

# USER'S VOICE

Vol. 2

**OKUMA**  
High-Accuracy Machining  
**SPACE TURN Series**  
**MB-V Series**

An LB250T User Testimonial

**High-precision  
turning**  
for safer parts

User Perspectives

**Okuma engineers comment  
on users' experiences**

Development Story

The developer speaks  
**Rational ideas for  
out-of-the-box innovation**

Welcome to OKUMA

**Impressions from new users**



Automobile safety rests on well-manufactured parts. But what is required of the machine tools in the mass-production lines making these parts? Reliability, combined with consistently high accuracies. Companies choose Okuma's SPACE TURN CNC lathe to meet these needs. We asked Michitsugu Ogusu, president of Ogusu Industry Co. Ltd., to tell us about the circumstances behind—and results of—their decision to go with an Okuma CNC lathe.

**Michitsugu Ogusu, President  
Ogusu Industry Co. Ltd.**

Hamamatsu City, Shizuoka Prefecture

Phone: 053-447-2051

Business: Production of powertrain parts and precision parts for automobiles, motorcycles, industrial machines (tractors, combines, binders, air-conditioning equipment, etc.), outboard motors, and electrical equipment.



## “The SPACE TURN is what we needed to produce precision parts for maintaining safety.”

***“The absolute position feedback system showed us Okuma’s commitment to user needs.”***

Okuma's OSP absolute position feedback system was what first caught my attention, and the reason we installed our first Okuma machine in 1982. The user-friendly software is really popular with our employees, even those not familiar with machine tools. It even remembers the coordinate positions if the power is cut. This first machine was an LB15 equipped with the OSP5000, which we bought for high-variety low-volume production. For our mass-production line, however, no off-the-shelf machine from any maker could be used due to size, operating speed, and maintenance issues, so we had to go with custom machines.

At first Okuma's LCC15 CNC lathe looked good for its small size and ability to use a loader, but the launch of the SPACE TURN caused us to re-evaluate.

We then compared the specifications of the Okuma machine with those of the machine made by a custom-machine manufacturer. The result is that we now have 107 Okuma units, including those in our mass-production line.

***“The LB250-T halved dimensional error over time.”***

Automotive suspension parts made of nickel are one of our main products. These are key parts that move like the joints in the human body. If the machining accuracy for the interference fit in parts with bearings is poor, chatter will occur during operation, leading to a possible accident. Each month we mass produce tens of thousands of these parts, meaning quite simply that machining accuracy is our lifeblood.

We looked at various machines in 2000 when we decided to update our processing line. After comprehensively

considering machining accuracy, compactness, ease of maintenance, and the included features of each, we chose and installed two SPACE TURN LB250-T units. We operate them 18 hours a day (from 8 a.m. to 2 a.m. the next morning), without warm-up or air-conditioning. Measuring the final workpiece of the day and the first of the next morning, we found that over the course of 6 days dimensional variance amounted to 8  $\mu\text{m}$  at most and zero  $\mu\text{m}$  at best! (See table on next page.) The custom machines we used before had a machining accuracy of 25  $\mu\text{m}$ . The Okuma machines can certainly be called stable.

This stability is probably the result of the thermal deformation features, the design calling for headstock and turret to be attached to the box bed, the anti-vibration features, and a gearless and beltless headstock. In addition, while wear has to be monitored, especially when operating a machine for long periods, the automatic compensation system makes



Precision turning of steering knuckles done by the SPACE TURN 250T (with loader)



The steering knuckle – plays an important role in the suspension of a car (2 locations) to insure safe motoring.

■ Workpiece dimension measurements

(previous day last part and next morning first part differences)

Day:	1	2	3	4	5	6
1st machine	ø4	ø6	ø2	ø8	ø2	ø6
2nd machine	ø3	ø5	0	ø7	ø2	ø8

● Dia: ø61.8 mm, Material: FCD 450

● Conditions: 8 – 2 am (18-hours), no air conditioning, no machine warmup

things easier. It is quite popular with our employees—who say it “really cuts down on our workload”—because of such features as tool life management via touch setter.

As a result, we are now using 15 SPACE TURN machines, including the LB300 we use to pre-finish various types of shafts for industrial machinery. These machines play a major role in our factory’s competitiveness.

**“We strive for accuracy and efficiency by combining operator, machine, and fixturing into a cohesive unit.”**

At Ogusu Industry, we customize our machines in order to produce higher quality products through precision machining, achieve speedier production start-up, and bring costs down. We also custom-make our own fixtures. For CNC lathes, for example, we all try to come up



Ogusu-made chip crusher and untended disposer provides comprehensive chip handling

with ideas for the chuck to reduce setup time, even if just a little. We were therefore able to develop a chip-crushing, untended chip conveyor system that automatically cuts up and conveys the chips to a container. The chips thus take

up only half the usual space. This has greatly streamlined how we deal with chips.

At the same time, we digitized the innovative ideas and experiences of our skilled staff to implement digital process innovation (DPI), which pools the know-how of our 300 employees.

The next thing we would like to see Okuma do is re-examine the process and troublesome points in the mass production line. Okuma then could further improve upon the non-cutting work aspects, such as tool change time and frequency and chip discharge.

“Smaller, fewer, lighter, shorter, and more beautiful.” These words were spoken by the president of Suzuki Motor Corporation, one of our most valued customers. As a standard from here on as well, we will continually strive to raise the level of every aspect of our production and operations.

By Atsunori Sakamoto

# Okuma engineers comment on users' experiences — SPACE TURN SERIES —

**“We know the thermally stable Okuma machines, are very accurate. We value their advanced Machine & Control applications.”**

We installed four SPACE TURN LB200 units, two in one line, and two in another line combined with a machining center. The LB200s are used to machine small, general-purpose crankshafts. Using a 2-shift system, we operate 24 hours a day. Thermal deformation prevention is very well thought out, and the surface quality and dimensional accuracy of machined workpieces are extremely stable.

The hardest thing to achieve in a

production line is high running efficiency combined with stability. Reliability in the machine itself is a given, but connectivity with peripheral devices such as transfer units, robust software support, and prompt service are also essential. What we really appreciate about Okuma is the comprehensive integration of Machine & Control in its products. In the future, we would like to see even more advanced one-chuck setups and compact designs.



**Joh Okawa, Production Engineering Manager**  
Kyoritsu Co., Ltd.  
Kanagawa Prefecture



**Okuma engineer Okubo comments—**

**“We aim for superior accuracy and service in customers' high-quality production lines.”**

Kyoritz Co. was the first company to clear emissions regulations in the United States for small, general purpose two-cycle engines. Having obtained ISO 09001 and 14001 certification, they also possess a high level of technical ability. For that reason alone, we revised and presented a new crankshaft processing plan based on process integration with connected loaders. The centerpiece of

this plan was the LB200, due to its superior thermal stability. I've heard cases of customers being really inconvenienced by connectivity errors between machines in lines formed of machines from different manufacturers.

At Okuma, we strive for swift handling of customer needs based on our strong point of smooth integration of machine and control. (Shinichi Okubo)

**“The LB300 is central to our FMS, thanks to stable machining accuracy and reduced cycle times.”**

At KS Sanoyasu Co. we have worked ceaselessly to upgrade our FMS, which uses robots to connect the NC machines. Our goal is to improve the efficiency of our medium-quantity production of a diverse range of products. We installed

an LB300 because we wanted to upgrade this system. It met our expectations for stable machining accuracy, rapid traverse, and turret rotation time.

Now we only have to check dimensional accuracy once in the morning. We operate 24 hours a day and if there is a problem in the line, the machine automatically stops thanks to the load monitoring function. This means we can leave it untended without having to worry. Chip disposal is smooth as well because the machine design prevents curling due to the well thought out balance among tool, speed, and

material. We plan to extract every ounce of performance out of our machines so that we can achieve even greater automation. We expect much from Okuma, since their machines are so well known for their rigidity and durability.



**Noriyuki Wada, Senior Executive Director**  
KS Sanoyasu Co., Ltd.  
Hyogo Prefecture



**Koichi Takeuchi, Engineering Dep Manager**

## The Okuma Engineers

**Kiyoshi Isogimi**  
**Shinichi Okubo**  
**Toshio Sawai**

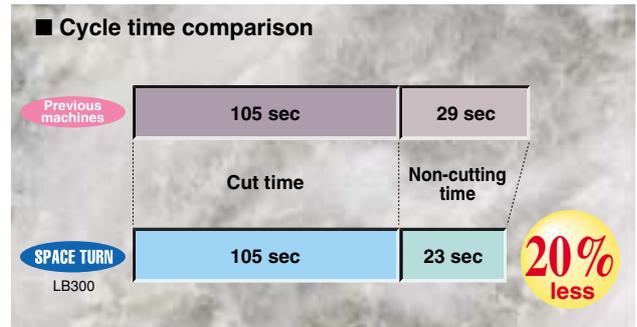
Lathes, Engineering Dep  
 Lathes, Engineering Dep  
 Lathes, Engineering Dep

### Okuma engineer Sawai comments—

**“We have the know-how to slash non-cutting time by 20% to meet the need for strong competitiveness.”**

Accuracy, speed, and non-cutting time are focal points for staying competitive amongst the rise of costs from increasingly stricter demands in every industry. Here is where the LB300 comes in: 1.5 times faster start-up on the X and Z axis than previous models, thanks to precision servo control; best-in-class rapid traverse (X: 20 m/min, Z: 25 m/min) from super rigid sliding guideways; and turret index time of 0.1 sec due to NC non-lift turret indexing.

KS Sanoyasu Co. wanted untended production, and we were able to help them by reducing their non-cutting time by 20% to improve their productivity using our unique technological capabilities. (Toshio Sawai)



**“The specifications of the LB300-M and -MY combined with special attachments allow us to perform untended operation at night, and cut machining costs in half.”**



**Tamio Nagasaki, President**  
 Nagasaki Jyaki Co., Ltd.,  
 Aichi Prefecture

The key to improving product competitiveness seems to be reduction of costs by simultaneously working toward increased accuracies with decreased labor. We purchased an LB300-M and LB300-MY (each with a loader) for our company. At the time, we asked Okuma for its machining know-how on the use of special attachments, since we were trying to thoroughly implement process integration for non-round parts.

As a result, we became able to bore a cylinder in just one chucking. Before, the same cylinder machining had to be done on multiple machines. Our machining costs were also just about cut in half, since we could operate the machines untended at night. The market competitiveness of our company's products has been dramatically increased. This ability of Okuma to customize is what we really count on.

### Okuma engineer Isogimi comments—

**“The multitasking ability of the LB300 let Nagasaki Jack Co. Ltd. realize their vision for a strategic reduction of labor.”**

They wanted to perform untended night operation by implementing process integration together with the ability to cut 40-50 different shapes for aluminum and steel castings. To fulfill this request it was necessary to multitask and reduce labor, which we achieved with a special-order, loader-equipped LB300-M because of its high speed, high accuracy, and stability. Utilizing the LB300's features, such as turrets equipped with L and M tools on all stations, 120 mm travel on the Y axis,

and handy touch setter for tool life management, we worked out a truly comprehensive plan, including dual-jawed chuck, M spindle with special bed, and tank and conveyer for cutting castings.

The customer was satisfied with the result, saying they had been able to improve accuracy and achieve 100% automatic operation, even for boring of non-round cylinders. (Kiyoshi Isogimi)



L or M tooling for all turret stations

# Okuma engineers comment on users' experiences — MB-V SERIES —

**“For orders with complex beveled grooves, the MB handles it all, right down to the software.”**



**Yoshihiro Ito**  
Touei Industry Co., Ltd.  
Chiba Prefecture

One of our customers asked us to machine grooves into a beveled surface for plastic mold parts. The first thing that came to mind was installing a multitasking lathe. We checked with an Okuma sales representative, and they said, “the MB-56VB would be better than a lathe, since the MB is equipped with a tilting round table for 5-axis machining. But it would be more efficient to have a lathe do part of the processing, since that way even if the workpiece specifications are changed in the future, the changes can be smoothly handled.”

After we installed the MB and combined it with macro software suitable for machining grooves into a beveled surface, we were able to improve accuracy and quality.

The customer expressed their satisfaction with the results, and we ended up with a larger volume order than initially expected. We especially appreciate the thermal stability of the MB, since we can continuously operate it for 14 hours a day without worrying about making dimension corrections during the run.

**Okuma engineer Takakuwa comments—**

**“Okuma offers hardware and software to extract every ounce of performance from the MB.”**

The success of Touei Industry Co. Ltd. is a combination of President Itoh’s drive for added-value processing and the suggestions of the sales representative, who took into account the situation throughout the entire factory.

At the same time, the MB’s ability to maintain high accuracy across 5 axes due to the tilting round table combined with highly-rigid basic construction also played a part. (Masamichi Takakuwa)

**“No complaints about accuracy, speed, or stability. We’re also very satisfied with the environmental features.”**



**Mamoru Niinomi** (sitting center)  
Hanabusa Sangyo Co., Ltd.  
Aichi Prefecture

**Koji Niinomi** (sitting right)

We introduced an MB-46VAE (15,000 min-1; Super-NURBS) into our shop floor for machining of prototype aluminum parts. We soon realized the difference with conventional machines, since it handled such jobs as grooving from roughing with confidence-inspiring speed. In addition to the performance, we really like the environmental features, especially since we are ISO 14001 certified. The MB needs no hydraulic unit and is quiet because of the full enclosure shielding, meaning we can use it at night without worrying about noise in the surrounding area. It emits no mist, and maintenance is a snap because there are very few lubrication points. If we were to make a wish list for additional features, we would ask for software that allows management of energy consumption for each individual unit.

## The Okuma Engineers

**Masamoto Takakuwa**  
**Mikio Kondo**  
**Makoto Takahashi**

Machining Centers Group, Engineering Dept.  
Machining Center Group, Design Dept.  
Machining Research Center, Engineering Dept.

### Okuma engineer Kondo comments—

**“The main points for Hanabusa were accuracy and environmental performance.”**

In addition to a thermo-active stabilizer spindle, the elimination of a hydraulic unit has a large effect on preventing heat. Conventionally, the hydraulic unit operates and consumes power even at times other than during tool unclamping, thereby generating heat.

Periodic oil changes are also necessary. Therefore, the MB series is equipped with a tool unclamp package that operates only when needed, thus reducing power consumption, heat generation, and oil amount to the minimum necessary.

In addition, the MB series uses PREX motors that need no permanent magnets or coils and the oil controller for the inverter control is energy saving. Finally, the full enclosure shielding keeps noise down. (Mikio Kondo)

## “Rubber molds for automobiles demand high accuracy, and with the MB we achieved a huge decrease in cutting time—over 30%.”

Rubber molds shaped for the window corner require a large undercut to allow removal of the molded part from the mold and to make the rubber flow easily. For that reason, once a machined mold is cut, the undercut portion is beveled and processed on an electrical discharge machine. We often send our molds to factories overseas, where the demand for accuracy has become increasingly stringent.

We therefore installed an MB-56VB

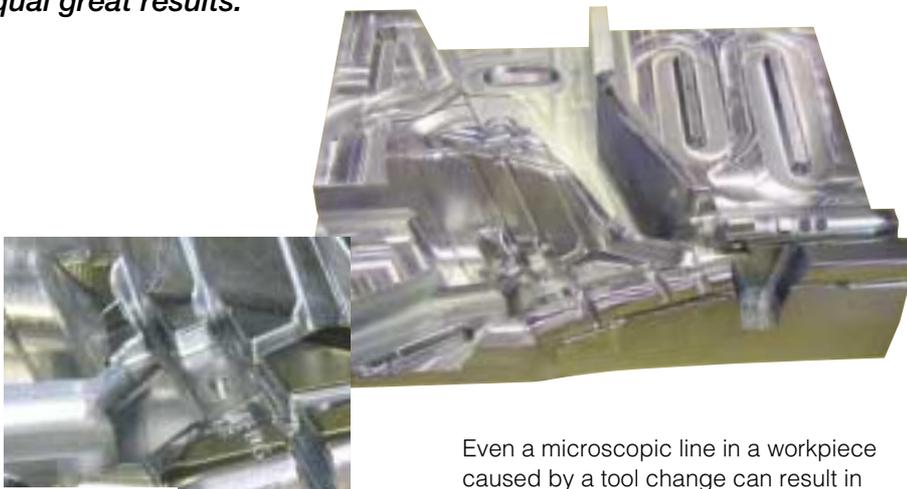
(12,000 min-1; Super-NURBS). What surprised us about the machine was the obvious difference (compared with other machines) in the surface finish of the processed workpiece, and the absence of steps in the machined surface even after a tool change. Thanks to this high-accuracy machining, we were able to slash cutting time by over 30% and greatly reduce our workload in the finishing process.



**Yuji Hasegawa**  
Hasegawa Mold Co., Ltd.  
Hiroshima Prefecture

### Okuma engineer Takahashi comments—

**“The basic capabilities of the MB-V combined with Super-NURBS equal great results.”**



Rubber mold with many undercuts and difficult carving

Even a microscopic line in a workpiece caused by a tool change can result in complaint. The MB-56VB can operate 20 hours a day every day, making it fit right in amidst such severe conditions.

This fact alone demonstrates the reliability of the MB more than anything else. In addition, Super-NURBS provides high-speed contouring capability since it keeps tool movement smooth and at near top speed. This combined with the basic capability of built-in thermal deformation prevention assures continuously high accuracy. The MB also improves machining accuracy, offers a high feedrate, and greatly reduces cutting time and post-processing work.

The MB will have an especially big impact in factories like Hasegawa Molds, where 70% of the processing is done on machining centers and a large volume of workpieces are beveled with custom tools. (Makoto Takahashi)

Kazuo Ichimura



## SPACE TURN Development Story

As told by the developer

Okuma's SPACE TURN CNC lathe aims to set a global standard for the 21st century. The SPACE TURN is positioned as heir to the best-selling LB15, but was developed in response to the need for a whole new dimension in machining and greatly surpasses the ideas and performance of its predecessor. Okuma engineer Kazuo Ichimura highlights the drama behind the development, from concept to realization.

# “A new dimension in machining—after we turned conventional wisdom on its head.”

### ***“Accuracy improved by one decimal place: the development of a lathe that cuts the need for grinding.”***

In the middle of the 1990s, just as the idea was conceived to develop a next-generation lathe, a customer expressed a desire that set the development direction. An automobile manufacturer had said, “productivity would really go up if only we had a lathe that milled with such accuracy that grinding wasn't needed.” At that point, we engaged ourselves in thermal analysis of the highly-popular and proven LB15-II lathe (known as the “mark two”) in order to achieve higher accuracies.

However, accuracy good enough to not require grinding equates to dimensional variance over time to a level of about 0.01 mm (10  $\mu$ m). This meant a machining accuracy improvement of an entire decimal place over the NC lathes of the time; a value more suited to a precision lathe used in a room temperature controlled to within a single degree Celsius. This was a target that could not be achieved by just upgrading the LB series. It was necessary to change the design concept from the bottom up.

### ***“A breakthrough bed configuration and dual purpose motor.”***

The development objectives for the new lathe were 1) machining accuracy of 10  $\mu$ m or less in a normal use environment, 2) compact size, and 3) easy maintenance.

The biggest obstacle, of course, was achievement of the target accuracy. Thermal analysis of the LB15-II proved to be the first breakthrough. Analysis software at that time was not as elaborate as today's. But even so, the largest effect on dimensional variance over time turned out to be bed construction, leading us to remember the excellent accuracy achieved with flatbed lathes of the past.



Slanted-box bed

We made a prototype thinking, “if we use a box shape for the bed and attach a spindle and saddle, then slant the bed, no torsional forces will be generated, and heat should be even throughout.” The slanted-box bed was born.

The next obstacle was compactness, for which the main hurdle was the turret. The design specifications for the turning center called for two motors, one for turret rotation and one for milling (M tool), which would have taken up too much space. What solved this problem was the PREX motor, developed in-house by Okuma. The PREX motor uses no permanent magnets or coil for the rotor, and does double duty as servo and drive motor. Using the PREX motor, turret rotation and M tool can be driven by a single unit, a big step in achieving the desired compactness.

### ***“Mounting the headstock and the manufacturing know-how all break the conventional mold.”***

Considered in terms of streamlining operations, the SPACE TURN includes several unconventional techniques. For

28th  
Machine Design Award  
Japan Machine Tool Builders  
Association  
**Winner**



Speed  
Power  
Accuracy  
Compact  
Environment

# SPACE TURN

example, there is no weight-supporting base below the headstock. If the motor and spindle are integrated (integral motor/spindle), a supporting base becomes useless from a structural viewpoint. Strangely enough, no one had made this modification. Even inside Okuma there were many dissenting voices, saying “if there is no base, won’t the balance of the machine be disrupted and thus act as source of vibration?” After giving it a try despite the opposition, the baseless design contributed to achieving our target machining accuracy, improving oil usage and chip disposal, reducing size and weight, and lowering costs. You can’t argue with success.

It is undoubtedly no simple matter to change the established manufacturing procedures at a factory, no matter what the industry. However in this case, we felt it would be easier to extract better accuracy by using a horizontal bed shape and then slanting the bed after attaching the headstock and turret. We thus proposed a procedure that ran counter to convention. Fortunately, those in the manufacturing department who

understood the reasoning were able to persuade everybody else, and we were able to make the line more efficient.

***“The field test yielded better than expected accuracy, with very pleasing consequences.”***

We were really surprised by the results when we field tested the new design at the factory of a customer engaged in the manufacturing of automotive parts. The test was done in the autumn, when there is huge variation between day and night temperatures, and the factory had no air conditioning. We measured the test workpiece at night and the following morning, and found a difference of just 4  $\mu\text{m}$ ! During a preliminary test in Okuma’s environmental test chamber, the data showed less than 10  $\mu\text{m}$  variation, but it was quite a surprise to achieve similar results in a non-temperature controlled factory environment.

As for the nickname SPACE TURN, we agonized over it until the final phase before product release. The point of using “space” was to condense the development concept into a single word. When we shipped the SPACE TURN in 1998, we received tremendous support from a customer engaged in the manufacture of automotive parts. They remain one of our most important customers to this day. Some of the comments we hear from customers are

“We get great accuracies even if we don’t make dimensional compensations” and “We couldn’t survive without the added value a machine like this gives us.” Thanks to the high industry praise received regarding the performance of the SPACE TURN, it won the 28th Machine Design Award of the Japan Machine Tool Builders’ Association.

When I started working at Okuma, I was in charge of domesticating a Schutte TGM, L.L.C, 6-axis automatic. At the time I was impressed with the precision mechanism on the machine that drove all 6 axes with one motor. In the development of the SPACE TURN, we were confronted many times with stomach-turning obstacles. What allowed us to overcome them all, by discarding conventional wisdom and choosing the most rational idea, could well be that 6-axis automatic I saw 30 years ago; it stuck in my mind because of the rational spirit it embodied.

**Kazuo Ichimura, Assistant Division Manager**

Technology Division and Design Department Senior Manager  
1972 – graduated from Mechanical Engineering Dep, Nagoya University.  
Member of domestic production project team to supply Shütte (German) 6-spindle automatic bar machines. Then helped develop Okuma CNC lathes (LB15, LR15).  
After transferring to lathes applications, worked as development team leader for the LU15 and LFS10-2SP in 1993, and as chief engineer for the SPACE TURN 1996

## Welcome to OKUMA

# Impressions from new users

*The innovative Thermo-Friendly Concept realizes next generation machining accuracy. Turning a round object truly round, milling a flat object truly flat; such are the problems faced by our customers. Here are some candid comments from users who have chosen Okuma as their machining partner.*



**Toshio Kishimoto**  
Factory manager  
Matsudaira Seisakusho Co.  
Niigata Prefecture

### The LB300 – a trusted friend

**A**ccuracy is the biggest concern when looking for a machine tool. We looked at the brochures of many machine tool makers. The description for Okuma's LB300 clearly pointed out the relation between temperature and accuracy, something I had never seen in a brochure

before. To put that in a brochure shows Okuma must have been really confident about their machine.

For a while after installing a LB300, it was confusing to operate because we had never used an OSP-equipped machine. Once we got used to it though, we were taken by the small number of dimension corrections needed and the quality of the cut surface. In a shop without temperature control, you really have to monitor the accuracy of the cut depth on the stable X axis.

Even for such work as continuously cutting a 0.5-mm groove into quench hardened, heat resistant steel over 4 hours, we obtained a variance of under 5  $\mu\text{m}$ . The dependable Okuma machine lets us take on prototype products with confidence, even though such products demand exacting accuracies. The LB300 has become our trusted friend on the shop floor.



**Kenichi Yamagishi**  
Executive director  
Goichi Seiko Co.  
Nagano Prefecture

### I can confidently recommend the SPACE TURN to my friends

**W**e installed an LB250-T the year before last with the aim of upgrading our aging equipment, reducing machining time, and improving accuracies. The sales representative told us about the machine's superior thermal stability and dimensional variance over time of under 10  $\mu\text{m}$ . But after giving it a try, we were pleased to find that the stable machining accuracy exceeded our expectations. This has been a tremendous help, especially in bore reaming of hydraulic parts, since it has allowed us to solve some of the problems we faced for many years, such as cylindricity, roundness, and surface quality. To top it off, our customers are also pleased. The reduction in machining time has raised our productivity, so we installed another one last year. I even recommend the Space Turn to associates.



**Kazunobu Kanda**  
Managing director  
Mita Denki Kogyo Co.  
Kobe, Hyogo Prefecture

### With the MB-46, we drastically reduced rejects

**W**e make plastic parts for semi-conductor manufacturing equipment. In recent years, the demands have become more stringent for high accuracies and shorter delivery times. We went looking for machines that would produce these high accuracies, and chose the MB46-VA, since we were confident that its thermo-active stabilizer (TAS) would meet our need for high speed and accuracy. Our manufactured parts have earned all-around praise for their machining accuracy and quality. And the proportion of defects has dropped off a full decimal place since we introduced the Okuma machine into our shop. As a result, orders for precision parts are on the rise, and our production capacity has been improved by the installation of more machines. We couldn't be more pleased.

I wonder if you're familiar with the thermo-friendly concept?

It's an idea used when building machine tools.

Everyone knows that machines expand and contract due to heat.

This expansion and contraction is eliminated by operating the machine in a temperature controlled room or by cooling the machine.

This is more popularly known as thermal deformation prevention.

But this costs a lot of money.

The spindle turns and the chips fly out.

The opening and closing doors reduce the air conditioner effectiveness.

Next is uniform temperature distribution.

Take a flat plate for instance, if it is used near a heater the surface won't change.

A layout in which temperature gradients are evenly distributed to the front and back, left and right, and up and down is what's needed.

The spindle is especially important—a double cooling oil jacket distributes heat evenly.

A machine designed this way has good thermal characteristics, since it expands and contracts in a straight line during operation and when subjected to temperature variation.

Add to that a thermal deformation compensation system that corrects distortion in units of  $0.1 \mu\text{m}$  and you have

## The Thermo-Friendly Concept



Isaac Newton

"Transcript of a lecture" at Cambridge University in 1670\*

Preventing thermal deformation is, in a word, hard.

Not surprisingly, things have to be re-thought from the bottom up.

This is the thermo-friendly concept—an awesome innovation that turns conventional wisdom on its head.

For one, it means not letting things get too hot.

And using a structure with as simple a shape as possible to ensure that components don't twist and warp in strange ways when hot.

The ideal simple shape is a slanted-box bed or box-built structure.

This is called "simplified structure for thermal distortion."

something really cool.

With this system, dimensions are right on the money.

Not only that, the fact that the thermal deformation compensation system can gather data in real time is quite incredible.

In other words, it can control accuracy by compensating on the fly during operation according to operating conditions.

Yes, you can relax and trust that it will maintain dimensional accuracy from the time it is fired up in the morning.

At any rate, there's nothing like good people and good machines, and people, with good character.

\* Fictional



# Okuma's new friendly approach to temperature changes



## Thermo-Friendly Concept

Automatic adaption to temperature changes



**ACE CENTER MB-46VA**  
Vertical Machining Center

Machining dimensional change over time:  
(ambient temp. change of 8°C)

*ø 5μm*

Machining dimensional change over time:  
(ambient temp. change of 8°C)

*8μm*



**SPACE TURN LB300**  
CNC Lathe