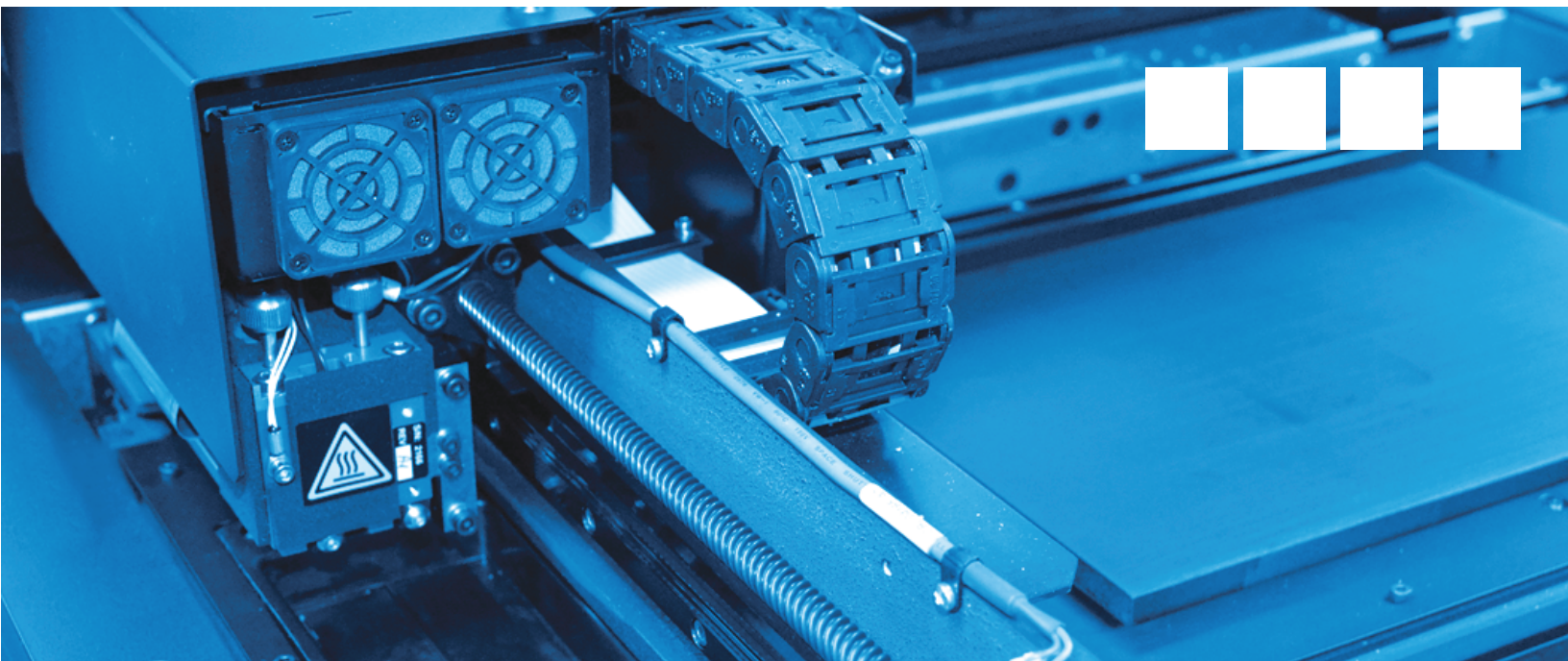




# CASE STUDY

## HOW ARE LEAD SCREWS USED IN A 3D PRINTER?



March 2013



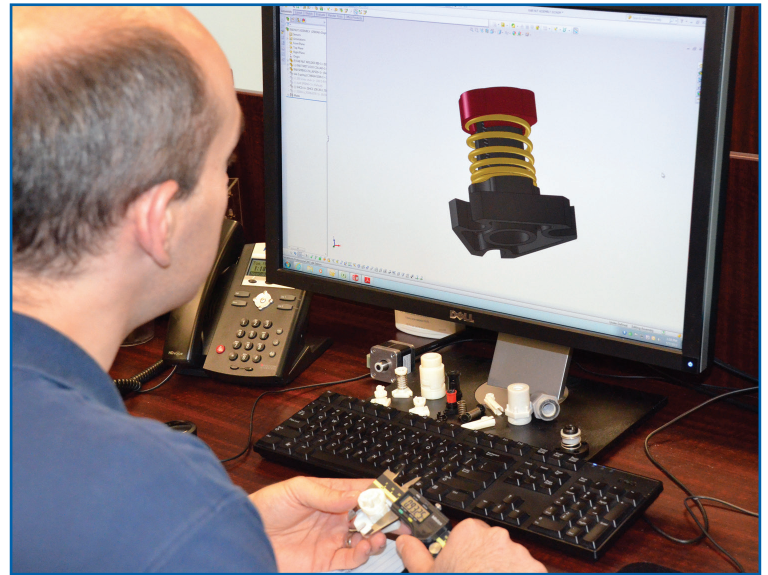
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# Rapid Prototyping 3D Multi-Material Printers.

For many of today's manufacturing organizations, 3D printers have become a fixture for the rapid prototyping of parts and products prior to their release for manufacture. With a 3D printer, product developers can quickly and cost-effectively create actual physical parts of product designs directly from product design data. Just as a desktop printer produces type on a 2D page, a 3D printer builds a physical object in 3D space, layer by layer. The majority of 3D prints are used for design interrogation and evaluation purposes. Some parts produced on a 3D printer are production-ready. Still others serve as the basis for creating molds for investment castings.

The benefits of using a 3D printer to rapid prototype parts versus the historical practice of machining prototypes as preview parts is that it's faster and less expensive. However, not all 3D printers are created equal. This article will examine the advantages of using precision-engineered lead screws for driving linear motion control applications in 3D printing systems.



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3 Dimensional Prototype Models



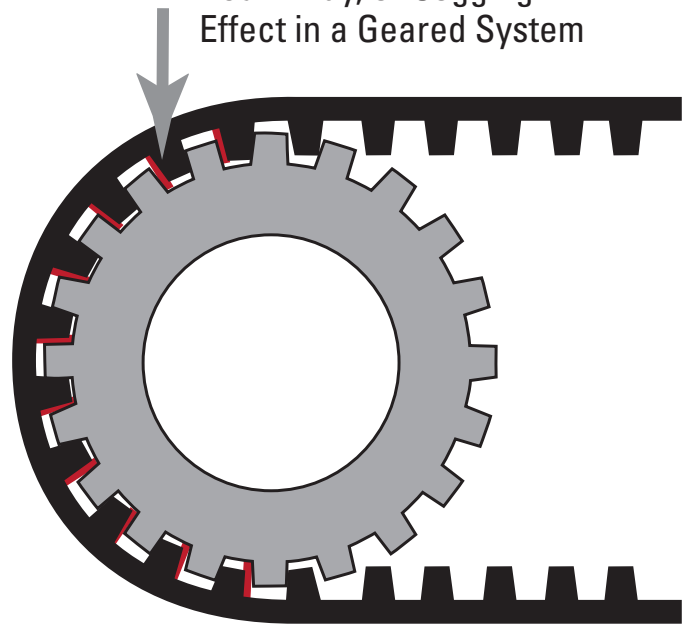
3D Multi-Material Printer

## Lead Screws Outperform Belt Drives in 3D Printers

Many of the 3D printers on the market today utilize belt-drive technology, which results in inferior performance characteristics when compared to precision-engineered lead screws. With belt-drive technology, accuracy and repeatability can be issues because belt-drives simply have more play in them, delivering less-precise linear motion control than precision formed or thread-rolled lead screws.

Because of the imprecision associated with belt-drive technology, 3D printers that use belt-drives for linear motion control output parts of less than optimal quality, with undesirable surface patterns, and with less resolution on certain types of part features, such as holes and cavities. Lead screws, on the other hand, provide higher levels of accuracy, repeatability, and performance when used in 3D printers. Thus, 3D printers that operate with lead screws output more precise, better quality parts.

Red = Play, or Cogging Effect in a Geared System

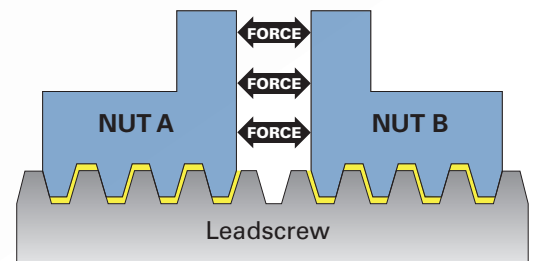


Belt-Drive Technology Simply has more Play, Delivering Less-Precise Linear Motion than a Roll-Thread Lead Screw.

HELIX™ Precision  
Engineered Lead Screw,  
w/Standard Anti-Backlash Nut



Yellow = Lash



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LINEAR TECHNOLOGIES  
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## How a Lead Screw Functions in a 3D Printer

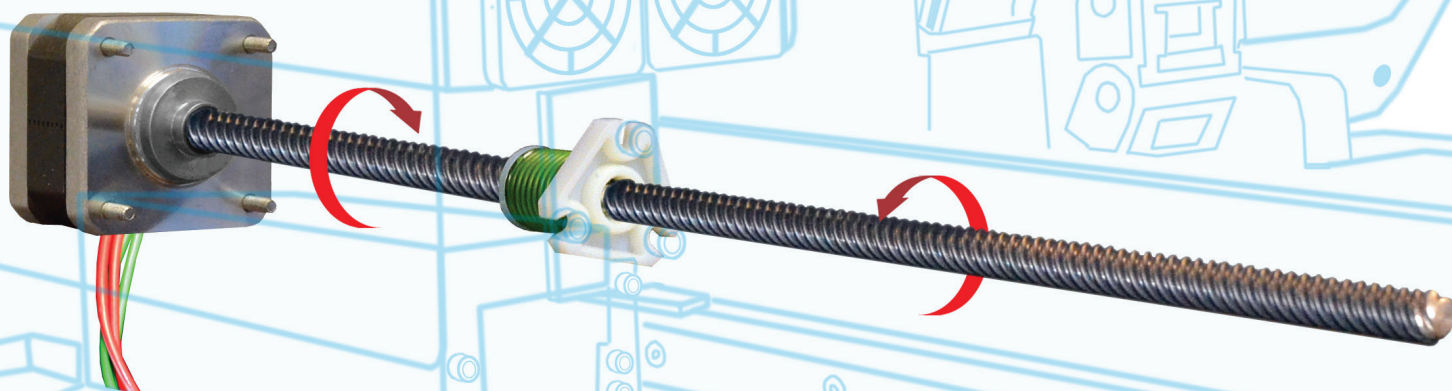
Within a 3D printing application, lead screws are typically driven by a stepper motor and guided by profile rails on the X and Y axes. Precision-engineered Acme nuts are connected to the carriage mechanism. All axes are actuated with a stepper-motor-driven lead screw with an anti-backlash nut, and move along linear ball bearing guides.

An important advantage of the lead screw-rail configuration for controlling linear motion in 3D printers is that it requires a fraction of the number of components that are necessary for belt-driven 3D printers and takes much less time to assemble.

Compared to belt-drives, which deliver linear motion with repeatability of  $\pm 0.1$  mm/m and a layer

height of 100 microns in 3D printing applications, lead screws offer linear motion with repeatability of  $\pm 0.02$  mm/m and a layer height of 50 microns, making them a lot more precise and accurate for controlling 3D printer performance.

Precision-grade lead screws have increasingly become the preferred option for low-cost, desktop 3D printers because they deliver the accuracy, repeatability, and performance that users demand at an affordable price. In other words, 3D printer designers no longer need opt for belt drives for controlling linear motion in 3D printers just to keep the cost down. With precision-engineered lead screws, you can have high-resolution parts while reducing cost.



## Use HELIX Lead Screws to Build Top-Performing, Cost Effective 3D Printers

Contact HELIX Linear Technologies to learn how you can use precision-engineered lead screws to develop cost-effective, high-performance 3D printers and rapid prototyping systems. HELIX offers a wide array of highly configurable lead screws that can provide the accuracy, repeatability, and performance that

you need to outperform other 3D printing systems on the market.

To learn how HELIX lead screws can drive 3D printing and rapid prototyping applications, download a copy of the newest HELIX catalog.

