

# Technological Foundation

## NSK's Four Core Technologies, and Giving Them Shape Is Manufacturing Engineering

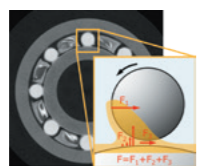
NSK has relentlessly pursued innovative technologies and focused on improving quality to contribute to a safer, smoother society and to protect the global environment, in line with its corporate philosophy. NSK leads the world in the product fields of bearings, automotive components, and precision machinery and parts. Its technological foundation consists of Tribology, Materials, Numerical Simulation, and Mechanics, which are NSK's Four Core Technologies, and Manufacturing Engineering, which gives them shape.

Through development activities that make full use of the Four Core Technologies and the "plus One" that adds manufacturing engineering to them, we work to realize a more prosperous society and conserve the global environment, such as by saving energy and reducing CO<sub>2</sub> emissions, while continuing to contribute to the development of a sustainable society. At the same time, aiming for sustainable growth as a company and having adopted Bearings & Beyond under MTP2026, we will strengthen the product appeal of existing products and grow new products and businesses.

### ● Four Core Technologies + 1

#### Tribology Studying, Clarifying, and Controlling Friction

Tribology is the study of friction and wear of contact surfaces in relative motion, such as rotating parts that endure enormous forces with a thin oil film. Severe operating conditions are mitigated through lubrication and surface treatments developed by NSK, resulting in superior performance for applications requiring low friction, high-speed rotation, quiet operation, or enhanced durability.



Friction on the bearing's ball surface

#### Materials Unrelenting Pursuit of Performance Durability and Reliability

Materials research and development affects nearly every aspect of product performance. Through the careful selection of material composition, heat treatment, and ceramic materials, NSK enables optimization of application performance. This can result from improvements in function, endurance, or reliability, or through advancements in cost-effectiveness or production efficiency.



Durability testing machines

#### Mechatronics Technology Supports People for a Convenient, Safe, and Comfortable Future

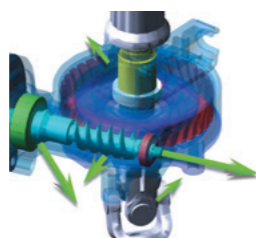
Mechatronics integrates machine elements technology with control technology. By combining bearings, ball screws, and linear guides, together with motors, sensors, and computers, greater mechanical functionality is elicited with computer control. This technology applies new functions and performance to a range of industrial machinery, such as for automobiles and biomedicine. It also contributes to greater reliability, as well as to convenience and safety in daily life.



NSK vibration control actuator for train cars

#### Numerical Simulation Simulated Recreation in Cyberspace to Predict Performance

In the past, accuracy and reliability in product development were achieved with experience-based design and longer testing periods. NSK's simulation technology allows virtual validation to accelerate design and production. Extreme conditions or innovative designs that defy previous expectations can also be evaluated and analyzed.



Simulated example of an automotive component

#### Manufacturing Engineering Giving Shape to Four Core Technologies

Contributing to the environment and heightening safety and security through our Four Core Technologies requires something to breathe life into these technologies. In addition, it is essential to consistently produce with high quality. NSK tackles these issues by applying AI to its equipment, utilizing IoT, and optimizing its overall production framework while it works to realize the creation of smart factories that economize on space, save on energy, and reduce manpower requirements.



Cheonan Plant in South Korea



## Development of Highly Skilled Human Resources

NSK established the NSK Institute of Technology (NIT) in 2007 with the aim of developing highly skilled human resources who will support NSK's competitiveness from a technical perspective.

In an era of many changes, at NIT we provide training for young employees to improve essential competencies of a working adult, so that while raising their own skill levels they can fully demonstrate their real abilities. In addition, we conduct lectures on general knowledge subjects, such as science, mathematics, and engineering, as well as on knowledge necessary for NSK engineers, such as safety, quality, the environment, engineering ethics, and the Four Core Technologies plus One. Having compiled learning content for the specialized technologies in each field, we are also enabling them to study online as required. NIT provides educational support so that NSK engineers can discover and contribute to solving problems through NSK's Motion & Control™ not only at our direct customers, such as automobile, home appliance, and industrial machinery manufacturers, but also of end users, local communities, and global society. In FY2021, 493 employees attended NIT lectures.

NIT also plays a role in nurturing the next generation in local communities, for instance, by dispatching instructors to universities and holding science classes for elementary school students.

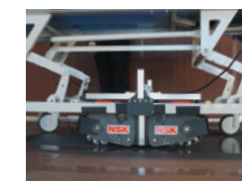


Holding a science class online

## Taking on the Challenges of New Value Co-Creation

### ✔ Supporting frontline healthcare through robotics

NSK is working to assist society by developing new service robot technology, including robotic devices for moving patients in medical settings. In October 2021, NSK joined a Kanagawa prefectural government project to implement robotic technology in hospitals to help prevent the spread of COVID-19. NSK is working to further develop its robotics technologies through dialogue with frontline medical staff.



Motorized assistance robot installed at the base of a stretcher

### ✔ NSK's joint research results published in the academic journal *Scientific Reports*

Academic paper's theme	Establishment of an integrated automated embryonic manipulation system for producing genetically modified mice.
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### ✔ Received the Japanese Society of Tribologists Technology Award for FY2021

Award details	Enhanced performance of rolling bearings by improving rolling elements
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## R&D Expenses/New Product Sales Ratio

Along with R&D expenses based on institutional accounting, NSK recognizes that all expenses involved in the technology divisions are R&D expenses in a broader sense. Under MTP2026, as an investment for sustainable growth, we will maintain R&D expenses at a level equivalent to 3%–4% of sales (about ¥30 billion–¥40 billion per year), continuing from the 6th Mid-Term Management Plan, and have newly set a target for increasing the ratio of net sales accounted for by new products. The FY2021 new product sales ratio was 14%.

