MELTIO

Applications Catalog

Application Overview

Near Net Shapes
Replacement of casting and forging near net shapes for prototyping, pilot runs and low volumes to avoid up front investment and minimum order quantities.

Lightweighting
Typical for the aerospace and aviation industries where weight savings have a significant impact on part cost and overall system efficiency.

Cooling
Incorporation of conformal cooling channels for increased performance, typically used in the aerospace industry, heat exchangers, molds and dies.

Repairs, Spares, and Obsolete Parts
Commonly used in mold repairs or heavy industries such as marine, rail way, mining and defense where parts are required for machinery in remote areas.

Business Case

The cost analysis represents an estimation for the total print cost and print time when using a Meltio metal 3D printing system in-house. It excludes costs such as machine amortization, operator labor rates and post-processing.

The gas installation source has a big impact on the variable cost of a part, using a standalone bottle is much easier but the gas is more expensive, about 4.75 $/m3. A proper liquified gas installation is more expensive but the cost per m3 can be as low as 2.53 $/m3.

Cost Scenario 1: 50L Gas Bottle*

Cost Scenario 2: Liquified Gas Installation

* The 50L bottles hold the gas at around 200 bars. It's 10.000 L

Combustion Chamber

Aerospace

This is the combustion chamber for a rocket engine with liquid cooling channels. Fresh fuel is flown past the combustion chamber to cool it down before it enters the engine to avoid overheating the chamber walls. This is a complex geometry that would never be made in a single-step process.

Size: 110.5 x 110.5 x 170 mm
Weight: 4.88 kg
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.8 mm

Business Case

Drivers:

Complex Geometry

Difficult to Machine

Additional Design Freedom

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 54.84	$ 54.84
Gas	$ 64.6	$ 35.65
Electricity	$ 16.41	$ 16.41

Print Time: 27 h 30’

Print Cost: $ 135.66
(50L Gas Bottle)

Print Cost: $ 106.90
(Liquified Gas)

Mining Drill Bit

Oil & Gas

It is attached to underground drills for drilling anchor points or exploratory holes in the mining and oil and gas industry. The component wears out quickly during operations in remote sites. There is a very small area of the part which wears out, teeth and surface.

Size: 96.5 x 96.44 x 91.3 mm
Weight: 3 kg
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm
Post-processing: CNC Machining

Business Case

Drivers:


Lead Time


Cost


Difficult to Machine

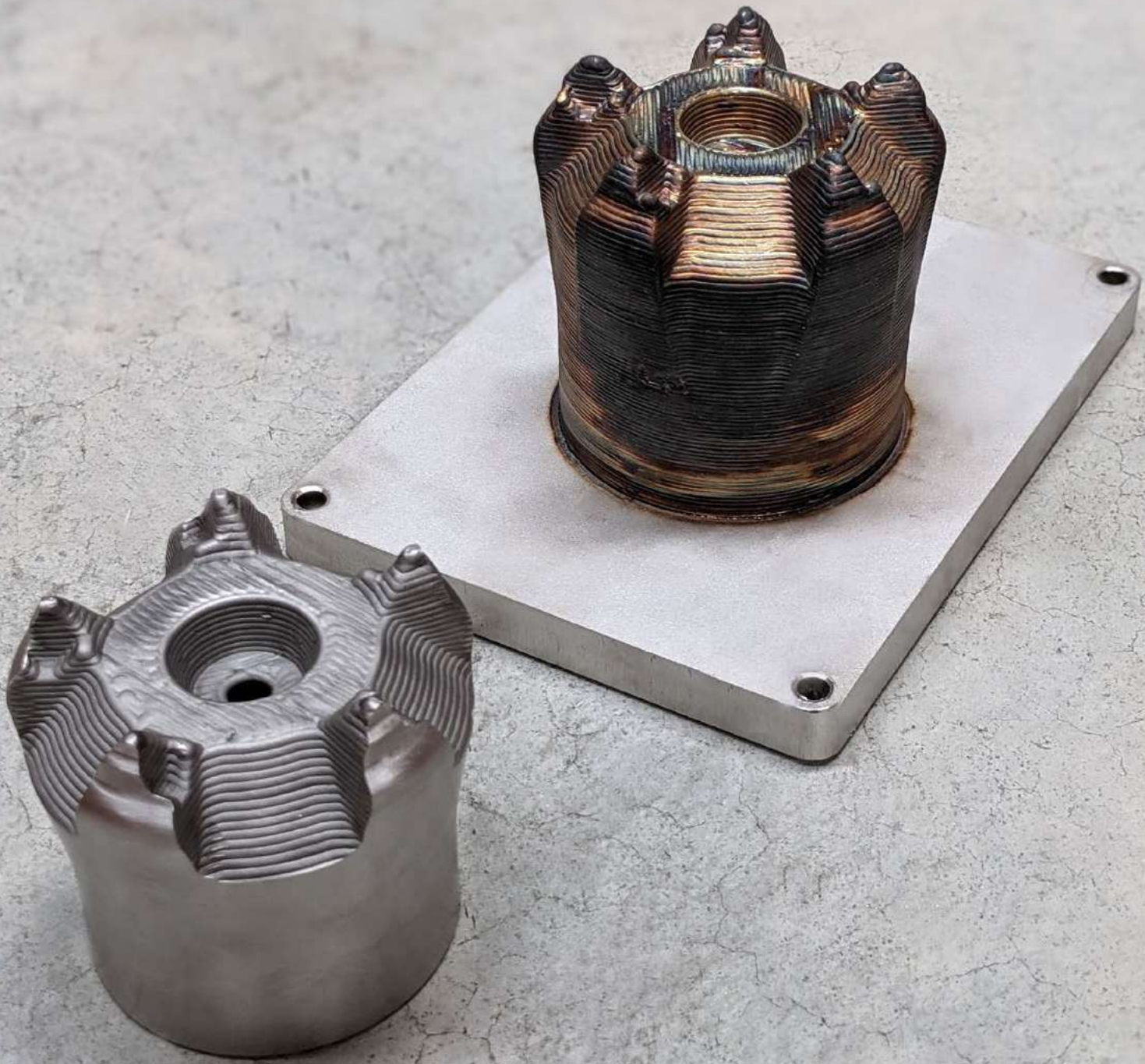
Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 56.72	$ 56.72
Gas	$ 24.09	$ 13.73
Electricity	$ 6.54	$ 6.54


Print Time: 10 h 5’


Print Cost: $ 87.35
(50L Gas Bottle)


Print Cost: $ 76.99
(Liquified Gas)



Glass Mold Core

Manufacturing

Half of a mold for the glass bottle manufacturing industry. Has a fairly complicated geometry made with a difficult material to machine to ensure longer lifetimes. This part would normally be cast, therefore long lead-times and high up front investment. Meltio's LMD process offers unparalleled flexibility and impact to the company's bottom line in terms of part cost and lead time.

Size: 158.5 x 79.31 x 144.3 mm
Weight: 6 kg
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm
Post-processing: CNC Machining

Business Case

Drivers:


Lead Time


Small Batch Production


Make it in Longer Lasting Materials


Difficult to Machine

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 138.94	$ 138.94
Gas	$ 69.93	$ 37.15
Electricity	$ 19.30	$ 19.30


Print Time: 24h


Print Cost: $ 228.24
(50L Gas Bottle)


Print Cost: $ 195.48
(Liquified Gas)

Piston Prototype

Automotive

Converts heat energy into linear motion inside automotive engines. Traditionally made by casting in large lot sizes, requires precision machining. Meltio enables rapid manufacturing of single quantity prototypes with minimum material waste and increased design freedom.

Size: 52 x 29 ø mm
Weight: 756 g
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm
Post-processing: CNC Machining

Business Case

Drivers:


Lead Time


Cost


Difficult to Machine

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 8.64	$ 8.64
Gas	$ 5.15	$ 2.72
Electricity	$ 2.10	$ 2.10


Print Time: 3 h 30’


Print Cost: $ 15.89
(50L Gas Bottle)


Print Cost: $ 13.46
(Liquified Gas)

Gas Turbine Fan Blade

Oil & Gas

Converts the expanding gas into rotational force inside a turbine to generate electricity. It is a very complex geometry made out of a difficult to machine material. Additive manufacturing affords greater geometry freedom which can increase process efficiency, whilst streamlining the supply chain by removing the mold-making and casting process; within a single gas turbine many different blade geometries are found further compounding the business case for Meltio Metal 3D Printing process.

Size: 35 x 75 x 135 mm
Weight: 1.11 kg
System: Meltio M450

Material: Inconel 718
Gas: Argon
Layer Height: 1 mm
Post-processing: CNC Machining

Business Case

Drivers:

Difficult to Machine Material

Supply Chain

Complex Geometry

Cost Scenarios:

	1. 50L Gas Bottle	2. Liquified Gas
Material	$ 127.14	$ 127.14
Gas	$ 4.67	$ 3.71
Electricity	$ 1.89	$ 1.89

Print Time: 3 h 10’

Print Cost: $ 133.70
(50L Gas Bottle)

Print Cost: $ 132.74
(Liquified Gas)

Watch Bezels

Jewelry

Holds watch mechanics and electronics, mass manufactured with highly sophisticated design and surface requirements. Difficult and very expensive to machine material for a high volume product, leading to cost savings due to the huge amount of lost material because of its low net weight geometry. Subtractive manufacturing cannot leverage high material removal rates due to the small feature size, further complicating the business case for traditional manufacturing.

Size: 53.37 x 44,59 x 10.85 mm
Weight: 155.93 g / 29.22 g per part
System: Meltio M450

Material: Titanium 64
Gas: Argon
Layer Height: 0.8 mm
Post-processing: CNC Machining

Business Case

Drivers:

Cost Savings

Reduce Scrap

Difficult to Machine Material

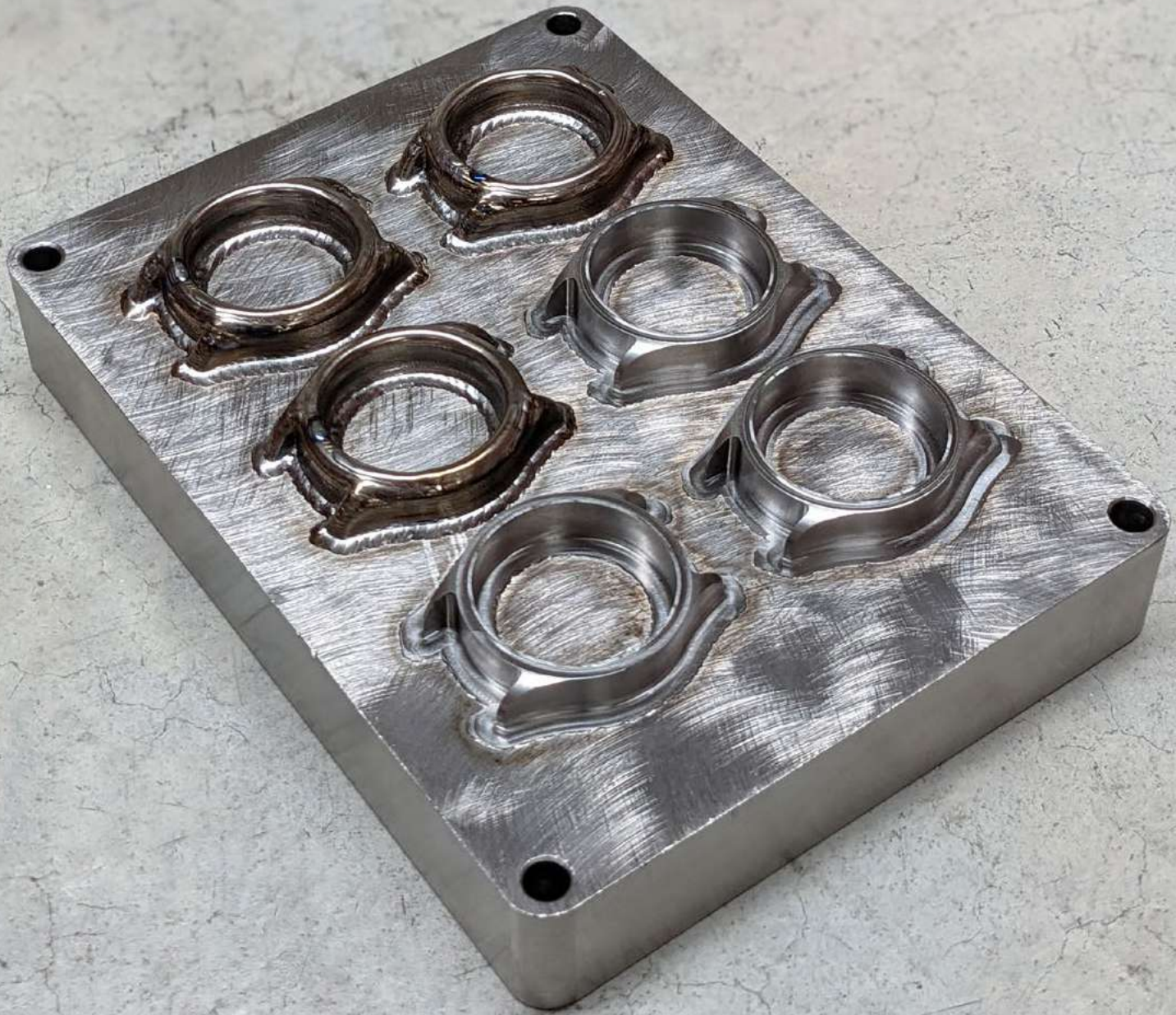
Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 12.86	$ 12.86
Gas	$ 33.36	$ 17.94
Electricity	$ 3.40	$ 3.40

Print Time: 5 h 40’
56’ per part

Print Cost: $ 49.62
$ 8.26 per part
(50L Gas Bottle)

Print Cost: $ 34.20
$ 5.70 per part
(Liquified Gas)



Spline Shaft

Mining

Industrial component for torque transmission in heavy equipment. A low volume component which is hollow and difficult to machine, due to its geometry and material. Production time and cost in traditional manufacturing are 10x higher. The machining of the near-net-shape component can be done quickly and cheaply as only certain critical areas need machining.

Size: 132 x 132 x 193 mm
Weight: 6.6 kg
System: Meltio M450

Material: Stainless Steel 308
Gas: Argon
Layer Height: 1.2 mm

Business Case

Drivers:

Lead Time

Cost

Difficult to Machine Geometry

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 75.85	$ 75.85
Gas	$ 44.19	$ 24.45
Electricity	$ 18	$ 18

Print Time: 30 h

Print Cost: $ 138.04
(50L Gas Bottle)

Print Cost: $ 118.30
(Liquified Gas)

Knee Implant

Medical

Medical component traditionally made from machining a billet of titanium which is a wasteful, time consuming and expensive process (tool wear). Also typically printed with SLM which reduces the post-processing but maintains a high component cost, Meltio enables low component cost by quickly producing a near net shape which can be machined in a cost-effective manner.

Size: 99 x 77 x 51 mm
Weight: 410 g
System: Meltio M450

Material: Titanium 64
Gas: Argon
Layer Height: 1.2 mm
Post-processing: CNC Machining

Business Case

Drivers:

Cost Savings

Low Batch Production

Difficult to Machine Material

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 57.29	$ 57.29
Gas	$ 38.3	$ 20.26
Electricity	$ 3.90	$ 3.90

Print Time: 2 h

Print Cost: $ 99.49
(50L Gas Bottle)

Print Cost: $ 81.45
(Liquified Gas)

Airfoil Cooling Blade

Energy

Cooling blade found on the hub of a multi-megawatt power plant generator. Forces air into the generator's housing to remove waste heat. Replaces complex welded assembly with large potential for manufacturing errors, allows for a better-optimized blade geometry and weight reduction, which increases generator efficiency.

Size: 200 x 152 x 55 mm
Weight: 516 g
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.5 mm
Post-processing: Polishing

Business Case

Drivers:


Lead Time


Replaces Complex Assembly


Lightweight


Optimized Geometry

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 9.85	$ 9.85
Gas	$ 9.04	$ 4.95
Electricity	$ 2.5	$ 2.5


Print Time: 3 h 50'


Print Cost: $ 21.39
(50L Gas Bottle)


Print Cost: $ 17.30
(Liquified Gas)

Aircraft Engine Mount

Aerospace - CiTD

"*Engine Mounts are high-performance structures that must withstand extreme loads and fatigue requirements. CiTD is developing new additive manufactured engine mounts for the new generation of electric A/C with high performances and reduced mass. Meltio's technology makes it happen on time, cost and quality. It has been developed under H2020 AMABLE program.*"

Marta García - CiTD Engineering & AM Director

Size: 95.6 x 95.6 x 215.75 mm
Weight: 502 g
System: Meltio M450

Material: Titanium 64
Gas: Argon
Layer Height: 1.2 mm
Post-processing: CNC Machining

Business Case

Drivers:

Difficult to Machine

Lead time

Lightweight

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 41.24	$ 41.24
Gas	$ 22.59	$ 11.95
Electricity	$ 2.30	$ 2.30

Print Time: 3 h 50'

Print Cost: $ 66.13
(50L Gas Bottle)

Print Cost: $ 55.49
(Liquified Gas)

Injection Mold Half

Manufacturing

Tool for high pressure injection molding of plastic components. Very difficult to machine geometry due to poor tool access to occluded areas requiring the use of small tools which have low material removal rates. Due to high mass and density not suitable for powder metal printing while fine features limits the effectiveness of WAAM. Meltio produces the part at a low cost with minimum post-processing requirements.

Size: 140 x 140 x 297 mm
Weight: 15 kg
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm

Business Case

Drivers:

Difficult to Machine

Lead time

Complex Geometry

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 171.43	$ 171.43
Gas	$ 103.17	$ 56.89
Electricity	$ 42.02	$ 42.02

Print Time: 70 h

Print Cost: $ 316.62
(50L Gas Bottle)

Print Cost: $ 270.34
(Liquified Gas)

Concrete Bagging Nozzle

Mining

Wear part used for fillings bags with cement. Production quantity too low to justify casting, very complex geometry to machine due to hard material requirements, high aspect ratio holes (hollow) and irregular surface which require the use of milling, rather than turning, using long tools with low removal material rates further increasing the cost of the component. Meltio delivers a 10x cost reduction for this low-volume application.

Size: 99 x 116 x 258 mm
Weight: 1.78 kg
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm

Business Case

Drivers:


Lead Time


Complex Geometry


Low Volume


Difficult to Machine


Cost

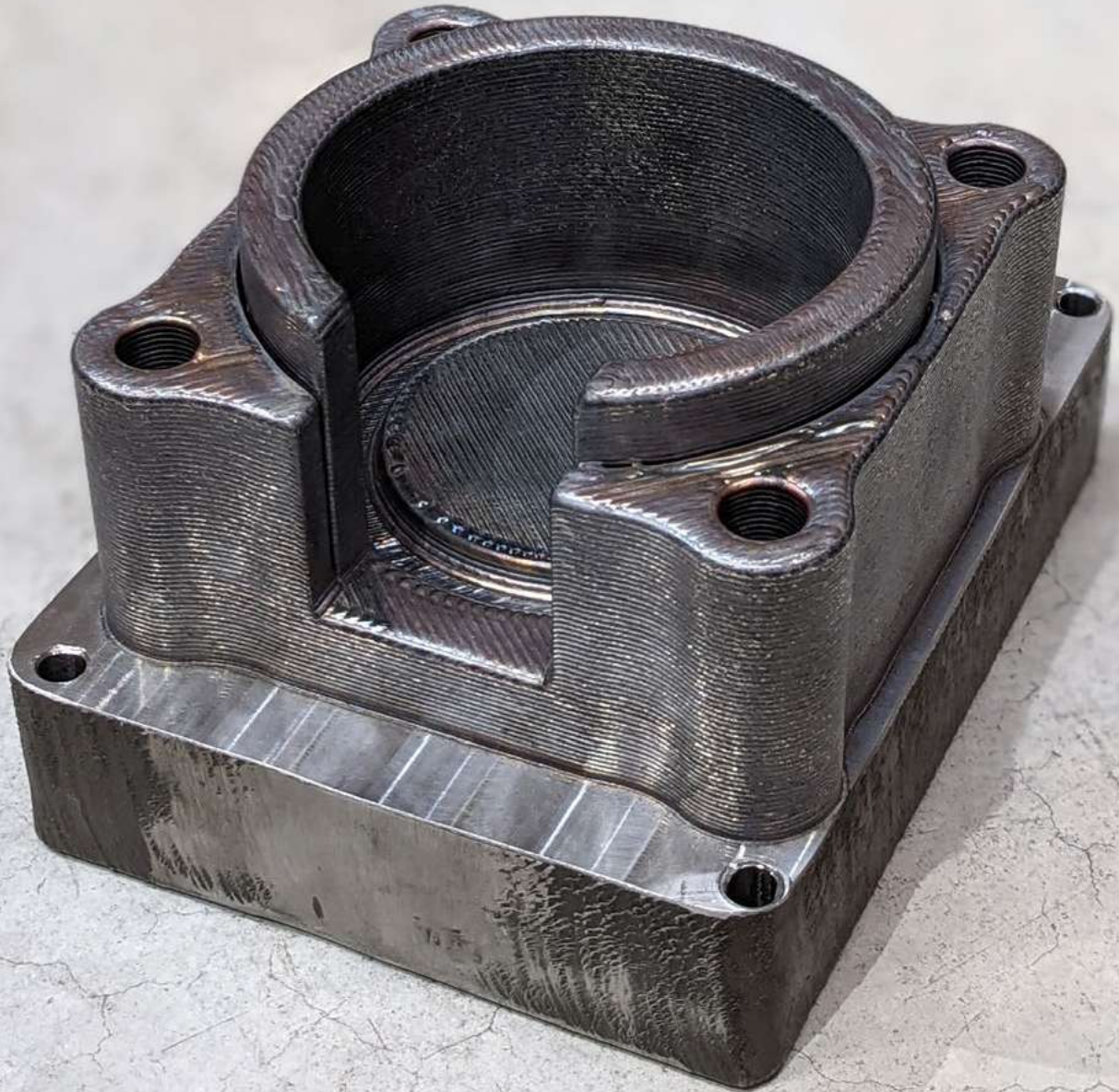
Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 20,17	$ 20.17
Gas	€ 18.19	$ 9,64
Electricity	$ 3.75	$ 3.75


Print Time: 6 h 15’


Print Cost: $ 42.52
(50L Gas Bottle)


Print Cost: $ 34.17
(Liquified Gas)



Prototype Bearing Block

Mining

Component that holds bearing in place as part of a concrete manufacturing plant. This is a wear component that is required for the production plant to operate. Digital manufacturing enables the optimization of stock and a cost-effective production of replacement parts. A heavy and bulky geometry like this one would not be cost-effective for powder metal 3D printing while machining would require warehousing of stock billets of the correct size and would lead to significant material waste.

Size: 143 x 143 x 75 mm
Weight: 6.5 kg
System: Meltio M450

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm

Business Case

Drivers:


Lead Time


Low Volume


Spare Parts


Difficult to Machine

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 73.57	$ 73.57
Gas	$ 50.31	$ 28.75
Electricity	$ 14.64	$ 14.64


Print Time: 24 h 38’


Print Cost: $ 138.52
(50L Gas Bottle)


Print Cost: $ 116.96
(Liquified Gas)

Turbo Impeller

Automotive

Converts exhaust gas pressure into rotary motion in turbo machinery. Traditionally made by casting in large lot sizes, requires precision machining. Meltio enables rapid manufacturing of single quantity prototypes with minimum material waste and increased design freedom.

Size: 140.3 x 140.3 x 47.7 mm
Weight: 1.85 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.6 - 1.2 mm

Business Case

Drivers:


Prototyping


Lead Time


Cost


Difficult to Machine

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 20.93	$ 20.93
Gas	$ 8.92	$ 6.26
Electricity	$ 3.44	$ 3.44


Print Time: 5 h 48’


Print Cost: $ 33.31
(50L Gas Bottle)


Print Cost: $ 30.12
(Liquified Gas)

Helical Coil

Oil & Gas

Technology demonstrator to showcase the wide process window of the Meltio Engine Robot Integration. The uniqueness of this 3D printed feat lies in non-planar slicing, optimizing the thicknesses of each point within an individual layer. This approach to slicing lends itself to many complex geometries in five axis additive manufacturing.

Size: 60 Ø mm pipe, 354 x 376 x 525 mm
Weight: 3.56 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.4 - 0.8 mm
Post-processing: Polishing

Business Case

Drivers:

Complex Geometry

Low Volume

Difficult to Machine

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 44.45	$ 44.45
Gas	$ 16.07	$ 8.49
Electricity	$ 8.18	$ 8.18

Print Time: 13 h 46’

Print Cost: $ 68.70
(50L Gas Bottle)

Print Cost: $ 61.12
(Liquified Gas)

Naval Propeller

Marine

Five bladed propeller for midsize commercial vessel. Traditionally, after casting the part would undergo a machining and polishing step to meet the requirements of the marine industry. Meltio's process allows to forego the expensive and time enable process whilst improving on the accuracy of the near net shape to be post-processed, allowing manufacturers to quickly innovate with extremely low overhead.

Size: 600 Ø mm, 250 mm
Weight: 12.1 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.6 - 1.2 mm
Post-processing: Polishing

Business Case

Drivers:


Lead Time


Complex Geometry


Cost

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 151.04	$ 151.04
Gas	$ 50.96	$ 31.89
Electricity	$ 25.95	$ 25.95


Print Time: 43 h 40'


Print Cost: $ 227.97
(50L Gas Bottle)


Print Cost: $ 208.88
(Liquified Gas)

Overhang Test

Design to showcase Meltio's capabilities in printing with the deposition head oriented non-vertically. Meltio's process remains stable even when printing at angles greater of 90 degrees as surface tension is the dominating force. Powder LMD alternatives often cannot work at the angles required by this geometry. This feature is particularly interesting for repairing parts that cannot be easily positioned such as large molds by allowing for in situ repair.

Size: 350 Ø mm, 180 mm
Weight: 2.14 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.6 mm

Business Case

Drivers:

Difficult to access

Repair applications

Feature Addition

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 26.71	$ 26.71
Gas	$ 7.48	$ 4.61
Electricity	$ 3.81	$ 3.81

Print Time: 6 h 26'

Print Cost: $ 38.01
(50L Gas Bottle)

Print Cost: $ 35.13
(Liquified Gas)

Spherical Tank

Oil & Gas

Pressure vessel for aerospace applications which contains propellants in liquid form. A near perfect spherical shape is required due to the large forces acting on the tank. 3D printing with laser metal deposition offers clear advantages over traditional manufacturing in terms of design freedom, material savings and overall part production cost. Specifically, Meltio's wire process allows for more precise deposition of material with less heat input leading to thinner walled tanks.

Size: 500 Ø mm sphere
Weight: 29.6 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 1.2 mm

Business Case

Drivers:

Difficult to process material

Lead Time

Complex Geometry

Cost

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 369.48	$ 369.48
Gas	$ 90.60	$ 59.01
Electricity	$ 48.34	$ 48.34

Print Time: 81 h 20'

Print Cost: $ 512.75
(50L Gas Bottle)

Print Cost: $ 476.83
(Liquified Gas)

Topology Optimized Beam

Construction

High-performance structural member for light-weight construction environments. Optimization of its profile allows for the creation of higher strength to weight components for a variety of industries without the inherent size constraints of powder bed additive manufacturing systems. The precise laser wire process enables the production of parts that require minimal post machining.

Size: 170 x 130 x 900 mm
Weight: 5.95 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: 0.6 mm

Business Case

Drivers:


Cost


Complex Geometry


Weight Reduction


Material Savings

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 74.27	$ 74.27
Gas	$ 22.27	$ 13.62
Electricity	$ 11.34	$ 11.34


Print Time: 19 h 5’


Print Cost: $ 107.90
(50L Gas Bottle)


Print Cost: $ 99.23
(Liquified Gas)

Engine Manifold

Motorsport

Guides gases from engine to exhaust. To achieve the highest performance the manifold needs to be optimized continuously. 3D printing allows unparalleled geometry freedom and avoids multiple welds and complex manual setups for the low volumes of motorsport production quantities. Meltio's wire LMD process is unique as it enables 3D printing of very smooth walls on large components while avoiding internal support structures by using 5 axis.

Size: 205 x 360 x 473 mm
Weight: 5.22 kg
System: Meltio Engine
Robot Integration

Material: Stainless Steel 316L
Gas: Argon
Layer Height: variable layer height

Business Case

Drivers:

Low Volumen Production

Geometry Optimization

Workflow Automation

Cost Scenarios:

	50L Gas Bottle	Liquified Gas
Material	$ 65.16	$ 65.16
Gas	$ 50.90	$ 26.92
Electricity	$ 11.52	$ 11.52

Print Time: 19 h 23'

Print Cost: $ 127.58
(50L Gas Bottle)

Print Cost: $ 103.60
(Liquified Gas)

Laser Metal Deposition

Laser Metal Deposition is a Directed Energy Deposition (DED) process that functions by precisely stacking weld beads on top of one another .
Meltio's multi-metal 3D printing technology comes packaged in a compact deposition head, host of multiple lasers, and capable of processing wire and powder simultaneously.

Single and Dual Metal 3D Printing

Single Wire

The bulk of the 3D printing process is built around wire, the safest, cleanest, and easiest to work with metal feedstock.

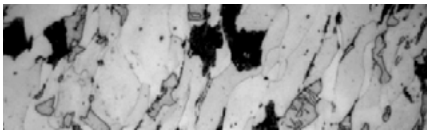
Dual Wire

Combine different metal materials in a single part. The wire switching process is quick, automatic, and clean.

Wire and Powder

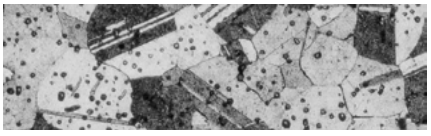
Create new alloys on the fly, testfunctional gradients and research metal matrix composites (MMC).

Open Material Platform



Stainless Steels

Excellent strength and corrosion resistance.



Mild Steel

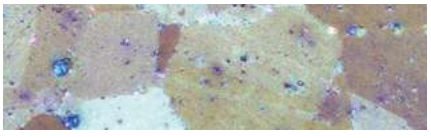
Cheap and ductile, with unparalleled machinability and weldability.

Carbon Steels

High impact strength, retain hardness at high temperatures.

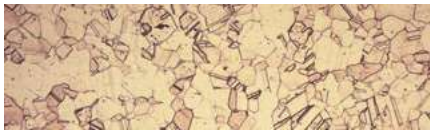
Titanium

Highest strength to weight ratio and corrosion resistance.



Inconel

High versatility, outstanding heat and corrosion resistance.



Copper

Under development.

Meltio M450

Designed for industry without the need for industrial infrastructure; affordable, reliable, safe and easy to use metal 3D printer. Ideal for small to medium size part fabrication, and multi-metal 3D printing research.

Reliable
The metal 3D printing process is monitored in real-time and compensated if required by process control.

Easy to use
Automatic toolpath generation and material print profiles supplied by Meltio make for a plug-and-play experience.

Safe
Suitable for any environment thanks to a process built around wire, a sealed chamber and a built-in 3 stage filter.

Affordable
The low capital and running costs of the Meltio M450 make metal 3D printing of conventional parts possible.

Technical Specifications

Dimensions (W*D*H): 560 x 600 x 1400 mm

Print Envelope (X*Y*Z) :150 x 170 x 425 mm

Weight: 293 kg

Laser Power: 1200 W

Laser Type: Six 200 W direct diode lasers

Laser Wavelength: 976 nm

Interface:USB, ethernet, wireless datalink

Enclosure: Laser- safe, sealed,controlled atmosphere.

Process Control: Cosed-loop laser and wire modulation.

Power Input: 208/230 V single phase or 400 V three phase.

Power Consumption: 2-5 kW peak depending on selected options.

Cooling: Active water-cooledchiller included.

Meltio Engine

Advanced control module for fitting existing CNC and robotic equipment with Meltio technology.Turn any motion platform into a metal 3D printing system with no inherent size constraints.

Geometry Freedom
Create highly complex parts with machining tolerances in the same process.

Retrofitting
Provide new capability to any CNC and robot arm by turning it into a metal 3D printing system.

Part Repair
Cost-effective component repair, part augmentation and feature addition.

Large Scale
No inherent constraints when the working envelope is only limited by the size of the motion system.

Technical Specifications

Dimensions (W*D*H): 390 x 700 x 1025 mm

Weight: 146 kg

Laser Type: Six 200 W direct diode lasers

Power Input: 208/230 V single phase or 400 V three phase

Interface: USB, ethernet, wireless datalink

Print Envelope (X*Y*Z): Inherent to motion system

Laser Power: 1200 W

Laser Wavelength: 976 nm

Process Control: Closed-loop laser and wire modulation

Power Consumption: 2-5 kW peak depending on selected options

Cooling: Active water-cooled chiller included

Meltio Engine CNC Integration

The most affordable hybrid manufacturing solution, fitting almost any CNC machine in the market. Enable 3D printing and machining of complex geometries in a single process step.

CNC Integration Hardware

Dimensions (W*D*H):
Retracted 255 x 320 x 872 mm
Unretracted 255 x 320 x 1045 mm

Weight: 46.5 kg

Meltio Engine Robot Integration

Unlock geometry freedom in part size and complexity by integrating Meltio with a Robotic Arm. The cost-effective solution for large metal part manufacturing.

Robot Integration Hardware

Dimensions (W*D*H):
202 x 297 x 784 mm

Weight: 15.5 kg

MELTIO

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