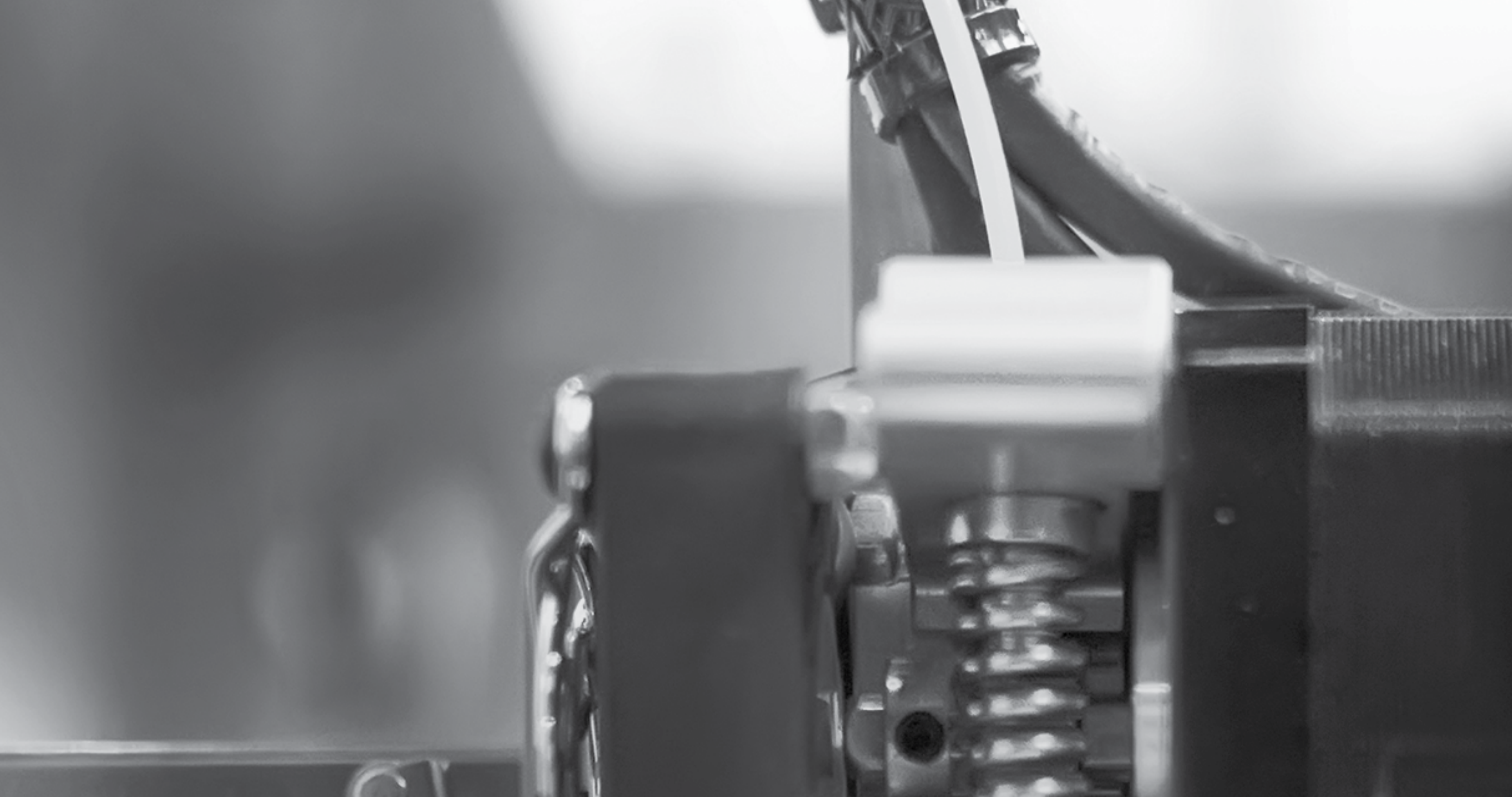

Additive Manufacturing

Powder Bed Fusion

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WHITE paper

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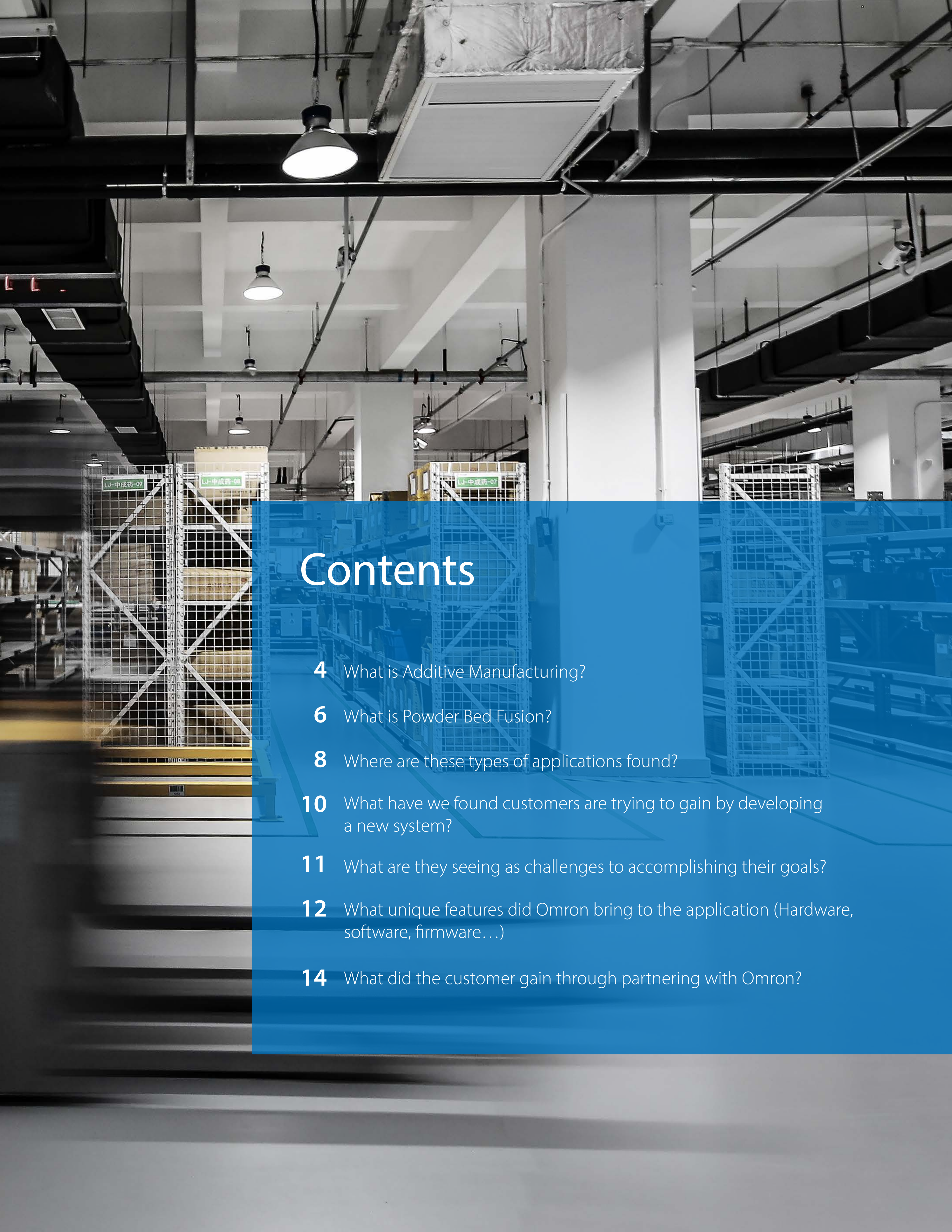
automation.omron.com

Purpose statement

This document is provided to give a general understanding of Additive manufacturing, specifically Powder Bed Fusion applications. This should help to understand what has been seen as challenges for customers and how Omron has been able to help them to create a solution to overcome those challenges.



Contents

What is Additive Manufacturing?

Additive manufacturing, also known as 3D printing, is a manufacturing process that builds three-dimensional objects layer by layer, directly from a digital design file.

Unlike traditional subtractive manufacturing methods that involve cutting or shaping a material to obtain the desired shape, additive manufacturing adds material layer upon layer until the final object is created.

Additive manufacturing has found applications in various industries, including aerospace, automotive, healthcare, consumer products, architecture, and more. It continues to advance, with ongoing research and development efforts focused on expanding the range of materials, improving printing speed and quality, and exploring new applications for this versatile manufacturing technology.

What is Powder Bed Fusion?

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Powder bed fusion (PBF) is a technique that uses a laser or electron beam to melt and fuse layers of material together

Powder bed fusion (PBF) is an additive manufacturing technique that involves the use of a laser or electron beam to melt and fuse layers of powdered material together, creating a solid object. This process typically involves the use of a bed of powdered material, such as metal or plastic, which is selectively melted by a high-energy source to create the desired shape.

In PBF, the powdered material is first spread evenly across the build platform. A high-energy beam, such as a laser or electron beam, is then directed onto the powder bed, melting and fusing the material together to create a solid layer. The build platform is then lowered, and a new layer of powder is spread on top of the previous layer, and the process is repeated to build up the object layer by layer until it is complete.

Where are these types of applications found?

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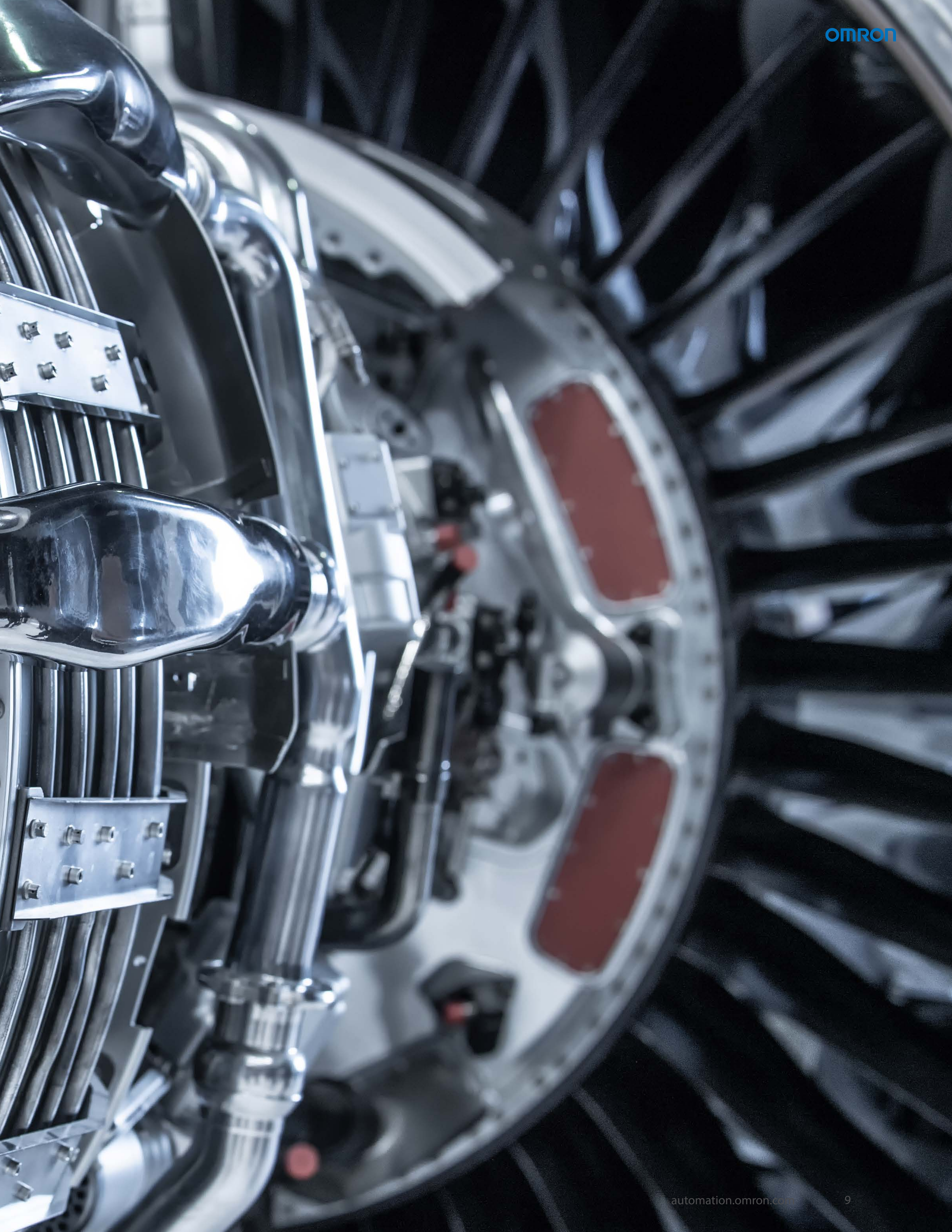
Powder bed fusion has a wide range of applications in various industries. In aerospace, it is used to produce lightweight, high-strength parts for aircraft and spacecraft. In the automotive industry, it is used to produce engine components, such as cylinder heads and pistons. In the medical industry, it is used to produce custom implants and prosthetics. Powder bed fusion is also used in the production of jewelry and other decorative objects.



What have we found customers are trying to gain by developing a new system?

Powder Bed Fusion faces several challenges that need to be addressed. Some of the main challenges include:

1. Accuracy, repeatability, and precision are the most prevalent challenges that most manufacturers are trying to achieve. This can have a major impact on the quality of the part that is being made.
2. LASER implementation can be difficult and add time to the manufacturing cycle through the communication from the LASER to the motion controller.
3. Training and retention of skilled labor has increased in the past few years and looks to be a continuing issue.
    a. Consistency in software and hardware knowledge
    b. Remote training for field engineers to promote comfort and efficiency
4. Future design and upgrade timing and efficiency.
    a. Future upgrades to machines while the machine in kept on the factory floor.
    b. Compatibility of new controllers with existing hardware (backwards compatible)

What are they seeing as challenges to accomplishing their goals?

1. Part quality: Achieving consistent part quality can be difficult due to variations in the powder, process parameters, and equipment. This can result in defects such as voids, cracks, and warping.
2. Build time: PBF can be a slow process, particularly for large parts. This limits the throughput of the technology and makes it less suitable for high-volume production.
3. Cost: PBF can be expensive, particularly for high-end materials and complex geometries. The cost of equipment, materials, and post-processing can add up quickly, making it less cost-effective for certain applications.
4. Safety: The high-energy sources used in PBF, such as lasers or electron beams, can be potentially hazardous if not properly managed. Appropriate safety measures must be taken to ensure the safety of operators and equipment.
5. Design limitations: PBF can have certain limitations when it comes to the design of parts, such as overhangs and unsupported geometries. Parts may need to be redesigned to accommodate the limitations of the process.

What unique features did Omron bring to the application (Hardware, software, firmware…)

LASER implementation can bring challenges to a system, with specialized LASER control cards the controller can implement the LASER right into the motion control system.

This can eliminate communication programming and time lag. In some cases, it can eliminate other control components that will reduce the overall machine cost.

Spectral decomposition is a feature that is used in LASERS with a medium to large work area. Spectral decomposition is used where the work area of the galvo cannot cover the entire work area. The customer then has the ability to use a precision stage to move the part around and work coordinated with the galvo and LASER. The controller will separate the trajectory into the two trajectories that are needed, one for the Galvo and another of the stage. The result is the tooling (laser) maintaining the highest quality cut while gaining a higher throughput.

To help the engineers, eLearning courses as well as in person software introductions were offered. A site license for software was critical to keep everyone together for version control and a well-trained engineering force helps throughout the entire machine life cycle from design to maintenance and eventual replacement.

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What did the customer gain through partnering with Omron?

Through partnering, the machine builder has been able to develop new designs to help them keep leading their industry. They have built and continue to maintain a well-trained engineering team around the world and keeping their machines in optimum performance. Omron engineers helped to make sure that the customer got the most out of the machine by applying their expertise which helped improve speed and performance. The onsite support provided by Omron was key to meeting deadlines and launching new product features on time.

Learn more about Additive Manufacturing›

Empowering people through automation

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Note: Specifications are subject to change.

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