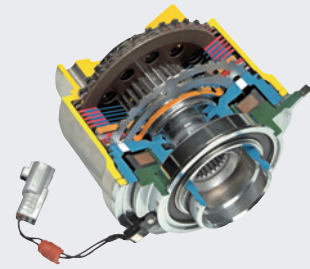




LFT-III



IFS



ITCC

1

Challenge to protect the beautiful Earth, led by one employee's zeal

2

Challenge to link safe performance and environmental performance

3

Challenge to add environmental kindness to the fun of driving

| Special Feature |

# Unique technology for a better future

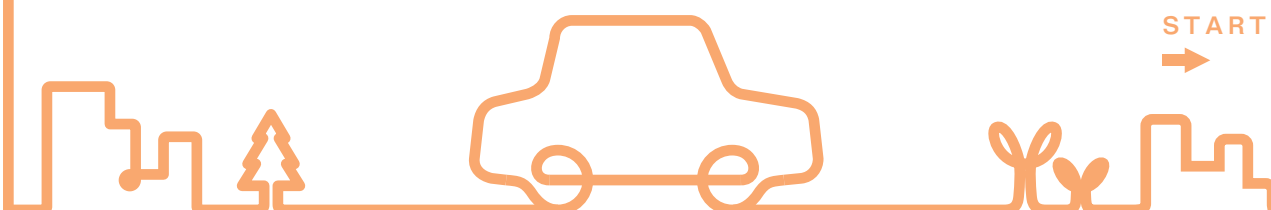
JTEKT is always aware of the social impact of product development.

What should we do to truly fulfill our social responsibility as a company?

The best answer is to help improve the global environment and society with our unique technology.

Fully demonstrating our abilities in our principal operation of manufacturing will be the source of improving our corporate value and of sustainable development.

In this special feature, we will introduce our development challenges in the future through three products developed with the use of unique technologies of JTEKT.



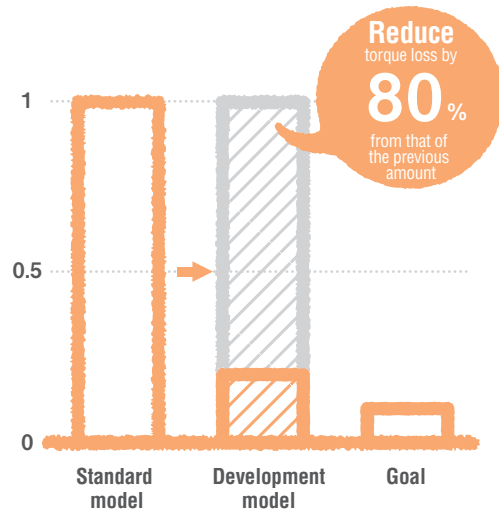
\*LFT, IFS, ITCC, RD-EPS and E-VGR are trademarks of JTEKT CORPORATION.

Low friction-torque 3<sup>rd</sup>-generation tapered roller bearing

**LFT-III**



## Challenge to protect the beautiful Earth, led by one employee's zeal



JTEKT started its operations as a maker of functional components through the merger in 2006. Our product development has always been based on considering our products' social meaning, and that is our heritage from the two predecessor companies of JTEKT. Our product development always starts from the question, "What is the current issue?" and "How can we respond to the issue with our technology?"

One of the solutions to the problem of how to preserve the environment was the development of "LFT-III".

**The first step was a voluntary effort to reduce torque loss to one-tenth.**

In the midst of a rapid increase in demand for automobiles worldwide, improving fuel efficiency and reducing CO<sub>2</sub> emissions are essential for the global environment and a motorized society to coexist. So, JTEKT started a project that goes against conventional ideas, the "Torque Loss 1/10 Project",

in 2002, to gain more effect only with a bearing system. It was originally an idea that came as a flash to one researcher who was strongly concerned about the global environment. It came as a flash because in the state-of-art technology, conventional wisdom was that many innovations result in one-tenth of a percentage point or so of improvement in effectiveness. At first, other researchers didn't pay attention to it because it was just

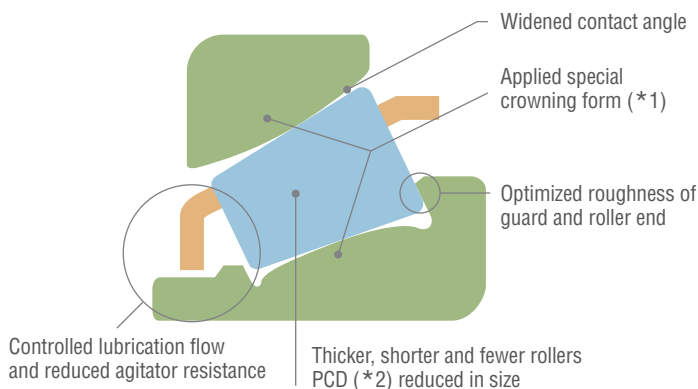
like a dream. But they were struck by his enthusiasm, and the number of researchers who sympathized with this idea increased. Then, employees from various departments voluntarily started research and development. It was the beginning of this project. Product development started officially.

**The power of the team pursuing an aggressive target made the development of the Low Friction Torque (LFT-III) tapered roller bearing successful.**

With the aspiration to exceed conventional wisdom through a united effort, the project team developed heat treating technology and design technology to succeed in long lifetime and reduction in size of the product after many trials and errors. Then, the team developed a new form for controlling the amount and flow of lubrication that no other company had tried, and reduced



## Innovative Technologies of LFT-III



**\*1 Crowning:**  
to process the form of the surface into a convex shape

**\*2 PCD:**  
abbreviation of "Pitch Circle Diameter", the diameter of the centers of the rollers in bearings

### 1 We optimized specifications and realized low friction, long lifetime and high rigidity at the same time.

We developed a new bearing design technology based on experiments and theories. In addition, we reduced roller viscous resistance and slide resistance by finding the best suited contact situation and achieved low torque, long lifetime and high rigidity at the same time.

### 2 Miniaturization through long-lifetime heat treating

We developed heat treating technology that optimizes the rigidity of the surface and material organization for the bearings to last longer, even in lubrication containing foreign substances such as abrasion powder from gears. We realized a 40% size reduction by increasing the load capability of bearings.

### 3 Control lubrication flow and reduced agitator resist

We found out the impact of lubrication flow on torque loss, which had not been examined, and developed a new form for controlling quantity and flow of lubrication. We reduced agitator resistance by controlling lubrication flow.



torque loss to one-fifth (20%) in 2004. The target value was to reduce to one-tenth, but to reduce to one-fifth greatly contributes to preserving the global environment. So, production of LFT-III tapered roller bearings started in 2007. Compared to standard tapered roller bearings, LFT-III reduced torque loss by 80% from that using regular ball bearings. In addition, it has a longer lifetime and variant-resistance, and was reduced in size by 40%. As a result, when it is adopted in the differential gears of automobiles, we can expect a gas mileage improvement of 2% and CO<sub>2</sub> emission-reduction of 3-5 g/km (nearly equal to 1.15 two-liter plastic bottles). If a car runs 10,000 km a year, 11,500 plastic bottlefuls of CO<sub>2</sub> emission-reduction will be expected with LFT-III. This beneficial energy conservation effect and originality and economical efficiency were greatly evaluated and received the "Minister of Economy, Trade and Industry Award" in "Energy-

Conserving Machinery Awards for 2006".

### Utilize technology and contribute to environmental protection in a wide range of fields

When we delivered a presentation to domestic and overseas manufacturers for practical application, they were struck by the fact that just one component improves gas mileage by 2%. Now, LFT-III is equipped to domestic automobiles and is scheduled to be equipped to industrial machines, too. As bearings are used in so many machines and components, we would like to develop the LFT-III technology for various fields to contribute to global environmental protection. Of course, we will also keep trying to mass produce bearings that allow a torque loss of only 1/10.



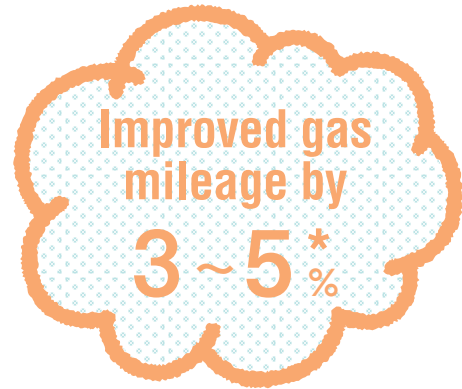
1. A failure of a trial product of which torque loss increased tenfold 2. One of the project members, Kazutoshi Toda, Office Manager of the Research & Development Planning Sect. 3. We contributed all of the supplementary prize of the "Minister of Economy, Trade and Industry Award" to UNICEF.



Intelligent front steering  
**IFS**



# Challenge to link safe performance and environmental performance



\* Comparison with hydraulic power steering

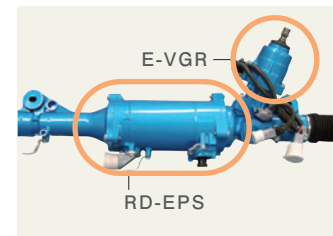
## An intelligent automobile that assists drivers

Can an automobile with intelligence to assist the driver prevent accidents? Expectation of such safety features as accident-preventing technology is increasing, as is expectation of improved environmental performance such as gas mileage improvement and reduction of CO<sub>2</sub> emission. To respond to the both demands, JTEKT developed Intelligent front steering (IFS) by combining Rack direct-drive type electric power steering (RD-EPS), that enabled the world's highest level of output, and an Electronically controlled variable gear ratio (E-VGR).

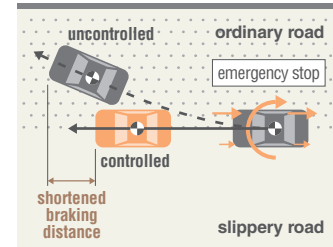
## Pursuing safer driving while considering the environment

RD-EPS is state-of-the-art electric power steering which has 70% more power and 23% less noise, compared to conventional models. Its high output enables it to be used in large cars. In addition, as it is an electric motor-driven type, it improves gas mileage by 3~5% compared to the hydraulic type.

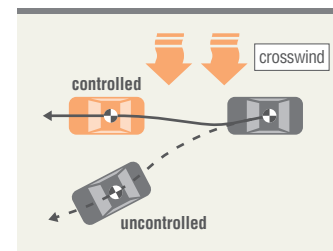
E-VGR is a system that enables changing the steering gear ratio along with the car speed. With this system, when driving at low speed or parking the car, the angle of the tires becomes wide with little steering, and when at high speed, running stability improves by narrowing the tire angle of steering. In addition, when changing lanes and applying the brakes on a slippery road or when a crosswind hits, the system checks the driving status and stability and assists steering. IFS, in which safe performance and environmental performance were combined, is a product that greatly contributes to global environmental preservation, operational performance, accident prevention and safety of automobiles.



Emergency stop on roads with different levels of slipperiness



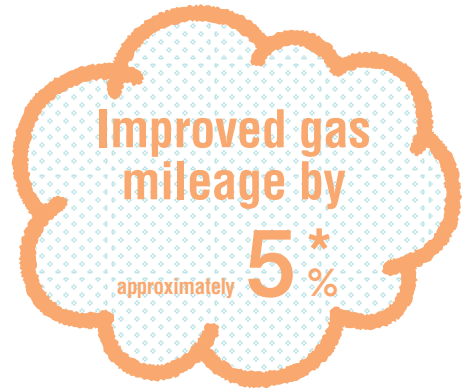
Sudden crosswind



Intelligent torque controlled coupling  
**ITCC**



# Challenge to add environmental kindness to the fun of driving



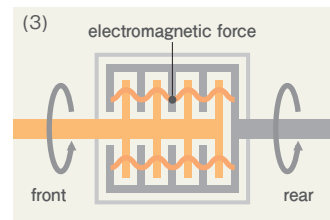
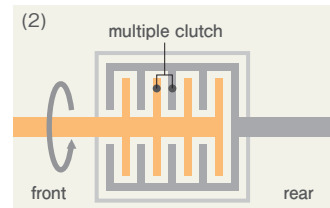
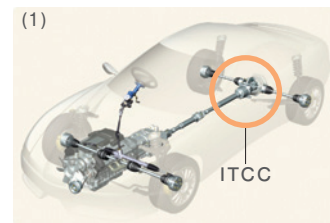
\*Compared with fulltime 4WD driving

## Realizing gas mileage improvement and the comfort and safety of 4WD

4WD is popular, due to its powerful driving, but these days, from an environmental standpoint, gas mileage is a problem. So, JTEKT developed a small and high-performance Intelligent torque controlled coupling (ITCC) for improving gas mileage of 4WD cars. ITCC is a driving part. It usually works in two-wheel driving and control power, but automatically changes to four-wheel driving on a slippery road such as a snowy-road. ITCC improved gas mileage by approximately 5% compared to fulltime 4WD while maintaining the comfortable and safe driving of 4WD by transmitting the most suitable power. At the same time, it enabled weight saving by 30kg because the burden on the rear wheel axle was reduced and the form was made more slender.

### Can be loaded to large cars. Promote environmental preservation by expanding share.

In large cars, the burden on the clutch in the coupling is very heavy, and it used to be a problem that the coupling was large. So, we developed an electromagnetic clutch covered with diamond-like carbon (DLC-Si) which has properties like diamond and wears slowly. Although it is lightweight and compact, it is eight times as durable as the old model, allowing ITCC to be loaded to large cars. Since its production in 2004, ITCC has been adopted by major manufacturers in Japan, America and South Korea and has a 54% market share worldwide for electrically controlled power transmission systems. This new technology that realizes safety, comfort and gas mileage at the same time indicates new possibilities in global environmental preservation and in the automobile industry. In addition, adoption of this technology in other industrial areas is expected.



- (1) ITCC loading point
- (2) Usually two-wheel drive; power is rarely transmitted to the rear wheels.
- (3) A sensor detects slippery roads due to freezing, engages the clutch with electromagnetic power and transmits power to the rear wheels.

