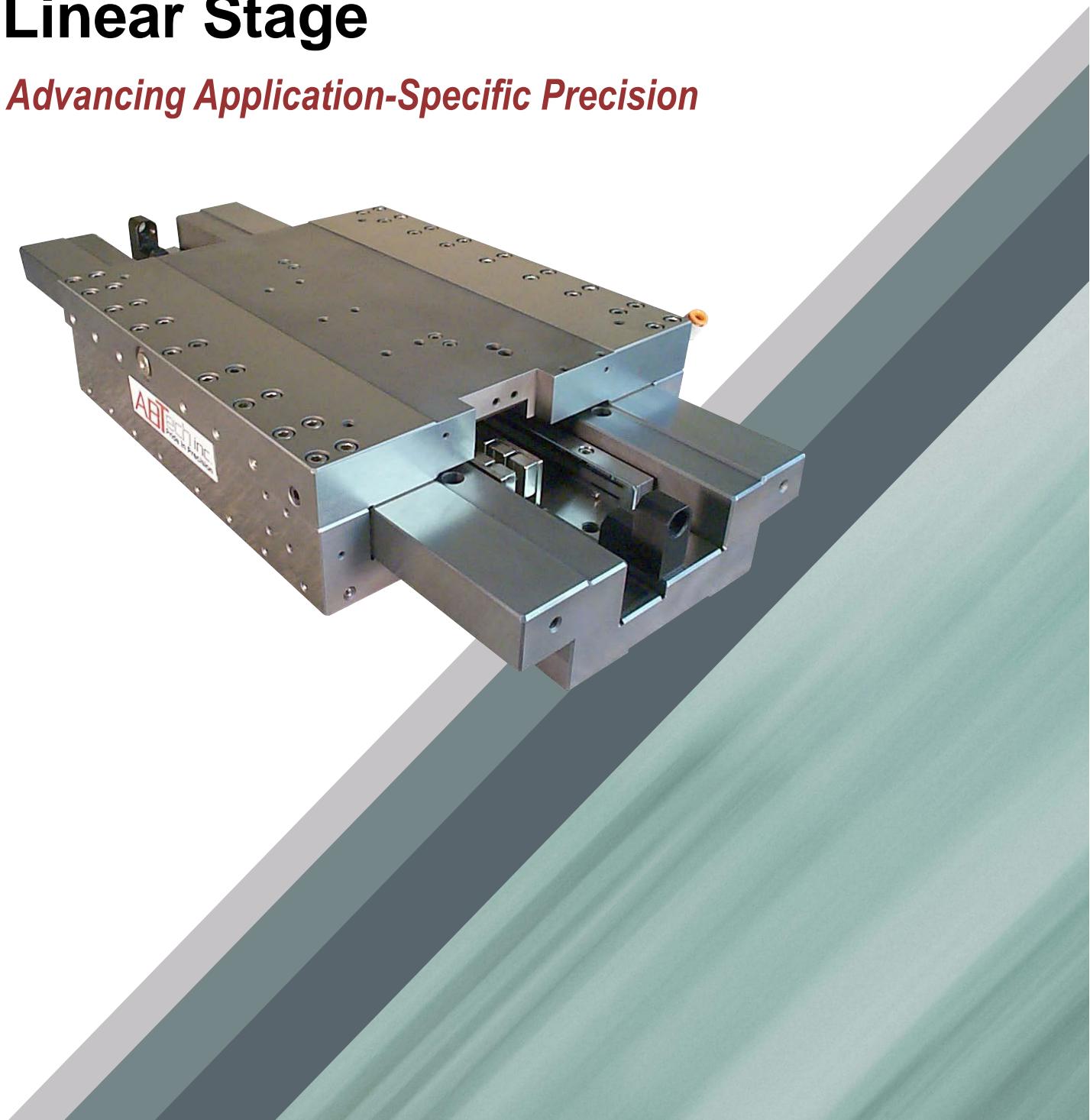


WHITEPAPER:

Selecting the Right Linear Stage

Advancing Application-Specific Precision



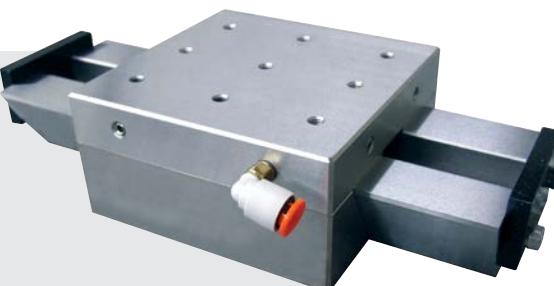
LINEAR STAGES

Linear stages are at the heart of precision motion control, enabling critical advancements in industries from aerospace and optics to semiconductor and metrology. Yet, not all linear stages are created equal. Depending on the application, different technologies—air-bearing, oil hydrostatic, or mechanical linear stages—offer distinct advantages.

In many advanced manufacturing environments, a project may have different demands and **application-specific** requirements:

- Ultra-smooth, frictionless motion for nanometer-level alignments
- Heavy-load capacity and ultimate stability for grinding or assembly
- Compact, cost-effective precision for inspection or multi-axis positioning

This paper outlines the unique benefits of each stage type, illustrating how they can be applied individually or in combination to create tailored, **application-specific** solutions.



THE ABTECH APPROACH

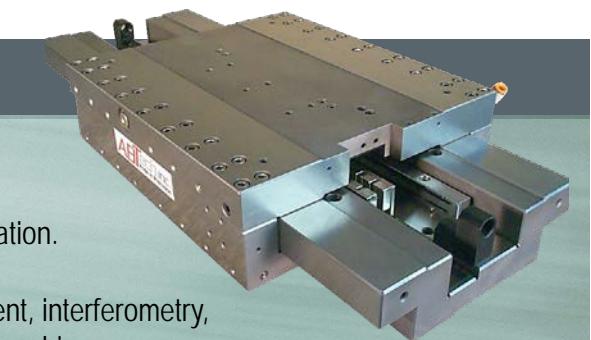
"ABTech engineers partner with each customer to analyze their application, develop key specifications, and leverage from ABTech's existing portfolio to create optimal linear stage solutions."

- Chris Abbott, ABTech Chief Operations Officer, on what sets ABTech apart

Air-Bearing Linear Stages:

Frictionless Accuracy

- **Strengths:** Sub-micron accuracy, zero wear, maintenance-free operation.
- **Ideal Applications:** Semiconductor wafer inspection, optical alignment, interferometry, surface metrology, ultra-precision machining, grinding and polishing machines.
- **Why It Matters:** In environments where even the smallest mechanical disturbance compromises performance, air-bearing stages provide unmatched smoothness and repeatability, ensuring long-term stability.



Oil Hydrostatic Linear Stages:

Stiffness Under Load

- **Strengths:** High load capacity, high stiffness, thermal stability.
- **Ideal Applications:** High-performance machining, including fly-cutting and grinding machines, heavy duty assembly and automation.
- **Why It Matters:** Oil hydrostatic designs maintain sub-micron precision even under tons of force, allowing industries to combine accuracy with productivity in demanding machining environments.



Mechanical Linear Stages:

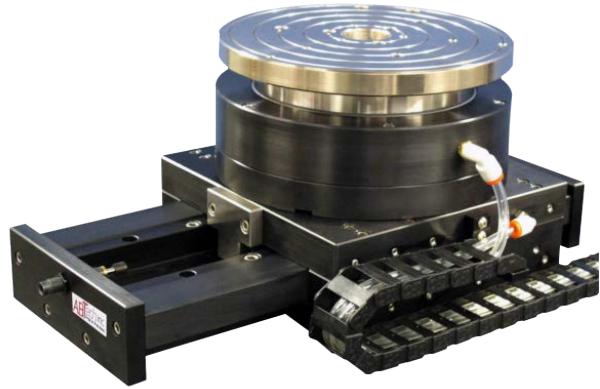
Compact Versatility

- **Strengths:** Cost-effective precision, compact footprint, high stiffness.
- **Ideal Applications:** Multi-axis inspection systems, positioning fixtures, assembly stations.
- **Why It Matters:** For inspection and light-to-medium duty tasks, mechanical stages offer repeatable accuracy at lower cost, making them an efficient choice in multi-axis configurations.



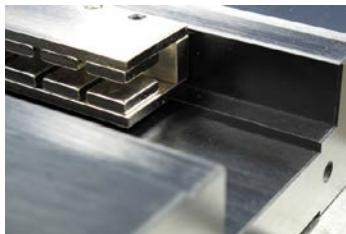
APPLICATION-SPECIFIC INTEGRATION

No single linear stage technology can address every requirement, but together they create a various options that round out ABTech's complete toolkit:



- **Air-bearing stages** deliver the smoothest motion for delicate, high-resolution measurement.
- **Oil hydrostatic stages** ensure precision is not lost under heavy forces or during aggressive machining.
- **Mechanical stages** offer reliable, cost-effective precision in compact systems.

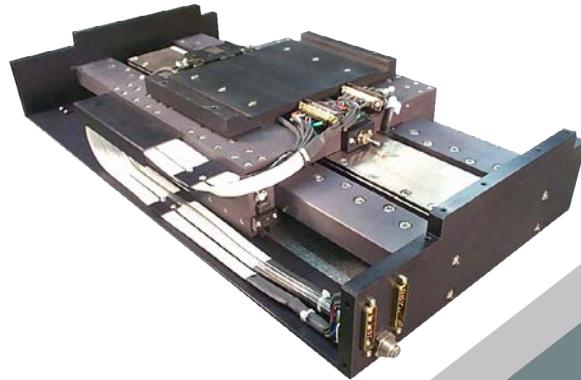
By carefully evaluating application needs—accuracy, load, footprint, and cost—engineers can integrate the right stage or combination of stages into custom solutions. The result is a motion system that is not only precise but also optimized for long-term performance and efficiency.



Motor close-up



Encoder close-up



Conclusion

Linear stages are not interchangeable components but **specialized technologies**, each excelling in a specific domain of performance. Choosing the right stage, or designing systems that leverage multiple stage types, allows manufacturers to meet the exact demands of their application.

At **ABTech**, our engineering philosophy centers on building **application-specific solutions**, using the full range of air-bearing, oil hydrostatic, and mechanical linear stages to achieve unmatched results.