

USER'S VOICE

vol. **6**

OKUMA
Multitasking
Machine
MULTUS B Series

MULTUS User Testimonials

Users impressed with single chucking that eliminates five setup changes

Trust in the machine lets users challenge their limits

Development Story

Full participation of related department leaders in basic design gives rise to

“collision-free machining”





KGK develops creative products for the fields of high viscosity fluid continuous flow supply units and ink piping for printing. The company is continuously growing with a product strategy of high-mix, low-volume production backed by solid technology. They tell us how they are promoting rationalized production with fewer workers, and what led them to purchase a MULTUS B300.

We want to raise productivity with a small MULTUS has never let us down.



KGK, Inc.

Shoichi Suzuki
President

Address:

4-4-20 Minami Hashimoto, Sagami-hara,
Kanagawa Prefecture

Tel: 042-773-0731

Business:

Design and fabrication of air-driven pumps, continuous flow devices and valves, and various kinds of control panels.

Design, fabrication, and construction of automatic machines for these devices.

Installation and piping for air driven pumps and other ink supply devices for printing.

How much can we raise productivity in a high-mix, small quantity product strategy?

KGK has contributed to automation and labor savings in the printing and automobile industries through development of continuous flow devices and valves in supply systems for ink and lubricants. We have maintained a unique position in this fiercely competitive field through high-mix, small volume production of innovative products, rather than through mass production. Many of the parts we use are complex parts and require much labor, so that raising productivity with low numbers of workers was a major issue for us. That is when we came to know about Okuma's MULTUS multitasking machine.

Impressive single chucking machining eliminated need for five setup changes

We were impressed when we brought in a MULTUS B300-W and completed a printing ink supply pressure regulator with a single clamping of the body. Prior to that we had done this with a total of five processes: two on an NC lathe and three processes to drill holes on flat surfaces, sides, and back surface with a machining center or milling machine. We saved time in changing the workpiece and also from higher feed rates, which immediately brought the machining time down from 40 to less than 20 minutes. We also began doing processes that we had previously outsourced, lowering our costs. Moreover, if several people are involved in machining a part there



MULTUS B300-W demonstrates the power to improve productivity



Discharge parts for automobile shield material, body portion of ink regulator machined on a MULTUS

number of workers.

always seems to be some variation in accuracy, but since a single person completes a full part on the MULTUS, we achieved the accuracies we were aiming for. This is also clearly an advantage.

Collision Avoidance System helps reduce operator stress

With a large number of machining axes, there is sometimes interference between the holder and jaws while the operator focuses his attention in the movement of the turret. People who have experienced bent beds or dropped workpieces due to collisions inside a machine as a result of operational error feel considerable pressure while they are operating a machine. Today rapid traverse speeds are high, and by the time an impending collision is noticed it is too late. This risk is particularly high in high-mix, low volume production, so the Collision Avoidance System that checks movements on a three-dimensional screen in real time and prevents collisions is significant.

In the period just after we purchased a MULTUS the tool and chuck registration for special shapes

and the modeling tasks were difficult, and interference errors were frequent. Our operators were nearly at a loss. However, we learned how to use the machine better with assistance from the Okuma Call Center and engineers. Some people say that there is no need to input complex tool shapes on the shop floor, but since our company shows its strengths in skillfully using complex tools with multitasking machines, we tell our people that while it may be difficult in the beginning, they will be able to machine a part with little difficulty when we receive a repeat order for a product. Skill improves with use, and it is better to learn to use the machine well even if that takes extra effort at first.

We decided to purchase an additional B400 because of its outstanding stability in dimensional accuracy

The materials of workpieces we machine with the MULTUS have a range of hardnesses, from duralumin

aluminum to S45C. But whatever we use, sufficient accuracy can be assured by compensating for tool wear only, without the need for warm air operation even in winter. The thermal stability with the Thermo-Friendly Concept seems almost too good to be true. The NC controller (OSP) also becomes easier to use with each new generation, and program editing has become easier with a change from letter to text input, and copying and pasting data or transferring it with a USB device.

We have seen the effects of Okuma's current B300 multitasking machine, and have just recently decided to add a B400 to our shop floor to increase our ability to handle large parts.

We do not sell our products directly but through distributors, and so we are always grateful to them and need to continue to develop superior products that they will want to sell. In the process of learning to use a multitasking machine like the MULTUS, we are acquiring new machining skills and gaining knowledge of integrated operations. We also hope to cultivate the kind of people who can make proposals that will lead to product improvements and the development of new products.



Manufacturing Dept. Mgr.
Isao Nakagawaji



TR Kogyo Co., Ltd.

Tokio Sato
Mizusawa Plant Manager

Natsuta, Isawa-ku, Oshushi, Iwate Prefecture
(Head office: Kamiya, Kita-ku, Tokyo)

Business:

Small valves for pneumatic and hydraulic equipment, mini cylinders, parts machining for machine tools, OA equipment die cast parts, others

MULTUS let's us perform precision machining with a single chucking of the chuck body

Air chuck demanded for high accuracy machining of complex shapes

Our company works under the banner of micro technology and high quality, and the reason we decided to purchase a MULTUS B300-W (with opposing spindle) was the high machining accuracy achieved with the machine rigidity and the Thermo-Friendly Concept. One of our major products, the air chuck body, has a number of sliding parts so that the structure, in addition to being complicated, requires curved and angle surface machining, groove cutting, and drilling with accuracies of 1–2 hundredths of a millimeter.

Not only when cutting small chucks, but when cutting large $\phi 240$ chucks from round aluminum material, rigidity was a point of concern with multitasking machines from other companies. The B300 was then recommended to us. The first impression on seeing it was that it was a solidly made machine, and its stability hasn't let us down.

Undiminished accuracy even after time off

Our Manufacturing Dept. Assistant Manager, Yukihiro Ina, said that on the shop floor they were surprised to find excellent accuracy of within one hundredth of a millimeter in hole diameter even when starting the machine up again after holidays. Other companies don't have a multitasking machine of the same size so a simple comparison cannot be made, but the machining time has been reduced considerably.

When we first heard about the Collision Avoidance System, we didn't really believe that it could prevent collisions. When we actually put together a program and used it, though, we realized how important it is. We often machine the same type of part repeatedly, so we do not use the Collision Avoidance System all that often. Even so, being able to run an interference check in advance with three-dimensional images has been a very valuable function.

Manufacturing Dept. Assistant Manager
Yukihiro Ina
MULTUS operation

Run at full operation 24 hours a day to make up for lack of people for setups

Any company would probably say this, but it takes time to train people who are capable of efficiently performing setups of both lathes and machining centers for complex and precision workpieces. In that sense MULTUS has been very valuable in giving precision with a single chucking, and we have continued to run it for 24 hours a day at full operation.

However, to further raise efficiency, we need to of course to understand the machine better and use all its functions fully, and we believe there is room for improvement in making programs more efficiently. If Okuma could develop software that makes good use of macro functions, and a Collision Avoidance System that did not require presets, we could use Okuma multitasking machines in a much wider range of applications.



Work of four people done on a single machine

Fewer operations also changed people's movements



Chiyoda Seiki Co., Ltd.

Yoshiyuki Chakihara
Director and Manufacturing Dept. Manager

Higashi Shiraike-cho, Nagata-ku,
Kobe, Hyogo Prefecture

Business:
Manufacture and sales of various high pressure gas controls, design and construction of gas control systems, manufacture and sales of gas welding and cutting equipment



Wide variety of regulator body types, which require many labor hours

Streamlining production of gas regulators that have a wide variety of attachments

Welding and cutting technology that uses argon, CO₂, and other high-pressure gases is essential in all types of industry, including steel, shipbuilding, automobiles, and semiconductors. Our factory produces regulators that control the pressure and flow of gases, but the main bodies of these regulators have a wide variety of attachments, such as meters and joint fixtures. We therefore run a range of operations including drilling and hexagonal machining, including angled holes, inlets, outlets, and connections. While the material is small brass blanks, we make a wide variety of products so there are large numbers of setup changes and machining processes. In producing a single product body an NC lathe, turret drill, and manual drill were used and there were four different people working on a product by the time it was completed. We brought in our first

multitasking machine in order to make this work more efficient.

Making human movements more efficient by greatly reducing setup and machining times

One thing that has changed with the introduction of a MULTUS is the movement of our workers. We set the workpiece once and press a button; then we can leave everything to the machine, freeing workers to do other tasks. The machining time itself has been reduced 30%, so products that used to require nearly an hour can be speeded up considerably. Drilling angled holes, which used to be done by hand, can now be done by machine for particularly large time savings.

The MULTUS can perform high accuracy machining, so almost no



Main factory
Shinichi Haku

deburring is required. It took about half a year, but we can also now use the Collision Avoidance System with confidence.

With the MULTUS we are also looking into ways to make work on irregularly shaped pieces more efficient

Previously, we machined forged parts that had irregular shapes and were difficult to grasp on one end with a number of different special-purpose machines. Now, however, we are looking to see whether we can cover them with a fixture combined with a sub-chuck or material-handling robot, and integrate processes on a MULTUS. Machines with high potential give rise to ideas for applying the same techniques in other places.

We produce one type of regulator in lots of about 300, and we would like to ask Okuma for a faster, more compact machine. We feel there are probably a large number of users who would also like a series of machines below the MULTUS 300 class.



Sugiyasu Co., Ltd.

Eiji Minamizawa
Director, Takahama Factory Manager

Main factory: Hongo-cho, Takahama,
Aichi Prefecture

Business:
Development, manufacture, and sales of
automobile service equipment,
environmental equipment, home care
equipment, and material handling equipment

Up to 78% reduction in setup changes Doing high-variety, small batch production and getting better machine utilization

Raising machine utilization while producing components requiring 4-5 operations

We develop and produce, under the popular Bishamon brand, a diverse range of products including lifts for automobile repairs, unmanned electric vehicles, waste crushers and compacters, and stair lifts. Ninety percent of our work, from parts machining to welding, painting, and assembly is done in an integrated system, and we conduct mixed production with one line producing 8–20 products each month.

We machine about 10,000 different parts, many with flanges, and there is an average of 4–5 operations per part. A major issue for us, therefore, is reducing the number of setups to the minimum and raising our machine utilization. We had previously used Okuma's LU 4-axis CNC lathe with rotating tools, but we then purchased a MULTUS B300 for machining heavy pieces of maximum $\phi 380$ mm or boring of long holes, and with the aim of reducing setup time.

Fewer setup changes for large pieces that use a crane has reduced our burden

If we add up all the results of integrating operations, we see that the MULTUS has had a large effect. Some of this is probably from the cutting speed, but for large workpieces that require cranes for movement we have cut setup time a maximum of 78% (138 min → 30 min), including the reduction in time to confirm measurements for each process. Holes of $\phi 50$ mm can be drilled with a single drill, and fewer tools are used. The proportion of setup time accounted for by tool change is also relatively high, but the ATC-40 can handle nearly all of these changes. We have selected about 20 different parts for which we can expect a large process reduction, and are currently machining them on the MULTUS.



With the use of ADMAC-Parts, we are working to improve our capacity utilization with an off-line system

We purchased the ADMAC-Parts CAD/CAM system at the same time as the MULTUS as a way to raise machine utilization. In the production of new parts in particular, the production engineering department puts together a program in advance with ADMAC-Parts and checks for interference. We try to do the minimum amount of correction on the shop floor, and run machines at full capacity. The Collision Avoidance System to prevent collisions in the machine therefore gives us confidence. Checking the machine for interference on the shop floor was a big burden, and there was always the fear of line stoppage if a collision and accident occurred. One thing that does take effort is searching for the bad spot when the alarm rings during shape input when changing drills or chips, and it would be good to have a function that would tell us that.

Two machines give micron accuracies and productivity that used to require twenty machines to achieve



Kyoritsu Seiko Co., Ltd.

Iwao Kawabe
President

12 Hanamaki, Iwate Prefecture (within the Hanamaki Engineering and Metalworking Industrial Park)

Business:
Fabrication of automatic machinery parts for liquid crystal exposure devices, optical communications, vacuum devices, and mounted devices



MULTUS and Koji Nezu of the Manufacturing Section

Parts machining of steppers that demand extreme precision

Steppers (reduced projection exposure apparatus) are ultra-precision devices that continuously expose, at the micron (a millionth of a meter) level, electronic circuit patterns for liquid crystals and semiconductors. Thus, their parts require strict quality assurance. For example, microscopic aberrations in parts around the lens will have a major impact on the focal accuracy, which may be considered the lifeline of an exposure device. Therefore, the parts require angle exactness of very close to zero error.

We had previously used multiple machines for these precision complex parts, including machines for 5-sided machining (vertical machining centers), wire electric discharge machines, and grinders. However, to assure accuracy and speed, we thought a multitasking machine that could perform 5-sided machining with a single chucking was essential, and we purchased a MULTUS.

We selected MULTUS based on opinions from the shop floor; preparation and machining times have been halved

In selecting a machine, our manufacturing section staff compared multitasking machines from several companies, and chose the MULTUS because of its rigidity, ease of use, and reliability. Although there were other machines that were attractive in price, we were at the stage of cultivating technology and, considering the results of test machining and long-term reliability, many of our people started pushing for the Okuma machine. Another factor was that there were a large number of Okuma machines among the production equipment of our customers.

We received a report from our shop floor saying that when they machined pieces on several machines and compared them, the preparation and machining time with Okuma was about half (Manufacturing Section: Koji Nezu). I myself have the impression that we can do with two MULTUS machines what it took us 20 earlier machines to do.

Inspection department gives machining accuracy highest ranking: "We can deliver products to customers with assurance"

Our company policy is to let no product leave our plant unless it has the required accuracy. Based on this policy we have a system of full inspection with precision measuring instruments, and our inspection department says that the machining accuracy of the MULTUS enables them to deliver products to our customers with assurance. Our business partners have also shown a strong interest in the machine and sometimes come tour our plant.

However, bringing in a new type of machine leads to requests from the shop floor to teach them simple ways to create programs, give examples of use of the B axis, and describe the results achieved by other companies so that they can draw out better performance. In a fiercely competitive industry such as ours, high value-added machining is our life, and we would like to ask Okuma to provide information that will provide that kind of support.

USER'S
VOICE



Okada Kenma Co., Ltd.

Yuei Okada
President

Tsubata-machi, Kahoku-gun,
Ishikawa Prefecture

Business:

Machining and assembly of completed parts for construction machinery, hydraulic equipment, automobiles, motorcycles, machine tools, industrial machinery, agricultural equipment, and more



After machining, parts are finished on a grinder

We can be adventurous because we trust the machine— It allows us to push the limits

In operations specialized for round workpieces, Okuma's rigidity has won us over

Since the founding of our company as a pioneer in the grinding industry in Kanazawa, we have focused on high value-added manufacturing, from parts processing to assembly, for machine tools, automobiles, home electronics, and industrial machines. Over the years we have worked with various machine tool manufacturers. However, in 1993 we had to think seriously about how we were going to survive in the future. At that point we changed our management approach, thinking that if we could bring together the skills and know-how that we had cultivated, and if we concentrated our efforts on round materials of the same shape, even products with a thin profit margin, then we could succeed as a business. In other words, we chose a path opposite to what other people were thinking.

We focused our attention on bushings



Single chucking machining of a pin part with MULTUS

and cushion rings (thin cylindrical products). In addition to grinding, we brought in NC complex lathes and other equipment with the aim of thoroughly rationalizing multi-quantity machining and other processes, and increasing added value for unbeatable competitiveness through cost, delivery, and work quality. The machines we introduced in this process were the Okuma LB300 and LCS. What really impressed us was that after 10 years, there was no change in the accuracy of these machines. We felt strong empathy with people involved in the same manufacturing field, and how have more than 40 Okuma lathes.

MULTUS for total machining of pin parts for construction machinery

We purchased a MULTUS in 2006 with the aim of making pin parts machining more efficient. In machining the two ends, internal diameters, and horizontal holes of thick shafts with a length of 600 millimeters, we had previously outsourced the majority of processes. After we brought in the MULTUS we were suddenly able to do all this in-house. The MULTUS enables high-accuracy, stable machining, and lets us cut exactly as we wish. I don't use an NC myself, but I have an eye for identifying

tricks for machining procedures and a machine's capacity. Having a young employee operate the machine while watching the tool rotation and NC tailstock thrust, we have been able to machine a workpiece that had been done in three processes and reduce it to two, recognizing that we were pushing things a little. Even the Okuma representative was amazed. Of course, it is because we trust the machines that we feel the desire to make bold attempts and draw out the maximum capacity of the machine.

Beating the global competition with a strategy of "slow and steady"

Our company does not have a single salesman. Our marketing is conducted through the products we make and the daily manufacturing activities of our employees. Looking back, our company has always been "slow and steady." We have specialized in machining of round materials, and earned a solid reputation, so that people would say "for bushings, go to Okada Kenma." This is because we accumulated skills while being tested in various industries and gaining wide experience. Taking bold steps to avoid competition with the same industry within our prefecture and continuing to respond to the needs of distant customers has also been a valuable asset. What manufacturers desire in order to win in global competition is a flexible partner that can provide stable quality and quantity. That is also the reason we aim to be a 60-person operation with performance comparable to that of 200 people, using superior skills, machines and equipment.

Eliminating setups is the key to competitiveness in moving toward high-mix, low-volume precision machining



Musashino Seiki, Co., Ltd.

Kentaro Suzuki President

Fukushima Plant: Naganuma, Sukagawa, Fukushima Prefecture
(Head office: Ueno, Uwatsuki-ku, Saitama, Saitama Prefecture)

Business: Development and manufacture of original products including granite surface plates and angle measuring instruments; design and fabrication of various test devices, special purpose machines, and tools and fixtures; machining and assembly of parts for OA, optic, and semiconductor devices.



Parts machining for optical devices that require micron accuracies

Precision machining that distinguishes us from competitors allows us to continue with operations in Japan

In addition to our core technologies of developing and manufacturing tools and fixtures and angle measuring instruments, a key aspect of our business is machining parts for OA equipment and optical instruments. For our turning operations, we are using Okuma's advanced LB lathes (high-tech specs). As global competition becomes more intense, however, our major business partners are shifting much of their production to China. This brought us to a crisis bigger than any since our company was founded. We seriously considered setting up an operation in China, but we decided that since our special characteristic was not labor intensive mass production, but rather high value-added precision machining and assembly even if volumes are low, we would aim to create a system that would enable us to survive in Japan.

Thus, our only choice was to try and make time-consuming parts machining more efficient, distinguish ourselves from competitors, and increase our competitiveness. We considered a multitasking machine that could satisfy strict accuracy demands such as hole location or dimensions to be essential for

this, and went ahead and purchased a MULTUS.

True value is seen in aluminum machining, and the amount of compensation for thin aluminum workpieces is different

In test machining we set the accuracy at 2/100ths of a millimeter, and we were impressed with the performance. That does not mean there was no compensation at all, but the amount of compensation was much less than what we had previously done for thin workpieces. Compared with iron, aluminum has a high coefficient of thermal expansion, and so with this material in particular we can really recognize the value of rigidity and thermal stability from the Thermo-Friendly Concept.

The Collision Avoidance System also allows us to speed up first piece machining, which previously we had done slowly with close concentration on the movement of the cutting tool tip. A collision in the machine was our greatest fear, because after a collision it is possible that accuracy will not be restored even following machine repair. We do a lot of trial production, so "Collision-Free" gives us a strong sense of security.

With reduced fixture making and setup, we can turn our sights to entering new fields

The biggest benefit we gained from the MULTUS was in setup reduction. In addition to less work fabricating dedicated fixtures for each process thanks to single chucking machining, the accompanying setup changes have also been reduced. This has enabled us to reduce total lead time by some 30%. The advantage of doing in 3-4 processes what used to require six processes with lathes and machining centers is immeasurable. We also receive thorough support for creating programs.

Introduction of the MULTUS into our plant also led to the start of technical consultations between our shop floor and those of our associates, and we receive advice on cutting angle and tool material from production engineers at our partner companies. In the future we hope to draw out the maximum performance of this machine, and expand our operations into other fields such as machining semiconductor parts.



Supervisor,
Mechanical Unit
Production Group,
Manufacturing Dept.
Hideo Sakuma



MULTUS Development Story 1

As told by the developer

This multitasking wizard, the MULTUS, completely changed the concept of multitasking. How did it come about? We asked the Team Leader in charge of basic design and mechatronics, and the General Leader of software development to tell the story behind the development of the MULTUS multitasking machines.



Leader, Product Development Project,
Technology Department

Takuji Nishimoto

Graduated in production systems engineering from Toyohashi University of Technology, then completed the graduate course at the same university. Joined Okuma in 1986. He was involved in the design and development of the GI-N internal grinder series, and development of machining center spindles and the horizontal machining center MA-800HB, among others. He has worked on the development of the MULTUS since 2004.

This unprecedented multitasking machine was the result of company-wide efforts that consolidated Okuma's knowledge and technology

Our aim: Innovative multitasking machines that satisfy customers one hundred percent

In 2004 there was growing awareness in industry that something needed to be done to withstand fierce global competition, and there were increasing needs for multitasking operations that would promote efficiency and save labor on the factory floor. However, the structure and movements of multitasking machines were complex, and in addition to being expensive, operation and assuring precision was difficult. Their reputation among users was poor. Okuma, beginning with its MACTURN series, had a lineup of multitasking machines that performed all processes with a single chucking, but we had no machine to meet the desires of some users for a moderately priced multitasking machine that could perform high accuracy machining of general machine parts. These users did not necessarily need a top-of-the-line machine equipped with both upper and lower turrets. We then began to develop an innovative multitasking machine that would satisfy such customers one hundred percent.

Full participation of related department leaders in basic design gives rise to "collision-free machining"

For development of the MULTUS, we set up an entirely new system. It was a company-wide project with participation from the basic design stage of leaders of all related departments—design, NC (electrical), production engineering, machining (parts machining), assembly, sales/marketing, service—who shared knowledge with each other on everything from detailed specifications to manufacturing processes. Everyone had suggestions: "To increase rigidity, how about a diagonal rib structure for beds and columns?" "Labor for assembly can be reduced by making not only the spindle as a unit, but also the ATC magazine, columns, and even covers." "From the viewpoint of maintenance, it would be better to have an NC rather than cam box type

ATC, since an NC type would be easier to restore on the spot." In this way, we were able to discover what was needed from a range of perspectives to give our customers what they wanted. We established basic specifications that went beyond the conventional wisdom for multitasking machines in terms of accuracy, rigidity, operability, and serviceability. In addition, we set the goal of reducing the assembly lead time from the normal 22 days to 8 days in order to reduce the delivery period.

In fact, collision-free machining with a "collision avoidance system" was not visualized from the beginning, but came about through discussions between the people involved. One team member remarked offhand to the NC leader that "people are afraid of collisions with multitasking machines, and so they move the machine very slowly during setup and first piece machining. If we could use our simulation and control technology to



MULTUS assembly line

Normal assembly lead time has been reduced from 22 to 8 days by creating modular headstock, column, ATC magazine, cover, and piping assemblies.

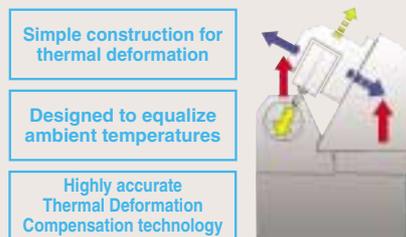


create a 'collision-free' machine, the benefit to customers would be immeasurable." NC responded: "We've already completed a next generation OSP with outstanding processing power. You know, that might be possible." With this, the added value of the MULTUS took a huge step up (see page 12).

Thermo-Friendly Concept has earned an outstanding reputation for machining accuracy

The structure of multitasking machines can make accuracy very difficult to achieve. In addition to being tall and complex, the column is not box-type, and the spindles are asymmetrical right and left. This makes it impossible to control for thermal deformation with compensation technology alone. However, Okuma has a trump card—the Thermo-Friendly Concept. We were one of the first general machine tool manufacturers to introduce an environmental test room, and gain the knowledge to conduct "no-bend, no twist, no tilt" (3 principles) design based on thermal analysis data of all kinds of structures; thus, our technology cannot be easily imitated. In developing the MULTUS

these three principles were thoroughly pursued down to the details, with collaboration between the Design and Research & Development Departments. Despite its complex structure, we were able to assure machining accuracies with thermal deformation over time of within 10 microns without warm-up operation or special air-conditioning, with or without coolant. In general, the greatest concern of customers is machining accuracy, but we have had no inquiries of this sort from customers who use machines with our Thermo-Friendly technology. (See page 12 of the catalog for an image of the Thermo-Friendly technology.)



Knowledge put to use fully to raise rigidity

Another major hurdle for multitasking machines is assuring rigidity. The headstock is tall, the number of axes

large, the distance between the fulcrum and working point great, and they are made compact in an effort to save space. To overcome all this, an innovative structure was adopted. The cast structures of beds and columns use the very strong diagonal rib method that is used on our double column machining centers. FEM and actual machine analyses are conducted repeatedly, and high targets for static and dynamic rigidity equal to those of NC lathes of the same class were met. Roller/guideway systems with 2.6–3 times higher rigidity than ball/guideways were used on the X, Y, Z, and W axes. Movement is lighter and smoother than with ball/guideway designs, and they also have superior wear resistance and damping of vibration. In addition, the bearings on the live tool spindle are not ball bearings but rather highly rigid roller bearings like those on turning spindles. Roller bearings make for a larger turret, but this is made up for by the compact and powerful PREX motor, so that the region of interference with the piece being machined is small. As a result, it can readily be used even for the boring of long holes.

Two hundred suggestions from our “Product Evaluation Group”

In the development of the LB15 NC lathe in the 1980s, we displayed a full-scale cardboard model of the lathe in the company and solicited suggestions for improvement from employees. The LB15 went on to become a best-selling model. With the MULTUS, we displayed a prototype and set up a “Product Evaluation Group” for the people involved to write down any and all opinions. We received some 200 suggestions, many of them detailed. These suggestions were from all perspectives, giving us hints to improve the serviceability and ease of use of the MULTUS. The distance setting for easy approach of the spindle, the cartridge system for easy changeover of the live tool spindle, and other innovations were assessed favorably by the group.

A “Disassembly Class” was also set up for service personnel to examine the serviceability. This was because we wanted them to understand the structure of the machine by changing spindles on the prototype or disassembling and reassembling the turret, and also because we wanted to make this a machine that was easy to maintain, right down to the details. The MULTUS was brought to completion as we looked at each of these suggestions in turn.



200 suggestions were received for the prototype from the “Product Evaluation Group” (an in-house review group).

We were delighted that the MULTUS was selected for a Top Ten New Product Award (sponsored by the Nikkan Kogyo Business and Technology Daily News) soon after its release, but we were even more delighted at the reception it received by customers, who viewed it as having outstanding accuracy as well as a “no worries—feel good” confidence assuredness that there would be no collisions. These are goals we had set in development. This reaction gave us greater confidence, and in developing the next size larger B400 our engineers went out and watched our customers to analyze the ease of use of the B300, and make further refinements for the B400. We did not have a final goal in development, but we are determined to enhance the MULTUS series to make these “Multitasking Wizards” the best in the field.



MULTUS Development Story 2
As told by the developer



Manager, IT Plaza, IT Products Department
Kazunori Miyake

Graduated from Nagoya University School of Engineering and joined Okuma in 1984. Was involved in software development (specifications/design) for One-Touch IGF, high-speed NC, and other projects as a member of development and planning for the numerical controller (OSP), and started OSP7000, U100, and E100. For the MULTUS, he served as the leader in developing new functions such as the Collision Avoidance System and Advanced One-Touch IGF for the P200.

A “collision-free” multitasking machine was achieved by combining technologies for basic software, high performance NC, and machines that we developed in-house

A strong sense of security is the first step to a best-selling machine

What is needed to develop a best-selling multitasking machine? The concept we used to answer that question is a “sense of security.” The

idea of a multitasking machine changes if functions can be achieved to release operators from stress from the worry of collision



If attention is focused only on the tool tip, a collision with the cover or tailstock may occur

because of the complex movements, or from the difficulty of programming operations. The idea to develop a system to avoid collisions also derived from this concept. To realize such a system, however, it is essential to have a high performance NC controller that can process huge amounts of data at very high speed, and control the machine instantaneously. In developing the MULTUS, we were fortunate that the OSP-P200, which has that processing ability, was completed at the same time. We had already developed a 3D Virtual Monitor that could simulate a machine's movement on a computer screen, and key points in development were connecting this to the NC, motor, and machine, as well as how well we could control the machine in real time.

Simulation, NC commands, and machine control with a single CPU

In simulations on a regular computer movements are sometimes delayed because of the huge amount of data, but in the world of machine tools such delays are unacceptable. The machine cannot be controlled unless the movements on the screen and those of the computer are synchronous. With general NC controllers, screen displays and machine control are processed separately with two CPUs. However, we do this with one CPU, and have developed in-house a real time OS that has optimized operation on a single CPU for machine control and screen displays such as simulations, so that the movements on the screen are synchronous with those of the

machine. In developing the program we went through a long series of trial and error, working late into many nights.

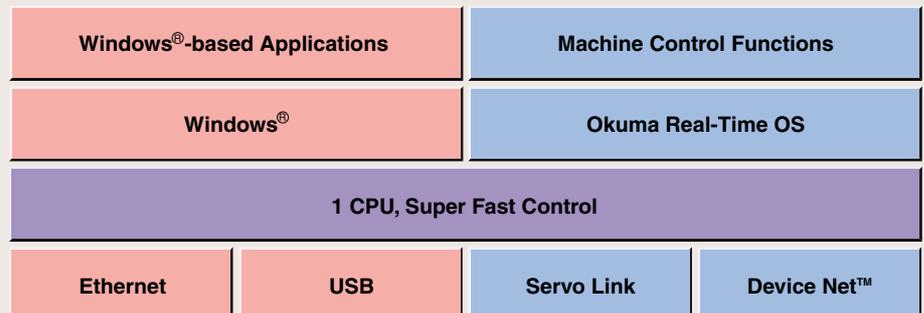
When we tried this system on a test model to confirm the movements, the members of the development team moved everything slowly, worried that if there was a programming mistake the machine would collide and be ruined. One of the executives was bolder, however, and pressed the button to run the machine at normal speed. Just as everyone's heart jumped as they thought a collision was about to occur, the machine stopped right before it happened. Shouts of "We did it!" were heard from the development members.

Workability greatly improved with Advanced One-Touch IGF

One other function that gives users a sense of security is the Advanced One-Touch IGF (optional). This allows

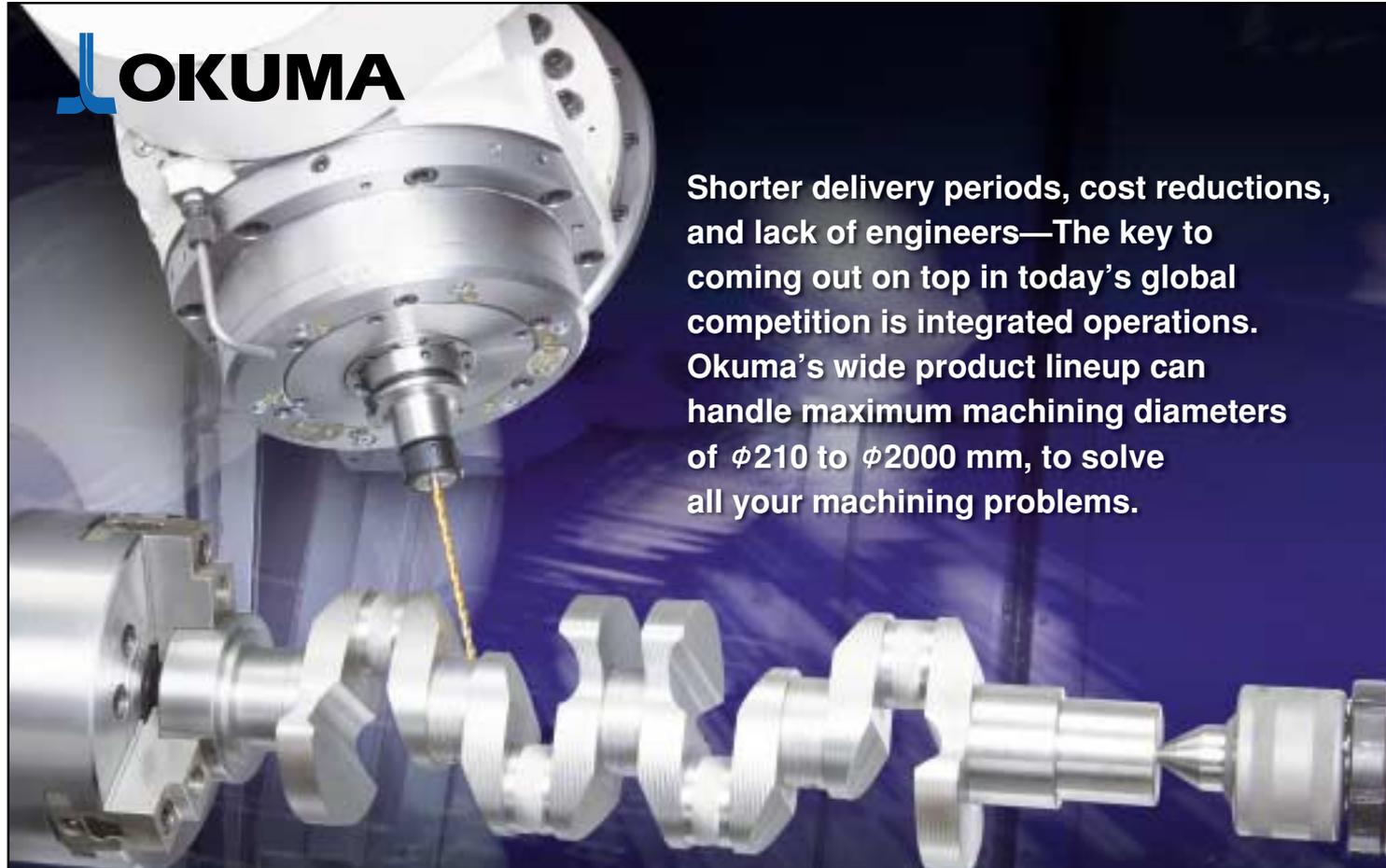
direct programming and operation using a single process sheet, for easy use without having to remember G/M codes. There is no switching between modes or turning pages; movements for the desired operations can be done directly on the screen, similar to shortcut keys on a personal computer. This reduces the number of keyboard inputs by 76% and greatly improves workability. This has also been welcomed by European users who tend to have "shop floor" type operations where everything up through programming is done by the machinist on the shop floor.

Many two-dimensional drawings are still seen in the machine shop, but when three-dimensional data become more widespread in the future the methods of manufacturing will also change. We will continue to work to resolve the various problems that our customers face in order to promote the development of manufacturing environments where three-dimensional data are used.



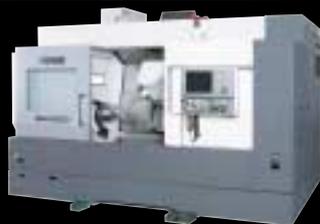
Computer architecture and Okuma's own real time OS make the world's first "collision-free machining" system possible

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Profit lies in integrated operations



MULTUS B300/400



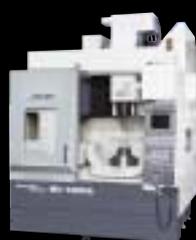
MacTURN250/350/550



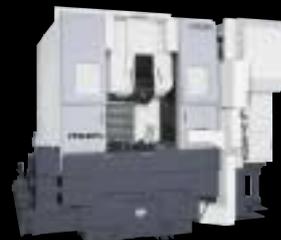
MILLAC 33T/33TU



LT200/300-M



MU-400/500VA



VTM-80/120YB

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