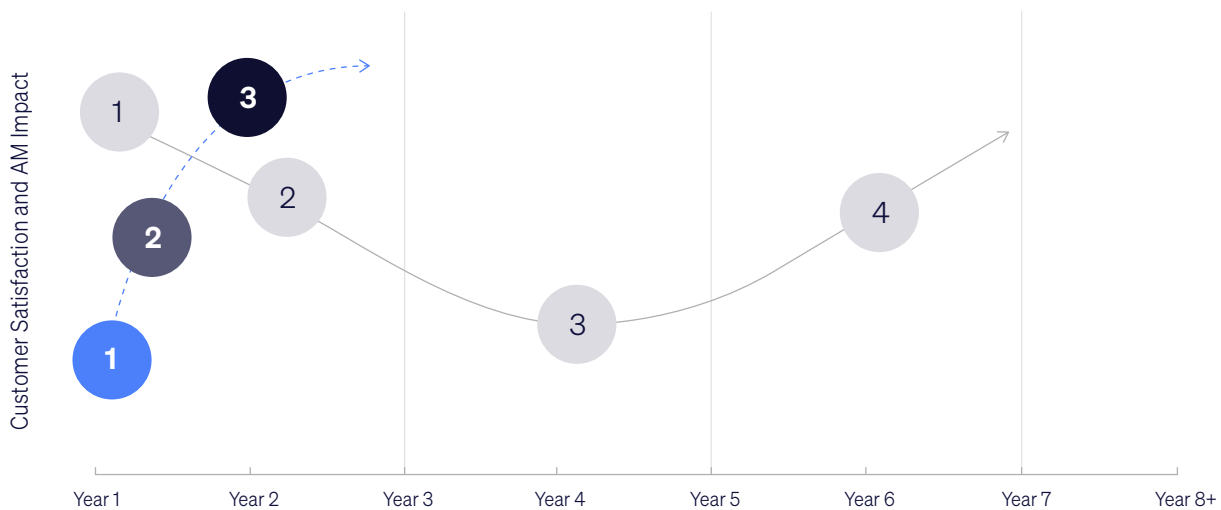
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- Designed to UL and CE standards
- Inert capable, sealed environment
- Automated loading of powder and consumables to machine
- Very limited use or need for PPE
- Automation enabled

# Additive partnership— where scale meets speed.

Getting to full production with additive can be a long journey with time often in short supply. With Colibrum's Binder Jet Line, you can combine your business and technical expertise with our additive expertise to shorten your path to full metal additive industrialization from what could be eight-plus years to three or less.

## Partnerships accelerate industrialization

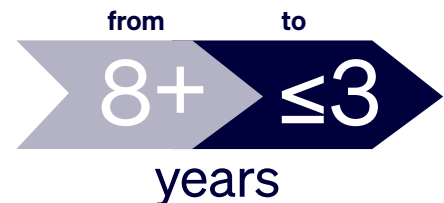


### Partnership journey

- 1 Technology development
- 2 Qualify & LRIP
- 3 Production readiness

### Individual journey

- 1 R&D/Experimentation
- 2 Low-risk, initial testing
- 3 Process refinement & production planning
- 4 Part qualification & ramp-up



### With support from Colibrum Additive

- Significantly reduce the timeline to full additive production
- Lower your investment and gain a competitive edge by leveraging Colibrum Additive's experience, resources and intellectual property
- Drastically reduce risk by incorporating proven methodologies
- Scale operations more seamlessly, internally or externally

### Without support from Colibrum Additive

- Undergo a steep, long learning curve to reach full production
- Large and unpredictable investment of resources to build expertise
- Risk your business case and part decision failing during development
- Face unanticipated expenses and obstacles alone



# Ready to get started? Let's tackle your top challenges.

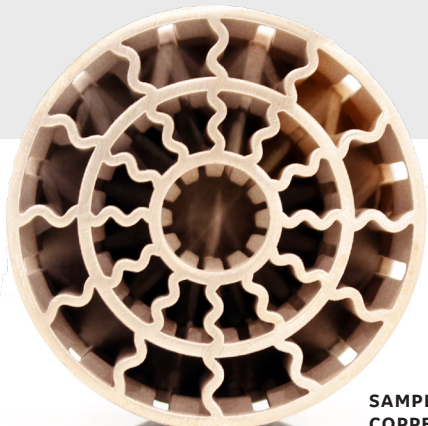
## Challenge 2

### Finding a good Binder Jet application

Historically metal binder jet has been limited to relatively small, thin-walled parts. Concerns around part cracking on larger parts, unmanageable variation in part dimensions and clean binder burnout in the sintering process have limited the technology's ability to really compete with castings.

**Colibrum Additive Solution: Develop a binder system and equipment suite that enables larger parts as well as clean binder burnout.**

We have developed a uniquely positioned binder jet technology that breaks the norms of what you've historically thought of as limitations for metal binder jet. Furthermore, we have a team of experts that are here to help you identify suitable applications for your business.



SAMPLE  
COPPER PART

## Challenge 1

### Proving ROI and building a business case

Building a business case is not as simple as comparing an additively made part vs. a traditionally made part. Similarly, it's easy to overburden a business model with all of the estimated costs to take an additive part into full production. Can you really get a return on your investment in additive manufacturing?

**Colibrum Solution: Develop your business plan with a team of additive experts.**

Our team collaborates with you to solve your toughest challenges and identify how AM can affect all areas of your business. We help you develop an ROI plan from powder to part that includes piece part cost, capital expenditures, operating expenses, and facilities layout and planning. We're here to share our experience to make yours better.

## Challenge 3

### Getting to full-scale production with Binder Jet

It's not as easy as installing a machine and pressing the print button. Reaching full-scale additive production involves careful design consideration, material and application development, business case execution at scale and much more.

**Colibrum Solution: Leverage AM industry knowledge and expertise throughout the process.**

Here are some ways we can support you:

- Start-up training by modality and/or on additive in general
- Material development and process optimization
- Material property characterization
- Part design training and services
- IQ / OQ / PQ consulting
- Facility preparedness and layout consulting
- Powder reuse strategies and consulting
- Industrialization workshops and consulting

# Binder Jet Line Series 3

## Technical Data

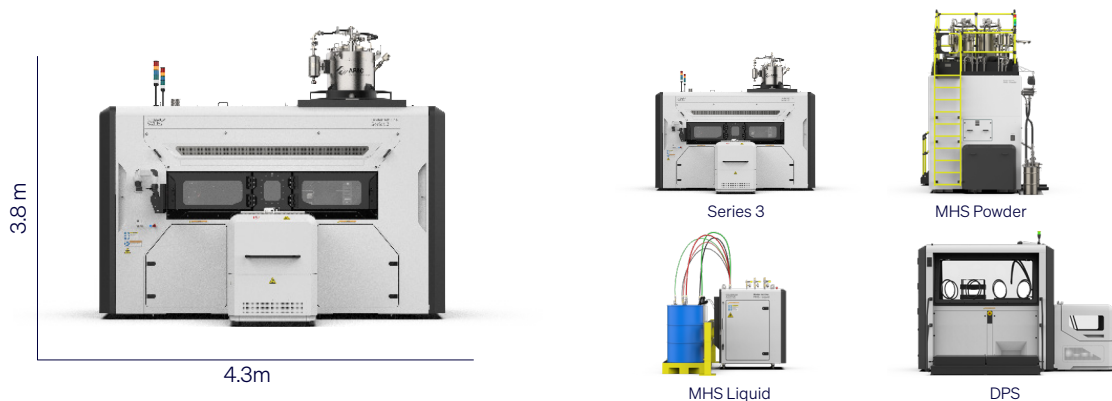
<b>Build envelope</b>	500 × 500 × 495 mm (x, y, z)*
<b>Part Sizes</b>	Capable of large parts (250+mm) as well as smaller parts; demonstrated wall thicknesses up to 45mm with uniform microstructure and carbon control
<b>Layer thickness</b>	100 µm standard; smaller and larger both possible (~50-200 µm)
<b>Print speed</b>	~5,000-7,000 cc/hr +/- at 100 µm layers, varies by material and other variables; actual part production throughput depends on part nesting
<b>Resolution</b>	8,000+ individually addressable nozzles and fully redundant jetting; placement resolution <30 µm +/- 5 µm
<b>Dimensional Accuracy</b>	Between CT7-9 with 100 µm layers and Stainless Steel 316L, though varies with material, parameter, geometry and sintering design
<b>Powder Handling</b>	Fully closed loop, inert capable; supplied automatically to Series 3 via MHS-Powder system
<b>Liquid Handling</b>	Fully closed loop, inert capable; supplied automatically to Series 3 via MHS-Liquid system
<b>Sintering</b>	Supplier agnostic, capability and profile recommended / supplied
<b>Sintered Density</b>	99%+ capable without secondary processes; optimizable based on application need
<b>Build changover time</b>	≤ 1.5 hours from one build ending to another starting
<b>Air/Inert gas</b>	Non-inert: Standard shop air. Inert: Fully inert capable, < 3% O2 level using either Nitrogen or Argon; includes full vapor capture capability
<b>Environmental</b>	Self-contained environmental control and isolation (30-40 °C +/- 2°; RH/Vapor <1% +/- 0.25%; 2-15mbar)
<b>OPCUA capability</b>	Included, configurable
<b>Power Supply</b>	400 VAC, independent ground leg
<b>Certification</b>	Designed to UL and CE standards
<b>Dimensions</b>	~4.3 × 4.1 × 3.8 m (W x D x H) with tunnels on front and back of machine (standard); ~4.3m x 1.7m x 3.8m without. Approximately ~17.7 × 6.7 × 3.7 m for full line footprint**

### Materials

- Stainless Steel 316L | *Now available on Series 3*

**Experience with all materials below on Series 2 Beta platform (varied degrees of maturity). Highly transferrable physics/print process from Series 2 Beta to Series 3, but requires further development for Series 3.**

- Stainless Steel 17-4PH
- Stainless Steel 304L
- Stainless Steel 441
- Copper C18000
- Tungsten Carbide
- Cobalt Chromium
- Inconel 718



\*Maximum usable build volume, can vary by material and/or parameter

\*\*MHS-Liquid, Series 3 printer, MHS-Powder, and DPS aligned in a cell, with ~3.7m forklift aisles. Excludes additional post-processing.



# Ready when you are.

To transform the way your business approaches today's toughest challenges. To reimagine the shop floor and how you create products, and cement a true competitive advantage.

With Colibrium's Binder Jet Line, your company can shorten the path to metal additive industrialization and see the return on your investment faster.

**Let's work together to overcome your AM challenges and build a fully realized additive factory floor fit for your business.**

Let's go. Talk to Colibrium Additive today.  
[colibriumadditive.com](http://colibriumadditive.com)