

AIR BEARINGS: TRANSFORMING THE FUTURE OF THE ADDITIVE MANUFACTURING

5 AIR BEARING APPLICATIONS

FOR THE NEXT GENERATION
OF ADDITIVE MANUFACTURING

Introduction

3D printing—or additive manufacturing as it's come to be known—has undergone massive growth in the 21st century. Once relegated to college labs, printing chess pieces, and curios for demonstrative purposes, additive manufacturing now provides an invaluable service for precision industries and the manufacturing product cycle, including such fields as:

Aerospace | Medical implants | Rapid prototyping
On-demand jiggling | Cleanroom manufacturing

For those of you providing 3D printing as your business model, or for those of you who use additive manufacturing in your processes—or contract out the service—several key factors often influence the quality of your print and the efficacy of your business model, including:

Precision | Reliability | Durability

New Way Air Bearings[®] is familiar with tackling new technologies and advancing them by leaps and bounds. Our first product line of linear air bearings was designed for coordinate measuring machines (CMM)'s. Air bearings offer unparalleled straightness, speed, durability, and cleanroom compatibility across both linear and rotary motion applications. And, with more than 25 years of experience in turnkey engineering, New Way is ready to help the additive manufacturing market jumpstart a new revolution.

In this eBook, you'll learn how New Way Air Bearings—powered by our proprietary Porous Media[™]—offer unique solutions for the exacting standards demanded by the industries which utilize additive manufacturing. By the end, you'll see just how much potential Frictionless Motion[™] provides the next generation of 3D printing.

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**Aerospace
Manufacturing**

Aerospace Manufacturing

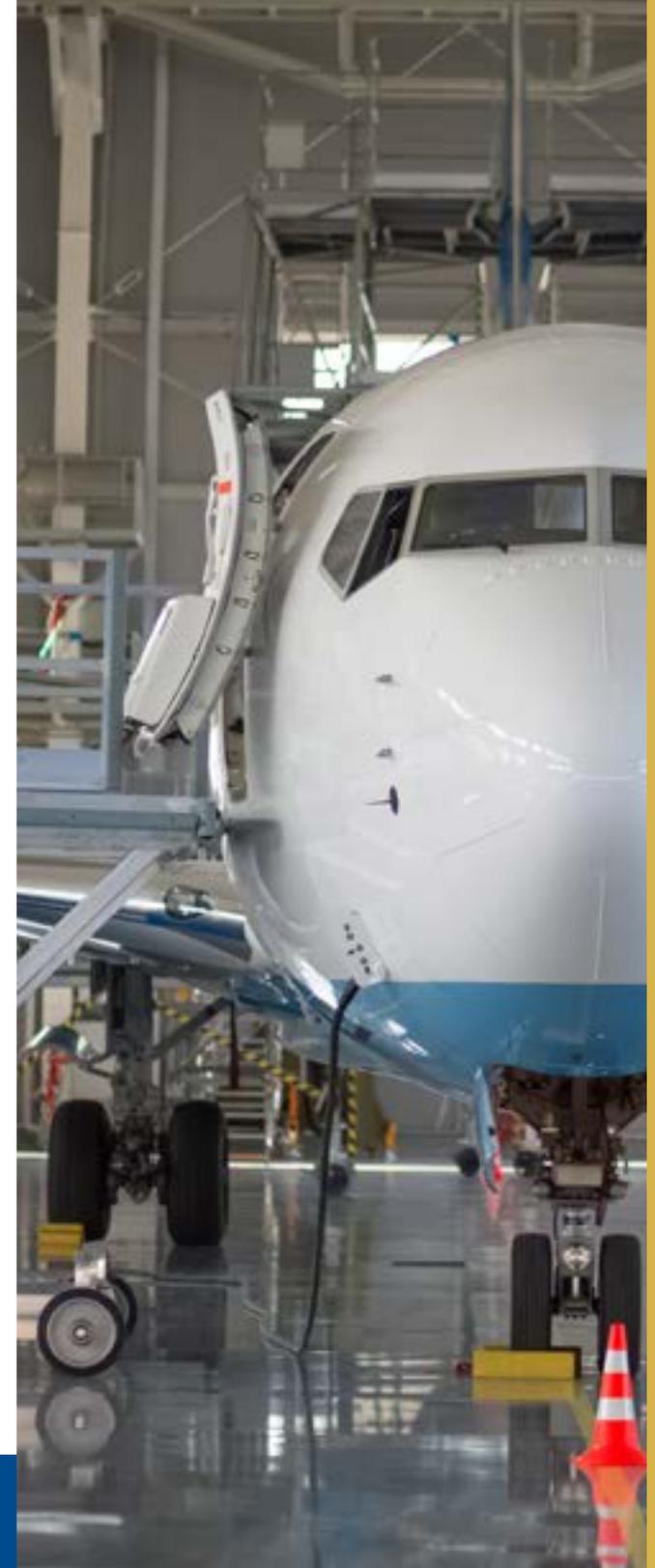
The Challenge

The aerospace engineering sector is always focused on the next innovation. Whether you are designing civilian or defense products, leveraging the latest technology is paramount to success. Current industry goals are focused on lighter, stronger materials, with the goal of developing airframes that can travel further and faster—all while consuming less fuel and requiring more infrequent maintenance.

3D printing provides a brand new path forward on all these frontiers, with the advent of printable thermoplastic resins and space-age metals, all designed for end-use applications in high heat, structural environments.

How Porous Media Air Bearings Deliver

The aerospace industry works around the clock, both literally and figuratively, to get their ideas off of the computer and onto the runway. This can often involve 24/7 production, and facility failures can grind production to a halt. Air bearings have zero dynamic components thanks to the stiff, microthin air cushions which act as the fluid medium between rotating or translating elements. In practice, this means air bearings are completely free from wear and tear, friction-induced spalling, or the need for lubrication (as would be required by traditional ball or rolling bearings.) This allows air bearings to operate for incredibly long life cycles effectively free of maintenance, and provide your manufacturing facility with the peace of mind you need to power the next generation of flight.





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Medical Implants

Medical Implants

The Challenge

The healthcare profession is responsible for every facet of our physical, mental, and emotional wellbeing. The manufacturers of medical implants are constantly on the search for the next big technology to increase patient comfort, longevity and reduce rejection rates. The latest breakthrough for joint replacement is 3D-printed implants.

For the longest time, implants were made in standardized sizes, which surgeons would then shape to the patient's anatomy, as best as they could. Now, providers are digitally mapping a patient's joint and additively manufacturing a replacement, accurate to every curve of their anatomy.

How Porous Media Air Bearings Deliver

Custom manufacturing implants specific to a single person's anatomy requires extraordinary precision, and air bearings built on porous media offer it in spades. Traditional ball and roller bearings are subject to the inherent inertia of their own internal components—and as a result—can suffer from overshoot and hysteresis error.

As a function of their frictionless motion, air bearings are precise down to the nanometer and are only limited by the positioning system they're utilized with. Rotary-based air bearing systems (such as the servo-driven rotary stage) can offer 1.1-arcsecond precision; exactly what you need for ensuring the next generation of implants produce long-lasting results with minimal side effects.





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Rapid Prototyping

Rapid Prototyping

The Challenge

For any precision industry, iterative design can be a time-intensive process. Creating a new design and sending it out for manufacture can consume weeks of valuable labor hours. And, manufacturing a part for basic form, fit, and function checks can take just as long as it might to manufacture it in a production capacity.

3D printing offers a new capability to iterative design: rapid prototyping. Not every print has to be an end-use item. Rapid prototyping takes additive manufacturing back to its roots, creating pieces that allow for form, fit and function checks in a fraction of the time it might take to produce an asset via traditional subtractive machining.

How Porous Media Air Bearings Deliver

For additive manufacturing processes tuned towards a rapid prototyping end goal, speed is everything. Roller and ball bearing elements are limited to three to five meters per second as a result of friction between the rolling elements and the raceways. However, porous media air bearings are unencumbered by friction.

Air bearings in a linear application can exceed speeds of 50 meters per second, a 10 fold increase in speed over their contact bearing counterparts. The next generation of 3D printers will be faster and even more accurate. And to keep your iterative design process moving along smoothly, you need the speed of frictionless motion for your rapid prototyping.





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On-Demand Jigging

On-Demand Jigging

The Challenge

For woodworking, metalworking, and composites manufacturing, proper jigging for bonding components is essential. Well-made jigging will hold components in place and resist thermal gradients, preventing pieces from expanding, shrinking, and breaking the bonds between components while you let them cure, harden or solidify.

3D printing offers the unique advantage of on-demand jigging, through new, high-strength materials like chopped carbon-reinforced polymers. These materials allow for on-site printing of jigging without the need to contract out components. Additive manufactured jigging, templates, and drill guides offer the knowledge of absolute precision, produced in-house with the strength to withstand your industrial processes.

How Porous Media Air Bearings Deliver

3D printing these components at scale can require large volume printers, and only porous-media-based motion solutions offer the straightness required to ensure your finished tooling is free of imperfections or geometric deviations.

A report conducted by Michael Chiu of MIT compared porous media air bearings against contact bearings for linear-motion-based machine tooling applications and found an order of magnitude reduction in straightness deviation when moving from roller bearings to air bearings.

Considering how 3D printers require an XY-gantry configuration and how deviation can grow exponentially as a part gets larger, air bearings provide the foundation for ensuring on-demand jigging is not just quick and ready to go, but is as accurate as its CAD model.





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**Cleanroom
Manufacturing**

Cleanroom Manufacturing

The Challenge

Cleanroom manufacturing is rapidly becoming a best practice for numerous industries. Already a requirement for semiconductor and pharmaceutical manufacturing, cleanroom conditions are becoming a necessity in numerous precision fields owing to their exacting standards and the catastrophic consequences which can occur when an environment is contaminated.

Additive manufacturing in a cleanroom can be accomplished, but requires special attention to be paid to the bearing systems within the printer, any potential particle generation which can result from spalling, and outgassing owing to the bearing's lubricant.

How Porous Media Air Bearings Deliver

While you might have to worry about contamination with ball and roller bearings, air bearings are fundamentally different. Owing to the microperforated structure of our porous media's carbon surface, all New Way Air Bearings act as a sub-micron filter, removing any particulates before they can enter the environment. Combine this with no dynamics components—and thus, no flakes from spalling or outgassing lubricant—and you have an ideal product.

Furthermore, internal New Way testing demonstrates all our products as being ISO class 3 and even ISO Class 1 cleanroom compliant, producing less than 1,000 0.1 micrometer-sized particles per cubic meter. This report, as well as the methodology and results, can be found on our website.



Transforming the Future of Additive Manufacturing

Air Bearings Offer Solutions to the Challenges of Modern 3D printing

Additive manufacturing can count itself as one of the hallmark technical achievements of the 21st century. 3D printers can be found from elementary school science classes all the way to production floors, owned by the biggest names in manufacturing, and their importance will only continue to grow.

Progress is not without its challenges, and the limitations of contact-bearing-based motion are evident in their overshoot, wear and tear, and speed limitations.

As captured in this eBook, porous media air bearings offer speed, durability, and precision across a wide range of industries and applications, including:

Aerospace | Medical Implants | Rapid Prototyping
On-demand Jigging | Cleanroom Manufacturing

With a broad array of standardized products, and with a team on staff for fully customized solutions, New Way Air Bearings is ready to help build the next generation of additive manufacturing on frictionless media.

If you have questions about our products or you're ready to move forward with an application, please visit us at www.newwayairbearings.com. Or, contact us directly for a complimentary consultation.



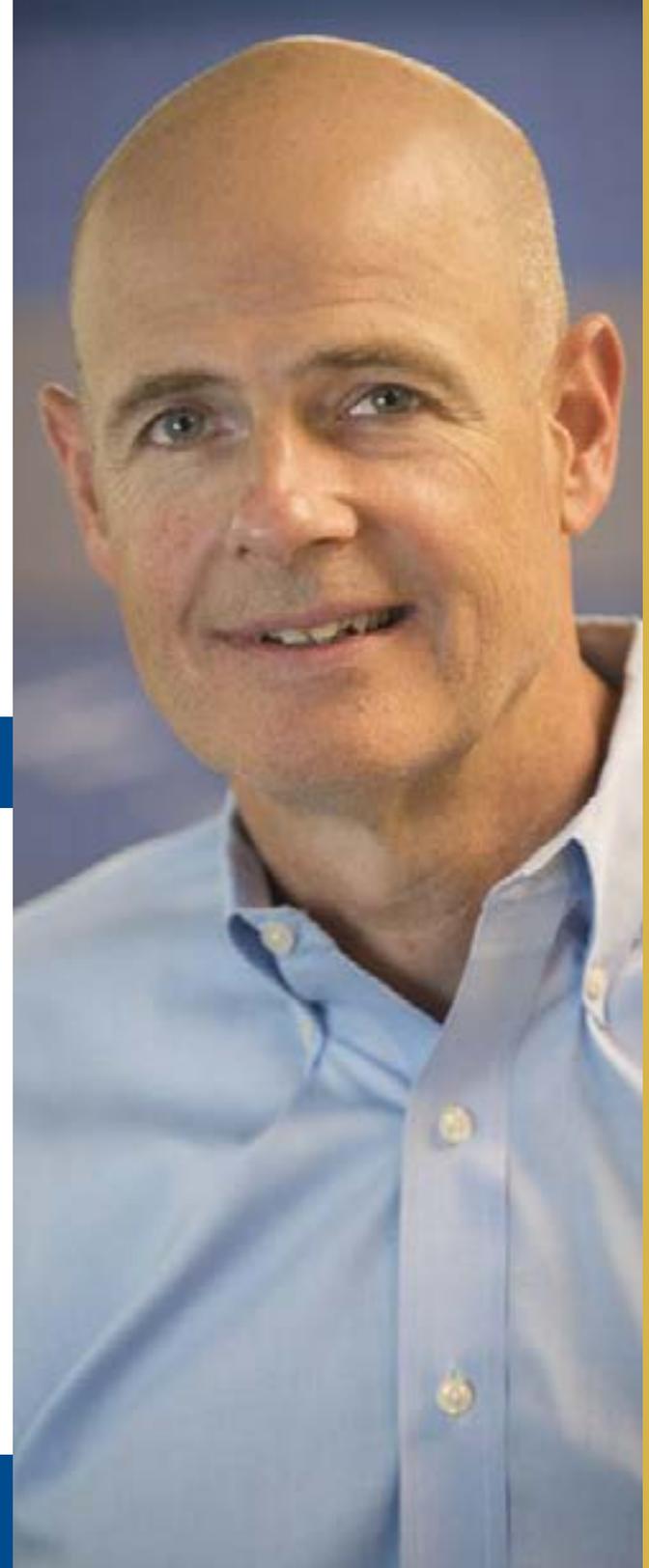
About Drew Devitt

Drew Devitt founded New Way Air Bearings in 1994 to realize business success through the commercialization of Porous Media Air Bearing Technology.

From the time of New Way's inception, Devitt, as CTO, has maintained its research efforts, and its connections with research and academic institutions, in order to foster the continued development of air bearing technology and the dissemination of the knowledge gained. Devitt is a major figure in the world of precision and was elected President of the American Society of Precision Engineering (ASPE) for the 2007 calendar year. He holds a Bachelor's Degree in Business Administration.

About New Way Air Bearings

New Way® Air Bearings, Inc. is the world's leading independent designer and manufacturer of modular air bearing products, and the recognized provider of Porous Media™ air bearing solutions, sold in over 30 countries worldwide. The company manufactures a standard line of modular, off-the-shelf components as well as custom products, and is ISO 9001:2015 Certified. New Way is headquartered in Aston, Pennsylvania, USA, just 15 minutes from Philadelphia International Airport.



New Way Air Bearings
50 McDonald Blvd.,
Aston, PA 19014 USA
610.494.6700 | www.newwayairbearings.com

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