Additive Manufacturing:

A Solution for Part Obsolescence

WESTWIND

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Introduction

Manufacturers, engineers, and fleet operators in sectors, such as defense and aerospace, have always been plagued by unplanned downtime due to aging equipment. And recent supply chain problems have exacerbated the problem. According to a recent study, average equipment downtime costs an estimated $250,000 an hour.[1] Meanwhile, soaring costs and budget restraints make it difficult or impossible to replace older machines. The cost challenges are further compounded when equipment downtime is due to an obsolete part.

Average cost of machine downtime:

$250,000/hour[1]

However, manufactures can take solace in the fact that part and equipment restoration is now easier and more cost-effective than ever due to advances in additive manufacturing (AM), otherwise known as 3D printing.

While AM has been around for decades, its primary application until recently was to quickly and efficiently create prototypes to support traditional manufacturing processes. As new technologies emerge, AM is rapidly becoming an industrial go-to for creating high-quality end-use parts by companies across a multitude of industries, including giants like Boeing, GE, and BMW. The popularity of AM is evident in the fact that the global 3D printing market was valued at $12.6 billion in 2020 and is expected to reach $37.2 billion by 2026.[2]

Global 3D Printing Market Value

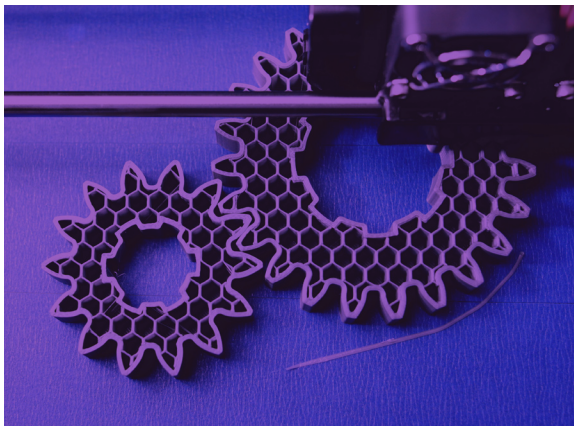
2020 Actual:

$12.6 billion[2]

2026 Forecast:

$37.2 billion[2]

New innovations have engendered a growing adoption of 3D printing technologies in manufacturing. The ability to produce parts faster and cost-effectively with added safety measures makes it an appealing alternative to traditional manufacturing methods. Manufacturers can now produce nanoscale parts, large industrial parts, and everything in between, with precision and repeatability. AM technology also provides a solution for producing parts once considered obsolete.



7 Benefits of AM

While solving for part obsolescence, AM provides additional benefits for manufacturers:

Minimize Supply Chain Dependency

Supply chain issues have become exceedingly common. A United States Census Bureau survey found that 64.6% of manufacturers report domestic supplier disruptions. AM allows users to print on demand, minimizing the reliance on suppliers to deliver needed parts and materials.

Decrease Turnaround Time

Traditional methods of producing obsolete parts have the potential to take months and result in additional opportunity costs directly associated with the downtime. With the newest technologies, manufacturers can now design and print parts quickly on-site.

Reduce Costs

AM eliminates the costly process associated with traditional manufacturing processes. Some of the cost benefits include reduced overhead, lower labor costs, and minimal maintenance. As the technology continues to improve, printing materials themselves are also becoming more affordable.

Enhance Part Designs

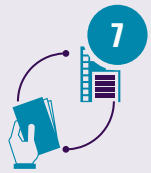
AM's ability to produce parts with complex geometries offers ways to enhance a part's design. Unlike parts that have multiple assemblies that require each section to be traditionally manufactured and welded together, AM prints the part in a single piece, improving its strength and durability while reducing production costs.

Limit Waste

Since subtractive manufacturing requires starting with a solid piece of material, the process results in added waste and cleanup processes, such as collecting shavings. AM machines are designed to maximize material usage, while also eliminating the need for large pieces of raw materials, thus freeing up warehouse space and minimizing material waste.

Gain a Competitive Advantage

The speed, accuracy, and reliability of AM allow businesses to be more agile and responsive to market needs. Plus, boosts in efficiency and the ability to be ready for an unexpected machine failure safeguard against extended periods of downtime leading to increased production capacity.



Access Affordable Entry Options

Service bureaus lower the barrier to entry for manufacturers interested in testing AM. These companies provide the services to manufacture replacement parts, while allowing organizations the opportunity to test and learn which AM options may be the most appropriate for them in the future, should they wish to invest in their own 3D printing equipment.

3 Ways Additive Manufacturing Enables Producing Obsolete Parts

Part obsolescence has long been a barrier to equipment maintenance. Typical causes of obsolescence vary from an original equipment manufacturer (OEM) going out of business to a manufacturer releasing newer models and no longer support older models by ceasing production of their replacement parts.

While alternative suppliers can sometimes be found, most do not have the inventory to support all equipment models. Plus, if a possible replacement is found, there is risk that the materials or the production process will be substandard.

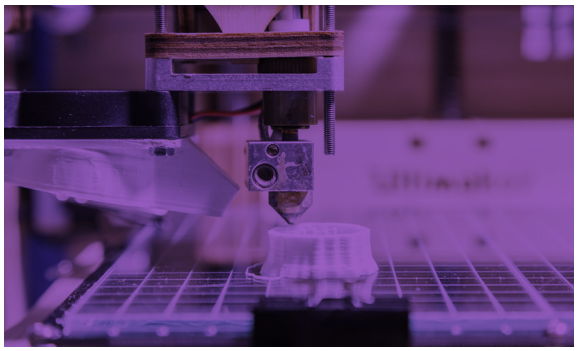
Ongoing advancements in additive manufacturing now offer a solution to the perennial problem of part obsolescence in three significant ways:

1. Reverse Engineering with 3D Scanning

A 3D model is needed to accurately reproduce an obsolete part. Even if 2D drawings or a manual are available, they often do not provide the detailed measurements required for perfect duplication. Reverse engineering extracts a part's dimensional information by measuring it and reconstructing it as a 3D model. If done manually with traditional methods, it is a tedious process rife with the potential for human error, especially when producing smaller parts. The advent of 3D scanning now makes reverse engineering a seamless process.

3D scanners enable the fast, accurate, and cost-effective creation of replicas down to the smallest detail. These scanners use lasers, projected light, or computed tomography technology to capture data points, providing an identical digital twin of the physical part.

The associated software converts those points into a mesh file, which is used to create the CAD file. The CAD file is then exported as a print file to the 3D printer. Some scanners can even send the print file directly to the 3D printer, bypassing the CAD system altogether. Depending on the part size, the 3D model may be ready for printing within a single day.



2. Versatile Printing Methods and Materials

Obsolete parts vary across industries, and each one has unique requirements. Even if it is possible to recreate a part with traditional methods, achieving the desired surface finish or upgrading the part's strength are not always practical options. The array of AM printing methods and the growing number of available printing materials provide the versatility to meet specific manufacturing requirements.

The common methods of printing include Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), and Selective Laser Melting (SLM). Each one has its own positives and negatives, depending on the part and time requirements. Most require the use of supports to ensure the part can be printed successfully.

When time is of the essence, for example, FDM has water-dissolvable supports that eliminate post-processing. For parts that require fine details and a smooth surface, SLA is an ideal option. SLM has become a common solution for functional parts that have complex geometries and require excellent mechanical properties.

Along with thermoplastic powders and photopolymer resins, new metals and carbon fiber filaments are consistently being qualified for use. Many of these materials are proving to be better than their raw counterpart. A recent study comparing manufacturing an aluminum part via AM and die casting concluded that the AM process enhanced the performance of the alloy.

In the aerospace, automotive and defense industries, carbon fiber has enabled printing lightweight, durable parts that limit the use of natural resources.

Material Innovation

As 3D printing evolves, manufacturers have the opportunity to use new materials that allow for lighter-weight and stronger parts. AM also eradicates the waste of precious metals.

Below are some of the metal materials now available for 3D printing:

Aluminum Alloys	• High thermal and mechanical properties • Electrical conductivity • Low density
Stainless Steel	• Highly wear-resistant • Weldable
Titanium Alloys	• Corrosion-resistant • Low thermal expansion • High weight to strength ratio
Cobalt-Chrome Superalloys	• Wear and corrosion-resistant • High hardness
Nickel Superalloys	• Resistant to temperatures up to 1,200° C • Highly corrosive-resistant • High mechanical properties

3. Complex Geometries

With traditional manufacturing methods, it is easy to produce standard parts over and over with reliability. While molds and machining have proven to be viable approaches for many parts, others have intricacies that make them difficult to create for repeatability or at all.

Whether recreating an obsolete part or designing a new one, AM offers the flexibility to produce a part with any shape, including those with multiple diameters, pieces that are not flat, or ones with a hollow structure.

Along with achieving the desired design, 3D-printed parts often perform better than traditionally manufactured ones. Since AM eliminates the need for welding, cutting, and other processes, the room for error is significantly reduced. This lower-cost alternative also makes it easy to make changes on the fly. If a modification is needed on a prototype or an opportunity is uncovered to enhance an existing part, the 3D model only needs a simple update and printing can begin.

No Machine Shop Necessary

As equipment ages, the likelihood of needing to replace parts increases dramatically. Depending on the part, a machine shop may not be an appropriate solution if the part has complex geometries or must meet rigorous industry standards. Even if a reliable machine shop is secured, traditional approaches still involve added cost, time, and the chances for error. Traditional machining methods such as injection molding and investment casting have significant lead times and high costs. In some cases, it may take up to 60 days to have the part in hand when using traditional manufacturing methods. And the process itself can be laborious because it depends upon obtaining a design of the original part. Also, these methods depend upon the time-consuming production of a prototype that may not turn out to be suitable, which would then require a repeat of the prototyping process.

AM eliminates these obstacles. From beginning to end, AM's capabilities allow for complete control of production. Manufacturers and fleet operators can feasibly build a digital library of parts to have on hand so that production can take place only when the need arises, reducing inventory requirements and the need for extra storage space.

Conclusion

Part obsolescence no longer has to shut down operations for weeks or months. Industries that rely on the continued operability of legacy machinery can increase production goals and minimize downtime by resolving part obsolescence through additive manufacturing.

AM provides a reliable and fast solution to eradicate part obsolescence. This growing industry continues to produce new technologies that are making 3D printing technology increasingly affordable and reliable, paving the way for new business models that result in improved part availability and decreased costs.

About Westwind & Roadrunner 3D

Westwind provides comprehensive, integrated IT and emerging technology solutions to government and commercial agencies. As one of its emerging technology solutions, Westwind delivers additive manufacturing and prototyping systems for a range of industries including aerospace, healthcare, military, and automotive. With decades of additive manufacturing sales and production experience, Westwind helps customers select the right solution for their needs. Westwind participates in numerous contract vehicles and has several Small Business (SB) certifications, including Minority, WomanOwned, and HUBZone designations.

Westwind's subsidiary, **Roadrunner 3D,** provides a digital manufacturing center featuring advanced 3D print technologies. With deep engineering and additive manufacturing talent, Roadrunner 3D's print specialists can fabricate products and parts for one-off or ongoing needs – from quick-turn prototypes to repeatable, production-grade manufacturing for end-use parts.

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