Eliminating Assembly

The Next Step in Metal Additive Manufacturing

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Many AM evaluations begin with a goal to reduce tooling costs or lead times. But the real challenge isn't parts - it's assemblies.

- Assembly labor
- Fasteners and joining methods
- Tolerance stack-up
- Quality inspection across multiple interfaces
- Supply chain complexity

Traditional metal manufacturing is limited not by making parts, but by assembling them. In many cases, assembly time and cost exceed the cost of the parts themselves. Additive technologies like MoldJet change this by enabling single-piece manufacturing and eliminating assembly operations.

AM disrupts the cost of assemblies.

The Hidden Cost of Traditional Manufacturing: Assembly

Modern manufacturing methods like CNC machining and casting are highly advanced - but they are still inherently fragmented.

1. Component manufacturing is Separate from Assembly

In conventional workflows, each component must be:

- Designed individually
- Manufactured independently
- Post-processed
- Then assembled into a final product

This creates a paradox:
The more complex the product, the more time is spent assembling it - not making it.
In real-world examples like suppressors, dozens of internal elements (baffles, spacers, threaded mounts) are machined separately and then assembled into a final unit.

2. Subtractive Manufacturing Starts with Excess

Technologies like CNC require:

- A large billet of material
- Extensive cutting, drilling, and removal

This leads to:

- High material waste
- Long machining cycles
- Increased tool wear and cost

> Instead of "creating," traditional manufacturing is fundamentally about removing.

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The Hidden Cost of Traditional Manufacturing: Assembly

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3. Precision Mismatch & Post-Processing

Even with high precision machining:
Threads often require **secondary finishing**
Interfaces between parts need **tuning or adjustment**
Tolerances stack across multiple components

In assemblies like suppressors:
Thread alignment and sealing are critical
Misalignment can affect performance or require rework
Assembly becomes not just a step—but a **risk factor.**

4. Assembly is Manual, Sequential, and Error-Prone

Final products require:

1. Step-by-step assembly
2. Human intervention or complex automation
3. Quality checks at each stage

For example:
Internal components must be inserted in order
Orientation and fit must be verified
Errors propagate and are costly to fix

Even in advanced facilities, assembly remains one of the **least scalable** stages.

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CASE STUDY

Eliminating Assembly in Copper Heat Exchangers

Heat exchangers highlight the complexity of multi-part thermal systems with internal flow paths.

Traditional CNC / Fabrication Approach

Process:

Individual components are produced:

- Tubes
- Fins
- Plates
- Manifolds

Components are joined by:

- Brazing
- Welding
- Mechanical assembly

Challenges:

- Multiple production steps across different processes
- Risk of leaks at joints
- Thermal inefficiencies at interfaces
- Complex tooling and fixtures
- Assembly dominates production time

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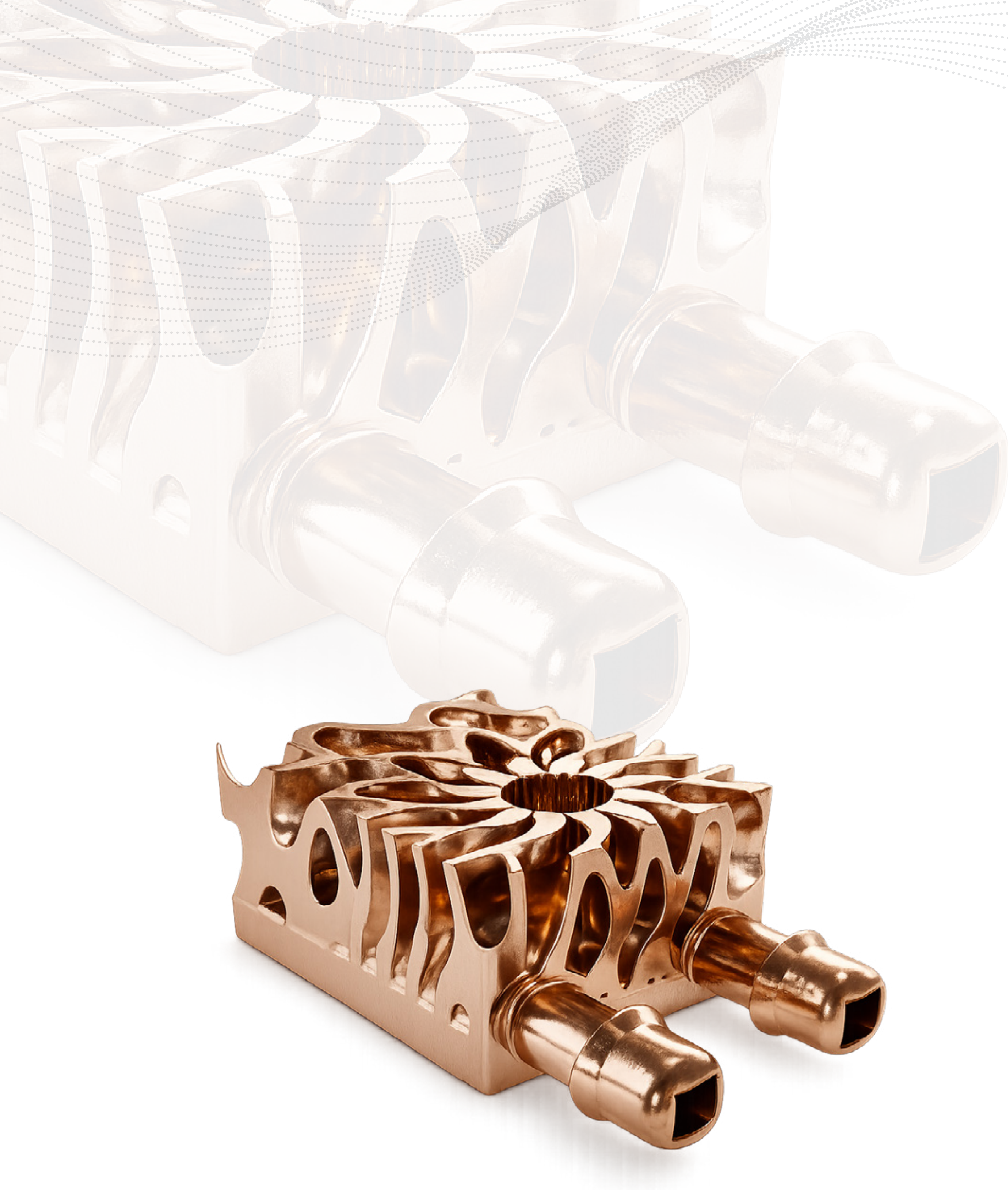


MoldJet Approach

Printed as a single unit

Process:

Entire heat exchanger is printed in a single build, including:

- Internal flow channels
- External structure
- Integrated connectors

Key Advantages:

No brazing or welding » eliminates leak paths

- Fully enclosed, complex internal geometries
- High dimensional control without sintering distortion
- No need for assembly or joining

Result:

> A fully integrated copper heat exchanger, manufactured as one part, with improved thermal performance and zero assembly steps.

Production Method	CNC + Assembly	Weldments	Casting	MoldJet
Material waste	High	Medium	Low	Low
Part Quantities	Low to medium	Low	High	Low to high
Tooling/setup costs	Medium/high	Medium	High	Low
complex internal geometry (flow paths)	Poor	Poor	Good	Excellent
Ability to consolidate components	Poor	Poor	Good	Excellent
Cost of final assembled component	High	Medium	Low	Low

CNC attempts to **optimize parts.**
MoldJet enables something fundamentally different -
It optimizes the
entire system as a single part.

Identifying Consolidation Opportunities

1. High Part Count Assemblies
5 components in a subassembly made of the same material

2. Alignment-Critical Interfaces
Features requiring tight positional tolerances across partS

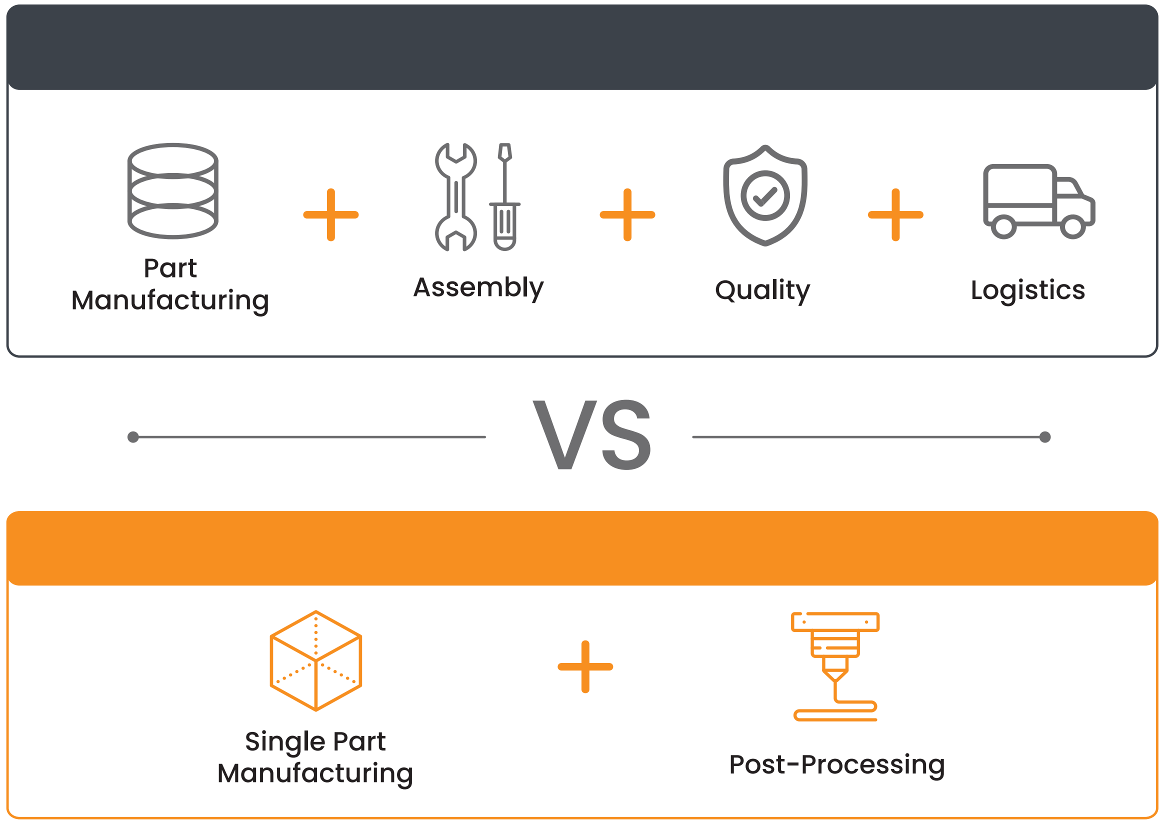
3. Labor-Intensive Assembly Steps
Manual joining, inspection, or calibration

4. Hidden Internal Geometry Constraints
Designs limited by tool access or joining methods

5. Failure Points at Interfaces
Leaks, loosening, wear, or fatigue at joints

Economic Framework: When Consolidation Win

A simplified model for evaluating AM adoption:



Reduce SKU's (stock keeping unit) in you Production Line

For sinter-based AM this Threshhold:

1. Parallelized production

2. Lower energy input

3. Scalability

Its time to explore to next generation metal manufacturing

Tritone manufacturing services is an industrial custom metal manufacturing service that provides full access to MoldJet technology. Developed to meet a clear market need, TMS enables customers to experience MoldJet's capabilities in real production environments and directly compare to legacy metal manufacturing methods.

Stop Investing Time to put Parts Together

Try us out