

MINEBEA

~HDD Spindle Motor Business, Now and Future~

March 23, 2001

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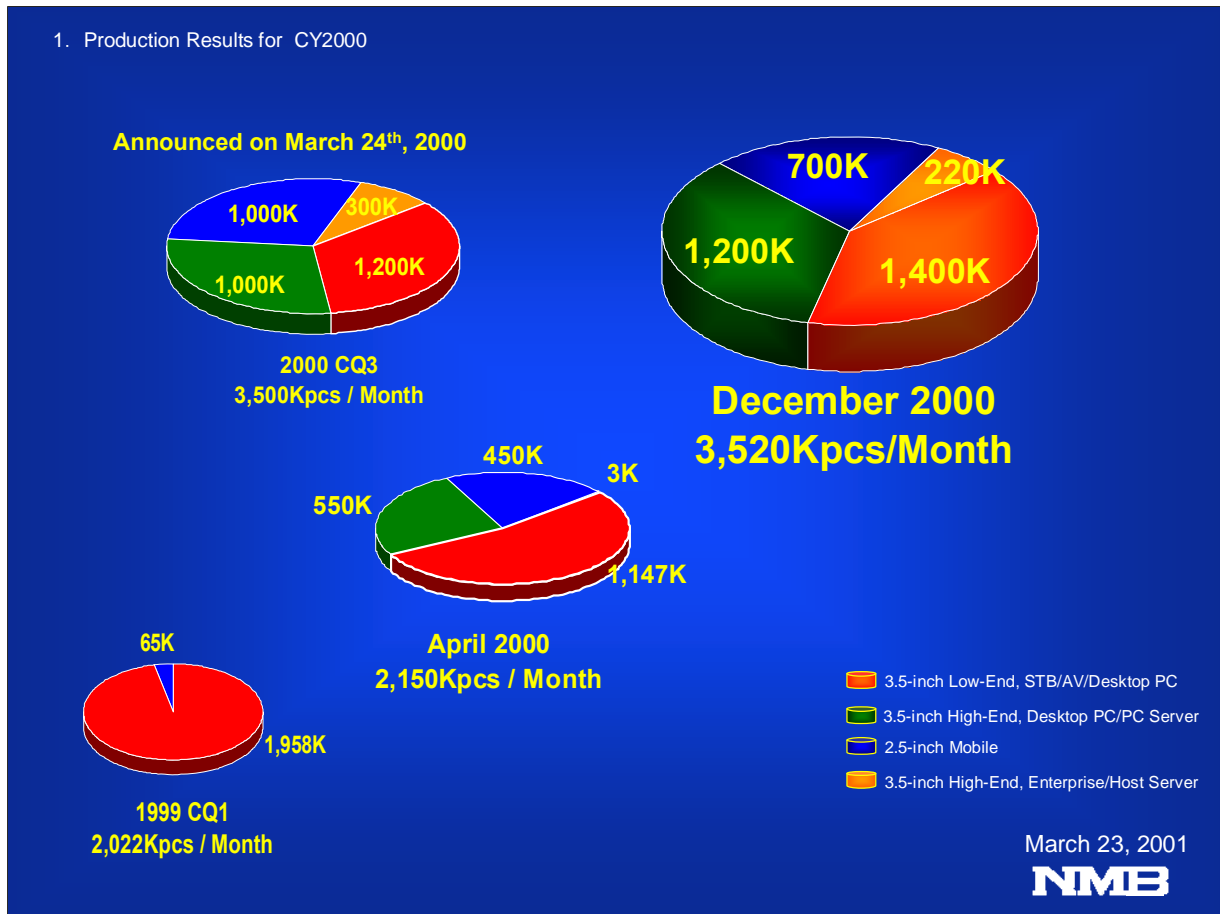
Contents

1. Production Results in CY2000
2. Spindle Motor Production Forecast
3. RO (Ball) Bearing Motor Precision Improvement and Production Quantity
4. Fluid Dynamic Bearing (FDB) Motor
5. Minebea's R&D and Engineering Organization
6. Summary
7. Minebea's R&D Activities
R&D Center Senior Manager Akio Okamiya

March 23, 2001

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1. Production Results for CY2000

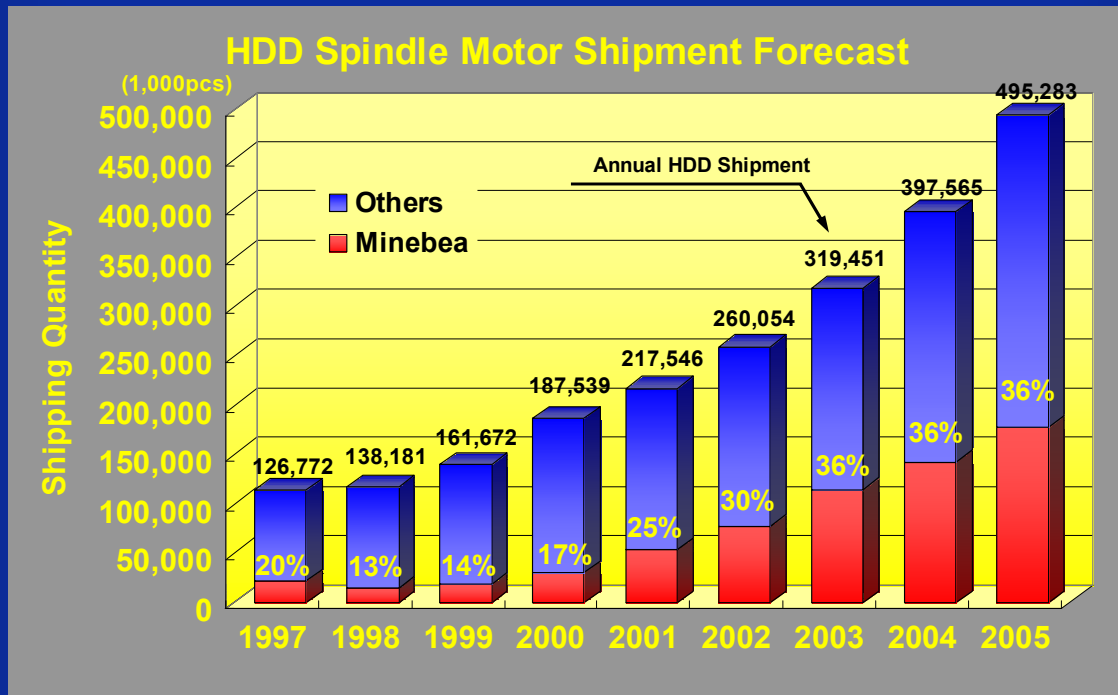


Production quantity of HDD spindle motors in April 2000 was 2.15 million pcs. In December 2000, Minebea increased the production to 3.52 million pcs., out of which 220 thousand pcs. were for 3.5-inch high-end Enterprise, 700 thousand pcs. for 2.5-inch Mobile, 1.2 million pcs. for 3.5-inch high-end desktop PC/PC server, and 1.4 million pcs. for 3.5-inch low-end HDD.

Let's compare this with the projection we gave at the Technical Conference held on March 24, 2000. (Summary of this conference is available in "Other IR Information.") We were to achieve an output of 3.5 million pcs. in CQ3. That is, we accomplished the target three months behind the projection.

Actual production volume was 220 thousand pcs. for 3.5-inch high-end Enterprise against the projected 300 thousand pcs., 700 thousand pcs. for 2.5-inch Mobile against 1.0 million pcs. in projection. On the other hand, production quantity was 1.2 million pcs. for 3.5-inch HDD high-end desktop PC against 1.0 million pcs. as projected and 1.4 million pcs. for 3.5-inch low-end HDDs against 1.0 million pcs. in forecast.

2. Spindle Motor Production Forecast



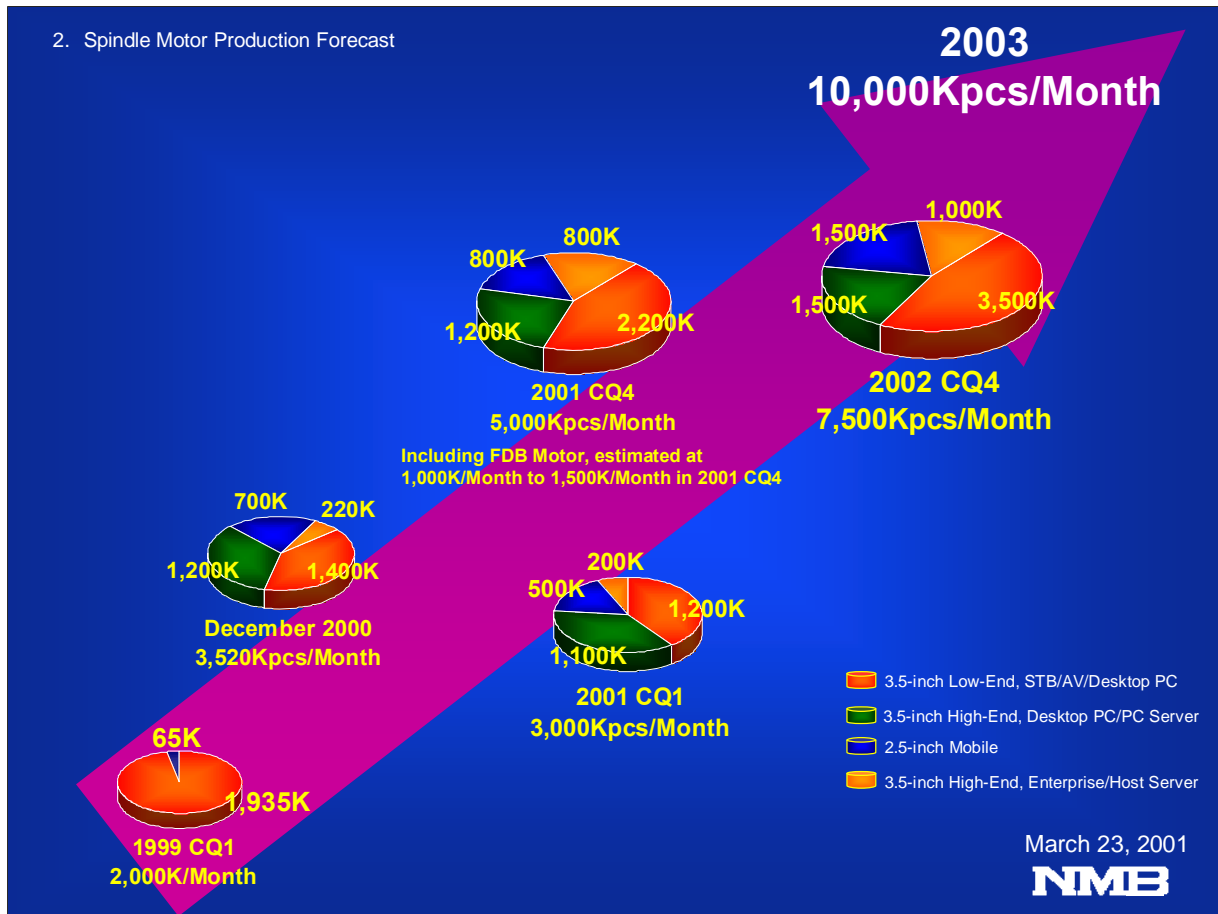
Annual HDD shipment quantity from Pixie Pinnacle Corporation

March 23, 2001

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The bar chart shows results and forecasts of HDD shipment and Minebea's market share up to the year 2005. In 2000, Minebea's market share was 17%. Its share in the years 2001, 2002, and 2003 are expected to be 25%, 30%, and 36%, respectively. Minebea estimates production volume to reach 10 million pcs. per month in 2003.

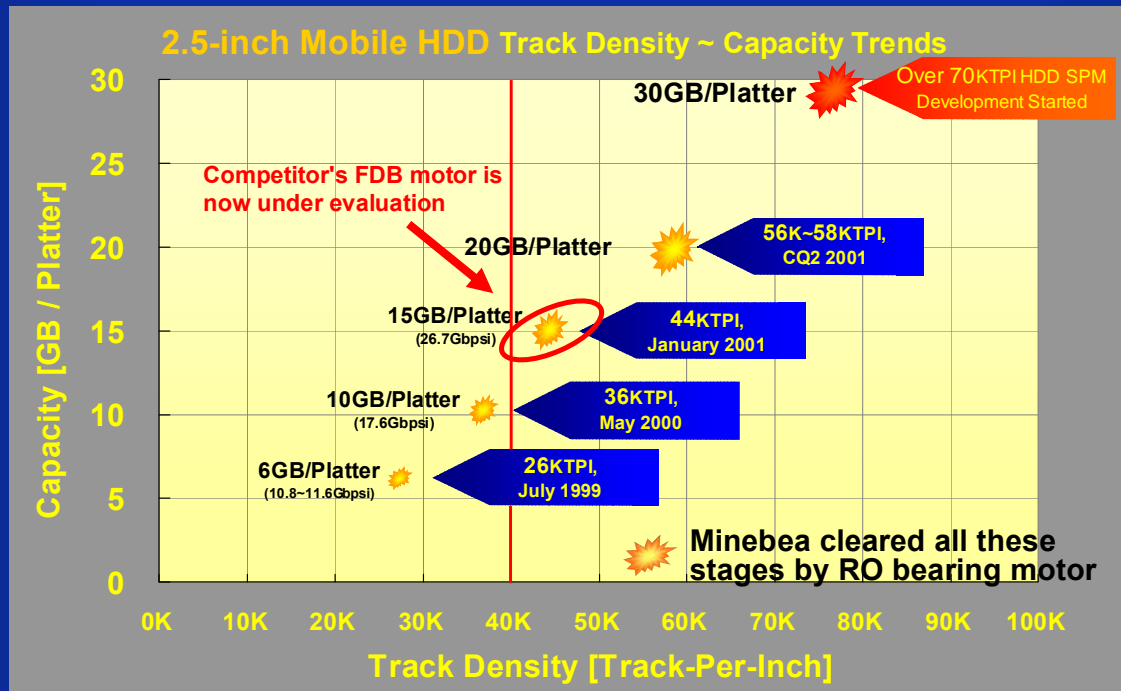
2. Spindle Motor Production Forecast



These graphs show production ratio by product item.

The market presently being less active than in December last year, production volume is 3.0 million pcs.. In CQ4 of the year 2001, production quantity is estimated to be 5.0 million pcs. per month. This is broken down into 800 thousand pcs. each for 3.5-inch high-end Enterprise and 2.5-inch Mobile, 1.2 million pcs. for 3.5-inch HDD high-end desktop PC, and 2.2 million pcs. for 3.5-inch HDD desktop PC.

Production quantity of fluid dynamic bearing (FDB) motors is estimated to be 1.0 million to 1.5 million pcs. in CQ4 of 2001. This volume largely depends on how Seagate's business turns out in the future, which gives some degree of uncertainty to the projection of FDB motor production volume. If FDB motor output falls short of the projection, production quantity of spindle motors using ball bearings will help make up for a decrease in FDB motor output as the total production volume of HDD spindle motors is expected to grow. Minebea aims to achieve a monthly output of 7.5 million pcs. in CQ4 of 2002 and 10 million pcs. in 2003.



March 23, 2001



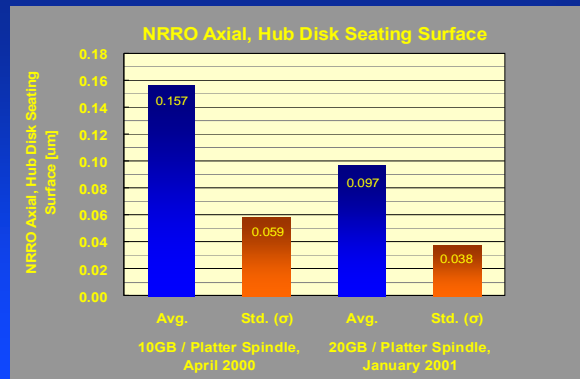
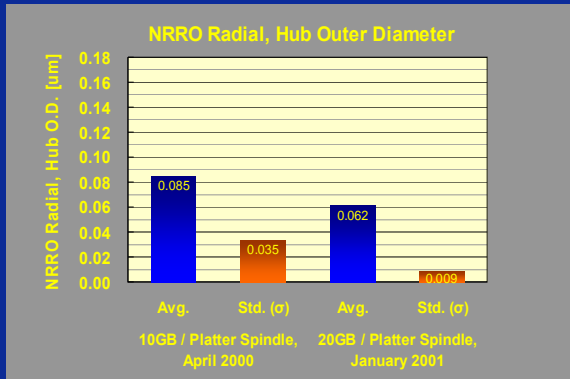
This is a roadmap of memory capacity and track-per-inch (TPI) of a 2.5-inch HDD using Minebea-made components. All of Minebea's spindle motors for 2.5-inch HDDs use RO bearings. (Motors using RO [ball] bearings as hereinafter called "RO motors.")

A 10GB/platter 2.5-inch HDD and a 15GB/platter 2.5-inch HDD, which are fitted with Minebea's RO motors and are currently on the market, have track density of 36K TPI and 44K TPI, respectively. A 20GB/platter 2.5-inch HDD, fitted with a Minebea RO motor, which is to be put on the market in April or thereafter, will have track density of 56K to 58K TPI. Minebea is currently developing RO motors that support 30GB/platter 2.5-inch HDDs with track density of more than 70K TPI.

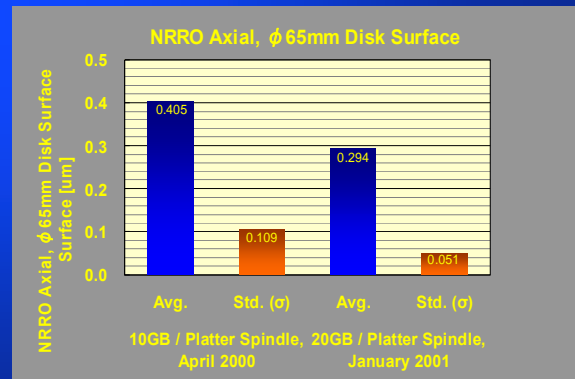
It has so far been said that an HDD, when supported by a spindle motor using ball bearings, reaches the ceiling at track density of 40K TPI. However, Minebea's RO motors have already increased HDD track density to a level far exceeding 40K TPI.

As far as Minebea knows, competitors' FDB motors for 2.5-inch HDDs, now under evaluation by HDD makers, are designed for 15GB/platter 2.5-inch HDDs. On the other hand, Minebea is ready to start in April this year the mass-production of RO motors for 2.5-inch HDDs with the capacity of 20GB/platter. This means that Minebea's RO motors are superior to FDB motors both in reliability and in performance.

3. RO (Ball) Bearing Motor Precision Improvement and Production Quantity



Minebea aims at further improvement in precision of RO Bearings.



March 23, 2001



The three bar charts given above show the accuracy improvement of RO bearings during the past 12 months. The chart on the left shows the radial non-repeatable run out (NRRO) on the outer diameter of motor hub. In April 2000, average was 0.085 micron and standard deviation was 0.035 micron. In January 2001, average and standard deviation improved remarkably to 0.062 micron and 0.009 micron, respectively.

The bar chart on the top right shows the axial NRRO on disk seating surface of motor hub. Average improved to a level below 0.1 micron from 0.157 to 0.097 micron. Standard deviation also improved considerably from 0.052 micron to 0.038 micron.

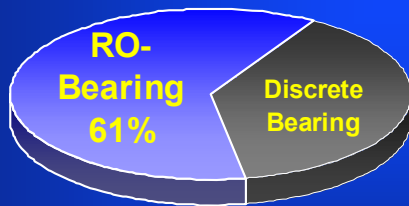
The chart on the bottom right shows the axial NRRO on the disk surface. Average improved from 0.405 micron recorded last year to 0.294 micron in January this year, and standard deviation also improved from 0.109 micron to 0.051 micron.

These improvements accomplished during the past 12 months have enabled Minebea to introduce into the market RO motors that increase HDD track density to a level exceeding 40K TPI.

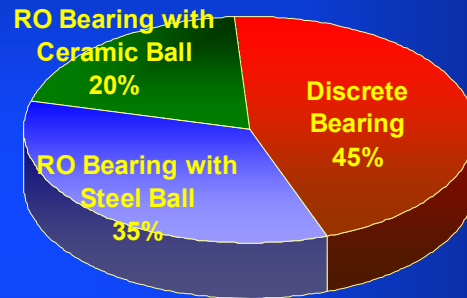
RO Bearing Motor Production Ratio

**RO Bearing Motor
Production Quantity 1,920K
Ratio Of 55% in December 2000**

Announced on
March 24th, 2000



**2000 CQ3
3,500Kpcs / Month**



**December 2000
3,520Kpcs/Month**

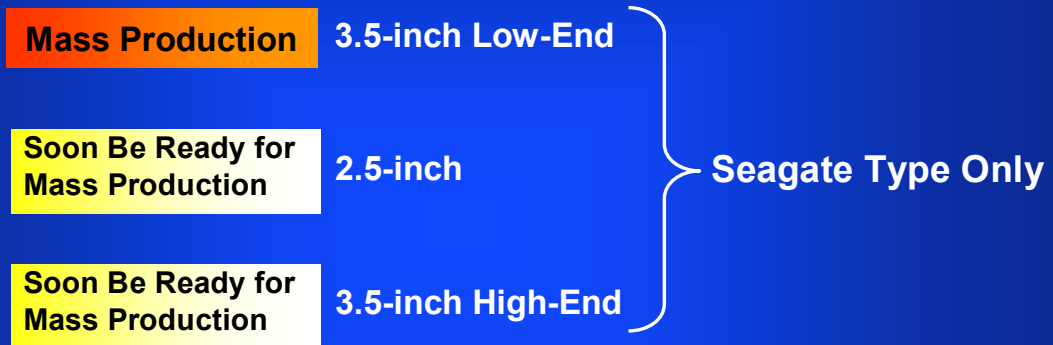
March 23, 2001

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When production volume of HDD spindle motors reached 3.52 million pcs. in December 2000, RO motors accounted for 55%, which is made up of 20% for RO motors using ceramic balls and 35% for RO motors using steel balls. Though the ratio fell a little short of 61% as forecasted at the Technical Conference held last year, RO motor production is progressing on schedule.

FDB Motor Update (1)

Products :



For The Moment, FDB Motor Production Is For Seagate Type Only. Through This Production, Minebea Is Committed To Do Everything To Establish Reliability.

March 23, 2001

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Minebea currently mass-produces FDB motors for 3.5-inch HDD desktop PC. FDB motors for 3.5-inch high-end HDDs and those for 2.5-inch HDDs are now in trial production. All of Minebea's FDB motors are for Seagate type only. Minebea intends to manufacture FDB motors exclusively for Seagate for the time being and is committed to do everything to establish reliability before starting production for other customers.

FDB Motor Update (2)

Production Capacity

At The Moment	April 2001 And After
500K/Month	→ 1,000K/Month

Current Production Quantity : 50K/Month ~100K/Month

Accumulated Capital Expenditure : 5 Billion Yen

(Machinery : 2 Billion Yen, Factory Building 3 Billion Yen)

Quality(Reliability), Cost Competitiveness, Supply Capability And Time-To-Market Activity Are Important When The Market Recognizes FDB Motors.

March 23, 2001

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Minebea plans to expand its FDB and FDB motor production capacity, which currently stands at 500 thousand pcs. per month, up to 1.0 million pcs. per month in April this year. Minebea, though already installed part of machinery for the production increase, intends to install machines and equipment at a slower pace than originally scheduled owing to uncertain factors in the market trend. Current production volume of FDB motors is 50 to 100 thousand pcs. per month, all of which are for 3.5-inch low-end HDDs.

Accumulated capital expenditure up to now is 5.0 billion Yen. Its breakdown is 2.0 billion Yen for machinery and equipment and 3.0 billion Yen for buildings and structures. Minebea thinks that the most important factors for FDB motor business are quality, cost competitiveness, supply capability, and time-to-market activity at the time FDB motors are generally recognized by the market.

4. Fluid Dynamic Bearing (FDB) Motor

Minebea Thai Ltd.
New Facility for HDD Spindle Motor & Fluid Dynamic Bearing



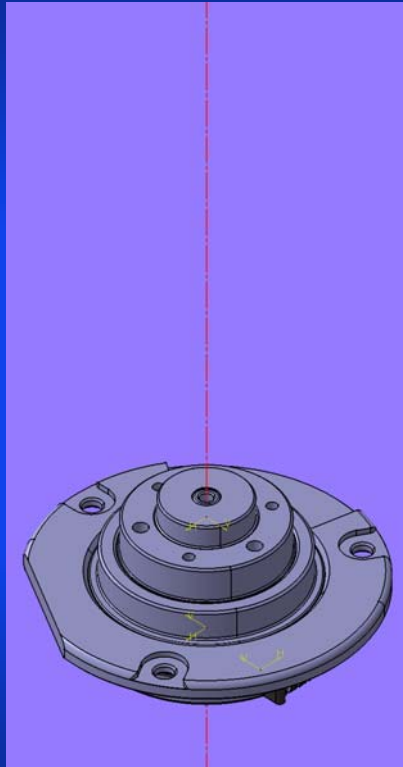
March 23, 2001

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The photo shows a clean room in the newly built spindle motor factory in Thailand. The factory is 240 meters in width and 105 meters in depth.

4. Fluid Dynamic Bearing (FDB) Motor

**An Example of
Single-Plate FDB motor
for 3.5inch Low-End,
STB/AV/Desktop PC**



March 23, 2001

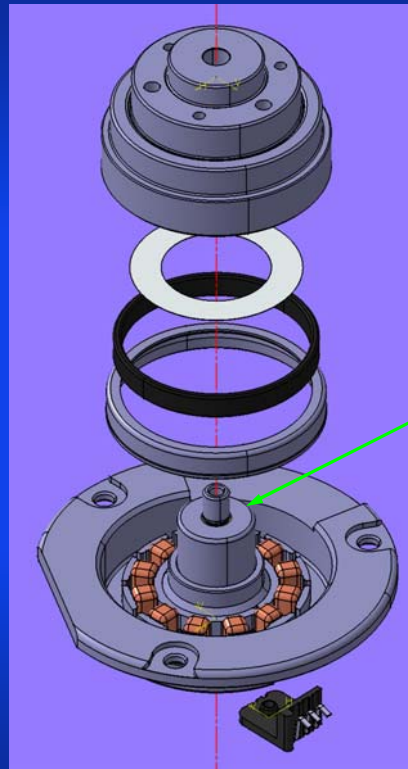
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The photo shows the structure of a spindle motor and an FDB.

The structural drawing shows two grooves inside the sleeve, one groove at the sleeve's lower end that faces the thrust plate, and one groove on the surface of the counter plate. The shaft and the thrust plate have no grooves.

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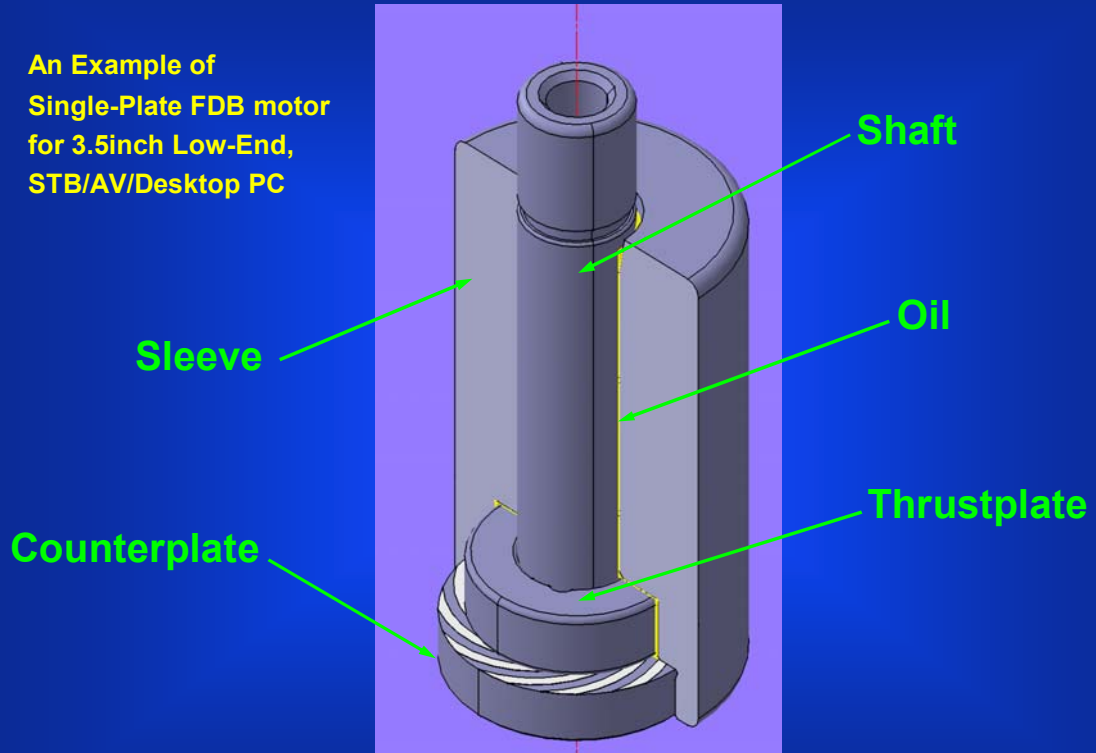
FDB

March 23, 2001

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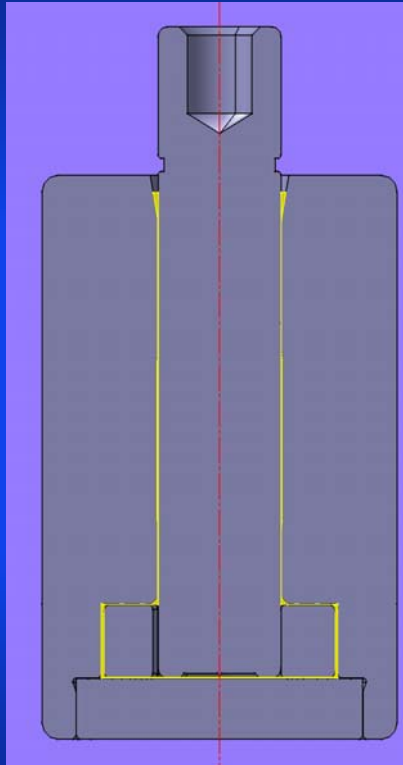


March 23, 2001

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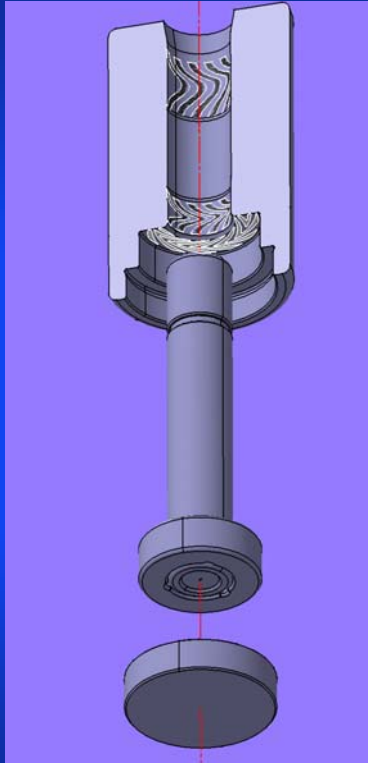


March 23, 2001

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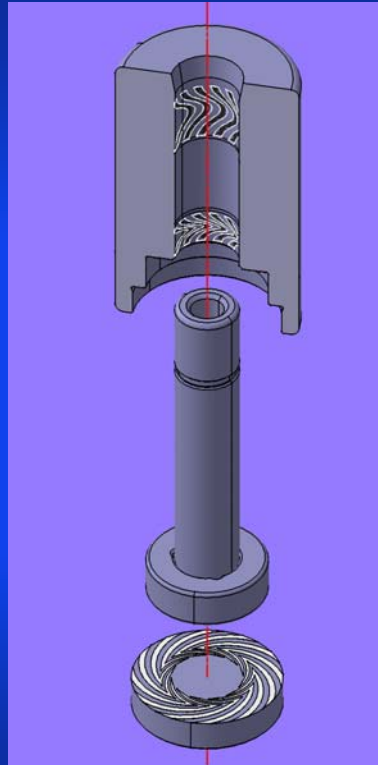


March 23, 2001

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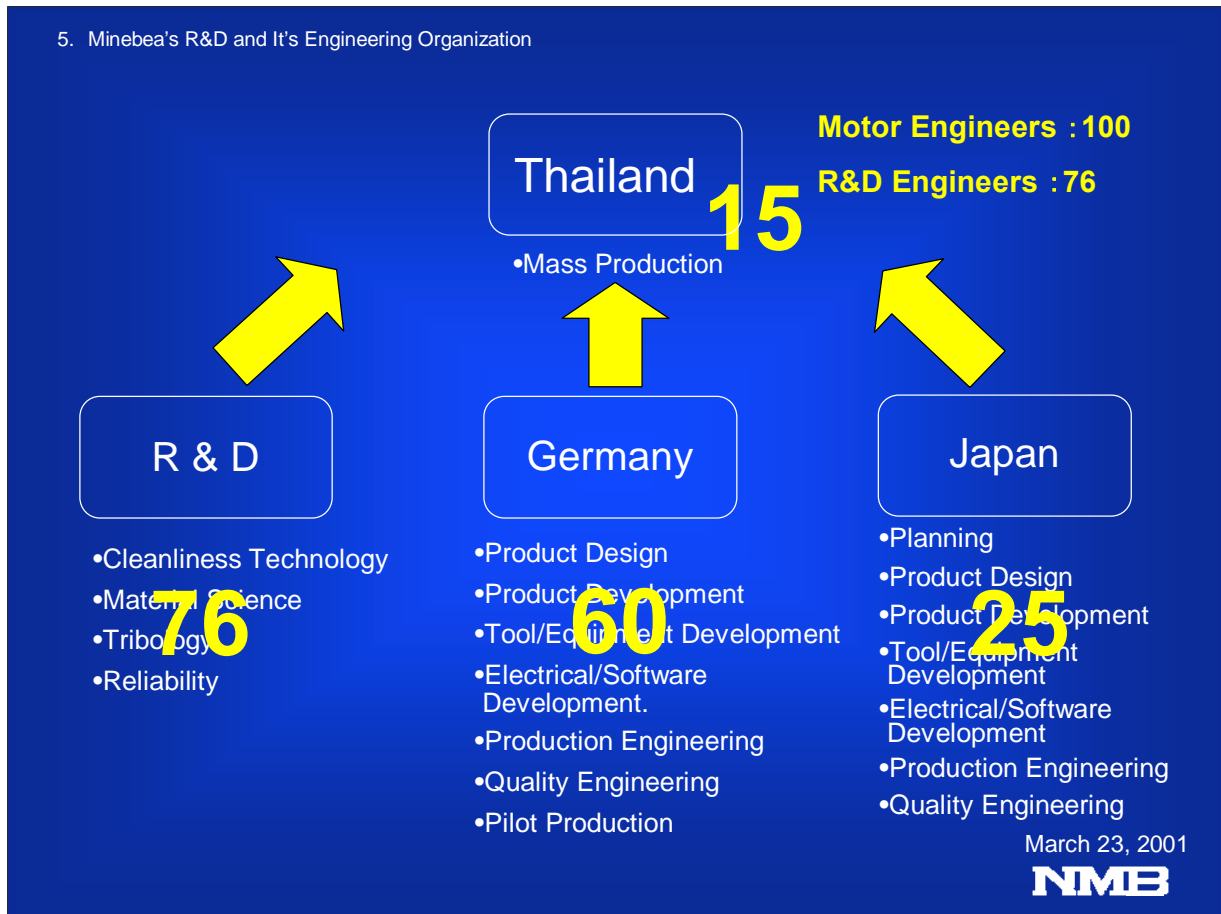
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STB/AV/Desktop PC**



March 23, 2001

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This chart shows Minebea's current R&D and engineering organization that is staffed with 100 motor engineers and 76 R&D engineers.

5. Minebea's R&D and It's Engineering Organization



March 23, 2001



These photos show the R&D Center in Karuizawa, Japan, the R&D Center in Thailand, the Technical Center in Detroit, the R&D Center in Singapore, and Precision-Motors-Deutsche-Minebea-GmbH (PMDM).

Precision Motors Deutsche Minebea GmbH "PMDM"



March 23, 2001

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A new building was completed in November 2000 at PMDM in Germany. This is the base for development of various types of small precision motors including HDD spindle motors.

6. Summary

1. Minebea's HDD spindle motor business is growing steadily.
2. The mainstream of Minebea's spindle motor business in 2001 is RO bearing motors.
3. Minebea's FDB motor has advantages in both productivity and reliability.
4. Minebea sees that FDB motors will be recognized in the market in CQ3 2001 and after.
5. RO bearings have made a big advance in performance during the past 12 months.
6. Minebea is able to manufacture and supply HDD spindle motors with any kinds of bearings, discrete ball bearing, RO ball bearing with steel or ceramic balls, or fluid dynamic bearing.

March 23, 2001

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It is unclear how FDB business will turn out in the future. This puts Minebea in the most advantageous position because of its ability to meet customer needs for HDD spindle motors using any kinds of bearings, i.e. discrete ball bearings, RO bearings with steel balls, RO bearings with ceramic balls, and fluid dynamic bearings (FDBs).