

Mauro Antolotti and BEAMIT: The story of Italy's leading AM parts producer and its founder's view on the industry

From machine producers to part manufacturers and end-users, the Additive Manufacturing industry is rich in success stories that are the result of one person's vision of what the technology could deliver. In the case of BEAMIT, Italy's largest metal AM parts producer, it was the vision of the company's founder, Mauro Antolotti. Here, Luca van der Heide interviews Antolotti for *Metal Additive Manufacturing* magazine and explores the company's development, his view of the industry, and ambitions for the future.

BEAMIT, an Additive Manufacturing company founded in 1997 when AM technologies were in their nascency, is today the largest AM manufacturer in Italy and one of Europe's leading players. Born from the vision of its founder, Mauro Antolotti, and sustained by careful planning and a strategic vision, the company has not only been able to survive the coronavirus (COVID-19) crisis, but to more than double its revenues throughout the period, culminating in an increase of 130% in 2020.

At the root of BEAMIT's success is Antolotti, the 'heart and soul' of the company, who shared with *Metal Additive Manufacturing* magazine how the business's current situation is the result of many years of experience in the industry, careful timing, and well-planned choices. After recent acquisitions and a major international partnership, Antolotti and his team are now eager to face the challenges of a market which is anticipating an increasingly widespread use of AM technology in industry.

"There is no doubt that AM processes will very soon become more accessible to the wider public," stated Antolotti, "but, first, we will have to navigate a crucial transition, from a technology that is still a prerogative of the richer markets to

one that is available to everyone." This vision is of a more affordable and automated AM value chain, leading to mass production and the replacement of more inefficient and restrictive industrial processes. But how will BEAMIT get there?



Fig. 1 Mauro Antolotti founded BEAMIT in 1997. Today the company is one of Europe's leading manufacturers of metal AM components (Courtesy BEAMIT)

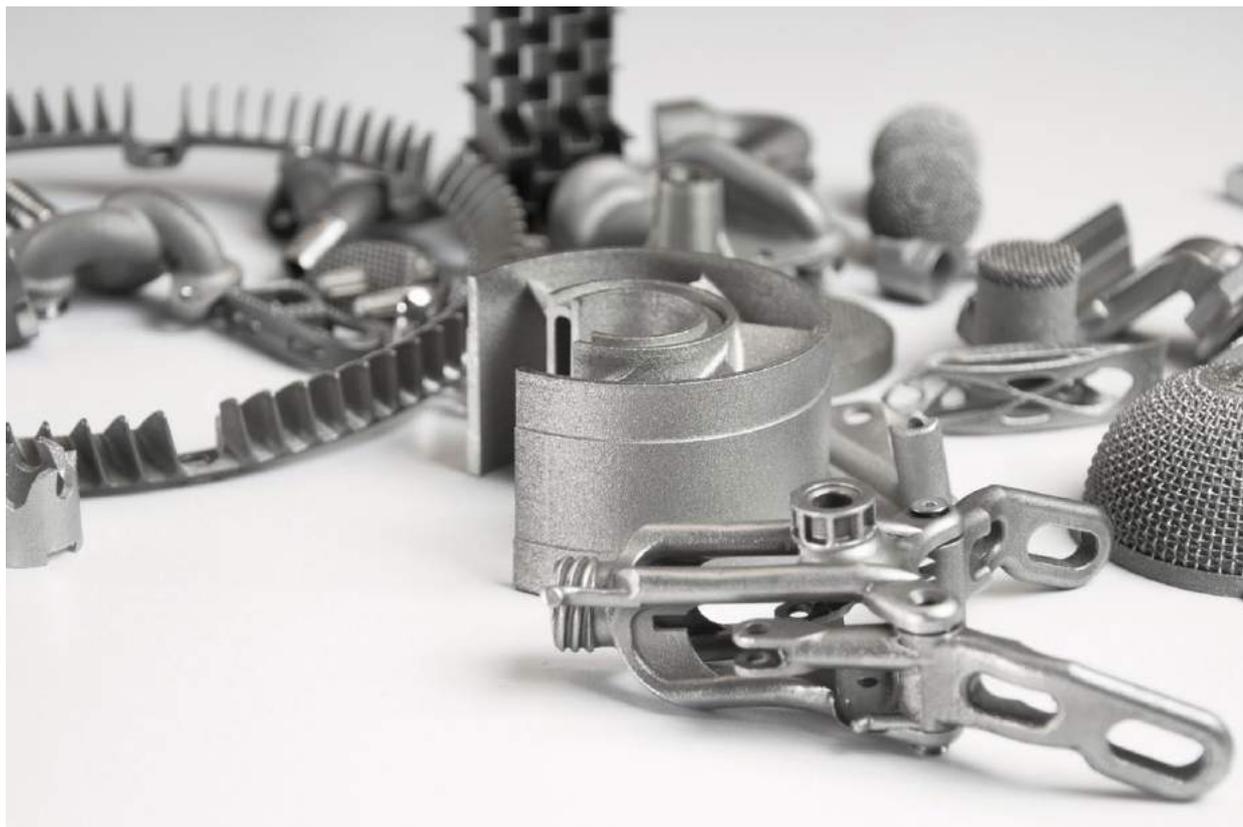


Fig. 2 A selection of metal additively manufactured parts produced by BEAMIT (Courtesy BEAMIT)

The BEAMIT story

Based in Emilia-Romagna, one of Italy's wealthiest regions and a globally recognised centre of industry, BEAMIT has grown from a startup with just a handful of employees to a company with more than a hundred employees distributed across five plants, as well as commercial offices in France, Germany, the United Kingdom and Japan.

Motivated by the commercial and technological opportunities in what is still a relatively new industry, BEAMIT opened its doors to international collaboration in 2019, when global engineering group Sandvik acquired a significant stake in the company. Sandvik has more than 150 years of advanced materials expertise and offers what is believed to be the widest material range for Additive Manufacturing on the market. By joining forces, the two companies now have leading expertise across the AM value chain, which is crucial to the industrialisation of the technology. In

2020, BEAMIT then acquired a share in the startup company Pres-X, which specialises in post-processing for metal AM, and the same year it fully acquired its main competitor in Italy, the AM service provider Zare.

The business has been built on solid foundations that are grounded in research and development. This has allowed it to focus on both its technical capabilities and quality management. Recently, it received its seventh NADCAP certification for its aerospace related activities. Financial stability has also been a consistently high priority, with the company having received CRIBIS Prime Company certification in recognition of the highest levels of stability and reliability in its business activities, something that has been granted to only 7% of six million candidate companies.

Such achievements are not the result of mere business acumen, but, rather, of Antolotti's near fifty years of expertise in the industry and a close familiarity with the processes

he is involved with. Since his modest beginnings in the small town of Fornovo, Antolotti has spent much of his life in search of innovations that would allow him to differentiate himself from the competition. When ground-breaking surface coating and heat treatment technologies first arrived in Italy from the USA, making it possible to extend component durability and improve quality, he seized the opportunity and became an expert in these special processes, quickly extending his experience in the following years to a range of sectors, including aerospace.

In 1997 Antolotti recognised the potential of Additive Manufacturing and invested. "BEAMIT has reached where it has today because it benefitted from strategies learned over many years of special processes and application development," Antolotti commented. "My experience in special processes taught me that, with technologies such as AM, it is crucial to have every variable under control, at



Fig. 3 Kristian Egeberg, president of Sandvik Additive Manufacturing, and Mauro Antolotti at the signing of the partnership between the two companies in 2019 (Courtesy BEAMIT)

every stage of the value chain, and to recognise that, in this market, only those who innovate and keep innovating can survive the fierce competition.”

These words seem to encompass the whole of Antolotti’s philosophy and entrepreneurial agenda: Innovation. In 1997, BEAMIT was in a research phase and could only work with polymeric products. However, as soon as the Additive Manufacturing of metals became possible, around 2004–2005, BEAMIT did not hesitate to set up its first metal AM facility. This was not for the purpose of doing business, since there was no business to be made, but rather to develop the technology and get it ready for market. “The market was only going to open its doors to the technology if we could demonstrate that its mechanical characteristics were reliable and repeatable. To achieve this goal, we worked in close contact with universities and research centres for ten years,” explained Antolotti.

It wasn’t until around 2014–2015 that the technology was finally accepted into the market, stated Antolotti. That’s when BEAMIT’s consistent efforts to innovate proved to be a winning strategy. “You can have as much capital as you need,” said Antolotti, “but, if you do not spend it on innovating, you will be out in no time. Important international customers see a reliable partner as one who continues to offer the latest available materials and technology, because they know it will give them the edge they need to differentiate themselves from their competitors. This is especially true in times of crisis.”

As 2019 approached, a year that would turn out to be pivotal for the company, BEAMIT realised that the objective of becoming one of the leading AM manufacturers in Europe was close, but that a leap of faith was needed. Antolotti knew that to reach the next level required more than just capital: he needed to pair

up with a strong industrial partner with an international reputation, which had a strong metallurgical background, a shared ethos, and that could bring longevity and credibility to the business.

Sandvik, which already had a world renowned metal powder manufacturing business as well as advanced metal AM research activities, proved to be an ideal match, and acquired a 30% stake in BEAMIT in July 2019. “Sandvik came to us spontaneously,” said Antolotti. “They came to visit our facilities and it was love at first sight. They are honest, respectful people and, after one year and a half, we are as committed as ever.”

Partnering with Sandvik was the qualitative leap they were looking for. “Many doors opened at a global level and, by assimilating our market strategy to that of a business with a 150 year-long history of successes, we know we have consolidated a future for our company. In this sector, you are chosen not only



Fig. 4 A motorsport exhaust system component designed for AM and built from a nickel-base superalloy (Courtesy BEAMIT)

on the basis of your technical resources, but also of financial stability and the guarantee to still be around in twenty, thirty years.”

With the capital provided by Sandvik, BEAMIT proceeded to acquire its main competitor, Zare, and the startup Pres-X. With these two acquisitions, the company boosted every aspect of the AM workflow, maximising customer care and value through a fully-integrated value chain and optimised post-processing solutions.

Although these developments stem from the same drive to provide all-round customer support and the highest product quality that was established many years ago, they are also part of a master plan to push the boundaries of AM processes and overcome the compartmentalisation of expertise that, according to Antolotti, is currently preventing the technology from expanding into true industrialisation.

The state of the AM industry and its biggest challenges

Despite recent major technological advances and the success of companies such as BEAMIT, Antolotti believes that the overall AM sector has also been under serious financial stress for the past year and a half. “Since many of the industry’s gurus sang the praises of this market five or six years ago, predicting extremely positive growth rates and future trends, it has been a gold rush. After years of continued growth, 2019 saw a deceleration for everybody: small, medium-sized and large enterprises. This technology is, still today, a technology for rich markets so, after years of economic boom, this was just the logical consequence. Impressive production capacity was created, but since the market was not yet large enough to justify such capacity, many

companies found themselves with idle machines, especially the small- and medium-sized companies that did not have enough capital to spend on innovation. Some manufacturers started struggling to draw efficiency and profitability from the machines they had invested in and, as a consequence, machine suppliers aren’t selling so many machines.”

Reducing costs is, therefore, the number one priority. “There are technological barriers,” stated Antolotti, “but the world today has all the resources necessary to overcome them. We at BEAMIT have run and keep running simulations of mass production projects. However, mass production is not sustainable in the long run at today’s technology costs. There is sometimes a gap between what the client wants to spend and the actual cost of production. The technology, therefore, must become more cost efficient if industrialisation can be possible in other industries than, for example, aerospace and medical.”

Hindrances to the wider adoption of AM in the industry do not seem to be related to misconceptions of the technology itself, but rather the lower costs of the main competitor, the foundry. Casting processes are today completely automated and cost much less. “Unlike casting, the process that is most widely used in industry,” Antolotti explained, “AM is heavily dependent on human operators, and there are a number of tasks that cannot be automated today. This is the next crucial innovation: to design machines that are self-sufficient and independent of human monitoring, that can operate day and night, with the same degree of reliability, but much faster and, most importantly, that can be cheaper to purchase and operate. In other words, the smart AM factory. This means that the machines should be entirely re-designed in the direction of automation and given many more lasers per machine so as to dramatically reduce build times. The whole range of post-additive processes should also be industrialised. Right now, they are far too disjointed.”

Antolotti believes that automating AM processes would considerably lower overall costs, with the result that the companies that are still forced to use casting processes because of their low cost could make the move from the more wasteful, environmentally polluting and high-CO₂ emitting foundry to a more efficient and cleaner technology.

Major markets and applications

It should come as no surprise that the markets that profit most from AM technologies are those that particularly benefit from its unique potentialities and are resourceful enough to absorb the costs. These are, for the most part, rich markets where time savings in development, sustainability and efficiency concerns are absolute priorities.

For the gas turbine and aerospace markets, AM processes have the two-fold advantage of curbing the environmental impact of turbines and aircraft engines, while allowing companies to reduce costs. "Where, with old processes, a turbine burned as much as 300 litres of oil," explained Antolotti, "by utilising AM technology they consume around 260 litres, producing the same energy with about 15% reduced waste. Financial advantages also come into play, as aircraft burn less fuel and, in turn, airlines see considerable cost savings. This proves that, even though the technology is expensive, the companies that can afford it end up saving money in the long term, while reducing carbon emissions at the same time."

Another crucial contribution to sustainability in the aerospace sector is weight reduction. "The aerospace sector is constantly searching for ways to reduce the weight of aeroplane components. We have produced components via AM whose final weight is up to 60% lighter than production via conventional technologies, and this, of course, represents a massive difference."



Fig. 5 A heat exchanger, originally developed in partnership with Politecnico di Milano, produced as a single piece in an aluminium alloy for high-performance motorsport applications (Courtesy BEAMIT)



Fig. 6 Some of the first metal AM applications were in the area of medical implants. This tibial implant is produced in Ti6Al4V and CNC machined (Courtesy BEAMIT)



Fig. 7 Additive Manufacturing can be used for complex geometries with extremely small and intricate internal channels that would be difficult, if not impossible, to obtain with traditional technologies. This AM aerospace component has been cut open to show such internal channels (Courtesy BEAMIT)



Fig. 8 EOS M 400-4 Laser Beam Powder Bed Fusion machines at BEAMIT (Courtesy BEAMIT)

In comparison with conventional manufacturing technologies, AM also represents a huge step forward for both design freedom and time efficiency. The possibility for engineers to create complex

money and time. "AM machines allow our customers to obtain very complex components in very little time," said Antolotti. "Let's take, for example, the world of motor racing. Before Additive Manufacturing, a team had to design

"Let's take, for example, the world of motor racing. Before AM, a team had to design a component for the following season, and it would take around ten months to end up with the part. Now, they can have the same part available in two to three weeks..."

designs through the use of specialist software means that there are virtually no limitations for designers when coming up with innovative products. At the same time, no tools or moulds are needed, saving a lot of

a component for the following season, and it would take around ten months to end up with the part. Now, they can have the same part available in two to three weeks; development times are drastically shortened."

Smaller markets and the Italian manufacturing landscape

Whilst the majority of BEAMIT's larger customers are the industrial gas turbine, space, aerospace and defence, motor racing, biomedical and general industrial sectors, they are not the only markets that benefit from AM. There are a multitude of small and medium-sized companies that also use the technology, albeit in a more occasional, selective way.

"If there were doubts on whether AM is a technology worth investing in, they remain in the past," said Antolotti. "Today, everyone seems convinced of the advantages of Additive Manufacturing and every major company now appears to have an AM expert. However, AM is utilised, for the most part, in an extremely selective way: only for small and special components, and only when a company has the funds to invest in higher-quality products. At BEAMIT

we have more than 350 active customers, many of which could be categorised simply as industrial businesses. Individually, such businesses take up a relatively small percentage of our workload but, collectively, their output adds up to an impressive quantity of 'niche' AM applications. An example is the packaging sector, a very important sector in Italy and one of the strongest industries here in the Emilia-Romagna region."

The Italian market has grown considerably in recent years, becoming an important market for big OEMs, as well as maintaining its historic reputation for excellence in small and medium-sized industry. Antolotti notes that BEAMIT's success hasn't been by chance, but has, instead, been greatly affected by its position in the very active and innovation-thirsty Italian manufacturing landscape. "In Italy, we have a proliferation of curious entrepreneurs with a strong drive to innovate and to be major creators of technological breakthroughs. Unfortunately, despite the recent success of leading manufacturing companies like us, Italy is still greatly undervalued. However, I do hope that, in the light of the evident fast expansion of major Italian capabilities, as well as the recent mergers and acquisitions, Europe will finally recognise the importance of Italy in the international marketplace."

Machines and manufacturing

To grow the recognition of Italian industry in the global AM market is even more relevant as 2021 begins, with BEAMIT now showcasing one of the largest AM machine installations in Europe. The company has nurtured relationships with a number of AM machine makers since the technology first became available. In 2017, the company signed multi-machine, long-term deals to purchase an increasing number of state-of-the-art machines in the following years. Last year, BEAMIT signed a letter of intent to purchase



Fig. 9 SLM Solutions PBF-LB machines at BEAMIT (Courtesy BEAMIT)



Fig. 10 View of the AM production area at BEAMIT (Courtesy BEAMIT)

fifteen more AM machines, bringing its total capacity to around fifty.

Today, the company offers both Laser Beam Powder Bed Fusion (PBF-LB) and Electron Beam Powder Bed Fusion (PBF-EB) Additive Manufacturing. Antolotti explained that whilst there are fundamental technical differences between PBF-LB and PBF-EB processes, from a customer perspective the main relevance is

the type of materials they can be used to process. Whilst both can be used to produce nearly 100% fully dense metal components, PBF-EB is able to process alloys such as titanium-aluminides that simply cannot be manufactured using laser-based AM.

The company's operations are designed to be highly efficient, operating around the clock with advanced process monitoring. Extensive post-production services



Fig. 11 A large format Concept Laser X Line 2000R PBF-LB machine (Courtesy BEAMIT)

and quality systems ensure that the company manufactures products that are always flawless and faithful to the customer's vision.

It is worth stating that, as well as enabling applications that offer improved efficiency and sustainability, Additive Manufacturing is also a clean technology in itself. AM machines consume significantly lower levels of electricity than conventional manufacturing processes. As opposed to casting and other subtractive industrial processes, AM machines obtain finished products not by removing, but by adding material, dramatically minimising waste. PBF-LB machines consume relatively low amounts of electricity, around 4–5 kW per hour.

Antolotti could not stress enough how, in order to ensure the correct functioning of the machines and maximise the potential of the AM process, it is fundamental to keep every variable of the process under control and to guide and support

the customer from start to finish. BEAMIT's experts work side by side with the customer on an application's design, providing ongoing support every step of the way to

personnel," he stated. "This calibration is certified, registered and archived, always at hand in case of need. We have to keep traceability of everything: from powder production

“Antolotti could not stress enough how, in order to ensure the correct functioning of the machines and maximise the potential of the AM process, it is fundamental to keep every variable of the process under control and to guide and support the customer from start to finish.”

ensure that a final product is as optimised as possible, and according to the client's specifications.

“Our responsibility is to make sure the machines are constantly calibrated by highly-specialised

to laboratory tests, every process that happened in the last thirty years is documented. This is a necessary safety measure to make sure that, if a problem arises, we can immediately call the technicians and solve it. If

something is slightly off, the quality system of the company notices right away, and intervenes.”

“This is why it is not just important, but decisive, to be involved in the complete process, from machine development to post-processing,” continued Antolotti. “BEAMIT has the most integrated value chain, and this will be further expanded in the coming years. This is the only way that we can guarantee complete reliability to the customer. We want to have the entire process in house, so that security can be further improved, and customer care elevated to the highest possible standards.”

The present and future

It is thanks to this resilient and advanced value chain that BEAMIT was able to face the coronavirus pandemic and come out of it stronger. While the effects of the pandemic have made, and are still making, many companies suffer, the AM sector has been impacted only indirectly: many companies had to shut down not for a reduction in demand, but because it was impossible for them to react quickly to the crisis. If BEAMIT was able to see constant growth and even an increase on its profitability, it was in large part thanks to careful planning and its consolidated position as a leader in the industry.

“When the pandemic struck,” said Antolotti, “we were seen as a positive example of how to survive such a crisis thanks to our integrated value chain, and we were therefore asked to contribute in a more substantial way to the biomedical sector. For this reason, in January 2021, we launched a new brand, Proxera®, with a dedicated facility specialised in highly-advanced biomedical and dental applications. When the demand came, we were able to respond quickly, because we were already equipped to do so and had already proved to have a credible, sustainable solution. At the same time, we were greatly helped by the fact that, at the end of 2019,



Carboni e Metalli: BEAMIT and Bercella explore combining metal AM and carbon fibre composites

As part of the ‘Carboni e Metalli’ venture of Bercella SRL and BEAMIT, The Lunar Project, created to celebrate the 50th anniversary of the first steps taken on the moon, explores the potential of combining carbon fibre composites and metal Additive Manufacturing.

Behind this project are two friends: Massimo Bercella, CEO at Bercella, and Michele Antolotti, son of Mauro Antolotti and Head of Engineering and R&D at BEAMIT Group. The Lunar Project represents not only their common passion for design, but also their interest in promoting and exploring the use of composites and Additive Manufacturing outside the

traditional niches of the aerospace and motorsport industries.

The Lunar Project is based on a reimagining of an old KTM 250 GS motorbike with a futuristic approach, combining vintage details such as a steel frame and a massive 2-stroke engine with the most advanced current technologies: a carbon fibre sub-frame, carbon fibre/AM titanium rear swingarm, and AM aluminium front fork mounts, to name a few. The bike has been presented at bike festivals around the world.

More information: www.bercella.it/en/stories-en/a-story-of-ordinary-technology-the-lunar-project/



Fig. 12 Light alloys such as aluminium are ideally suited to single-piece AM engine blocks for motorsport (Courtesy BEAMIT)

we already had orders planned for the whole of 2020. So, even though the flow of incoming orders did slow down, our turnover has kept growing dramatically in the last year."

Thanks to its position in the market, BEAMIT benefits from an important competitive advantage, and Antolotti predicts another year of growth for 2021. "As soon as the marketplace returns to a normal and steady pace, there will be many opportunities to seize. The future is full of potential for organic and inorganic growth, as well as global market expansion."

Together with Sandvik, the BEAMIT Group already offers an end-to-end process covering the full AM value chain, as one of very few specialist AM service providers. "We now continue to build for a future where we will add increased customer value and productivity through further factory automation and digital integration, thereby taking the lead in terms of helping the AM industry reach the plateau of productivity it needs to reach."

Although Antolotti remains discreet when it comes to future projects for the company, he has open and clear ideas on the future of the technology. "The goal of achieving a completely automated, smart AM factory is not that far away – but in order to unlock the technology's true potential, it is necessary to bring together the areas of expertise that remain, at this moment, disjointed. Today, there is no company that has all the expertise needed. We are aware of this and vouch to act as a promoter and facilitator of this process in the coming years. Everyone has a part to play. Now, we have to continue our journey to put all the pieces together."

Author

Luca van der Heide
Luca is a writer and English teacher, published both at an academic and personal level. He is the author of four novels, the last one published in June 2020. lucavdheide@gmail.com

Contacts

Giuliana Massimino
Head of Marketing and Communications
BEAMIT Group
g.massimino@beam-it.eu
www.beam-it.eu

Lena Berg
VP Marketing and Communication
Sandvik Additive Manufacturing
lena.berg@sandvik.com
www.additive.sandvik

In our fast moving industry...

As this issue of *Metal AM* magazine was going to press, news broke of BEAMIT's purchase of UK-based metal AM parts producer 3T Additive Manufacturing. Read the full story on page 9 of this issue.