

SPEE3D

Metal Additive Manufacturing *The Opportunity in Heavy Industry*



Business Pressures Demand an Innovative Approach to Spare Parts

Businesses in industries such as defense, mining, oil and gas, heavy equipment, and heavy manufacturing are in a tough position. Like other businesses, they face challenges created by geopolitical conflicts, economic uncertainty, supply chain disruptions, labor shortages, and fast-changing customer demands. At the same time, they must deal with challenges ranging from remote work locations and tumultuous markets for their products to public perception of their operations.

Together, these challenges make it very difficult to achieve the levels of profitability, resilience, and sustainability needed to meet shareholder demands and improve their image.

No company can control the macro-level challenges that affect businesses globally. But businesses in heavy industry can resolve day-to-day challenges related to spare parts in a way that helps them achieve their business goals.

“Spare parts are sometimes small in size, but they create big financial, operational and environmental issues.”



Spare Parts Come With Too Many Costs

Maintaining a vast inventory of spare parts comes at a significant cost:



FINANCIAL COST

Storing spare parts eats into profits, but so do breakdowns.

In harsh industrial environments, parts wear faster and corrode sooner, which means they must be replaced and repaired more often. To anticipate any conceivable need, many companies store massive inventories of spare parts worth tens or hundreds of millions of dollars at or near their facilities. The pre-emptive move is understandable. The cost of lost production and unplanned downtime can quickly reach hundreds of thousands of dollars.



OPERATIONAL COST

Business resilience relies on spare parts that can be difficult to access.

In heavy industry, operations and assets are often situated in remote areas, making it difficult to access traditional manufacturing and supply chains for spare parts and components. Getting spare parts where they're needed is a complex and time-consuming process. Supply chains can be disrupted by global events, and there are numerous logistical difficulties transporting parts to remote locations in a timely way. If spare parts aren't available when needed, productivity slows and can grind to a halt.



ENVIRONMENTAL COST

Transporting spare parts long distances increases carbon emissions.

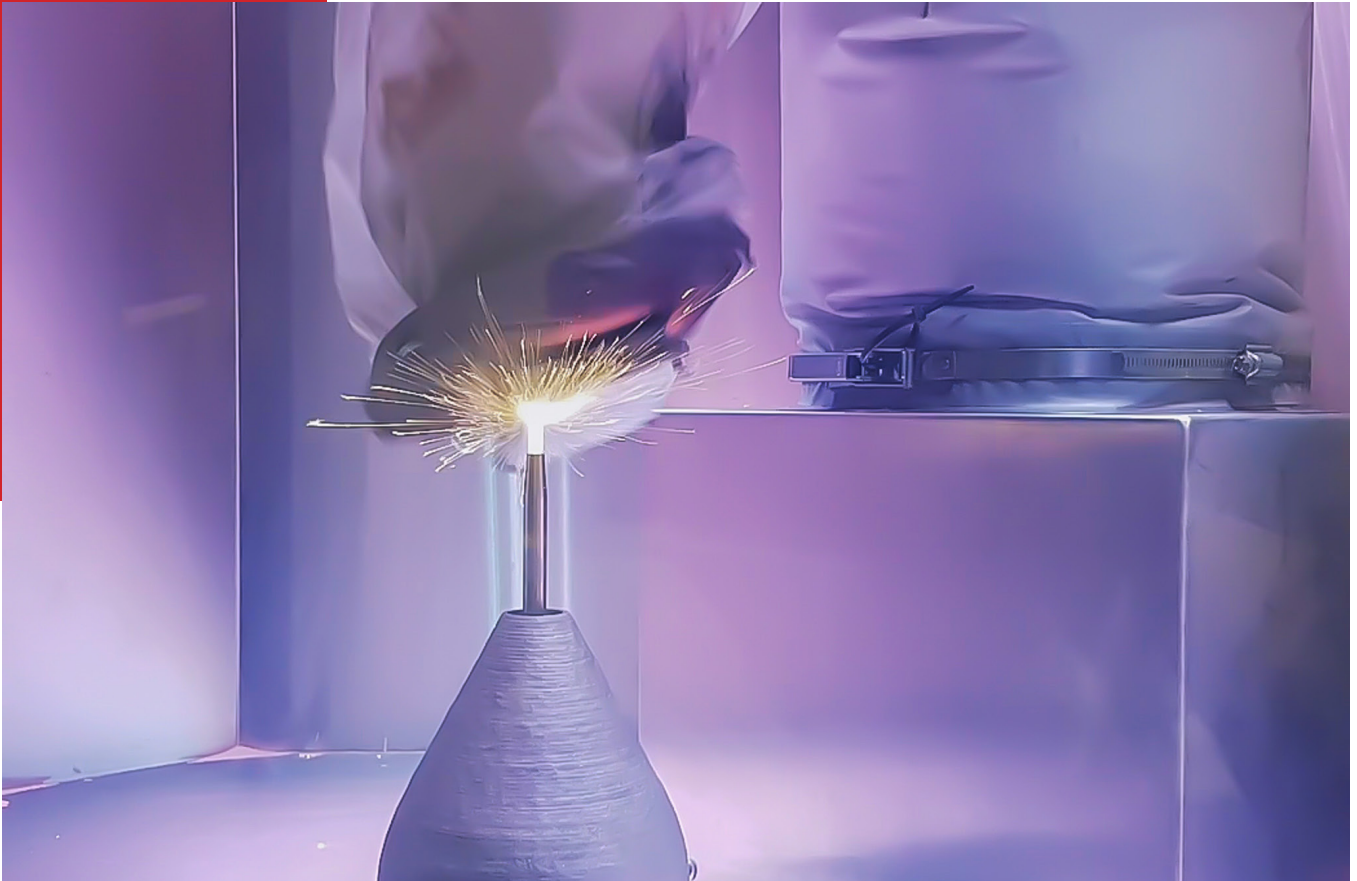
It's difficult for businesses to prove they're committed to reducing their carbon footprint when thousands of spare parts are being transported long distances by air, land, or both. The need to construct, heat, and cool massive storage facilities for spare parts further erodes sustainability credentials.

Local Manufacturing Reduces Risks and Costs

There's an easy solution to these challenges: Introduce metal additive manufacturing (AM) – metal 3D printing – at the right point in the supply chain so select metal spare parts and tools can be manufactured much closer to where they're needed.

With the cutting-edge metal 3D printing solutions available from SPEE3D today, businesses have a safe and affordable way to quickly and easily print robust metal parts and tools where it makes the most sense for their operations – whether that's at their sites, or at warehouses, machine shops, or repair facilities that support one or more sites. At the same time, they can modernize their operations to meet increasingly aggressive business and environmental targets.

The best way to discover what's possible with SPEE3D's innovative approach to metal 3D printing is to see our solution in action. [Contact us](#) to arrange a demonstration or [visit our website](#) to learn more.



Cold Spray Vs Traditional Metal AM

With on-demand metal 3D printing, businesses have new flexibility to manufacture a wide variety of the spare parts and tools needed to operate and maintain equipment, vehicles, and infrastructure. If the parts are not safety-critical and are not overly detailed or intricate in design, dense and strong replacement parts can now be printed.

Metal 3D printing technology layers metal materials on top of one another based on a digital design to build up a complex metal part or tool. The technology is evolving rapidly, and it's important to focus on advances in layering techniques as they provide business-critical benefits.

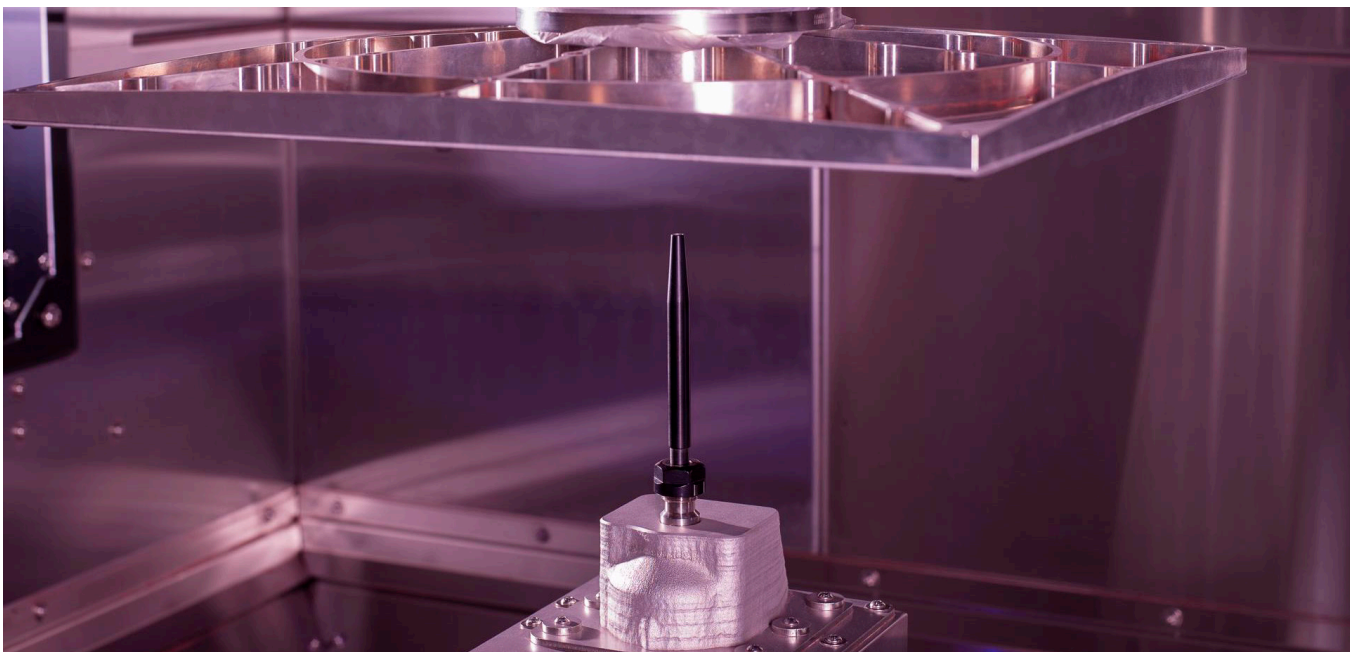
SPEE3D Cold Spray Offers Important Advantages Over Other Techniques

Cold spray technology is the best example. With SPEE3D solutions that feature this innovative layering technique, oil and gas companies and their suppliers can print stronger, more durable metal parts and tools than they can with traditional layering methods. And they can print those pieces faster, safer, and more affordably, using a wider range of materials. The technique is proven to be highly effective and is trusted by leading defense organizations to produce metal parts and tools that can withstand harsh environments on land and at sea.

In cold spray technology, metal particles are accelerated to supersonic speeds and sprayed onto the substrate to build up the layers of the part. When the particles hit the substrate at high velocity, they undergo plastic deformation, a permanent distortion that causes them to bond extremely tightly to one

another. This solid-state deposition process provides key benefits compared to other metal 3D printing processes:

- ❑ **Lower porosity, higher density parts.** With cold spray technology, there's no need to melt or sinter metal powders, a process that can create tiny cavities that reduce the density of the part and increase the likelihood of cracking or fatigue failure over time. The high-velocity impact created with cold spray technology results in a denser part with lower porosity and enhanced mechanical properties to help ensure reliable operation of parts and tools over a longer lifespan.
- ❑ **Less cracking, warping, and thermal distortion.** Cold spray technology does not use the extreme heating and cooling processes that cause parts to expand and contract. That means there are far fewer residual stresses on the part, and significantly less risk it will crack, warp, or become distorted during production. As a result, reliable, high-quality parts and tools can be produced without wasting time, energy, or materials printing pieces that are defective or unusable.
- ❑ **Far faster 3D printing speed.** The supersonic speeds used in cold spray technology are considerably faster than other additive manufacturing techniques. In addition, the overall process is orders of magnitude faster than traditional metal manufacturing methods. With faster print speeds, maintenance and repairs can be completed sooner and there's less risk of costly downtime.
- ❑ **More choice of materials, which means more parts can be printed.** A wider range of metal powders can be used with cold spray technology than with traditional metal 3D printing. For example, parts can be created using aluminum, copper, stainless steel, aluminum bronze, and other alloys. This flexibility allows a more diverse range of parts and tools to be printed, increasing the value of the solution and accelerating return on investment.
- ❑ **Safer metal 3D printing.** Unlike other metal additive manufacturing approaches, cold spray technology requires no dangerous or expensive inert gases or lasers. The process simply compresses and accelerates the air in the room, using kinetic energy to build up the metal part. That means cold spray metal 3D printing solutions can be deployed to a wider range of locations with far fewer risks to human and operational safety.





Achieve Your Business Goals with SPEE3D

The advantages described in the previous section help to overcome day-to-day tactical challenges related to spare parts. However, they also offer important strategic benefits that help to reduce costs and risks while increasing resilience and sustainability.

Control Costs and Profitability

Fluctuating raw material prices and increased operational costs put pressure on businesses to find innovative ways to control expenses and maintain profitability.

With the ability to manufacture a wide variety of spare parts much closer to where they're used, fewer parts need to be manufactured in far-off locations, transported to remote sites, and stored. These efficiencies slash the cost of the entire supply chain.

▣ Immediate Availability

Our on-demand spare part production capabilities ensure that essential components are available when and where they are needed most. Say goodbye to lengthy lead times and costly delays associated with traditional supply chains.

In addition, because spare parts can be rapidly produced on demand, the costs for maintenance and repairs to mining equipment, vehicles, and infrastructure drop. There's no need to spend time and money sourcing the right parts, wait out lengthy delivery timelines, or pay premium costs for rush deliveries.

❑ **Cost-Effective Solutions**

Our efficient metal additive manufacturing process optimizes costs, allowing you to allocate resources more strategically and maintain profitability even during challenging times.

❑ **Enhanced Equipment Uptime**

In competitive and demanding industrial environments, downtime is a costly adversary that directly impacts the bottom line. Equipment breakdowns can bring operations to a grinding halt, resulting in significant financial losses and missed opportunities.

SPEE3D technology empowers you to take charge of equipment maintenance and repairs with unprecedented efficiency. The ability to rapidly replace worn or damaged parts enables smoother maintenance routines, reducing the overall duration of scheduled downtime. With improved equipment uptime, you can maximize the productivity of your operations and seize every revenue-generating opportunity.

❑ **Supply Chain Resilience**

The global supply chain is susceptible to disruptions beyond our control. Geopolitical conflicts, natural disasters, and unforeseen events can lead to delays and uncertainty in parts procurement. By embracing in-situ spare part production, you fortify your operations with a reliable, localized supply chain. No longer will you be at the mercy of external factors; instead, you will possess the flexibility and resilience needed to stay ahead in an ever-changing industry.

❑ **Customization and Adaptability**

Our metal additive manufacturing technology empowers you to design and produce customized spare parts tailored precisely to your equipment specifications. This adaptability allows you to continuously optimize your machinery's performance, ultimately extending its lifespan and reducing the frequency of breakdowns. Customized spare parts also enable you to keep pace with technological advancements and enhance equipment efficiency.

❑ **Long-Term Savings**

While upfront investments in advanced technology may raise eyebrows, once amortized over the life of a project the cost per kilogram for parts is one of the lowest available and the long-term financial benefits of reduced downtime and enhanced operational efficiency are undeniable. By embracing our metal additive manufacturing solution, you invest in your mining operations' sustainability and profitability, securing a brighter and more lucrative future for your business.

❑ **More control**

The ability to produce spare parts, when and where you need them, empowers you to optimize equipment uptime, minimize financial losses, and maximize profits. Embrace the future of spare part production and seize the competitive advantage that comes with being the master of your mining destiny.

Reduce Carbon Footprint and Waste

Getting spare parts to a remote site generates a lot of carbon, whether it's making them to begin with, transporting them, building facilities to store them in, storing them or transporting them rapidly in emergencies. Producing only what you need, right where you need it, is the only way to guarantee minimum carbon production.

The rapid production of parts in situ (on-site) compared to relying on the global supply chain, results in:

❑ **Reduced Carbon Emissions**

Rapid on-site production of parts significantly reduces the need for long-distance transportation of spare parts. Shipping parts globally involves burning fossil fuels, which contributes to carbon emissions and environmental pollution. By manufacturing parts locally, the carbon footprint associated with transportation is substantially reduced.

❑ **Minimized Packaging and Waste**

Traditional spare parts delivered through the global supply chain often come with extensive packaging to ensure safe transport. On-site production eliminates the need for excessive packaging, leading to reduced waste and environmental impact.

❑ **Lower Energy Consumption**

Local manufacturing of parts on-site can be more energy-efficient compared to the energy-intensive transportation involved in the global supply chain. Additionally, advancements in metal additive manufacturing technologies, like cold spray technology, enable faster, more efficient production, further reducing energy consumption.

❑ **Conservation of Resources**

On-site production allows for better resource management since parts can be manufactured in real-time as needed. There is less need for massive warehousing and stockpiling of spare parts, reducing the demand for raw materials and resources.

❑ **Enhanced Sustainability Credentials**

Adopting a technology that enables on-demand part production showcases a commitment to sustainability and environmental responsibility. Businesses can improve their sustainability credentials by minimizing their contribution to the carbon footprint associated with transportation and logistics.

❑ **Sustainable Materials and Consumables**

Cold-spray metal additive manufacturing allows for a wider range of material choices, including recycled or sustainable materials. With SPEE3D equipment companies can opt to use more environmentally friendly materials, consumables, and energy sources, further promoting eco-conscious practices.

❑ **Local Community Benefits**

On-site parts production supports the local economy and community by creating job opportunities and reducing dependence on external suppliers. This localized approach contributes to regional development and can increase community support for industrial operations.

❑ Part Durability

Thanks to the advanced cold spray technology, parts and tools produced are durable enough to be repaired, restored, and modified if needed. This robust construction extends the lifespan of printed components to eliminate the need for early replacements and minimize waste.

These efficiencies help businesses prove to shareholders, customers, and the public they are strongly committed to sustainable operations and minimizing environmental impact.

Increase Operational Resilience

The vehicles, equipment, and infrastructure used in heavy industry are often located in harsh environments, leading to frequent wear and tear of parts. Timely maintenance and repairs are crucial to ensuring continuous operations, but sourcing and replacing damaged parts can be challenging and time-consuming. Businesses rely on complex global supply chains to source equipment and spare parts, but geopolitical conflicts, natural disasters, and other disruptions can impact the timely delivery of essential components and negatively affect operations.

Fast access to very high-quality parts and tools helps maintenance staff and mechanics keep assets and operations running at peak performance at all times. This helps to ensure promises made to customers can be kept, to avoid the risk of contract penalties and poor perception that can affect stock prices and customer loyalty.



Applications Examples

The Potential for On-Demand Metal 3D Printing in Heavy Industry

Each company will have metal 3D printing requirements that are unique to its area of business, site(s), operations, and goals. However, there are a number of general examples that provide a glimpse into the potential additive manufacturing provides.

For example, to support operations on land and at sea, parts and tools can be printed for:

- ❑ Vehicles such as trucks, construction equipment, and forklifts
- ❑ Equipment such as production machines, motors, generators, pumps, and tools
- ❑ Infrastructure such as buildings, staff accommodations, water and sewage facilities, and elevators

Metal additive manufacturing is also an ideal way to help staff work more efficiently and effectively. For example, it can be used to:

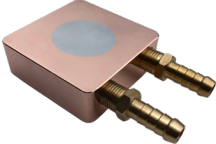
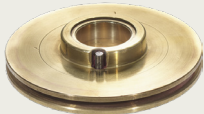



Rapidly prototype new parts and tools so their design and functionality can be validated without the time and high costs of small-batch manufacturing in far-off locations.

Create jigs, fixtures, and aids that simplify and accelerate machine shop tasks.



The Speed and Flexibility of Cold Spray

The range of parts and tools that can be produced with mobile metal 3D printing solutions that use cold spray technology is very broad, and can include parts as small as door latches and brackets to large parts that weigh dozens of kilograms. Here are just a few examples that highlight the flexibility and efficiency these solutions provide.

		Material	Print time	Weight
	Cooling Block	Copper and Aluminum 6061	10 minutes	1kg/2.2lbs
	Flywheel	Aluminum bronze	25 minutes	2.5kg/5.5lbs
	Valve housing	Aluminum 6061	1.25 hours	6.5kg/3.1lbs
	Pipe Flange	Aluminum bronze	3.5 hours	3kg/6.6lbs
	Base Plate	Aluminium 6061	6 hours	14.1kg/31 lbs

The Right Partner Is Essential

As companies in heavy industry explore the huge potential metal additive manufacturing brings to their operations, they'll need to carefully evaluate technology approaches from multiple vendors. But technical comparisons are not enough. To get maximum value from their investment, they must also choose a vendor that will partner with them to integrate and use the solution in the optimal way for their operations.

SPEE3D delivers on both of these needs. The company understands the supply chain challenges companies in heavy industry face and has developed the world's most advanced mobile metal 3D printing solutions, featuring patented cold spray technology. For maximum flexibility, SPEE3D metal 3D printing solutions are proven to operate in extreme conditions, can be safely used in almost any environment, and include a ruggedized, containerized model that can be moved as easily as a standard shipping container.

The SPEE3D team also understands this is new technology for its customers and works closely with them to develop the adoption strategy that's best for their unique situation and requirements.

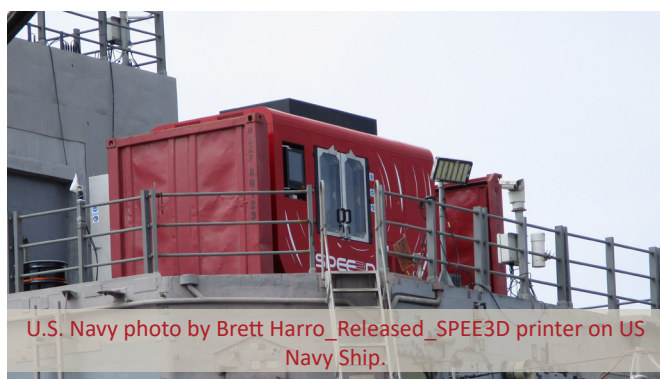
To help customers integrate mobile additive manufacturing in a smooth and efficient way, SPEE3D partners closely with customer teams to:

- ❑ Identify where in the supply chain metal 3D printing best fits.
- ❑ Audit inventories and applications to determine which parts make sense for printing from strategic, tactical, and compliance perspectives.
- ❑ Choose the right metal 3D printing solution for the manufacturing location and part sizes to be printed.
- ❑ Understand and explore new ways to think about the design and materials used for parts and tools.
- ❑ Introduce a phased approach to metal 3D printing that reduces risks and ensures compliance is maintained.
- ❑ Maintain a comprehensive digital thread for each part to track and manage its complete life cycle from design through service.
- ❑ Implement robust quality control measures throughout the production process, including material selection, equipment maintenance, in-process monitoring, and post-processing inspection.
- ❑ Train operators to safely operate the additive manufacturing equipment

See SPEE3D in Action

To discover what's possible with SPEE3D's innovative approach to metal 3D
Contact us to arrange a demonstration or **visit our website** to learn more.

www.SPEE3D.com



U.S. Navy photo by Brett Harro_ Released_ SPEE3D printer on US Navy Ship.



Australian Army soldiers in front of WarpSPEE3D Mount Bunday 2020.