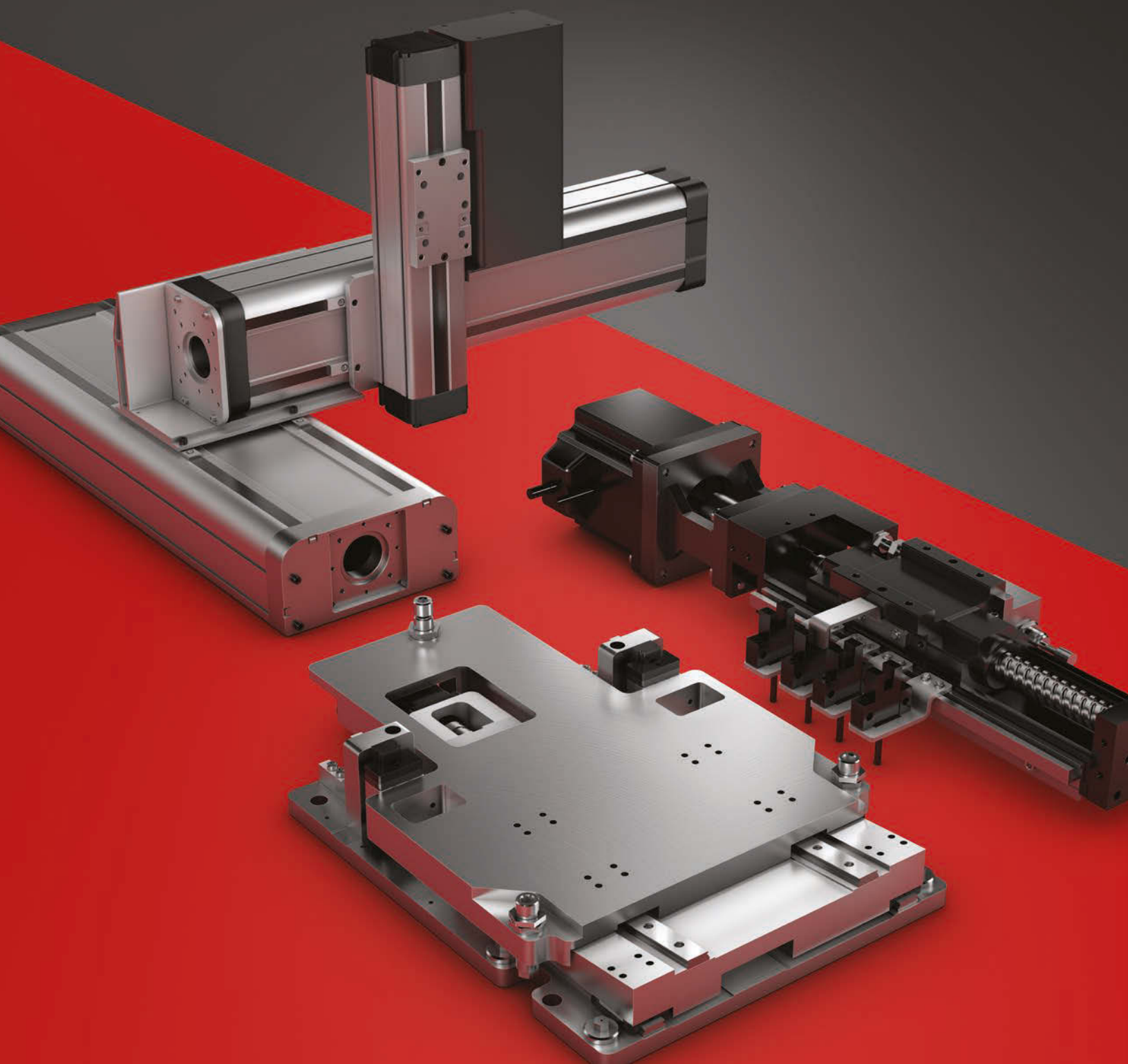
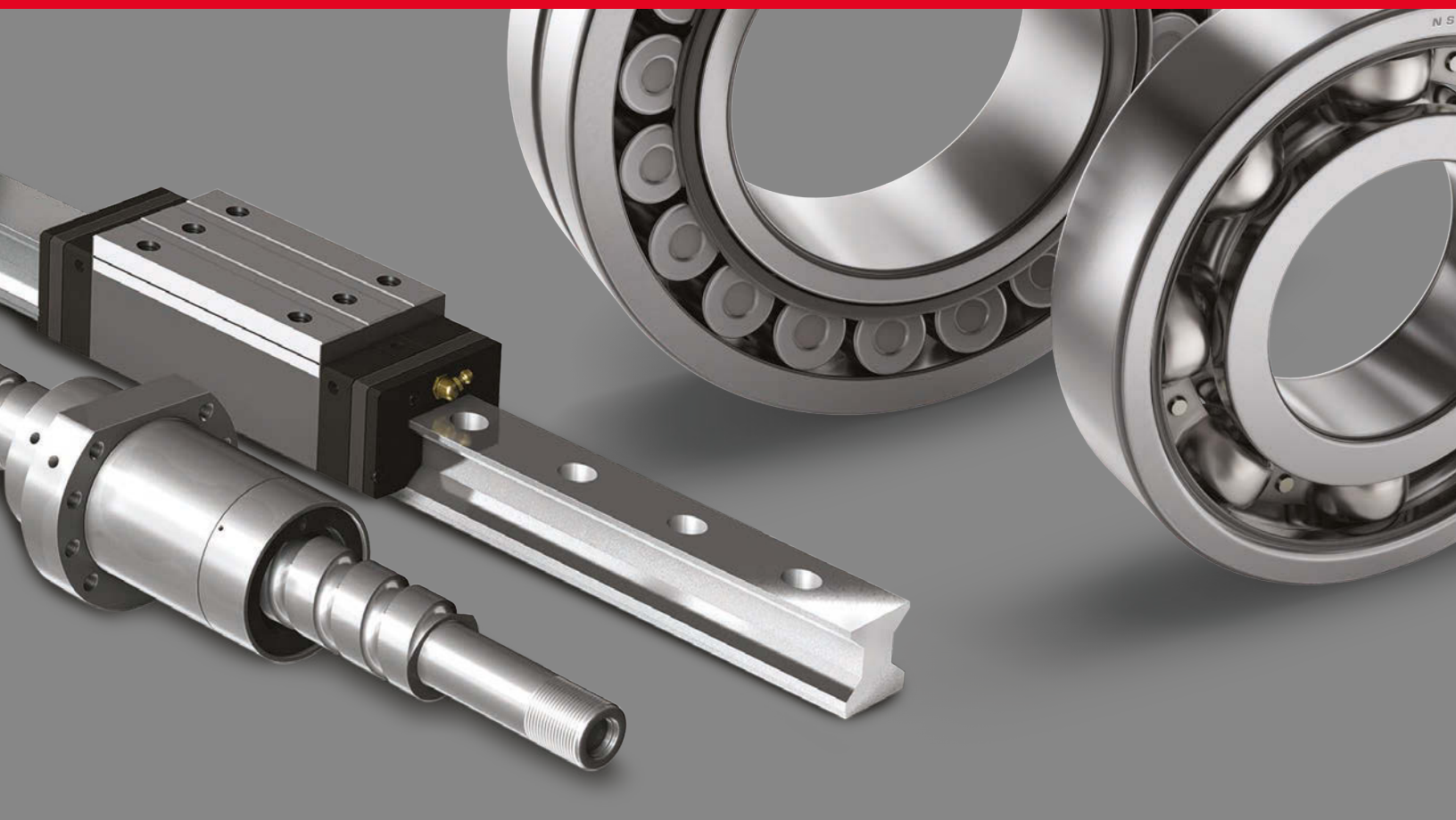




NSK INTEGRATED SYSTEMS SOLUTIONS

ENABLING AUTOMATION IN MOTION AND CONTROL





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A GLOBAL PARTNER AND SOLUTIONS PROVIDER

As a leading manufacturer of rolling bearings and linear technology components, NSK can be found on almost every continent – with production facilities, sales offices and technology centers - providing our customers with responsive design and decision-making, effective logistics and dedicated local service.



THE NSK COMPANY

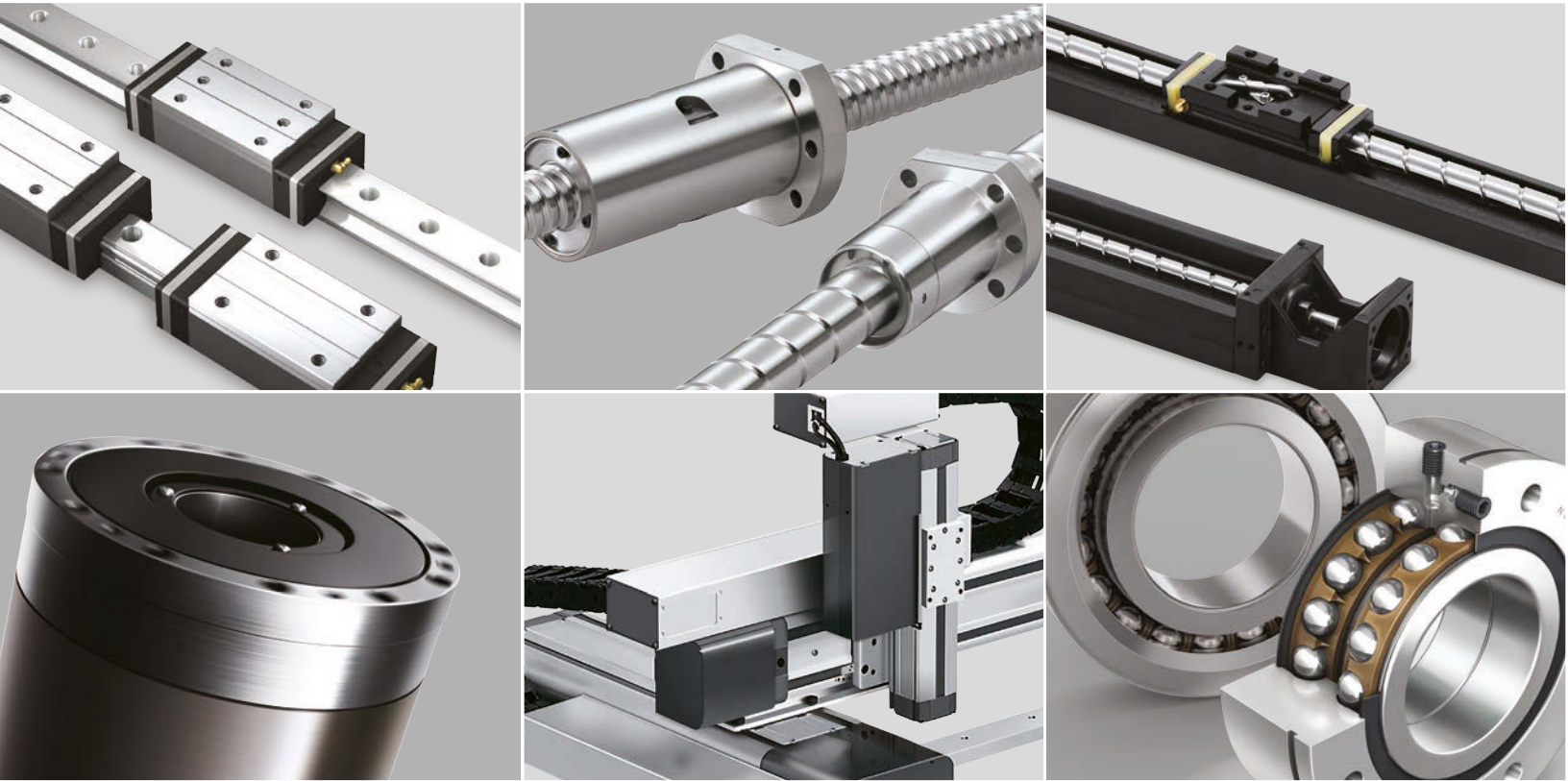
NSK commenced operations as the first Japanese manufacturer of rolling bearings in 1916. From the outset, we have been continuously expanding and improving not only our product portfolio but also our range of services for various industrial sectors. In this context, we develop technologies in the fields of rolling bearings, linear systems, components for the automotive industry and mechatronic systems. Our research and production facilities in the Americas, Europe, and Asia are linked together in a global technology network. Here we concentrate not only on the development of new technologies, but also on the continuous optimization of quality – at every process stage.

At the core of our research activities is the development of advanced material and lubricant technologies, simulation applications using a variety of analytical systems, and technological innovation in the field of mechatronics.

	THE AMERICAS	EUROPE / AFRICA	ASIA / OCEANIA
Manufacturing Sites	10	9	45
Sales Locations	20	15	82
Technology Centers	2	3	10

As of January 2019

ACCUMULATED EXPERTISE IN MOTION & CONTROL



CORE PRODUCTS / TECHNOLOGIES

NSK's accumulated expertise in bearing technology is no more profoundly evident than with our broad range of precision machine components, and our capabilities to integrate these products into highly customized and customer-specific solutions.

With a product lineup that includes linear guides, ball screws, actuators, robot modules, rotary indexers and support bearings, NSK employs cutting-edge friction control technology and precision accuracy to supply products that ensure optimal movement and positioning. In applications that present unique challenges with load capacities, high / low speeds, constrained movement and compact design requirements, NSK precision machine components consistently deliver reliable, smooth and precise motion and control.

Pictured (from top left):

- › Linear Guides
- › Ball Screws
- › Linear Actuators
- › Direct Drive Motors
- › Robot Modules
- › Support Bearings

Not Shown:

- › advanced material, coatings, seal and lubrication options

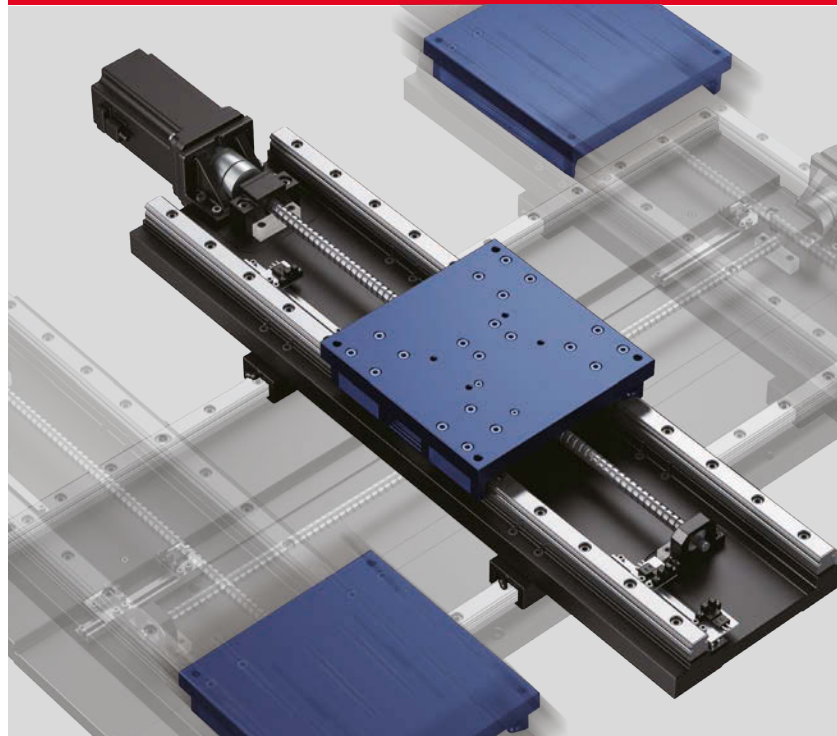
ENABLING TECHNOLOGY THROUGH INTEGRATION

By partnering with NSK mechatronics experts to develop integrated product solutions, our customers can be a crucial step ahead with accelerating product development and achieving higher levels of machine performance. Our advanced electromechanical solutions drive machinery automation and accuracy. Our collaboration and engagement from design to delivery drives project management and process efficiency. For NSK integration customers this translates into significant benefits derived from our project partnership:

- › **streamline** - consolidate multiple components into single, customized part number
- › **simplify** - reduce design, test and installation time
- › **support** - dedicated collaboration and project management
- › **systems** - one-axis or complex assembly capabilities, built to print or advanced design solutions for specific application requirements

With a pre-configured, pre-built and fully tested integrated motion system:

- › **optimize system performance, space and life**
- › **accelerate product development**
- › **simplify procurement and expedite production**



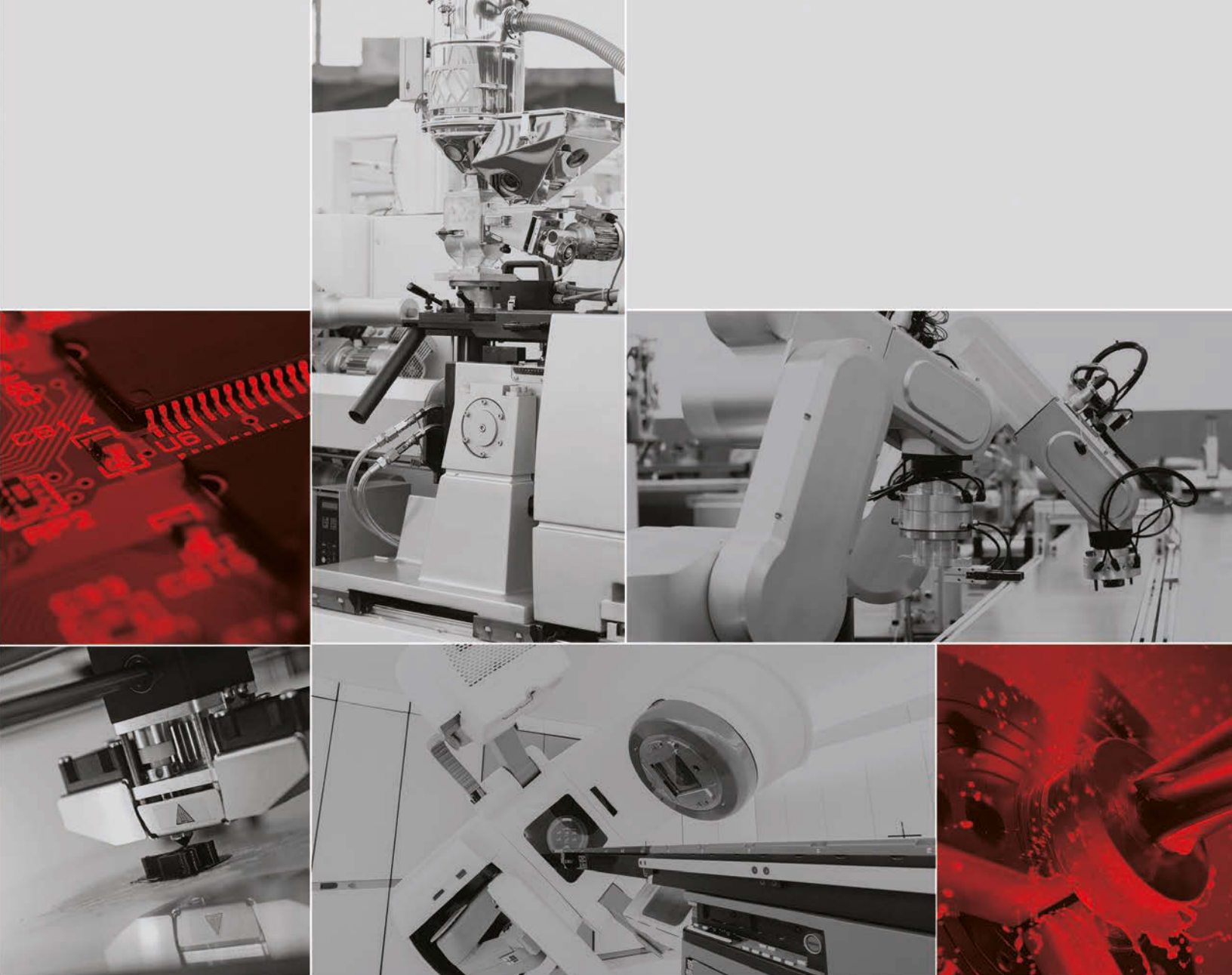
INTEGRATION AND AUTOMATION AT WORK



By definition, integration refers to NSK's capabilities to combine our precision machine components – with or without electrical control technology – to achieve a specific, repeatable motion and control function. By extension, our pre-configured and pre-built motion systems provide the opportunity to augment machine function and accuracy, improve reliability and increase performance in a vast array of industrial applications.

Typical applications / functions for NSK integrated systems include:

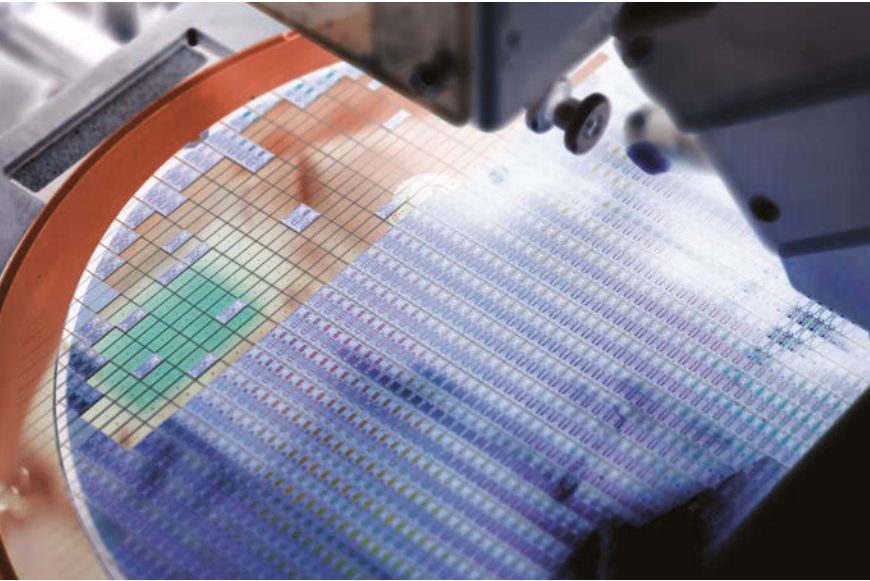
- › lifting
- › positioning / alignment / gimbaling
- › rotational platform / indexing table
- › telescoping slide mechanisms
- › throttling / controlled “small” motion
- › dispensing, mounting, pick and place
- › special environments - vacuum, clean, contaminated, corrosive



INDUSTRIES SERVED

- › robotics
- › autonomous vehicles
- › semiconductor
- › 3d printing
- › injection molding
- › automotive assembly
- › electronics assembly
- › material handling
- › packaging
- › general factory automation
- › medical - clinical chemistry
- › medical - lab automation
- › medical - scanning and imaging
- › machine tool

SEMICONDUCTOR

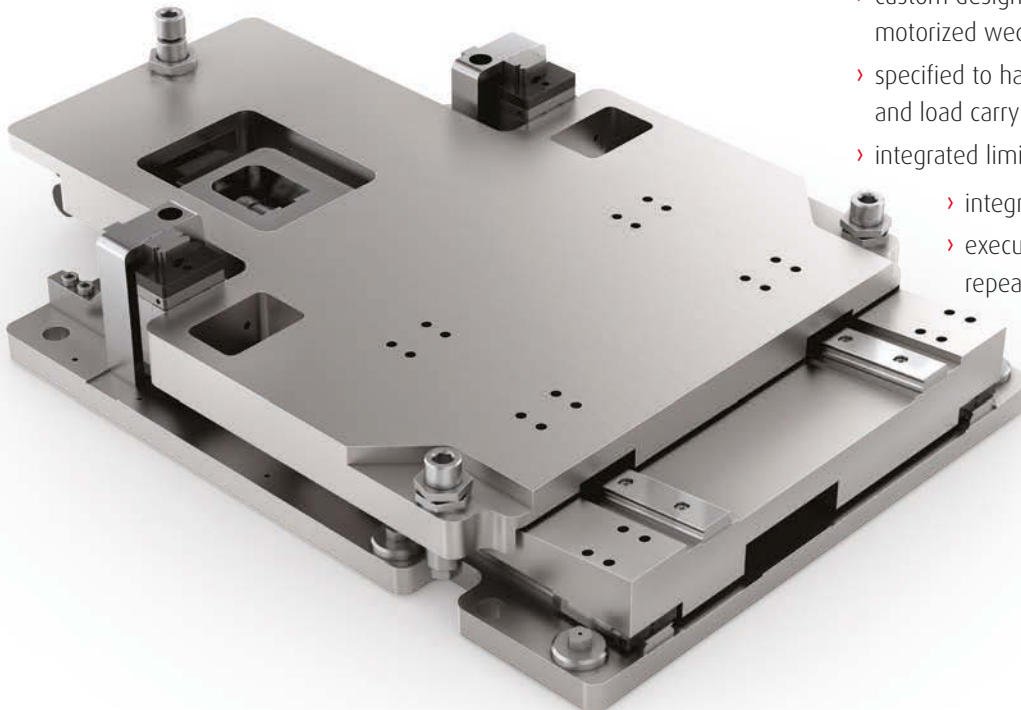


CUSTOMER CHALLENGE

A semiconductor OEM customer was seeking an original design solution and manufacturing partner for a low-profile laser positioning assembly capable of lifting a heavy load with “small motion” in a compact space. Integrated sensors and stepper motors were a requirement, as was suitability for operation in a clean-room environment.

NSK SOLUTION

- › custom designed NSK linear guide and ball screw-based, motorized wedge lift linear actuator
- › specified to handle travel parameters, mounting interface and load carrying conditions
- › integrated limit and home switches
 - › integrated payload pitch / roll adjustment features
 - › execution of design validation for rigidity and repeatability of assembled lift
 - › quality testing of each assembled system prior to shipping

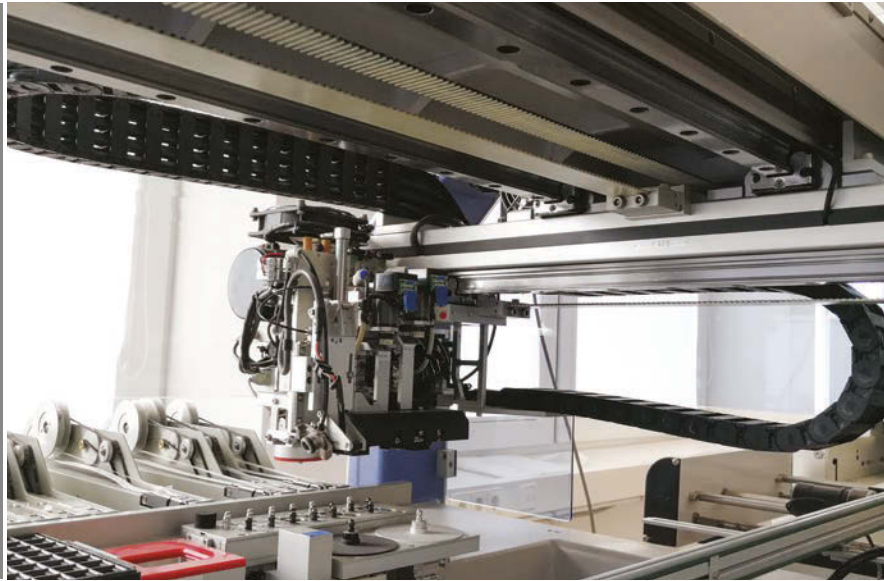


Pictured: Wedge Lift - low profile, z-lift actuator for laser positioning

MATERIAL HANDLING

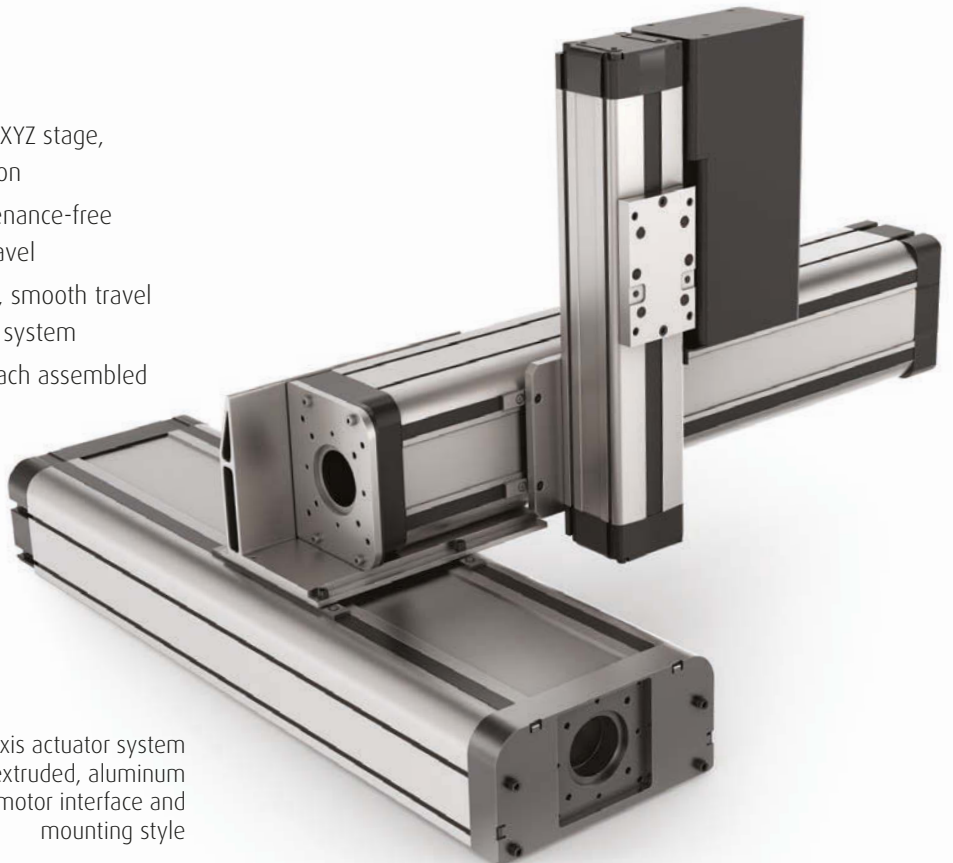
CUSTOMER CHALLENGE

An automated distribution center required a multi-axis linear translation stage to move supplies across the warehouse. In order to significantly increase the durability and life of the three-axis positioner, extruded aluminum is required to resist rust and corrosion. In addition to long travel life, high load capacity and easy installation were needed to minimize downtime when setting up the new system.



NSK SOLUTION

- › a pre-configured NSK robot module forming XYZ stage, facilitating simplified assembly and installation
- › equipped with K1 lubrication units for maintenance-free operation as long as 5 years or 10,000 km travel
- › execution of design validation for loaded life, smooth travel performance and repeatability of assembled system
- › domestic production and quality testing of each assembled XYZ system prior to shipping



Pictured: Multi-axis actuator system integrated into an extruded, aluminum housing with flexible motor interface and mounting style

MEDICAL: ANALYTICAL CHEMISTRY



CUSTOMER CHALLENGE

An OEM customer developing a next generation syringe pump was seeking a compact linear motion system with high accuracy, repeatability and reliability, to smoothly and quietly position the plunger for extremely precise fluid dispense. Previously, the customer had used lead screws - or sliding screws - which generate particles from the sliding motion. multiple axes. Previously, the customer had used lead screws - or sliding screws - which generate particles from the sliding motion.



NSK SOLUTION

- › a motorized ball screw actuator (MBSA)
- › precision ground ball screw directly integrated into a NEMA 17 stepper motor
- › space-saving design with the elimination of motor coupling
- › longer life compared to lead screw due to the higher efficiency, smoother operation, zero backlash and improved rigidity of a precision ground ball screw
- › configurable encoder pre-assembled to motor
- › easy disconnect, simplifying field replacement

Pictured: Motorized ball screw actuator (MBSA)

MEDICAL: CLINICAL CHEMISTRY

CUSTOMER CHALLENGE

A global manufacturer of diagnostic equipment required a custom, fully tested and assembled XYZ platform with rotational positioning to allow continuous reagent processing. Extended lifetime to ensure uninterrupted operations was essential, as was greater rigidity and smoothness over lead screw-based actuators. Specified travel requirements, load conditions and envelope dimensions for their diagnostic equipment had to be met.



NSK SOLUTION

- › robust, NSK designed and assembled system featuring 3 miniature monocarriers for XYZ positioning, along with sensor, sensor rail, combining brackets, motor brackets and stepper motors
- › super high resolution, direct drive Megatorque motor to rotate the three-axis stage in numerous discrete locations within the platform
- › equipped with K1 lubrication units for maintenance-free operation for up to 5 years or 10,000 km travel
- › design validation of rigidity and repeatability of assembled system
- › quality testing of each assembled system prior to shipping



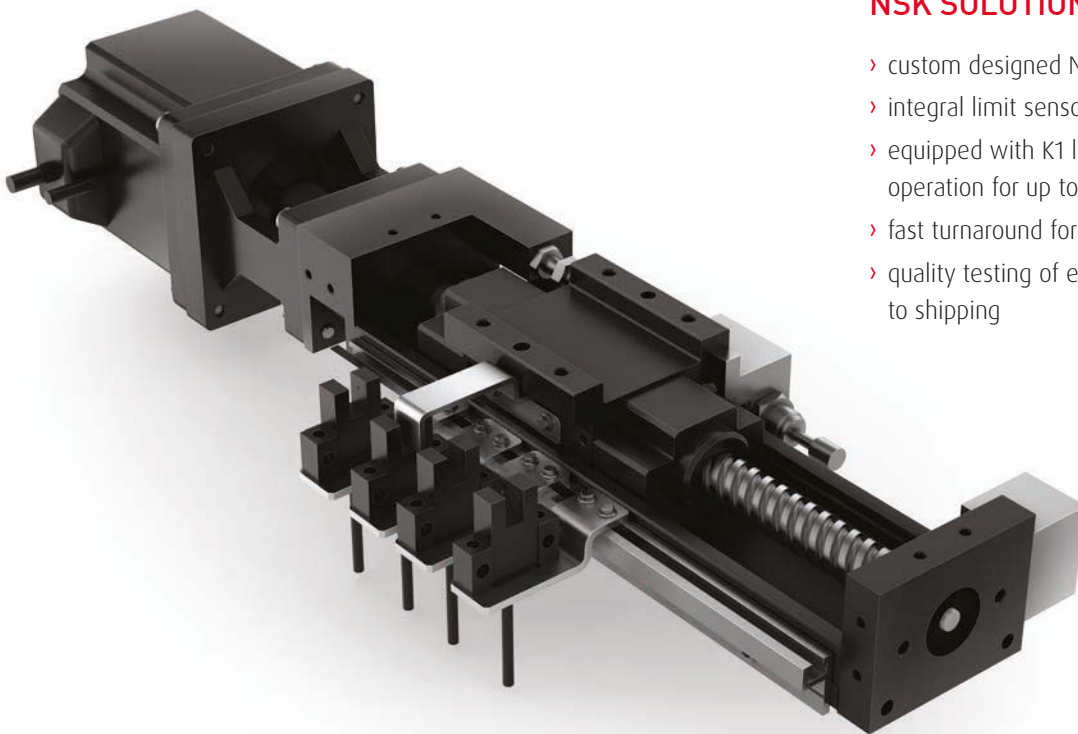
Pictured: Multi-axis linear positioner
with rotational indexer

ELECTRICAL ASSEMBLY



CUSTOMER CHALLENGE

An electronic contract manufacturer (ECM) performing assembly and testing of electronic circuit boards was looking for a complete solution for a motorized actuator that could perform highly precise positioning and lifting functions while enduring 24/7 operation. Aside from high accuracy, sustainable performance reliability and long service life were critical - the technology was being adopted in manufacturing facilities worldwide.



NSK SOLUTION

- › custom designed NSK motorized linear actuator
- › integral limit sensors and capabilities for hard stops
- › equipped with K1 lubrication units for maintenance-free operation for up to 5 years or 10,000 km travel
- › fast turnaround for design and prototyping
- › quality testing of each assembled actuator prior to shipping

Pictured: Motorized linear positioner with limit sensors and hard stops

AUTOMOTIVE ASSEMBLY

CUSTOMER CHALLENGE

An automotive OEM presented a not-so-surprising challenge for a transmission case assembly process - zero failure and zero downtime. The requirement was to support an automated nut runner system moving in X,Y or Z axis, tightening nuts individually within a predefined travel parameter set.



NSK SOLUTION

- › three-axis NSK robot module designed with high stiffness /rigidity required to accommodate the heavy load of the customer's nut runner process
- › precision, controlled motion for individual tightening of the nut to minimize deformation and oil leak from the transmission case
- › efficient connection points for XYZ stages ensured simplified installation and minimal set-up time
- › equipped with K1 lubrication units for maintenance-free operation as long as 5 years or 10,000 km travel
- › execution of design validation for loaded life, rigidity and repeatability of assembled multi-axis system
- › quality testing of each assembled XYZ unit prior to shipping
- › zero failure rate performance of the assembled system



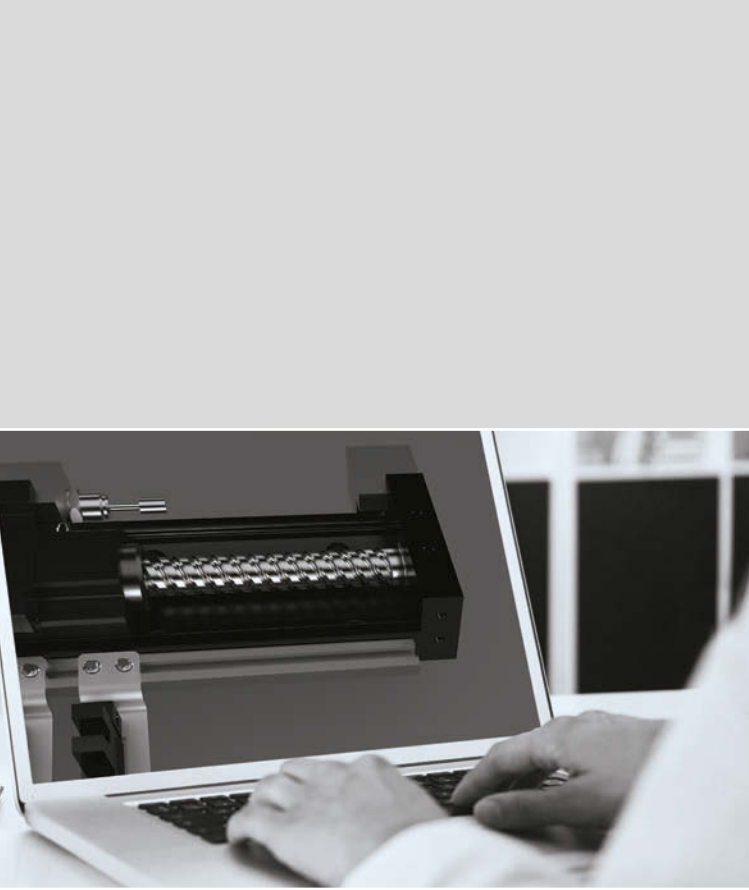
Pictured: Multi-axis actuator system integrated into an extruded, aluminum housing with flexible motor interface and mounting style

CUSTOMIZED SOLUTIONS, OPTIMIZED SUPPORT

- › **Advanced product technology**
- › **Accumulated mechatronic expertise**
- › **Application insight**
- › **Local manufacturing / assembly focus**
- › **Global technical network**
- › **Project management**
- › **On-site support**

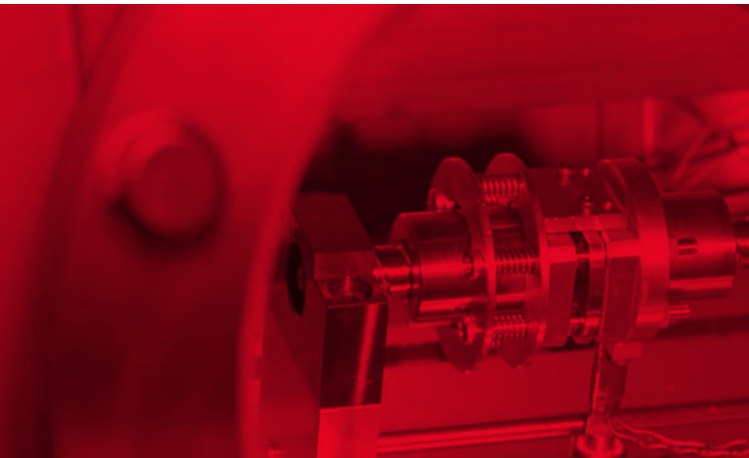
For your customized integrated system solutions from NSK you can rely on the optimum interaction of innovative design solutions, comprehensive engineering support, domestic manufacturing capabilities and access to our global technology network. To do so, our local integration and manufacturing teams will collaborate closely with you through all aspects of design, provide intensive project management and extend comprehensive technical support. We aim to offer you the ideal integrated motion solution to give you a critical advantage in your production processes and in your competitive market.

- › **Expertise** - all systems are tested and built by mechatronics experts and integration teams based in the USA
- › **Manufacturing** - domestically from our Franklin IN facility and worldwide
- › **Experience** - supporting market leading customers in industries including robotics and autonomous vehicles, 3D printing, injection molding, medical, semiconductor, material handling, electronics and automotive assembly and other automation applications
- › **Fit** - our solutions meet your performance needs, cost, maintenance intervals and / or lifetime requirements



DESIGN AND DEVELOPMENT

- › system design proposal with CAD model
- › component failure analysis and benchmarking
- › material technologies
- › applications simulation



PROJECT MANAGEMENT

- › design review – as many as 5
- › quote – non-recurring engineering, prototype, full production
- › prototype demonstration
- › test report
- › lead time / production schedule
- › individual system test before shipping



AFTER SALES SERVICE

- › on-site support for system installation
- › training
- › bill of materials for replacement parts



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