

## Future of Steering Business



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### 1. Introduction

I am honored to have the opportunity to write an article for this inaugural publication of the *JTEKT Engineering Journal* on the future of JTEKT's steering business. I first will discuss product technology trends regarding automotive steering systems and then present JTEKT's strategy, based on a consideration of such trends, to be the leading global supplier of steering systems.

### 2. Steering Technology Trends

In a previous article<sup>1)</sup>, I provided an outline of the history and future direction of automotive steering technology and products, and you may refer to that article for a detailed discussion. The main points thereof are reviewed below.

Hydraulic power steering was introduced in the 1950s in order to reduce steering effort. Electric power steering was introduced in the 1980s, and although hydraulic systems are still predominant in terms of production quantity, we clearly have entered the stage in which product technology development is focused on electric systems.

The above provides an easy, general overview of steering power assistance, but when we look specifically at how steering systems have been changed over time to improve the basic automobile features of safety, fuel efficiency and driving pleasure, the discussion becomes more complex, and the future direction of technology is not at all clear. Issues involved in the continued improvement of these three features are outlined below.

#### (1) Safety

A topic of unending consideration by steering engineers is the extent to which the power assistance system should allow the driver to feel vehicle operating conditions, or whether it should influence this feeling at all. Without power assistance, the driver must exert considerable steering effort, but on the other hand via the steering wheel the driver can feel vehicle operation conditions precisely without any filtering and can control steering exactly as desired (although a certain amount of skill and experience are required to do so). Therefore a major

topic of consideration regarding power steering systems is the power-assist control logic to be used. Moreover, the discussion becomes even more complicated when we consider active steering (such as IFS, or Intelligent Front Steer), which utilizes such technology as variable gear ratio steering<sup>4)</sup> (described below). Also, as we consider the future evolution of steering systems, there are many points regarding failsafe function that must be studied.

Regarding mechanical aspects, there are various issues that must be tackled steadily, such as the effective absorption of energy during collisions and placing parts in positions most compatible with engine-room layout. We also must aggressively pursue steering system compatibility with such advanced safety systems as airbags and immobilizers.

#### (2) Fuel Efficiency

Unending focuses of attention in regarding to fuel-efficiency aspects of steering systems include improving the torque transmission efficiency of the steering system itself, improving power-source efficiency, and reducing weight. In particular, it must be recognized that efforts have only recently begun on technology to improve the efficiency of electric power steering motors and ECUs. Attention must be given to developing new materials for weight reduction and other purposes. Regarding torque transmission, non-steering technology such as that regarding drivetrain products should be utilized in order to achieve improvement.

#### (3) Driving Pleasure

The ultimate purpose of power steering is to improve driving pleasure by reducing steering effort, but application thereof is limited by considerations of system size, weight, cost, etc. We must offer a full lineup of lightweight, compact, inexpensive power steering systems that can provide pleasurable driving in a wide variety of vehicles. The need is urgent to develop noiseless systems that contribute to overall vehicle quietness. We mustn't forget that steering feeling and quietness are important aspects of product strength and that improvement thereof will contribute to customer delight.

In summary, we can say that future issues related to steering system technology mirror those related to automobile technology in general. My hope is that JTEKT's steering engineers will learn automobile technology more deeply, seek aggressively to work in

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close cooperation with automakers, and strive to provide them with the steering systems they truly desire.

### **3. Parts Composing the Steering System**

Basically, the steering system comprises the column, which supports the steering wheel; the intermediate shaft, which transmits steering force while undergoing three-dimensional shaft bending; the gear, which converts this rotational movement into linear movement; and the linkage, which connects the gear to the suspension and transmits force to the apparatus changing wheel direction. Functional parts involved in providing power assistance include the pump, hoses, cylinder, control valve and other parts composing the hydraulic circuit<sup>2)</sup>, or, in the case of electric power steering, the motor, reduction gear, and electronic control unit (ECU). Also there is the torque sensor<sup>3)</sup>, a part critical to the power assistance function. And recently, a variable gear ratio steering mechanism<sup>4)</sup> has emerged, which fulfills the critical function of actively changing the ratio between steering wheel rotation amount and gear linear movement amount. Other important functional parts include steering wheel tilt and telescope mechanisms.

Among automobile systems, the steering system has a relatively large number of parts; JTEKT steering systems can comprise up to about 80 parts. As touched upon above, steering systems can include more than 10 important functional subsystems, some of which are unique to the steering applications but the majority of which have applications in various product fields and involve technology of suppliers specializing in these subsystems. JTEKT, like other steering suppliers, is highly dependent on these specialist suppliers, each of which works diligently to develop new technology in such areas as theory, materials, and mechanisms. JTEKT, as a steering supplier, cannot hope to compete with these specialist suppliers in their respective fields of specialty and therefore must rely on them.

In the previous section I described how our steering division must work in close cooperation with customers, and in the same way, it is imperative that we aggressively pursue common efforts and cooperative research with suppliers.

### **4. Aiming to be the Leading Global Supplier**

One of the aims in creating JTEKT was to become the leading global supplier of steering systems. If a manufacturing company desires to be the top in its field, competitiveness in the areas of quality, product strength, cost and delivery are essential. Outlined below are issues our company must tackle in each of these areas.

#### (1) Quality

The importance of quality goes without saying and requires no comment, but I think we must remind ourselves of that most important principle: Quality is determined by the customer. Of course it is true we must steadfastly follow specs and not produce defective parts, but we must consider whether our specs haven't been determined just for the sake of convenience. In other words, do we think any specs are OK as long as the automaker's requirements are satisfied, or do we decide specs based on close discussions with customers and the sharing of wisdom with suppliers? I fear in many cases the former is closer to the truth. The specs I am speaking of here are not only drawings but also materials, processes, inspection methods, inspection standards, etc.

As described previously, the steering system must function integrally with the vehicle and relies heavily on subsystems and parts procured from suppliers. In view of that, it is critical that we learn how vehicles are used in the field, field conditions, and details regarding properties of purchased parts, and that we determine specs based on a thorough examination of such factors through exhaustive discussion. If we follow this process, we naturally will arrive at specs determined by the customer. We will not succeed against the competition unless we become more sensitive to the thinking of customers. Quality begins with our suppliers, continues through us, and is evaluated by our customers. Kaizen is then carried out based on feedback from the customer. As the company standing in the middle of this chain, we play a vital role. It is my hope that we will work quickly to strengthen this quality chain.

#### (2) Product Strength and Cost Competitiveness

Although it goes without saying that a product's price is determined as a natural result of its market value, it seems there are many cases in which this basic principle is forgotten during the course of work. In many cases we discuss only whether a product's price is too high or too low and leave consideration of the product's value as seen by the customer out of the picture. A supplier normally determines price mainly on the basis of cost (value added through the manufacturing process), but we must remember that this is the viewpoint only of the supplier and that the customer does not necessarily share this viewpoint. And even if a product's value from the supplier's viewpoint remains unchanged, its value in the eyes of the customer declines if it is perceived as outdated or unattractive. If the customer has cause to believe defective products have been delivered, it will consider all the products little better than junk and conversely ask the supplier for compensation. In the end, our best weapon in the battle for cost competitiveness is product strength and reliability.

While automakers demand products with improved environmental friendliness and safety, they are not willing to pay higher prices, and inexpensiveness is a precondition to the proliferation of automobiles in underdeveloped countries. In other words, automakers, while demanding ever-increasing levels of steering performance, will not allow vehicle prices to be pushed up by high steering prices, so steering makers are caught between a rock and a hard place. But it is our duty to provide steering systems with high value at reasonable prices in order to allow people around the world to enjoy automobiles. We must develop low-cost technology, create innovative manufacturing technology and improve processes and logistics, not just to improve profit but for the sake of people everywhere.

### (3) Supply Capability

Of course much time and effort are required to develop and manufacture new products, but customers want to receive products when they need them. We therefore as a supplier must deliver products when and in the quantities required and require that our suppliers do the same for us. Unless sales personnel obtain information from customers at an early stage, we will not be able to meet recent demands for shortened development lead times. We must carry out marketing activities ceaselessly and pursue advanced development steadily, or we will be removed from the supply chain. It is important that we reduce the lead times required for all functions, including sales, planning, design, sample manufacturing, evaluation, procurement, production preparation, manufacturing, and logistics.

Recently the trends among automakers toward common platforms and worldwide simultaneous production launches are accelerating, and suppliers likewise are increasingly being required to launch simultaneous large-quantity delivery of products to various locations throughout the world. It therefore is imperative that we reinforce and improve the efficiency of our manufacturing network, supplier network, and logistics system. Fortunately, JTEKT's capability was expanded by combination of the two companies' manufacturing and supplier networks, but on the other hand, overlapping capability exists, and there is much room for improvement in the area of efficiency. Improving the efficiency of global manufacturing, procurement and logistics is a task requiring immediate attention.

Also, the achievement of uniform quality around the world is not an easy task. As we carry out process design and manufacturing control around the world, we must fully utilize the strengths of each region. Preparation of standards in languages usable by our bases around the world is also a task requiring urgent attention.

## 5. Conclusion

In this article I have discussed the important role we play in today's automobile-centered societies as a steering maker. The steering division of JTEKT was begun with a clear understanding of that responsibility and vision of fulfilling it; however, it is apparent that much effort will be required. Although we have become larger, this presents certain challenges of its own.

I request that all members of JTEKT's new Steering Business Operations Headquarters strive diligently to overcome the challenges laid out before us. The guidance of support of our readers will also be appreciated.

## References

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