

Leading the Competition through Manufacturing Excellence

Since its establishment, Minebea has built up a tradition of manufacturing excellence in the area of ball bearings. Today, Minebea is returning to the basics of manufacturing in an effort to extend this tradition—its DNA—to all of its products.

Outperforming the competition by continuously enhancing manufacturing capabilities

“Leading the competition through manufacturing excellence”: This year, the annual report team speaks with Eiichi Kobayashi, Senior Managing Executive Officer and Chief of Manufacturing Headquarters—who has played a leading role in ensuring broad acceptance of this new guiding standard throughout the Minebea Group—about what defines manufacturing excellence for Minebea.

Interviewer: Management has outlined two themes at the moment: “Leading the competition through excellence” and “Returning to the basics of manufacturing.” How do you interpret these themes?

Kobayashi: In the years since its establishment, Minebea has built up a tradition of manufacturing excellence in the area of ball bearings. This is the reason we have succeeded in expanding this business while maintaining a consistently high level of profitability to date. The idea of returning to the basics of manufacturing is important in everything we do. In the bearings business, it means returning to the roots of this excellence.

Of course, in manufacturing there are always challenges, no matter how advanced or improved processes are. This is true even in our core bearings business. The role of the Manufacturing Headquarters is to articulate the need to rethink the most fundamental aspects of how we manufacture and at the same time to identify specific challenges and work together with all groups involved in manufacturing to find answers.

Interviewer: What do you mean when you say the “basics” or “fundamental aspects” of manufacturing?

Kobayashi: The basic premise of manufacturing is to manufacture the best possible products for the lowest possible cost. Minebea manufactures components, so it is essential that we remain abreast of the requirements of our customers. There is a commonplace Japanese expression, which essentially means “It all comes down to whether you can

sell it and whether you can make a profit.” Customer requirements vary significantly. We must respond to performance and function requirements at the development stage. At the manufacturing stage, our job is to respond to requirements in terms of quality, cost and delivery time. Regardless of how difficult a customer’s requirements are, we cannot just say “No, sorry, can’t be done!” and give up. It comes down to how far we can improve yield and how quickly we can produce, that is, how much we can shorten production time. Time equals cost; it’s that simple. So, from these two perspectives we are rethinking all of our manufacturing processes and operations, as well as our production floor environments and equipment. Our responsibility is to do whatever is necessary to enhance our manufacturing capabilities.

Interviewer: Can you give us an example of how a measure you have implemented has enhanced manufacturing capabilities?

Kobayashi: We produce the bonded magnets used in Minebea motors in-house. One step in the production of a bonded magnet entails sintering at a low temperature, which used to require 15 seconds. Essentially what happens is that powdered materials are heat-pressed into pellet form, so we took a hint from the pelletizing processes used in the manufacture of pharmaceutical pills, noting that pharmaceutical manufacturers allow less than one second per pill. By looking at the production methods they used and adapting certain aspects to our own sintering process, we succeeded in reducing the time required for sintering bonded magnets to 0.8 second. This reduction in time facilitated reductions in equipment, space and operational personnel requirements for the sintering process, which, in turn, enabled us to significantly lower related costs. This is a classic example of how producing more quickly led to a reduction in costs.

Eiichi Kobayashi

Director
Senior Managing
Executive Officer and
Chief of Manufacturing
Headquarters



Minebea

Minebea's Strategy

Our products, especially our mainstay bearings, involve a vast range of machining processes. Looking at it in a different way, we purchase a lot of high-priced raw materials and spend considerable time and effort on cutting and grinding, then discarding the swarf. Accordingly, it is important for us to pursue bold improvements that enable us to eliminate waste as much as possible.

Interviewer: Does “enhancing manufacturing capabilities” translate into greater profitability?

Kobayashi: The cost of any product is the cost of materials plus the cost of processing. In addition to rethinking manufacturing processes, we are reviewing the materials we use. At present, persistently high raw materials prices continue to push product costs up and thus to exert pressure on the profitability of our businesses. Seeking ways to lower the cost of purchased materials may not be our direct responsibility, but looking at materials availability and workability does fall within our brief. We operate under a vertically integrated manufacturing system, a key feature of which is that in addition to machined parts, many of the pressed, diecast, molded and other parts we use in manufacturing are produced in-house. From the perspective of production departments, these are the materials they purchase. We also manufacture our own dies, so the cost of die manufacturing is also reflected in the cost of materials. Because the cost of materials is an equally significant component of a finished product's cost, as is the cost of processing, ensuring these materials are better manufactured has an unequivocal impact on the profitability of products and businesses.

Interviewer: Minebea has set a clear vision for itself—that of a company which leads the competition through manufacturing excellence. Has this enabled you to better define the role of the Manufacturing Headquarters?

Kobayashi: As I said initially, Minebea has built up a unique tradition of manufacturing excellence in the area of ball bearings. Over the past few years, however, we have seen our sales and profits stagnate. Surely the main reason for this is that we allowed ourselves to lose sight of the basic goal of “enhancing manufacturing capabilities,” focusing instead on maximizing the benefits of mass production. In promoting automation, our attention was entirely on the extensive installation of equipment. We neglected to strive for progress in the basic aspects of manufacturing. The role of the Manufacturing Headquarters is thus to review all aspects of manufacturing, identify issues and work with others in the Company to find solutions. We are here to support the various manufacturing departments. We don't go around telling departments what they should do. Nonetheless, the removal of organizational barriers has paved the way for frank exchange and the setting of common objectives. It has also enabled us to share a sense of satisfaction when something is successful. The Manufacturing Headquarters has identified and is currently working to address more than 100 specific issues. The initial step—i.e., identifying an issue—is the first step toward leading the competition through manufacturing excellence. I am confident that resolving these issues will transform Minebea into an even stronger company than it is today.

Interviewer: Thank you for taking the time to talk to us. We look forward to the ongoing contributions of the Manufacturing Headquarters as the core of Minebea's efforts to address the challenge of “Leading the competition through manufacturing excellence.”

Kobayashi: Thank you. We will continue to do our best to respond to expectations.





Interviews with Mid-Level Managers from Key Minebea Production Departments

Ball Bearing Business Unit

In the years since its establishment, Minebea has built up a tradition of manufacturing excellence in the ball bearings business. Minebea has also achieved a balance between profitability and growth, which it has long maintained.

A part of Minebea's business portfolio since its establishment, ball bearings indisputably remains a core business in terms of sales and income. The ball bearings business also gave rise to a distinctive business model that features manufacturing operations overseas, a high percentage of parts produced in-house and a horizontally organized production management system encompassing 10 plants around the world.

Interviewer: From the Ball Bearing Business Unit, we welcome Susumu Kawahara, Hiroyuki Kato and Yoshitake Matsui. Thank you for agreeing to be interviewed.

Kawahara, Kato, Matsui: Thank you for asking us.

Interviewer: Ball bearings demand an incredibly high level of precision, but they have a very simple structure don't they—two rings, one on the inside, one on the outside, and some balls. A layperson might be forgiven for thinking that as long as you have the basic design, all you have to do is carefully follow the specs. But there is more to it, isn't there?

Kawahara: You're right, the configuration of a ball bearing is extremely basic. In addition to the parts you've mentioned, there is a retainer, which keeps the balls in place, and a shield, which protects it against contamination from foreign substances. All you need to add is oil or grease, which acts as a lubricant, and your ball bearing is complete. At first glance, it all looks very simple, but as someone who has been in this business for many years, I can tell you that I am constantly amazed at the speed at which performance requirements evolve. The explosive growth in demand for ball bearings in the past is attributable to several key applications. These include household VCRs and spindle motors for PC hard disk drives. To develop ball bearings appropriate for each of these applications, we had to overcome some pretty significant technological hurdles. One time it might be enhancing high-speed rotation performance, while another time it might be lengthening useful life or reducing noise. My generation is the one that perfected the original spindle motor bearing through endless trial and error on the production floor.

Today, fluid dynamic bearings are definitely preferred for these applications, so the task for us is finding a way to pass our experience and accumulated expertise on to the next generation of engineers.

Matsui: In the area of production, I am primarily responsible for assembly processes. We get a wide range of parts and are responsible for putting them all together into products. All of the parts we use are reliable. Every part is produced in line with our specifications and well within the tolerance limit for quality. That said, no two finished products are exactly the same. Each customer has different requirements. The assembly process is responsible for making whatever adjustments are necessary to ensure our products meet these requirements. This is the spirit with which we approach our jobs.

Kato: The precision of ball bearing processing is measured in submicrons. The most critical consideration is raceway roundness. Even if you use the same equipment and the same materials, the result will vary from hour to hour—all within the tolerance limit, naturally. Yields are never 100%, either. When you look at it that way, you start to see that the challenge of improving manufacturing processes really is infinite. Of course, there are also other crucial challenges, like shortening the cycle time, so it's not like you can just take it easy and still ensure a quality product.

Interviewer: Minebea has outlined a new vision, that of a company which leads the competition through manufacturing excellence. Coming from the division that is essentially responsible for Minebea's tradition of manufacturing excellence, what does this vision mean to you?

Susumu Kawahara

Employee since April 1982
Manager of Manufacturing
Engineering Section,
Bearing Manufacturing
Department
Ball Bearing Business Unit



Minebea's Strategy

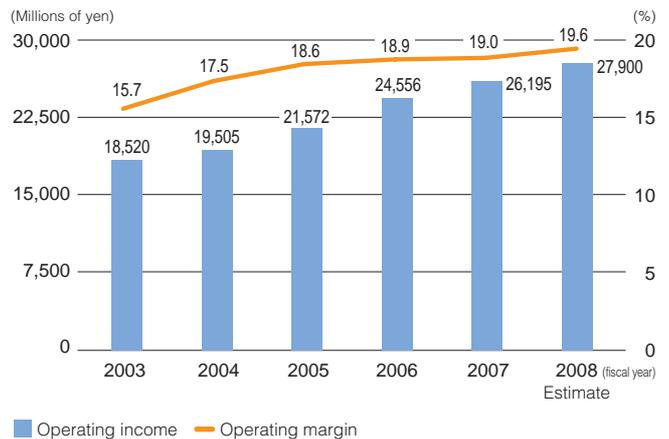
Kawahara: I think you can look at the concept of “Leading the competition through manufacturing excellence” as the cumulative result of a lot of small efforts. After all, our products are small and simple. It’s important to create a manufacturing culture that recognizes the value of persistence. Just to give you an example, in the cutting and grinding processes, we use a significant number of dies and biting and grinding jigs. We are getting into trade secrets here, so I can’t go into more detail. Even though we don’t have anyone who is a real pro in this area, we have pursued a number of initiatives on our own, including recycling and altering the shapes of these dies and jigs to reduce costs.

It’s been only three years since these efforts began, but in that time we have succeeded in reducing the cost of raw materials used in the manufacture of ball bearings to one-third of what it was three years ago.

Kato: Aside from everything else, with ball bearings we are dealing with absolutely huge production volumes. Minebea alone manufactures more than 200 million pieces a month. If we can shorten the grinding time, for example, by 0.1 second per piece, you can see how much of an overall time saving that would be. We can take that time we’ve saved and plow it back into production. So as you can see, it is more than a question of just adding more equipment.

Matsui: To lead the competition you need rivals. In business you need other companies that are equally competitive. The Ball Bearing Business Unit is fortunate in that our 10 plants around the world compete with each other. This creates considerable tension, which in turn does put pressure on people, but it also drives us to take on new challenges.

Operating Income and Operating Margin in the Machined Components Segment



Miniature Ball Bearings with Outer Diameter of 2.2 mm



Hiroyuki Kato

Employee since April 1980
 Manager of Grinding Section,
 Bearing Manufacturing
 Department
 Ball Bearing Business Unit



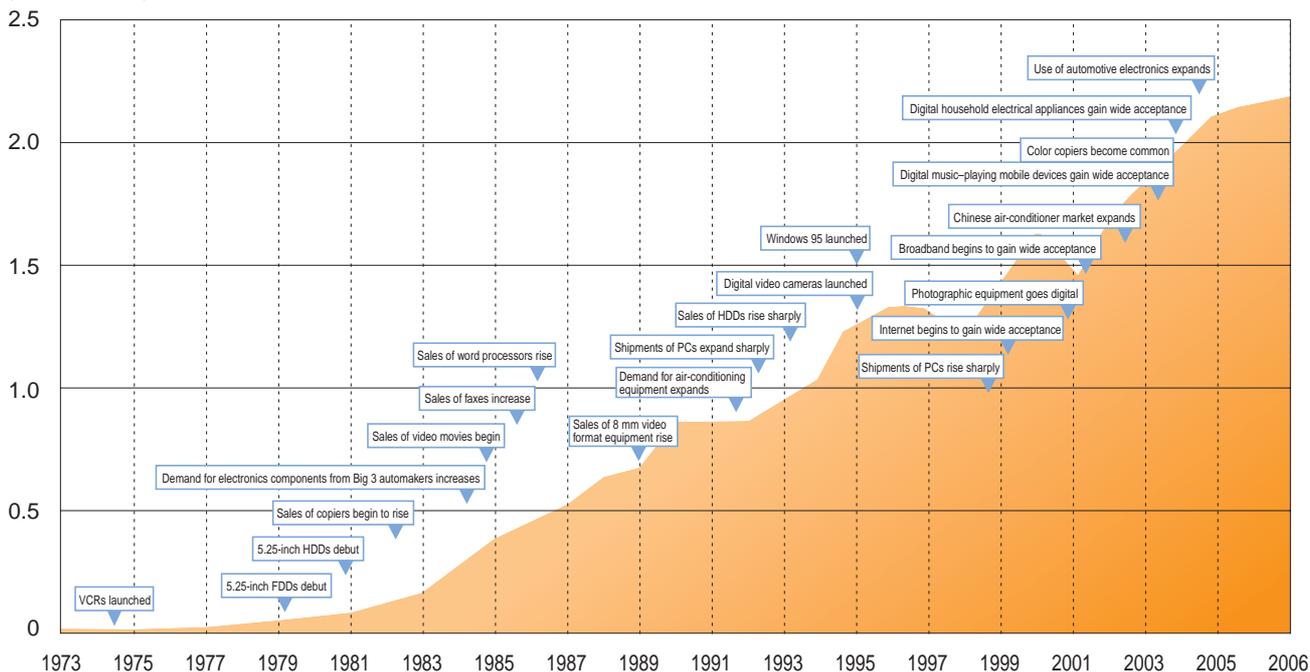
Yoshitake Matsui

Employee since March 1984
 Manager of Assembly Section,
 Bearing Manufacturing
 Department
 Ball Bearing Business Unit



Ball Bearing Shipments

(Billions of units)



Interviewer: In closing, management has also expressed the need to rethink manufacturing from the most fundamental aspects. How will you address this challenge?

Kawahara: A passive approach—looking around for something to model ourselves on, or expecting someone to give us a manual to follow—won't accomplish anything. In May of this year, we completed our smallest bearing ever. This was in response to a specific request, of course, but deep down I think we wanted to test ourselves, to see just how far we could go. Taking on new challenges like this allows us to reaffirm that we are on the right track, that our approach is the right one. The most fundamental aspects of production are part of what we do every day and always will be, and to me they are something that we should constantly rethink and revise.

Matsui: In my experience, Minebea offers young employees a fertile ground in which to seek out and take on challenges. So it is up to each group to identify issues and work together to find solutions. Such broad-based efforts are crucial in manufacturing.

Kato: This is something I learned from my predecessors, but people tend to think that machining is all about base levels and benchmarks. There are many ways to look at it, but in my opinion what is most important is to isolate those things that are absolutely essential to product quality. If your focus is wrong, you will never be able to manufacture a quality product. Manufacturing is an incredibly broad field. I think it is important to focus on the front lines and set one's own benchmarks.

Interviewer: Thank you again for taking time from your busy schedules to speak to us.

Kawahara, Kato, Matsui: Thank you.



Minebea's Strategy



Mechanical Assembly Business Unit

The Mechanical Assembly Business Unit dates back to the 1960s. Along with rod-end bearings for aerospace applications and stepping motors, mechanical assemblies are representative of Minebea's early diversification efforts. Products in this business unit include differential gears, which contain Minebea ball bearings, tape guides and other high-precision processed components. In the early 1990s, the unit saw sales in the PC market rise sharply along with demand for pivot assemblies for use in the swing arms of HDDs. Today, Minebea controls a 65% share of the global market for pivot assemblies, making it the number one manufacturer.

Interviewer: Hitoshi Nakajima and Yasuhiro Mohri from the Mechanical Assembly Business Unit have agreed to be interviewed for this year's special feature. Thank you both for coming.

Mohri, Nakajima: Thank you. It's our pleasure.

Interviewer: The Mechanical Assembly Business Unit began with the production of precision mechanical parts containing ball bearings. In the early 1990s, however, sales of pivot assemblies took off, increasing to the point where they accounted for almost 100% of the business unit's sales.

Nakajima: Yes, pivot assemblies currently account for approximately 90% of business unit sales. However, sales are essentially for one application only. Such a high degree of dependence on one market is really not a good situation. Nonetheless, keeping abreast of growth in the PC market has become our business unit's top priority. Fortunately we have succeeded in maintaining our leading share of the global market.

Interviewer: Despite having the top share of the global market, the Mechanical Assembly Business Unit is not extraordinarily profitable today. Why is that?

Mohri: Last year, we were hit hard by the appreciation of the baht. Our principal manufacturing base is in Thailand and our poor results reflected this factor. That said, Thailand is the principal manufacturing base for many Minebea products, so it's not that we felt the negative impact of the strong Thai currency more than any other business unit.

Interviewer: Minebea's management has outlined an ambitious new vision, that of a company which leads the competition through manufacturing excellence. What does that mean to you?

Mohri: That is exactly the right message. When this new vision was announced, it was a real wake-up call. During the past two years, we had already begun to rethink the basics of manufacturing, so the challenges that have been set are exactly what we have been doing.

Nakajima: The Mechanical Assembly Business Unit uses nearly half of the ball bearings manufactured by Minebea for internal use. For this reason, we have always been of the opinion that we were still contributing to the business of the Minebea Group, even if our profitability was low. Looking back now, we were a little nonchalant about it all.

Hitoshi Nakajima

Employee since April 1982
Senior Manager in Charge
of Manufacturing
Engineering, Section 1,
Karuzawa Pivot Assembly
Manufacturing Department
Mechanical Assembly
Business Unit



Yasuhiro Mohri

Employee since April 1983
Manager, Engineering Section,
Karuzawa Pivot Assembly
Manufacturing Department
Mechanical Assembly
Business Unit





Mohri: We are engaged in a thorough reexamination of all processes. It's crucial that we change our thinking. A pivot assembly consists of a pair of ball bearings in a flanged housing. The housing is manufactured on a cutting line. We cut the inner and outer rings of the ball bearings in just a few seconds today, whereas we previously took six or seven times longer. At the moment, we are taking decisive steps to shorten the cycle time.

Nakajima: We received a lot of helpful advice from employees regarding plant layout. We had grown so quickly and expanded as necessary to meet demand, so revamping the layout has greatly improved workflow.

Interviewer: I see. That makes a lot of sense. You have indicated a number of challenges that will be addressed. Does this mean that we can expect to see an improvement in the Mechanical Assembly Business Unit's income performance?

Mohri: Reviewing our manufacturing processes enabled us to rediscover where our real strengths lie. Right now, we are working hard to revive our precision mechanical assembly (PMA) business. As Mr. Nakajima said earlier, we've always understood the danger of relying so heavily on a single market, but we just didn't have the resources to attempt anything new. It's strange, really—taking on all these issues and striving to improve how we work has inspired us to seek out new challenges. The PMA is where this whole business started, but it is really a challenge for ultrahigh precision machining technologies.

Nakajima: Saying we are the inheritors of Minebea's tradition of technological excellence sounds a bit over the top, but the people who brought Minebea's PMAs to their technological zenith were many generations before either of us. It may appear as if PMAs have been eclipsed by pivot assemblies, but we plan to expand sales of these products to ensure this technological legacy is passed on and to promote the growth of the PMA business.

Interviewer: With the new challenges you are taking on, it seems likely we can look forward to significant growth in the future. Thank you again for your cooperation.

Mohri, Nakajima: Thank you. We will continue to press ahead with reforms.

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Precision Mechanical Assemblies

The term mechanical assemblies encompasses pivot assemblies and PMAs. Minebea's PMAs are assembled from its miniature ball bearings and precision mechanical parts utilizing its miniature ball bearing machining technologies. Minebea supplies PMA units—until now usually assembled by users from parts purchased—as finished products. This approach offers three key merits for users:

- Engineering: Reduces need for charts and diagrams and simplifies management
- Purchasing: Reduces ordering and administrative burden
- Manufacturing: Reduces need for post-assembly inspections

Going forward, Minebea will continue to focus on expanding PMA sales.



Minebea's Strategy



Fan Motor Business Unit

In 2004, Minebea established Minebea–Matsushita Motor Corporation (currently Minebea Motor Manufacturing Corporation) with Matsushita Electric Industrial Co., Ltd., with the aim of integrating the two companies' information motors businesses in four categories. Minebea's fan motor manufacturing department also participated, supplying one of the joint venture's core products. Recently, Matsushita's fan motor business was also merged into the joint venture, signaling the start of a new phase in the company's development.

Interviewer: From the Fan Motor Business Unit, we welcome Seiichi Tsukutani and Yasuhide Hirashima. Thank you for agreeing to talk to us today.

Tsukutani, Hirashima: Not at all.

Interviewer: I understand that the Fan Motor Business Unit conducts all of its production at Minebea's plant in Shanghai, under Minebea's vertically integrated manufacturing system. What is the scale of this operation?

Hirashima: Fan motors are manufactured at the Xicen Plant of MINEBEA ELECTRONICS & HI-TECH COMPONENTS (SHANGHAI). The plant puts out a combined total of approximately 8 million AC and DC fan motors monthly. Minebea's success reflects its emphasis on the production of ball bearings and other parts in-house. Accordingly, a high percentage of the parts used in Minebea fan motors are sourced internally. This includes ball bearings, of course, but also molded parts, including casings and impellers, as well as certain molds for manufacturing other molded parts.

Interviewer: Minebea's vertically integrated manufacturing system, which seeks to increase the percentage of parts sourced internally, is really Minebea's unique manufacturing excellence put into practice, isn't it?

What supports Minebea's competitive advantage in terms of mass production capabilities?

Hirashima: I think internal sourcing has both merits and demerits. For the Fan Motor Business Unit, however, it is crucial to have a strong internal sourcing capability that works with us in a manner that underscores our mutual reliance.

Tsukutani: Looking at recent customer needs, uniform mass production, even for a largely standardized product like a fan motor, will not be appropriate for much longer. Fan motors are primarily used in PCs, office automation (OA) equipment and home electrical appliances. In recent years, we have seen a trend in demand toward motors that are tailored specifically to suit different models and types. Not so long ago, the main performance requirements for a fan motor were that it was solid and long lasting and drew out a huge amount of air. Today, however, requirements have changed to where customers want to know how Minebea motors can be incorporated into their products to help them resolve the problem of thermal emissions. The solution is to press ahead with greater customization. We must step up efforts to offer products that respond to a variety of specifications, which will in turn contribute to a broader product range.

Seiichi Tsukutani

Employee since April 2004
Senior Manager in Charge of DC Axial
Fan Group, Fan Motor Division,
Karuizawa Plant
Minebea Motor Manufacturing
Corporation



Interviewer: Management has outlined a new vision for Minebea, that of a company which leads the competition through manufacturing excellence. Is the idea of “Rethinking manufacturing from the most fundamental aspects” also part of your brief?

Hirashima: With the establishment of the joint venture, the Fan Motor Business Unit entered a period of significant change. We had already begun working on fan motors with engineering and development teams about a year prior to the merger, so we were able to integrate manufacturing facilities promptly and easily, thus combining two businesses with proud histories and solid performance records.

Tsukutani: Minebea uses ball bearings in its fan motors, but we had no experience with sleeve bearings. You can't manufacture two motors with different types of bearings in the same way. Even in terms of basic product construction, we had two companies with very different manufacturing cultures. The idea was to combine our strong points and work together, but it really wasn't that simple. Both companies were forced to take a good, hard look at their own manufacturing cultures. This was really the first step toward the harmonious union of the two businesses.

Hirashima: As I said earlier, management set forth this new vision at a time when we were taking the first steps toward learning from each other and working together to address a variety of challenges, so it was really encouraging.

Tsukutani: The fan motor plant in Xicen is undergoing some significant changes at this time, actually. We have dramatically revamped the final assembly line, where various parts are brought in and assembled into fan motors, shifting from a traditional linear configuration to manufacturing

cells. The overall layout of the plant has been modified to accommodate cellular manufacturing. There was a lot of debate about this, but eventually we concluded that this would be the best solution for ensuring the fan motor business moves forward. I'm repeating myself, but we are coming up to a time where mass production of standard products will no longer be viable. Such a major shift in approach usually takes quite a while to implement. There is no doubt that management setting a direction for us that called for decisive change accelerated our efforts to realize a harmonious union.

Interviewer: The impetus behind the original merger may have been external pressure, but am I correct in concluding that it spurred you to focus anew on leading the competition through manufacturing excellence?

Hirashima: For us in the Fan Motor Business Unit, the idea of “Leading the competition through manufacturing excellence”—essentially an internal challenge—was prompted by the merger. The fact that extensive discussions on the subject of modifications to our manufacturing processes led to the somewhat daring decision to adopt cell manufacturing is largely due to Minebea's tradition of taking on new challenges in the quest for manufacturing excellence.

Tsukutani: The manufacturing revolution in the Fan Motor Business Unit is ongoing. All of us recognize that it is imperative we make this work—and I am confident we will.

Interviewer: Thank you. I look forward to hearing about more and greater successes.

Hirashima, Tsukutani: Thank you for asking us to talk with you today.

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Yasuhide Hirashima
Employee since April 1991
Manager of Production Control Office,
Fan Motor Division, Karuizawa Plant
Minebea Motor Manufacturing Corporation

