



CASE STUDY

Metal Binder Jetting Speeds Up Product Development at MSA

MSA Safety Inc. leads the industry in innovative products that protect people and facility infrastructures. ExOne metal 3D printing has helped ensure MSA products get developed quickly for testing, so they can get to customers even faster.



“ExOne saved us a good amount of time. Time is critical on all projects at MSA. Lead times for a tool are 16-plus weeks, meaning we would traditionally have to order these parts without a good prototype solution to evaluate performance. ExOne’s solution allows the engineering team to quickly iterate through design concepts. ExOne was also picked for this application because of the time savings, as well as price savings over buying a tool, which would run about \$10,000.”

Matthew Jacob, Mechanical Engineer, MSA

INDUSTRY	Industrial Safety Equipment Manufacturing; Fire Service, Oil & Gas, Construction, and General Industry
APPLICATION	Self-Retracting Lifeline Device
LOCATION	Cranberry Township, PA
CHALLENGE	Determine a process to allow engineering to quickly iterate metal parts through design concepts while saving time, costs, and shortening time to market.
SOLUTION	
PRINTER	X1 25Pro® metal 3D printer
MATERIAL	316L stainless steel
BENEFITS	ExOne’s quick turnaround time on prototype parts help speed up MSA’s new product development.

COMPANY

• MSA Safety Inc.

WEBSITE

• <https://us.msasafety.com/>



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Established in 1914 following a mining tragedy that killed 80 West Virginia miners, MSA Safety Inc. has now been a world leader in worker protection and industrial safety innovation for more than a century.

MSA employs approximately 5,000 people worldwide. The company is headquartered north of Pittsburgh in Cranberry Township, Pa., and has manufacturing operations in the United States, Europe, Asia and Latin America. Remaining competitive and offering smart, modern safety equipment over such a long span requires a deep commitment to innovation and quick product development.

In fact, MSA has hundreds of patents and a new generation of engineers leading the way for the safety innovations of the future.

Matthew Jacob, a mechanical engineer at MSA, has been with the company since 2012 and said speed is one of the core elements of his work, where he leads one of the advanced technology teams looking at potential new innovations in product development.

Since 2016, ExOne has been working with MSA to provide prototypes and small to medium batches of products for testing.

MSA Safety Inc. uses ExOne binder jetting technology to accelerate their product development of fall protection equipment for construction workers to wear when working at heights.



By the numbers, MSA Safety has developed hundreds of products, own thousands of patents, and have a global reach into the millions to keep in motion their mission that began 100 years ago.

“I first had some parts printed probably four years ago,” said Jacob, who uses ExOne’s Quick Ship quoting and ordering tool for his orders. “We like the low cost and quick turnaround for prototyping parts. In particular, some of our components, and the ones that I ended up focusing the most on, are the ones where we end up using a powder metal process for production.”

“Those processes work great for production at higher volumes, but not for prototyping. We’re constantly looking at how can we shorten our process and time to market. So, parts from ExOne have enabled me to really shorten that time.”

MSA has plastic FDM printers in-house, which are great for certain types of prototypes, but using ExOne’s metal 3D printing service usually ends up being faster and delivers a part in actual metal, the same material in which the part will be produced. This has many benefits for the engineers assessing the part.

A Wide Range of Metal Parts

Today, MSA Safety develops and manufactures a wide range of products, including self-contained breathing apparatus, fixed gas and flame detection systems, portable gas detection instruments, industrial head protection products, fire and rescue helmets, and fall protection devices. As part of the fire service industry, MSA manufactures fire-fighting gear from head to toe—from boots to clothing, helmets and breathing apparatus.

While most of the design and manufacturing work for these products is done at MSA’s headquarters in Cranberry Township, PA, MSA has a global footprint with facilities in every major continent.

Jacob said he typically uses ExOne’s metal 3D printing services for structural components. Recently, that included one of MSA’s self-retracting lifelines (SRL), which construction workers use when working at extreme heights and propelling from buildings. The SRL connects to the worker’s harness and allows them to move freely around a job site. In the event of a fall, the device locks up and safely arrests a fall.

These small devices – the part is roughly 40 x 20 x 20 mm – meet the toughest requirements for protecting worker’s safety at heights, enabling workers to safely return to the ground.



When working at heights, having access to comfortable equipment can make a world of difference, especially from the perspective of worker compliance and safety. That's why global safety equipment manufacturer MSA Safety invested in designing and manufacturing innovative and comfortable fall protection harnesses, like the V-Series branded line of equipment, that meet a wide variety of needs – and budgets.

"The device recognizes a certain rate of speed. Whenever somebody is falling, it'll lock up exactly like your seat belt," Jacob explained.

The structural metal components 3D printed by ExOne, Jacob said, "replicates pretty closely" to the material properties of the final processes used to produce them for long-term production. Most of the parts end up being traditionally produced with press-and-sinter or metal injection molding (MIM) processes.

Metal 3D Printing Time Savings Biggest Benefit to MSA

Before deciding to have parts 3D printed by ExOne, Jacob solicited quotes from his regular manufacturer, but decided that ExOne provided several benefits. In addition to time, those benefits included the ability to iterate the design and get a new round of parts without tooling, if necessary.

"ExOne saved us a good amount of time," Jacob said. "Time is critical on all projects at MSA. Lead times for a tool are 16-plus weeks, meaning we would traditionally have to order these parts without a good prototype solution to evaluate performance. ExOne's solution allows the engineering team to quickly iterate through design concepts. ExOne was also picked for this application because of the time savings, as well as price savings over buying a tool, which would run about \$10,000."

"We ran probably close to 100 of our actual prototypes, and there are two of the ExOne component per prototype, so 200 parts for the first run. Again, where this is nice is after that first run, we had some issues with mating components. We had to change some geometries. So, I was able to go back, tweak the component that ExOne printed for me, and then put in a second order for another 20 parts printed based on the design change. And, I didn't have to deal with changing a tool and waiting for all that to happen. That was a huge benefit for me, the ability to move a lot faster with changes," Jacob said.

In 2020, MSA launched its new V-Series™ harness line, representing "the next generation of fall protection."



About ExOne

ExOne is the pioneer and global leader in binder jet 3D printing technology. Since 1995, we've been on a mission to deliver powerful 3D printers that solve the toughest problems and enable world-changing innovations. Our 3D printing systems quickly transform powder materials — including metals, ceramics, composites and sand — into precision parts, metal casting molds and cores, and innovative tooling solutions. Industrial customers use our technology to save time and money, reduce waste, improve their manufacturing flexibility, and deliver designs and products that were once impossible. Learn more about ExOne at www.exone.com or on Twitter at @ExOneCo. We invite you to join with us to #MakeMetalGreen™.

MSA is constantly looking for ways to save on manufacturing time to get product out to their customers quicker and differentiate themselves from other similar companies in the industry. Today, MSA Safety is a repeat customer of ExOne's Quick Ship 3D printing service, and ExOne has printed over 500 parts for MSA since 2016.

"The primary driver is time," Jacob said. "That's what makes the biggest difference for me. We are constantly looking for ways to shorten our lead times, and ExOne was able to deliver the parts to us in under two weeks. So, the cost portion is nice. But the time part is my biggest decision driver."

Quick turnaround times are also important to the company's focus on innovation, which is vital to keeping products fresh and relevant. The ability to turn over new designs and prototypes for testing quickly is helping MSA accelerate.

"As a company with a storied history, we continue to instill a culture of steadfastness but innovation as well," Jacob said. "There's been a big focus on how we can really innovate and make progress. For some guys, a hard hat is a hard hat is a hard hat. But we've been having a bigger push – how can we add customer-facing features and benefits? That's been a big factor of where we've been going in the safety protection area. There have's been a ton of new products that have come out in the last three years or so, and a lot of new innovations we can add to products that have maybe been taken for granted. In the future, we will continue working with ExOne for quick prototype parts that help speed up our new product development."

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