HELIX™
LINEAR TECHNOLOGIES

CASE STUDY

LEAD SCREWS: DRIVE MISSILE FIN ACTUATION SYSTEM

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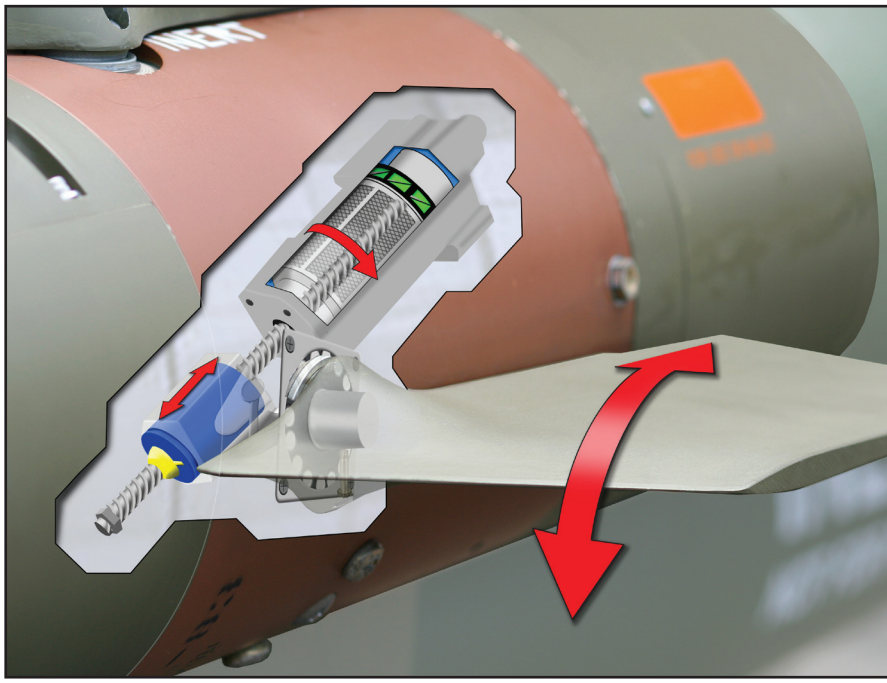
Lead screws are used for a variety of linear motion control applications, ranging from syringe pumps to pan-and-tilt systems for security cameras. However, one of the more interesting applications of lead screws involves their use for driving the fin actuation that guides a missile to its target.

In this application, precision miniature lead screws are used to position the sighting mechanism that identifies and acquires the target while maneuvering at high speed. Lead screws also provide the actuation that controls the missile fins, which in turn, guide the missile's flight. The fins are the missile's wings, some missiles also have real wings and using lead screws to position wings and fins enables fine positioning and control to maximize speed and minimize drag during transonic and supersonic flight. In addition to directing the missile, lead screws are used to raise missile-launching systems and deploy sighting, range-finding, and antenna equipment.



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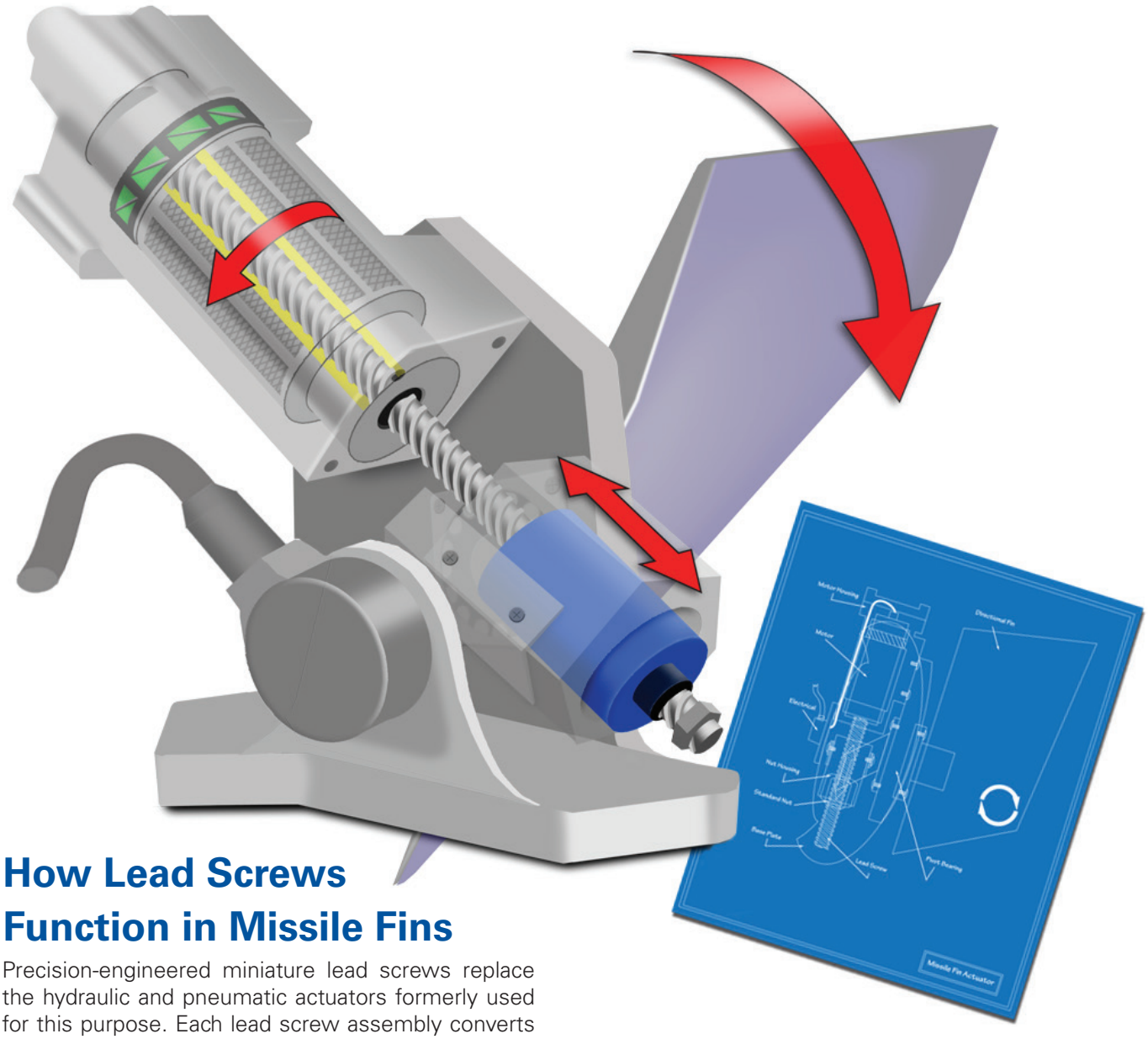
The lead screw mechanism eliminates sliding friction and stick-slip, it requires little or no maintenance besided initial lubrication.



How Lead Screws Function in Missile Fins

Precision-engineered miniature lead screws replace the hydraulic and pneumatic actuators formerly used for this purpose. Each lead screw assembly converts torque to thrust as the screw or nut turns to move the other component in a linear direction. Because the lead screw mechanism eliminates sliding friction and stick-slip, it requires little or no maintenance besides initial lubrication.

Lead screws automatically minimize the power required to drive missile-fin actuation because of their high efficiency. The size and weight of the fin drive transmission is also reduced, making lead screws a better option for small missiles and targeted munitions.

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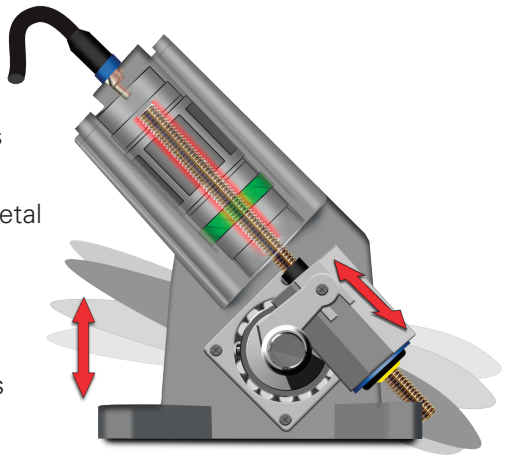
Advantages of Lead Screws for Missile Actuation

Precision-engineered miniature lead screws, like those produced by HELIX Linear Technologies, provide many advantages when used for missile fin actuation over traditional linear motion control systems.

Key Advantages of using HELIX Linear Lead Screws for this Application include:



- **Lower Cost** – Lead screws cost less when compared to ball screw assemblies and pneumatic or hydraulic actuators.
- **Custom Designs** – Lead screws can be custom-designed to match specific design envelopes.
- **Range of Leads and Diameters** – Lead screws are available in a range of leads and diameters from 1/8" to 4".
- **Corrosion Protection** – Stainless steel lead screws and internally lubricated Acetal nuts eliminate corrosion.
- **Lubrication-Free** – Internally lubricated plastic nuts operate without lubrication.
- **Quiet Operation** – Much less audible noise compared to ball screws.
- **Lightweight and Compact** – Highly efficient, miniature lightweight assemblies mean there's less mass to move and less space consumed.
- **Precision and Accuracy** – Precision-engineered lead screws are highly accurate with a lead accuracy of 70 millionths of an inch when used for missile fin guidance control mechanisms.
- **Strong and Durable** – High-strength steel provides proven reliability under rigorous and demanding environmental conditions and speeds.
- **Better Field Performance** – HELIX lead screws feature a unique thread that maintains tighter and more rigid contact angle control, resulting in lower contact stresses,higher load capacity, reduced wear, optimum thrust control, and maximum predictable life.
- **Precise Positioning** – Tighter contact angle control over the full stroke length maintains high repeatability with precise positioning.
- **Long Life** – Lead screws have less drag torque and provide longer life expectancy.
- **Precision Engineering and Advanced Manufacturing** – HELIX can engineer customized and unique lead screw assemblies, machine lead screws to exact specifications, and provide motor mounts, or complete lead screw stage assemblies.

Use HELIX Lead Screws to Support Your Most Sophisticated Applications

When you need to support a sophisticated linear motion control application like driving a missile fin actuation system, HELIX Linear Technologies can provide you with the advanced, precision-engineered lead screws to do the job. HELIX offers a wide array of standard plastic nut assemblies in anti-backlash or standard nut designs. HELIX zero-backlash nut designs offer assemblies with high axial stiffness, zero backlash, and the absolute minimum drag torque.

To learn more about how HELIX Linear Technologies lead screws can drive even your most sophisticated linear motion control applications, just visit www.helixlinear.com or download a copy of the newest HELIX catalog.

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