



Air Bearings Provide a *More-Precise* View of Print Head Variations

Photos courtesy of EFI and New Way Air Bearings



An EFI printer for which the print head reference system was developed.

In the printing industry, image is everything and reproducing images that are visually pleasing can be a challenge for large-format printers. The human eye can discern print resolutions of 300+ dpi using more than 10 million colors. Unfortunately, slight variations in print heads as well as in the mechanics of the printers themselves are often directly translated into artifacts in a print image that the human eye can easily distinguish.

Electronics for Imaging, Inc. (EFI), located in Foster City, California, has made a name for itself as a leader in digital print servers and controllers as well as super-wide format printers and inks. In order to understand some of these print head variations, EFI contracted motion control specialist Axis New England to design and develop a reference mechanical system for the in-house testing of various print heads from

different manufacturers. Understanding the differences in the print heads requires a reference system with precise mechanics that will minimize print artifacts. To accomplish this level of precision, Axis New England utilized air bearings.

New Way Air Bearings is an independent manufacturer of modular air bearing products and a provider of porous media air bearing solutions. The company manufactures a standard line of modular, off-the-shelf components including: transition and precision zone air bars; flat round and rectangular air bearings; vacuum preloaded air bearings; radial air bearings; air bushings; and air slides. The company's flat round air bearings were the first to be offered as a complete product line and they remain one of the most popular standard components offered by New Way. The 65 mm flat round bearing seemed a suitable choice for the needs of the mechanical system in question.



Unlike rolling-element bearings, air bearings utilize a thin film of pressurized air to provide a 'zero friction' load-bearing interface between surfaces that would otherwise be in contact with each other. And unlike traditional 'orifice' air bearings, New Way delivers the air through a porous medium to ensure uniform pressure across the entire bearing surface. This enables a consistent, robust, non-contact performance that virtually eliminates traditional bearing-related problems like friction, wear, and lubricant handling. It also offers distinct advantages in precision positioning, speed, acceleration, and—as it related to EFI's requirements—straightness and flatness of motion.

New Way's porous media air bearings are used as an enabling technology in an increasing array of linear and/or rotary motion applications in diverse industries including: semiconductor, flat panel display manufacturing, CT scanning, medical, automotive, aerospace, metrology and precision machine tool.

"We knew we would be limited with a rolling-element bearing," said Greg Ellrodt, senior systems engineer at Axis New England. "New Way's porous media air bearing technology provides consistent, precision performance characteristics that contact bearings just can't touch."

Axis matched these characteristics with a precision Tru-Stone granite guideway, a combination that enabled EFI to meet the stringent five-micron straightness and planar flatness specifications

required between the lower-axis vacuum table and the upper-axis print-head fixture over the center 30" print zone.

Finite element analysis (FEA) and the utilization of Invar alloy with a low coefficient-of-thermal-expansion were also required to maintain specifications in the operating environment. Further, New Way's gimbal-mount design and Omron's precision laser sensors allowed the flatness to be dialed in "to spec" with slight adjustments to the air bearings.

The center of gravity of the X-axis carriage was optimized to minimize the pitch and yaw moments on the air bearings induced by the Parker Trilogy linear motor's 2G acceleration—up to 2.5 m/s. An ultra-quiet Igus cable track was required to minimize velocity ripple during the print process.

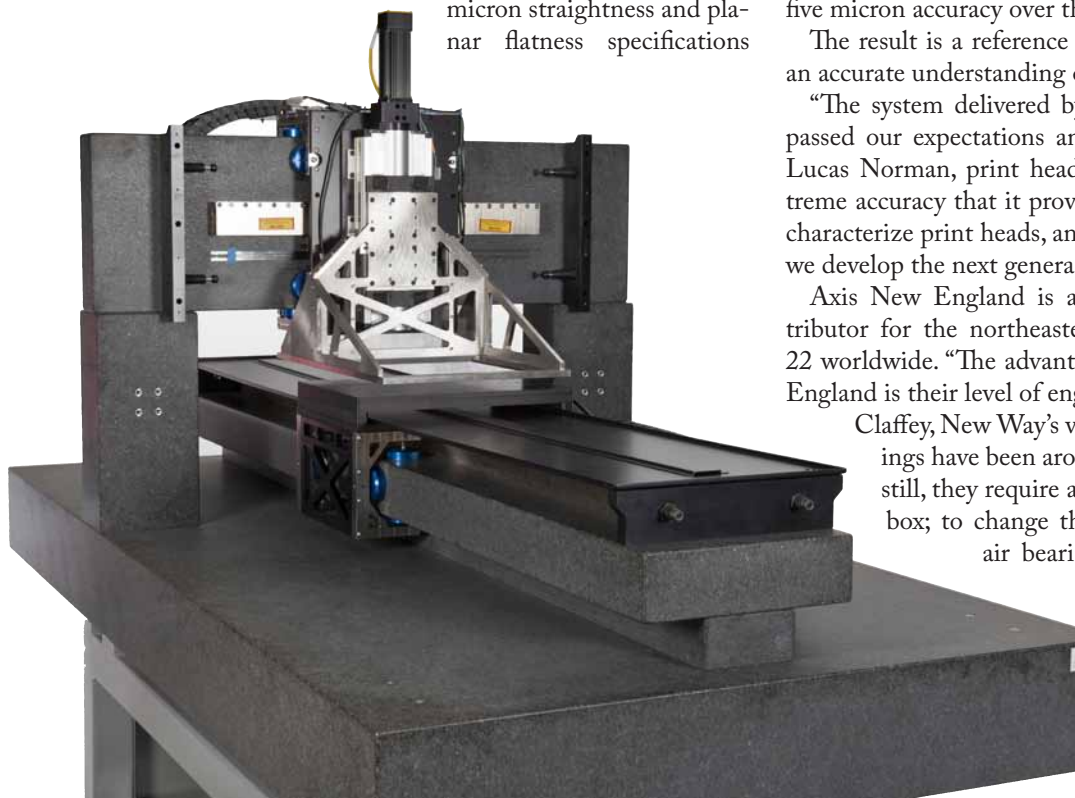
The system utilized a Delta Tau Turbo ultra-light controller with Copley Xenus macro drives on a fiber optic network. This allowed for the seamless integration of the Renishaw Resolute series of high-accuracy, absolute linear encoders with 50 Nm resolution on the Y and Z axes, and Renishaw's dual-output, tonic series incremental encoder. One signal was used to synchronize the printing to the motion, while the other was used in the control loop. The entire system was laser-aligned and calibrated with the Renishaw XL-80 laser system; compensation tables were applied to the Delta Tau controls to obtain a better than five micron accuracy over the lengths of travel.

The result is a reference system that provides EFI with an accurate understanding of print head variation.

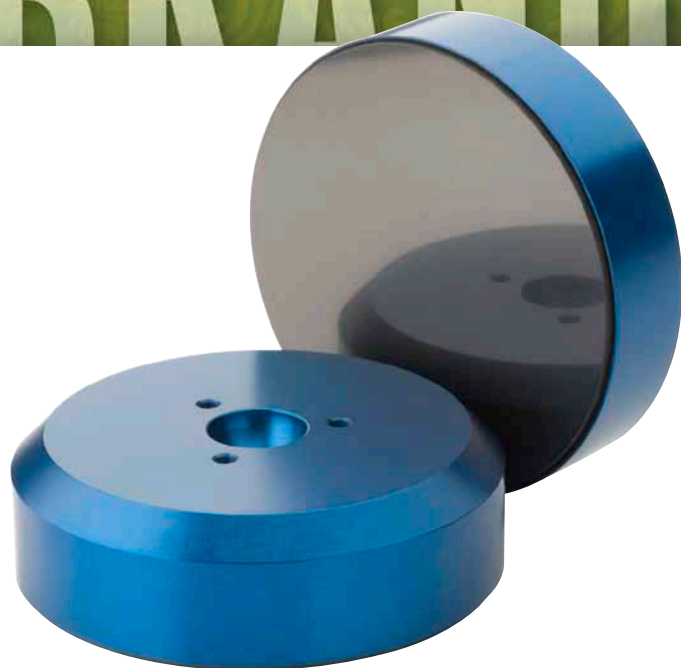
"The system delivered by Axis New England has surpassed our expectations and original specifications," said Lucas Norman, print head engineer II at EFI. "The extreme accuracy that it provides is furthering our ability to characterize print heads, and will play an important role as we develop the next generation of inkjet printers."

Axis New England is a New Way Air Bearings distributor for the northeastern United States, and one of 22 worldwide. "The advantage of working with Axis New England is their level of engineering expertise," noted Tim


Claffey, New Way's vice president of sales. "Air bearings have been around a long time but sometimes, still, they require an engineer to think outside the box; to change the paradigm. Axis understands air bearings. Not only do they convey



EFI reference mechanical system for the in-house testing of print heads



New Way 65 mm flat round air bearing.

the advantages exceptionally well, but they show their customers exactly how to get there, quickly, cost-effectively, and successfully. The differences are often measured in orders of magnitude. EFI is just one example.” 

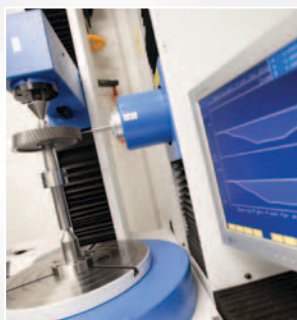
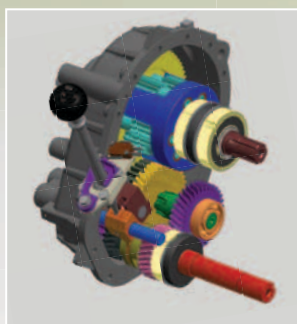
For more information:

Gregory Ellrodt, senior systems engineer
Axis New England
6 Cherry Hill Drive
Danvers, MA 01923
Phone: (978) 774-7100
Direct: (978) 406-4070
Greg@axisne.com
www.axisne.com

Michael Wright, director of marketing
New Way Air Bearings
50 McDonald Blvd.
Aston, PA 19014
Phone: (610) 364-3453
mwright@newwayairbearings.com
www.newwayairbearings.com

ODG

DESIGN • MANUFACTURE • ASSEMBLE • TEST



One-stop powertrain solutions...

Specializing in Quiet Gear Technology

Ontario Drive & Gear Limited • New Hamburg, ON, Canada • 1.888.662.2840 • www.ODG.com