# DMG MORI

COMPANY LIMITED



### Key Figures

DMG MORI Group adopts IFRS since fiscal year 2015 to improve international comparability of financial information in the capital market, and to consolidate accounting policy throughout the group.

	In 100 million JPY			In million EUR				
	2017	2016	Change	s Changes in %	2017	2016	Change	changes in %
Order intake	4,483	3,670	813	22%	3,539	3,050	520	17%
Sales revenue	4,297	3,766	531	14%	3,391	3,131	260	8%
Operating profit / EBIT	294	20	274	14.7 times	232	16	216	14.5 times
(Operating profit margin)	6.8%	0.5%			6.8%	0.5%		
Profit before taxes / EBT	248	-11	259	-	196	-9	205	-
Net profit	157	-57	214	-	124	-48	172	_
Net profit attributable to the owners of the company	153	-78	231	-	120	-65	186	-
Cash flow from operating activity	314	182	132		248	152	96	
Cash flow from investment activity	-14	-100	86		-11	-83	72	
Free cash flow	300	82	218		237	68	169	

January – December 2016: 1 EUR = 120.3 JPY (average rate for the period) January – December 2017: 1 EUR = 126.7 JPY (average rate for the period)

	2017	2016	Changes
Employees	12.375	12.307	68

\*Employees at the end of each period

## Financial Calendar

#### DMG MORI CO., LTD.

22 March 2018	70th Annual General Meeting of Shareholders
08 May 2018	Release for the 1 <sup>st</sup> Quarter 2018
08 August 2018	Release for the 2 <sup>nd</sup> Quarter 2018
07 November 2018	Release for the 3 <sup>rd</sup> Quarter 2018

#### DMG MORI AKTIENGESELLSCHAFT

26 April 2018	Release for the 1 <sup>st</sup> Quarter 2018
04 May 2018	116 <sup>th</sup> Annual General Meeting of Shareholders
26 July 2018	Release for the 2 <sup>nd</sup> Quarter 2018
25 October 2018	Release for the 3 <sup>rd</sup> Quarter 2018

### Glossary

Below are additional explanations to some selected vocabulary in this annual report.

Descriptions in the annual report	Explanations
DMG MORI DMG MORI Group	The entire DMG MORI Group consisting of DMG MORI CO., LTD, DMG MORI AKTIENGESELLSCHAFT, and other group companies
DMG MORI CO CO	DMG MORI CO., LTD.
DMG MORI AG AG	DMG MORI AKTIENGESELLSCHAFT
DPLTA	Domination, Profit and Loss Transfer Agreement (An agreement based on German law to enable DMG MORI CO., LTD. to give directions to the Board of Directors of DMG MORI AG. This agreement came into effect in August 2016.)
Additive Manufacturing	Laser metal deposition technology
DMQP	DMG MORI Qualified Product (Peripheral equipment certified by DMG MORI)
Technology Cycles	Technology Cycles are DMG MORI's solutions to make complex machining easy and fast by combining the following 4 elements: 1) machine tools, 2) Open innovation of cutting tools and peripheral equipment, 3) Embedded software, 4) HMI (Human Machine Interface) such as CELOS.
MATRIS	Module Automation Transfer Robot Intelligence System (MATRIS is a new robot system with modularized peripheral equipment to enable quick installation and set-up of systems and layout changes after installation.)
EMO 2017	EMO HANNOVER 2017 (The world's largest machine tool exhibition held in Hannover, Germany in September 2017.)

### Reporting term

January 2017 – December 2017 Some contents include subjects that occurred outside of this term.

### Disclaimer

This annual report contains targets, plans, etc. concerning the future of DMG MORI. All predictions concerning the future are judgments and assumptions based on information available to DMG MORI at the time of writing. There is a possibility that the actual future results may differ significantly from these forecasts, and described plans may not be implemented. There are many factors which contain elements of uncertainty or the possibility of fluctuation for a variety of reasons.

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As a global corporation continually striving to be the world's largest and most respected international manufacturer of turning centers, machining centers, multi-axis turning centers and advanced technologies.

----- From DMG MORI MISSION STATEMENT





To Our Shareholders

# Message from the President



Dr. Eng. Masahiko Mori

DMG MORI Group CEO DMG MORI CO., LTD. President DMG MORI AG Chairman of the Supervisory Board

#### Management analysis Overview:

In 2017, the first year after the integration, we started to see the successful outcome of efforts we made in advanced machine development and quality improvement. In addition, total engineering business, in which we combine optimal peripherals and software upon system sales and installation, bore fruit as a core management initiative. It helped us expand the market share worldwide. We also launched an IoT platform ADAMOS, which will play an intermediary role among different kinds of network protocol, for Industrie4.0/IoT to help machine tool users boost their productivity. SDGs (Sustainable Development Goals) is another important topic for us, and we are adjusting ourselves in accordance with the economic, social and industrial environment. As part of the approach, we increased the consumption ratio of paid holidays by our employees, reduced overtime and further expanded education programs for employees. We believe that the management foundation to create mid-to-long term value is successfully cultivated.

#### Review of 2017:

Our products' quality was further improved by minimizing variance in machining accuracy and other methods, precedently with advanced machines like 5-axis machines, mill-turn centers and Additive Manufacturing machines. We have also enhanced the range of DMQP (DMG MORI Qualified Product), and Technology Cycles. As a result, we established the position as a leading innovation company in the machine tools industry that provides optimal systems and valueadding after-sales services for each customer.

Additionally in our efforts to strengthen Industrie4.0/ IoT, we have launched the IoT platform "ADAMOS", together with leading European companies in software, engineering, and measuring equipment. Various machine tools and peripheral devices such as measuring equipment at customers' plants can be easily connected through ADAMOS, which enables centralized management of information. It contributes to productivity improvement and downtime elimination by failure diagnosis (predictive maintenance). The platform is highly compatible with other platforms, such as FANUC's "FIELD System" and Siemens's "MindSphere."

On the sales front, in our attempt to raise customers' experience, we introduced machining methods by industry and by workpiece type, as well as automation systems, at various exhibitions. In particular at the EMO show, the world's largest machine tool trade fair held in Hannover, Germany in September last year, we received the record-high orders for a single month. In November, we opened the Shanghai Technology Center with turnkey exhibitions, DMG MORI Academy and spare parts bases to strengthen solution proposal and service provision functions for customers in China and the neighboring countries.

In the meantime, our company is working on employee trainings, promotion of paid vacation, overtime elimination and development of in-house childcare center. For employee trainings, we enhanced TQM (Total Quality Management) activity, OJT (On the Job Training) and other curriculum. We also established the Emerging Technologies Laboratory, for further promotion of Industrie4.0/IoT and AI (Artificial Intelligence) to address technological development in ten to twenty years and more. As for annual paid vacation, we succeeded in consuming all allocated holidays. However, we exceeded the target of 2,000 total working hours per year by 26 hours due to an increase in production workload caused by higher order intake. We will continue working on improving productivity of our employees while increasing average salaries and wages.

As a result of the measures mentioned above, order intake increased by 22% from the previous year to a record-high JPY 448.3bn. Market share has improved in all regions. Sales revenue increased by 14% year-onyear to JPY 429.7bn, operating profit was JPY 29.4bn, and net profit attributable to the owner of the parent company was JPY 15.3bn (loss of JPY 7.8bn in the previous fiscal year due to disposal of redundant assets). On the financial front, the net debt balance at the end of the period (balance of interest-bearing debt, less, shortterm financial assets) was reduced to JPY 105.7bn (JPY 130.8bn at the end of the previous fiscal year) due to timely collection of trade receivables, strict inventory management, and collection of advance payment.

With the improvement of profitability and ability to generate cash flow, we raised our annual dividend per share to be 40 yen, including the commemorative dividend of 10 yen for our 70th anniversary.

#### Future Priority Initiatives:

We will continuously and efficiently catch up with the changes in society, such as shift to EV (electric vehicle), development in Al(artificial intelligence) and aging society.

The EV trend in the automobile industry will raise demand for machine tools and other equipment, as it requires new parts such as motors and batteries, as well as new processing methods for diversified material. Al shift will increase semiconductor demand, and the semiconductor production equipment needs processing facility for ultra-precision parts. Aging society will bring about changes in the facility environment, including automation of material handling. It also leads to an increased demand for medical parts production such as knee and hip joint socket, bone screw and implant. We believe that these structural changes will support the expansion of machine tools and the peripheral equipment market. However, the mere extension of conventional technology might not be enough to cope with the changes in materials and processing methods. From now on, only innovative companies can survive and provide customers with continuously improved value. In addition to multi-axis machines and mill-turn centers, we have also pioneered the industry in laser machines, ultrasonic machines, Additive Manufacturing etc. We have successfully proposed processing methods for complicated workpieces and wide variety of materials. Automation accounts for more than 20% of total order intake.

In the fiscal year 2018, we will gradually expand the application of in-house SmartSCALE to our products in pursuit of higher machine precision than our competitors'. In addition, we extended the warranty period of the spindle MASTER series from 2 years to 3 years to enhance customer satisfaction for after-sales service.

As a leading innovation company in the industry, we are putting efforts in SDGs (Sustainable Development Goals) to meet the expectations of a wide range of stakeholders. As an immediate task, we further strengthened export control function in relation to the Foreign Exchange and Foreign Trade Control Law in Japan. In industrial development front, we are financially supporting research and human resource development through the Mori Manufacturing Research and Technology Foundation. With our motto "Play hard, Study hard, Work hard", we continue to encourage our employees to take full paid vacation and work less than 2,000 hours per year. We further enhanced our in-house childcare system starting in April 2018 as well as our training system.

Through the above mentioned actions, we will strive to continuously enhance corporate value.

# Message from CEO of DMG MORI AG



Christian Thönes DMG MORI AKTIENGESELLSCHAFT Chairman of the Executive Board

### DMG MORI has the power to dynamically shape the future.

In financial year 2017 the high demand for our innovative machines and technology solutions continued. Order intake, sales revenues and free cash flow achieved record levels. Earnings also increased significantly. The order intake of AG increased by +16% to  $\in$  2,754.8 million (previous year:  $\notin$  2,369.9 million). We thus achieved the highest order intake in the AG's 147-year history to date. Adjusted for the effects of the realignment in 2016 – such as, among other things, the changed sales and service structure in Asia and America – our order intake even increased by +23%. The global consumption of machine tools rose by +4.5%. Sales revenues also reached a new record high: Over the whole year, sales revenues went up by +4% to  $\notin$  2,348.5 million (previous year:  $\notin$  2,265.7 million).

Adjusted for the effects of the realignment, sales revenues increased even by +9% compared to the previous year. We also further improved on our results: EBITDA increased by +49% to  $\notin$  252.9 million (previous year:  $\notin$  169.7 million). EBIT increased by +73% to  $\notin$  180.1 million (previous year:  $\notin$  104.0 million) and EBT rose by +87% to  $\notin$  176.4 million (previous year:  $\notin$  94.1 million).

As of 31 December 2017, we reported EAT of  $\in$  118.4 million – a growth of +149% (previous year:  $\in$  47.5 million). In addition to the good results of operations, our financial situation also developed positively: Free cash flow rose by  $\in$  99.9 million to a record high of  $\in$  142.4 million (previous year:  $\in$  42.5 million).

On the one hand, while we achieved record figures for significant performance indicators, we actively pushed forward important future topics: Automation, Digitization, Additive Manufacturing, Technology Excellence as well as DMG MORI Qualified Product (DMQP). Along with these five strategic future topics, in 2018 we are focusing more strongly on the optimization of quality and service. Now more than ever, DMG MORI aims at quality without compromise. For this aim, we are driving our "First Quality" offensive forward with numerous measures. For example, since January 2018 we have been offering a 36-month warranty period for all motor spindles of the "MASTER" series, without any restriction on hours. With our "Customer First" program we are striving for an increase of service satisfaction of our customers. As a worldwide leading manufacturer of machine tools, we also want to become the service champion for our customers – with excellence.

All our dynamic excellence would be impossible without DMG MORI's most important pillar: our employees. They are the face of DMG MORI and the interface to our customers. Only thanks to their engagement, expertise and strengths are we able to implement our objective to provide premium products and our ambitious goals. Innovative power, dynamics and excellence: That is the DNA of DMG MORI. Our highly qualified employees and strong partnerships keep us firmly on our success course.

For financial year 2018, we (AG) are planning around  $\in 2.5$  billion in order intake and around  $\in 2.45$  billion in sales revenues. EBIT is expected to amount to around  $\in 180$  million and free cash flow to around  $\in 100$  million. The current financial year will be marked by dynamics and excellence in technology, services and quality. We intend to dynamically promote our future topics and sustainably optimize our existing achievements. Therefore, our motto for 2018 is "Dynamic. Excellence".

CO's stake in AG: 76.1% (as of December 31, 2017) DMG MORI AKTIENGESELLSCHAFT HP https://ag.dmgmori.com/en/

# Message from External Director



Tsuyoshi Nomura DMG MORI CO., LTD. External Director, Dr. Eng.

### Enhanced governance with appointment of external directors

In June 2015, I took office as External Director of DMG MORI Co., Ltd., as one of the two External Directors DMG MORI assigned for the first time. In March 2017, when the two DMG MORI companies in Japan and Germany merged their businesses into one, the number of External Directors increased to 4.Together with 3 External Auditors, the Board of Directors now consists of 7 members from DMG MORI and another 7 members from outside. The composition of members of the Board - 50% from DMG MORI and 50% from outside - reflects strengthened corporate governance of the company.

In my view, External Directors are expected to play their roles in the following two areas: 1) Monitoring of the management, and 2) Advising to the management. In both areas, the role of our External Directors is becoming increasingly deep and widespread. External Director Mr. Aoyama is Professor of Keio University. External Director Mr. Mitachi brings in his experiences at Boston Consulting Group, a global business consulting firm. External Director Mr. Nakajima led the Patent Office of Japan and worked at Sumitomo Electric. I assumed leading roles at Mitsubishi Heavy Industries and Panasonic. External Auditor Mr. Kato comes from Toyota. External Auditor Mr. Kimoto introduces his experiences at SMBC and Olympus. External Auditor Mr. Tsuchiya provides valuable inputs from his career at Denso. Indeed, DMG MORI's External Directors and External Auditors have experiences at Japan's excellent companies representing a wide range of industries and functions. Compared to other companies, DMG MORI's External Directors and External Auditors are making increasingly powerful contributions as a monitoring and advising body to the management of DMG MORI.

#### DMG MORI's strengths and future challenges

DMG MORI's strengths derive from the fact that it has grown to the No.1 company in the machine tool industry worldwide, which lead to the following strengths: 1) Attractive workplace for outstanding and diverse talents, 2) Enhanced product lineup, 3) Enhanced capability of product development, 4) Geographical diversification of sales and production locations, 5) Advantages in the access to market information (market trend, machining and control technologies, software), 6) Stronger purchasing power in the supply chain, 7) Cost reduction by usage of common components throughout the group, 8) Advantage in financing and investment, and 9) Stronger branding and sales force. Moreover, DMG MORI represents unique advantages which can be summarized as follows: A) Strong leadership of Dr. Mori, quick decision making, forward looking and strategic approach, as well as B) Strong driving force by uniting the power of all the employees. On the other hand, I would expect stronger commitment from employees and organizations of DMG MORI to fully exercise their potentials.

At the board meetings, members discuss proactively and intensively on a variety of issues to achieve further growth of DMG MORI by exercising their roles to provide monitoring of and advising to the management. In parallel, External Directors and External Auditors provide a lot of advices and suggestions to Operating Officers who report on areas they are responsible for. Such suggestions aim at enhancing the said strengths of DMG MORI even further, and to monitor the progress of business. Furthermore, External Directors and External Auditors take up every opportunity to visit DMG MORI's factories to better understand the company's operation outside of the board meetings; they observe the operation on-site and give practical advices and suggestions for improvement.

To overcome the challenge of DMG MORI by encouraging individuals and organizations for stronger commitment, the company launched TQM (Total Quality Management) activities. PDCA (Plan-Do-Check-Action) is a useful tool within this scheme. PDCA is not only helpful for the company's performance, but also for human resource development, such as skills development, visualization of the current skill level, and training. I am convinced that continuous implementation of the said efforts for an extended period of time will give great impacts on the growth of DMG MORI going forward.

The communication between the members of DMG MORI's management, External Directors, and External Auditors is open and candid. The management of DMG MORI implements what they discuss with External Directors and External Auditors after the board meetings in real business. This would be a strong driving force for the growth of DMG MORI.



BUSINESS SITUATION



# Message from Executive Vice President (Administrative)



Hiroaki Tamai DMG MORI CO., LTD. Executive Vice President

#### Towards cultural integration with DMG MORI AG

We consider human resources as the most important management resources for innovation. We pursue effective talent management and investment, in line with organizational integration with DMG MORI AKTIENGESELLSCHAFT (hereinafter referred to as AG) and other group companies, flexible standardization and delegation of authorities.

Recent assignments of executives, including those of AG and other subsidiaries, have helped us convey the top management policy across the group. We will further explore and develop potential management staffs, both in DMG MORI Co., Ltd. (hereinafter referred to as CO) and AG.

### Human resources development policy and risk management

One example of flexible standardization among the group is personnel training in the long-term perspective. Conventionally we have sent staffs hired and trained in Japanese headquarters or in German headquarters to the rest of the world, but we started to explore and cultivate local talents instead. We employ new graduates from high educational institutions in Asia and train them internally. The first batch of people already joined us in 2017 from China, India and Indonesia. We are recruiting from other parts of the world as well.

We also need partially decentralized management system and delegation of authorities, with a respect

to AG's autonomy, in order to manage more than 12,000 employees in the group in a speedy and efficient manner. The headquarters in Japan will handle personnel affairs and compensation of around 100 top management members of CO and AG, while the regional managements will manage around 500 middle-class managers and other staffs' transfer, employment and so on.

Among the most important challenges are recruiting and training of staffs who can catch up with the market transitions and help grow the business. This initiative is pioneered by in-house leadership training in the U.S. The training combines the internal and external know-how, drawing participants from Canada, Mexico, Brazil and Japan. It will be applied to wider range of attendees in the future.

On risk-management front, we are committed to maintain appropriate corporate governance system by detecting risks inside and outside the company, and eliminating and mitigating them. Staffs engaged in internal control systems, security trade control, legal affairs, intellectual properties and property/ casualty insurance keenly watch the risks in their responsibilities.

Internal auditors of CO and AG are working together on internal control reporting system over financial reporting, based on Financial Instruments and Exchange Act (J-SOX). The consolidated assessment is conducted by financial auditors before submitting to the regulatory bodies and reporting to the public.

As of security trade control, we follow the regulations of Japan, Germany and other exporting countries in acquiring permissions. The whole DMG MORI group is well aware of the importance of export control and pay close attention in their daily tasks.

CO and AG's legal departments cooperate closely in such areas as product liability and contract management.

We apply for patents and design rights for internally developed technologies, and trademark rights for brands and names to protect our intellectual property (IP). We also continuously investigate that of other companies to avoid infringement of IP.

With increasing risks inside and outside the company, each risk-managing department has to coordinate closely with the AG counterparts in developing and reinforcing the current processes and methods.

# Message from Executive Vice President (Accounting / Finance)



Hirotake Kobayashi

#### Financial performance for FY2017

Fiscal year 2017 was the first year after full integration with DMG MORI AKTIENGESELLSCHAFT (hereinafter referred to as AG). We tried making best use of the global collaboration in sales, development, manufacturing and procurement, in order to achieve committed figures in sales revenue, profits, reduction of interest-bearing debt as well as other items in the consolidated financial statements.

The sales revenue was resulted in JPY 429.7bn., increased by JPY 53.1bn (+14.1%) from last year, operating profit in JPY 29.4bn., up by JPY 27.4bn.(Y-o-Y 14.7 times) and the net profit attributable to the owner of the parent company in JPY 15.3bn (in the previous year, loss of JPY 7.8bn due to the one-off items). We believe the results meet our shareholders' and investors' expectations for the initial year of full integration.

As of the financial position at the year end, the equity ratio ended up in 19.0%, improved by 1.0 per cent point from fiscal year 2016. The net debt balance, which is calculated by deducting short-term financial assets from the balance of interest-bearing debt, decreased by JPY 25.1bn from previous year to JPY 105.7bn.

Cash flow generated from operating activities in FY2017 reached to JPY 31.4bn, thanks to enhanced down payment collection, timely collection of accounts receivables and reduction of working capital by, for example, stricter inventory management, and so on. The cash flow from investing activities was negative of JPY 1.4bn

after netting receipt from sale of shares with the capital expenditure of JPY 9.4bn. As a result, the free cash flow for the year was JPY 30bn.

#### **Future initiatives**

The social and industrial structure is dramatically changing in mid-long term, with shift to EV, penetration of AI and aging of society. As CFO of the company, I am committed to provide healthy and solid financial foundation for the company to make necessary investments responsive to the ever-changing market and customers' needs, as well as to continuously enhance the company's value. Now that the fullyintegrated DMG MORI gained better profitability and cash flow generating capability, our annual free cash flow target is set at JPY 20bn or more in the coming years to reduce the net debt balance to less than JPY 50.0bn by the end of FY2020. We intend to attain these goals while balancing investments for growth and shareholder returns.

Minimizing financial risks and maximizing capital efficiency are also among my biggest challenges as a CFO, and we have introduced global cash management system to address them. It enables capital visualization, enhanced financial management and centralized control of foreign exchange risks.

Given the continuous favorable trend in machine tool's market in FY2018, we set the sales revenue target as JPY 450bn. (up by 4.7% from last year). With further synergy effects expected this year, we aim for JPY 35bn in operating profit (up by JPY 19.0% from last year), as well as JPY 20bn. for net profit attributable to the owner of the parent company (up by 30.7% from the last year). As for shareholder returns, annual dividend for FY2017 was 40 yen per share (14 yen plus from last year), including 10 yen per share as commemorative dividend for the company's 70-year anniversary. As a result, the dividend payout ratio was 34.4%. We are expecting annual dividend of 50 yen per share for FY2018. We will aim for well-planned and stable shareholder returns. With the basic financial policy to maintain and improve financial soundness, we will remain committed to stronger financial bases and improved company value. Fair and timely disclosure is also a key to establish better relationship with shareholders and investors through constructive conversation. Your continuous understanding and support are greatly appreciated.

# Message from Executive director (Development / Quality)



Naoshi Takayama DMG MORI CO., LTD. Executive Director, Dr. Eng.

#### **Total Solution Development**

We observe significant changes in the market trend; climate change has ignited a shift to electric vehicles; aging society pushes up demand in the medical industry; AI (Artificial Intelligence) and IT technologies make our daily life more convenient and productive. On the other hand, we observe challenges our customers are facing at their production sites; lack of skilled engineers and operators; difficulty in hiring young people and transferring skills from elder to younger employees; speedy production of prototypes of new components arising from EV-shift, AI-shift, and aging society; flexible production of different kinds of components in variable volume.

In order to address these changes, DMG MORI will continue developing new technologies to improve performance and quality of our machine tools. In addition, we will release new products to cover the complete production processes from raw material to end product. Further, DMG MORI will offer system solutions to support customers to maximize the availability of their machines and equipment. Our goal is to become a total solution provider for our customers to improve the productivity of their factories as a whole.

#### Development Strategies in 2017 and 2018

In 2017, DMG MORI Co., Ltd. (CO) and DMG MORI AG (AG) released in total 15 new models. In parallel, we have been continuously reducing the number of models since 2009 when the collaboration started. We started reviewing more than 300 models of both companies in 2009, eliminated redundancies and less profitable models from our product lineup, and reached at 164

models by the end of 2017. In 2018, we plan to release 14 new models.

In addition to machines, we continuously develop and release Technology Cycles to make manufacturing much easier for customers.

For example, MVC (Machine Vibration Control) is a Technology Cycles to visualize the machine's and machining conditions by sensing technologies and to guide customers to the best-fitting cutting conditions with a help of AI; MPC (Machine Protection Control) is a Technology Cycles to detect machine's abnormal behaviors and to maximize machine's availability; we added more Technology Cycles in the last year to support machine operators by predictive maintenance and status monitoring.

At EMO 2017, one of the most renowned machine tool exhibitions held in September in Germany, DMG MORI released a new IoT platform "ADAMOS". ADAMOS makes it possible to connect customers' production equipment and DMG MORI's cloud through internet, and to facilitate centralized production control and optimized operation of customers' factories. After completing pilot tests at customers and performance evaluation, ADAMOS will become available in 2018.

DMG MORI's new robot module system "MATRIS" (Fig.1) will enter the market this year. MATRIS' module design makes it possible to shorten respons e time to customization requests by around 80%. With MATRIS, DMG MORI is aiming to increase the percentage of machines with automation solutions from today's 20% to 30% by 2020.

In the area of Additive Manufacturing, we enhanced our product lineup by introducing powder bed technology for higher precision in addition to powder nozzle technology for better deposition efficiency. The new enlarged product variations cover the spot size from less than 100 to 500 mm for deposition. In 2018, we will develop a new model with the spot size of more than 1m for deposition to meet a growing demand from medical and aerospace industries.

DMG MORI is leading the machine tool industry. As the No.1 in the market, we will focus on further development of elementary technologies to improve accuracy, cutting performance, reliability (durability), and energy efficiency of our machine tools.

3 years ago, we released speedMASTER, a new spindle series for machining centers jointly developed by AG and CO. This cutting-edge spindle brings spindle runout accuracy and torque performance to the next stage, contributing to even higher competitiveness of DMG MORI.

speedMASTER tripled the lifetime of conventional spindles and paved the way for extending the warranty period of spindle to 3 years from 2018 for the first time in the industry. Other new topics from Development include: attachment of smart scales with 10nm resolution as standard produced by Magnescale, a group company; release of  $\mu$ -precision specification with 10 $\mu$  m/m volumetric accuracy; GREEN mode to save electricity consumption by 40%; new functions to control thermal displacement; development of a new operation panel CELOS with outstanding usability and functionality.

#### Challenges and Future Development Policies

The most critical challenge is to cultivate nextgeneration human resources, who have strong initiative to meet various requirements worldwide, and make optimal proposals to benefit each customer. As part of the efforts, we proactively assign younger employees to management positions to promote dynamic and flexible development environment. For better understanding of customers' point of view, we also visit customers' plants as often as possible to directly hear the voice of customers, on such issues as machine operation status, machine working environments and their issues and their requests to our products. In 2017, we received around 500 feedbacks through customers' visits and reflected them to the current or new models' designs.

One of corporate missions is to "Increase our customers' productivity and efficiency through our latest development in technology as manifested by our increasingly accurate and progressive manufacturing capabilities." We will stick to this approach and persistently explore new technology to address everchanging customers' challenges and needs.

#### (Fig.1) Structure of MATRIS (robot system)



# Message from Executive director (Purchasing & logistics and production)



Kenji Oishi DMG MORI CO., LTD. Executive Director

### Normalization of procurement and production, and beyond

In 2017, the first year after full integration of DMG MORI AG, we achieved solid advancement of development and production strategies. To give you some examples of global optimization, we integrated the platform of NLX series (designed by CO) and CTX series (designed by AG) and started mounting MASTER spindles made in Iga plant on machines produced in Europe as standard. Mutual supply of components and products between CO and AG is one of the strengths of DMG MORI and we will pursue this approach in 2018 and onwards.

The mission of the purchasing & logistics department is to procure necessary parts and materials in good "Quality" at appropriate "Cost" by on-time "Delivery" through optimal logistics method to enable smooth manufacturing by production department. In 2017, however, significant supply and demand gap emerged at some suppliers with oligopolistic global market position, causing difficulties for us to achieve our original production plans. Delivery delay occurred at some sheet metal suppliers, too. In 2018, we once again anticipate strong demand. We will strengthen alliance and joint negotiations with AG's purchasing department. Moreover, we will make ourselves more involved in productivity and quality improvement at outsourcing suppliers by dispatching experienced DMG MORI engineers to support them, just like we do to our own production department.

In 2017, production department worked hard to keep pace with strongly increasing order volume whose growth rate increased from one quarter to the next.

To enlarge production volume through productivity improvement, we introduced new machine tools of DMG MORI to reduce machining time, increased machine operation ratio of existing production machines and in particular, started restructuring of Iga Machining Plant. Additionally, we allocated human resources flexibly according to workload and reduced redundant inventory between work processes as much as possible. Nevertheless, the average production lead time from order to shipment extended from 4 to 5 months as usual to 4 to 7 months. To meet the continuously high demand in 2018, we are committed to normalize production lead time by taking additional measures for productivity improvement. For example, we will shift from cell production to line production for the most frequently ordered models. We will improve productivity by fixing the production calendar to 5 working days followed by 2 days-off and taking long holidays in April/ May, August and December/January. We will build the world's most sophisticated machining plant by 2020 by using DMG MORI's 5-axis and mill-turn machines, DMQP and Technology Cycles. In this new plant, where we are going to provide high value to our customers, accuracy of all the production machines and equipment must be constantly maintained or improved and all the machines, fixtures and tools need to be always neat and tidy to qualify as "Super2S" factory. The new machining plant should also be a place for TQM (Total Quality Management) activities and human resources development through education and training.

To consolidate our position as the leading innovation company in the global machine tool industry, we must timely produce and deliver excellent products that will meet customers' diversifying demands. Traditionally, manufacturing companies try to achieve high quality and productivity by developing products by their own technologies and producing them by themselves at their own factories. To fulfill customer's diversifying expectations, however, manufacturers need to pave the way for open innovations instead of sticking to own technology and own production sites and for combination of in-house manufacturing and outsourcing to optimize supply chain. The operations of purchasing & logistics and production departments must be linked closely with each other under integrated strategies. I will continue to lead both departments and consistently implement a variety of important actions described above.

## **Business environment**

#### Outlook by industry

Automotive industry is expected to grow by 3.6% in 2018, exceeding 3.3% of 2017. <sup>\*1</sup> More than half of the new vehicle sales will be SUVs due to a wide range of product segmentation from mid- to high-price models and consumers' preference for wide space and safety. Other factors would be commercialization of self-driving cars that will change the industry trend and demand increase of electric vehicles facilitated by some countries' environmental policies.

Expected growth rate of the aerospace market is about 4% in 2018, resulting from economic recovery and increased number of passengers. \*<sup>2</sup> Airplane production will remain strong as high amount of order backlog at Boeing and Airbus exists. Many companies will develop new components made by new materials such as CFRP (Carbon Fiber Reinforced Plastics), and by new technologies such as Additive Manufacturing.

Semiconductor industry will remain positive in 2018 by exceeding the results of 2017. The memory segment will be especially positive due to increasing demand for IoT and mobile solutions. Gartner, an US-based IT advisory company, forecasts sales revenue of worldwide semiconductor market in 2018 as 451 billion USD, up by 7.5% year-on-year. Within the memory segment, capital investment in NAND will be higher than that of DRAM. <sup>\*3</sup> Machinery and components will remain strong as a result of first-time or enlarged production transfer to India and South East Asia, and of investment in IoT and Industry 4.0 related equipment, etc.

- \*1 BMI Research, 2018
- \*2 Moody's, 2018 Outlook for the global transportation sector, 2017
- \*3 Gartner, Forecast Analysis : Electronics and Semiconductors, 2017

#### Outlook of the machine tool industry

Oxford Economics and VDW (German Machine Tool Builders' Association) estimate the worldwide machine tool market volume of 73.2 billion Euro in 2018, exceeding 2017 results by 3.6%, following recovery of capital investment by manufacturing industry. Economic recovery at global level will boost investments in automotive, aerospace, industrial machinery, medical and other industries.

In North-, Central- and South Americas, machine tool market is expected to grow by 2.9% in 2018. Recovery of commodity price will help economies in Central America get back on track and US government's support for manufacturing industry will affect the market positively. Growth rate by country will be 3.1% in the United States, up from 3.0% in 2017, 4.4% in Brazil, and 1.8% in Mexico, respectively.

In Europe, economies of strong players in the manufacturing industry such as Italy and Germany will continue to grow and production volume in East Europe will increase, leading to a forecast of 4.1% growth in 2018. France will mark the highest growth rate, followed by Italy and Germany. UK, on the other hand, is estimated to shrink by about 3.1% due to Brexit decision discouraging new investment.

Growth rate of machine tool market in Asia will be 3.5% in 2018. In China, replacement of existing production equipment and the industrial policy to support advanced machinery will boost demand by 3.5%. 3.4% is the forecast for Japan, reflecting the ongoing positive trends in export of component and machinery. Indian government's economic reform will push the growth rate to 5.3%. Thailand, Indonesia, and other countries will benefit from production transfer by global manufacturing companies to avoid China risks, resulting in estimated 4 to 6% growth in 2018.

Today, we observe increasing demand for machining work pieces with complex geometry by using light and tough-to-cut materials. This is why we expect more demand for cutting tools to machine tough-to-cut materials such as titanium alloy and heat-resistant alloy that are increasingly used in automotive, aerospace, and medical industries. We also anticipate further demand for high-precision 5-axis machining centers.

At the same time, Additive Manufacturing technologies started to replace the conventional cutting technologies in the areas where small lot production is required for prototyping and customization, and where production processes are modernized. Annual growth rate of Additive Manufacturing with laser technology exceeds 40% in each of the past several years, with the market volume in 2016 being about 130 million USD.

# BUSINESS SUMMARY

6



# Machine tools involved in our life

Our daily lives consist of a variety of activities including eating, moving, communicating, and maintaining health. Machine tools are fundamental to successfully pursuing these activities and are found in virtually every facet of life today as we know it.

For example, moving requires automobiles which are composed of many parts that were directly produced using machine tools. Plastic bottles are an instance of such as they are manufacturing by injecting material into a mold that was created with machine tools.

Products often taken for granted in every day life may not seem to have a corollary to machine tools, but in fact are linked to machine tools in the production of the product. Evolution of machine tools makes our lives richer.



AC ball hub

Gear box housing

Wheel hub



Food



Garments



Information



## Focus area

#### - Medical -

As a partner of virtually all large manufacturers of medical equipment, DMG MORI plays a decisive role in ensuring implants and instruments are machined efficiently and above all that they meet the high demands on quality. This includes the complete material mix, from high-strength plastic to stainless steel and titanium and on through to cobalt chrome and now biodegradable magnesium alloys. CNC solutions for 6-sided turn-milling, 5-axis simultaneous milling, ULTRASONIC technology and high-speed cutting are just as much a part of the portfolio as Additive Manufacturing and digital solutions for future-orientated processes in the medical technology sector.



The Pro-Flex prosthesis from Össur, who is one of DMG MORI products users, consists of carbon, titanium, steel and aluminum.



Helgi Sveinsson is the world record-holder in javelin in the Paralympics F42 classification. His prosthesis is made on DMG MORI machines.



#### - Aerospace -

Average annual growth rates of over seven percent make aerospace one of the global growth industries. However, this sustained increase is only one side of the coin for airlines. They must be profitable if they wish to remain competitive. They can achieve this among other things with more modern aircraft, which of course leads to a noticeable rise in demand for manufacturers. Traditionally America and Europe have a large share of the manufacture of aerospace products, but Asia is meanwhile gaining ground, with a 37 percent market share.

As a supplier of technology for aircraft manufacturers, DMG MORI has observed this development through its order intake.



Blisk

# As an origin of social life

We have to machine materials to make products, and machines and tools are required for the machining process. A machine tool is a constant source of products and parts worldwide.

Precise products and parts created by a machine tool provide solid foundation for planes that can keep flying in severe conditions or cutting-edge communication equipment that emerges in the market one after another. The accuracy of machine tools significantly affects accuracy and quality of finished products. DMG MORI is committed to creating better products as an origin of our social life.



Every product has a unique life-cycle. In the general sense, products start with material extraction from natural resources, which are refined and then manufactured into a product. At each stage of the lifecycle, three components, machine tools, tooling, and materials, combine together to play the major role. Let's take a car as an example. Automotive parts are made by machining the material directly by machine tools, or they are changed to desired forms by using metallic molds made by machine tools. Machine tools are also necessary to make raw materials for parts. However much a car may evolve, the composition pattern will never change.

In other words, the machine tool will continue to be an integral part of our lives, no matter how far the times may go.

Consumers are always seeking products with the best quality. To meet demand for high quality, manufacturers must use very precise and accurate parts. Therefore, the machine tools that produce these parts must be of equally or greater quality. The accuracy of machine tools has a profound impact on manufactured product quality. Because a machine tool is capable of machining to the micron or sub-micron level, which is not visible to the human eye, it is able to produce components of extremely high precision.

DMG MORI serves the ever-increasing component accuracy requirements by taking full advantage of our accumulated technologies and expertise.

The state-of-the-art machines of DMG MORI can position their tools precisely to within three-thousandths of a millimeter as they process workpieces. Scarcely imaginable precision. But absolutely necessary. The ability to perfectly shape materials down to the tiniest detail is a prerequisite for the very existence of some products —in medical technology, for example, or the aerospace sector. Just as important is the ability to achieve the highest degree of accuracy not just once, but time and again. This is what defines quality.

#### Machine tools are in constant need



1 μm Responding to demand for higher accuracy —— Machine tool accuracy defines product accuracy

#### Best in class precision by DMG MORI

# World's largest lineup with the advanced technologies of Japan and Germany

DMG MORI provides high-performance and high-efficiency machine tools. We offer a wide range of product lineup as a fruitful result of our tradition and knowledge accumulated since the foundation of the company, as well as continuous efforts and a bond of solidarity among our employees across the world. The world's largest lineup is available to respond to every customer's needs and requests.



After DMG MORI CO., LTD. (former Mori Seiki) started the production of machine tools in 1958, our differentiation strategy in domestic and overseas markets won us the reputation of "Mori Seiki, the master of lathes." DMG MORI AKTIENGESELLSCHAFT (former GILDEMEISTER) has also cultivated manufacturing technique of turning centers through its 150-year history. With a synergy of the two companies, the lathes with superior turning capability have now developed into high-rigidity, high-accuracy turning centers combined with milling ability brought by BMT (Built-in Motor Turret) and traveling axes, which enabled production of wide variety of workpieces.

Machining centers were born to perform various kinds of machining by changing rotary tools for facing, drilling, boring and tapping with an automatic tool changer. In 2016, we began selling the CMX V Series that can operate in collaboration with robots and automation systems. The models with a space-saving body offer some 290 options to meet diverse needs of customers. Origin of DMG MORI [Turning Centers]



Responding to needs of various fields [Machining Centers]



With 120-year development and manufacturing history in DECKEL MAHO AG, DMG MORI 5-axis machines feature outstanding milling performance and superior operability achieved by advanced technologies. As the machines are capable of multi-face indexing, machining can be completed in one clamp. It reduces setup times and simplifies / eliminates fixtures, contributing to a drastic reduction of process time. 5-axis machines use the turning axes to make tools approach workpieces at optimal angles, ensuring high-accuracy machining that no 3-axis / 4-axis machines have achieved. We released DMU 50 3<sup>rd</sup> Generation, a standard simultaneous 5-axis model in October 2017.

Multi-axis machines are able to complete the entire process of machining on a single machine without operators, which conventionally has been done with several machines. Superior machining performance by a combination of a turning center and a machining center drastically reduces production lead time, and efficiently integrates processes for various production types, from high-mix low-volume production to mass production, bringing great benefits to customers.

High-quality laser machines enable low-cost, high-efficiency simultaneous 5-axis machining of any types of metals and new materials. It delivers outstanding performance with Shape (laser structuring of geometrically defined surfaces, 3D laser ablation for intricate cavities, and engraving), FineCutting (machining of metal sheets, tubes, and 3D parts for watch and medical-related industries), PrecisionTool (manufacturing of tungsten carbide cutting insert molds, pressing, and PCD / CBN / CVD cutting inserts) and PowerDrill (drilling of turbine parts for aircraft engines and industrial gas turbines).

Ultrasonic machines are capable of machining advanced materials, which are generally considered difficult to cut, such as ceramic, glass, corundum, tungsten carbide and composite materials, into complex shapes in an efficient way. They reduce machining resistance by up to 40% compared with existing machines by overlapping ultrasonic vibration with the tool rotation and the travel in the Z-axis direction. This can prevent cracks of workpieces and expand tools' life-span.

#### Powder nozzle method

DMG MORI's original and innovative technology integrated the cutting-edge milling technology with Additive Manufacturing for the first time in the world. It sprays metal powder from the powder nozzle to deposit the layers, enabling high-speed forming of various materials.

#### Powder bed method

Metal powder is spread over a platform in layers, and a laser fuses the layers to create a targeted figure. This method is preferable for precise shaping of hard-to-cut and small workpieces, such as impellers and artificial crowns.

Changing the conventional wisdom of parts machining [5-axis Machines]



Integration of two cutting-edge technologies [Multi-axis Machines]



Fine machining [Laser Machines]

#### Machining of advanced materials [Ultrasonic Machines]

Innovative advanced technology [Additive Manufacturing]



# History and achievements of business collaboration

In March 2009, DMG MORI Co., Ltd. (formerly, Mori Seiki Co., Ltd.) started business and capital collaboration with DMG MORI AG (formerly, Gildemeister AG), the world's largest machine tool builder at that time, through mutual shareholdings of 5 % each. DMG MORI AG had a massive presence especially in Europe based on its unique direct sales network and 5-axis machining centers. DMG MORI CO, on the other hand, had strength in mill-turn and horizontal machining centers in Japan, Americas, and South East Asia in particular. Both companies expected a great deal of benefit from business collaboration to expand customer bases and product lineup, to distribute production locations, and to exchange technology information. After 2 years of business collaboration, both parties became convinced of future success of business integration. At the same time, they enhanced capital collaboration by CO purchasing newly issued shares in AG.

In September 2013, CO's shareholding ratio in AG increased to 24.3%. To gain trust from customers, both companies agreed to use the common brand name "DMG MORI" for their products. They changed the company names, too, to DMG MORI CO and DMG MORI AG, respectively. Integration of global sales and service network was almost accomplished by the end of 2014. In January 2015, CO implemented a tender offer toward AG. In May 2015, CO increased the shareholding ratio in AG to 52.54% to form a consolidated group structure. Following approval from designated authorities in some

countries in relation to competition and anti-monopoly laws, both parties accelerated streamlining product lineup, usage of common design and components, optimization of supply chain network, etc. In April 2016, CO's shareholding ratio in AG reached 76.0%. In August 2016, both companies achieved full integration by concluding "Domination, Profit and Loss Transfer Agreement" (DPLTA). Following DPLTA, both companies further optimized their management resources by the end of 2016 through disposal of overlapping assets and withdrawal from non-core businesses.

2017 was the first year after full integration. Fruits of business integrations are clearly visible for example as better global coverage of customers, advancement in cutting-edge technology products such as 5-axis and mill-turn machining centers, enhanced system solutions by peripheral equipment and software, including Technology Cycles, and competitive advantage in service. As a result, DMG MORI increased its market share and achieved higher profitability in orders.

In Europe and North America, in particular, customers are making a quick shift to new machining technologies and new materials especially in Aerospace, Medical, Automotive (EV) and Die & Mold industries. Integration of both companies enables DMG MORI to suggest more machining solutions than any other company in the industry. DMG MORI will continue to create added value for its customers worldwide.



#### Grow with customers – A total solution provider

ed by DMG MORI based on VDW/ Oxford Economics data 2018 figures are forecasts.

# Corporate history

### 1950

1980

1983

No.1 Plant

#### 2000

#### **Business history**

#### MORI SEIKI

1948 Began manufacture and sales of textile machine in Yamato-Koriyama City, Nara Prefecture

Products history

#### 1958 Started production and sales of high-speed precision lathes 1970 Construction and launch of lga plant 1979 Listed shares on the second section of the Osaka Securities Exchange 1981 Listed shares on the second section of the Tokyo Stock Exchange 1982

Established MORI SEIKI GmbH

Began manufacture and sales of

reached the top in the Japanese machine tool industry

numerically controlled lathes

Market share of NC lathes

The Company was transferred to the first section of the Tokyo Stock Exchange and Osaka Securities Exchange 1987 Completed construction of Nara Head Office Started actual operations at the Nara No.1 Plant 1992

Established MORI SEIKI U.S.A., INC.

(current DMG MORI U.S.A., INC.)

Started actual operation at Iga

Started operations at the Iga No. 2 Plant 1997

Started operations at the Iga No. 2 Plant High-Precision Facility

#### 1999 Completed construction of MORI SEIKI Nagoya building (current Nagoya Head Office) Acquired ISO9001 certification

1981 Began export of high-speed

Began manufacture and sales of vertical machining centers

1983 Began manufacture and sales of horizontal machining centers 1994

Developed SH-50



#### 2000

Established Digital Technology Laboratory (DTL) (current DMG MORI Digital Technology Laboratory Corporation)

#### 2001

Acquired ISO14001 certification Established MORI SEIKI (SHANGHAI) CO., LTD. Consolidated TAIYO KOKI CO., LTD. as a subsidiary

#### 2002

Started 24 hours a day, 365 days a year service support Took over operations from former HITACHI SEIKI Started operation as part of the MORI SEIKI Group Acquired OHSAS18001 certification

2003 Started operation of the Chiba Campus

2004 Established the Human Resources Development Center (current DMG MORI Academy) Transferred Head Office to Nagoya

#### 2000

2004

Developed

Motor Turret)

Developed SH junior Expanded MT Series line-up Started use of CAPS-NET

2003 Developed DCG (Driven at the Center of Gravity) Developed DDM (Direct Drive Motor) Developed NV 4000 DCG and NH 4000 DCG Introduced a machine equipped with a HEIDENHAIN CNC into the European market



GILDEMEISTER

#### 1870

Friedrich Gildemeister founded GILDEMEISTER & Comp. in Bielefeld

1906

Wilhelm Berg took over the company management and started mass production of machine tools

#### 1910

Concentrated on its flagship products: turret lathes, multi-spindle automatic lathes, milling machines, and vertical and horizontal milling machines

#### 1928

Released the POX multi-spindle automatic lathe

1960

1968

1976

1977

Developed SL-2

precision lathes

1950 Exhibited the RV50 turret lathe at Hanover trade fair

#### 1961

Built a new manufacturing plant in Sennestadt and started operation (in1965)

Exhibited the company's first NC lathe (NEF) at EMO

#### 1999

Entered the laser technology sector with the takeover of LCTec GmbH (present SAUER)

its history (1998 average exchange rate: 1DM = ¥70)

put the milling and drilling machine business on track ※ DECKEL AG and MAHO AG

#### 1998

1995

Entered the field of the ultrasonic merged in1993 machining technology by the investment in SAUER GmbH & Co. KG Sales exceeded one billion Deutschmarks for the first time in

#### 2002

2000

2001

The new plant in Seebach won the "Best Factory TM - Industrial Excellence Award 2002"

Repurchased its former subsidiary **GILDEMEISTER** Italiana

#### 2003

DMG Nippon K.K. opened a technology center in Yokohama Established in Shanghai the first production plant in Asia



#### 2005

#### 2005

Completed construction of the Iga Campus Heat Treatment Plant

#### 2006

Completed construction of the Iga Campus Casting Plant

#### 2007

Established AKISHINO MOLD LABORATORY, LTD. Consolidated DIXI machines as a subsidiary

#### 2008

Consolidated TOBLER S.A.S. as a subsidiary Consolidated B.U.G., Inc. (current DMG MORI B.U.G. CO.,LTD.)

2005 Developed NVD 1500 DCG Developed NT Series

2006 Developed NMH 6300 DCG Developed NMV 5000 DCG

2007 Developed NZ Series



NZ 2000 T3Y3

2005 DMG Asia established the spare parts center

2008 Adopted new design

2011 Opened the HSC center

2012 Expanded the plant in Seebach

#### 2009

Collaboration started

#### 2009

Established the Tokyo branch Started capital and business collaboration with DMG of Germany

2013

unified

Company names

#### 2010

Acquired the measuring equipment business of Sony Manufacturing Systems Corporation, and consolidated as a subsidiary named Magnescale Co., Ltd

#### 2009

MAPPS integrated operation panel completely revamped, and started installing on new models as MAPPS IV

2010 Developed the X-class machines (NLX, NVX, NHX, NTX)



March 2009 Started husiness collaboration with DMG

September / October 2010 DMG/Mori Seiki joint booth at IMTS and JIMTOF

April 2012 Established DMG MORI Europe AG in Switzerland Started joint sales and service across Europe

August 2013 Established the Joint Committee

September 2013 Unveiled CELOS and machines with premium design as the World Premium at EMO Hannover 2013

October 2013 Company names unified

March 2014 Became the Exclusive Premium Partner of Porsche team

July 2014 Tokyo Global Headquarters started operation

April 2015 Adopted IFRS Changed accounting period (irregular accounting period from April to December) Consolidated DMG Established DMG MORI WASINO, LTD.

June 2015 Developed NRX 2000 Developed A 150 Series Developed G 100 Series

July 2015 Opened the world's largest Global Solution Center in Iga

September 2015 Ulyanovsk Plant (Russia) started operation

December 2015 Developed NLX 6000

January 2016 Established the System Solution Plant in Nara

February 2016 Released Technology Cycles

August 2016 Domination, Profit and Loss Transfer Agreement came into effect

#### 2015 Started integrated management as a

consolidated entity

#### 2016 Accomplished

business integration 2018

Products history

2011 Established MORI SEIKI SALES AND SERVICE CO., LTD. (current DMG MORI SALES AND SERVICE CO., LTD.)

2012 Established the Iga Campus Bed / Column Precise Processing Plant Established North American Factory in Davis city, California

2013 Established Tianjin Factory in China

2011 Developed NTX 2000 Developed NZX Series Jointly developed MILLTAP 700 with DMG

2012 Developed NVX 5000 II Series



### DMG MORI

September 2016 Released CMX V Series Agreed on technological cooperation with Microsoft Japan

January 2017 Partnership agreement with TOYOTA GAZOO Racing

February 2017 Introduced powder bed technology to additive manufacturing segment

June 2017 Released LASERTEC 30 SLM

July 2017 Table-integrated vise Released built-in vises Opened Emerging Technologies Laboratory

September 2017 Standardized GREENmode

October 2017 Released DMU 50 3rd Generation

November 2017 Opened Shanghai Technology Center

January 2018 Released 3-year warranty service for MASTER spindle series

#### **Global Network** The most comprehensive sales and service network in the machine tool industry. Global production network for optimized production. Ekaterinburg Moscow Ulyanovsk Shenyang Istanbul Beijing Ankara Tianjin Izmi Seoul Xi'an Tel-Aviv Shanghai Cairo Chongqing • New Delhi • Dubai Dongguan Taichung Ahmedabad Hamburg Hanoi • Pune Fredericia Pirkkala Frankfurt Bangalore Manila Bielefeld Amata Nakorn Gothenburg Stipshausen Ho Chi Minh Dusseldorf Veenendaal Kuala Lumpur • Hilden Pleszew Singapore Zaventem Seebach Langenhagen Coventry Brno Borchen Trencín Jakarta 🔍 Stollberg Stockerau Paris Wernau \_\_\_\_\_Leonberg Plana Budapest Hufingen Winterthur — Ljubljana Pitești Zagreb Toulouse Belgrade Wiazburg San Sebastian Munich Sofia Geretsried Barcelona •Lecce Thessaloniki Madrid Pfronten Sydney Klaus Marinha Grande Padova Melbourne • Bergamo Milan Tortona Strambino Scionzier Lyon

Global Headquarters Centrally manage DMG MORI's global

sales, service, marketing, finances, accounting and human resources

Tokyo (Japa

National Headquarters Function as the head offices of DMG MORI CO and DMG MORI AG





Bielefeld (Germany)



Production and development bases (overseas)

Pfronten (Germany)













Tortona (Italy) [GRAZIANO]





Stipshausen (Germany) [SAUER GmbH]







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Development and production bases (Japan)



Development and production bases (Group company)



# DMG MORI's innovation

The world's leading machine tool manufacturer DMG MORI owns technologies to offer advanced and optimal solutions for customers. As a total solution provider, we holistically provide solutions combining a machine tool with systems and software.

With the milling mechanism of conventional turning centers, the power from the motor is transmitted through various parts such as gears and belts, causing heat and vibration over a wide area. DMG MORI employs the industry's first builtin motor turret structure. This has minimized heat generation and vibration and improved transmission efficiency, contributing to drastically enhanced machining accuracy and cutting force.

Highly efficient drive is achieved by transferring the driving force directly, without transmission through gears, and there is no backlash either. Because there are fewer parts to wear out, there is less maintenance and the product life is extended. In addition, high-speed feed has been enabled by substantially increasing the transmission efficiency when compared with conventional worm gear systems. A DD table where the DDM is fitted to turning tables and the DDRT where it is fitted to rotary tables are also available.

In addition to quality improvement and short-term delivery, DMG MORI promotes in-house parts production to shorten lead time for product development.

Under this unprecedented initiative, we utilize on-premise facilities to machine, assemble and inspect in-house spindles and ball screws, both of which are decisive factors for machine tools' quality.

Furthermore, we extended charge-free warranty coverage in pursuit of safer and more comfortable operation. Since January 2018, 3-year warranty has been available for MASTER spindle series, which are mounted universally on DMG MORI machine tools. It is applied to 5 types of MASTER spindles; powerMASTER for heavy cutting, speedMASTER for high-speed machining, 5X torqueMASTER for large sized 5-axis machining centers, compactMASTER for mill-turn centers and turnMASTER for tuning centers.

The DMQP (DMG MORI Qualified Product) program certifies machine tool's peripheral equipment that meets DMG MORI standards in quality, performance and maintainability. Over 5,000 kinds of equipment and software from 60 companies in the world have been qualified. We provide customers with total support, from proposals of our reliable DMQPs to delivery and maintenance, ensuring long-term and comfortable operating environments for them. We will continuously enhance the lineup to offer greater solutions for customers.

# Higher machining accuracy and cutting ability

[Built-in Motor Turret]



# Long life-span and energy saving [Direct Drive Motor]



Self-manufacturing of industry-leading core technologies



Comprehensive support with machine + peripherals



DMQP: DMG MORI Qualified Product

A new IoT platform for engineering industries "ADAMOS" was initiated in October 2017, as part of our solution to improve productivity with IoT / Industry 4.0. This open and neutral IoT platform links cutting-edge machines and software from any manufacturers. It allows one to connect multiple machine tools around the world via an operation system CELOS, and to perform remote maintenance, operation management, and accurate failure prediction to enhance machine availability. Furthermore, with "CELOS NETbox" to exchange data among DMG MORI's and other companies' machine tools, we will demonstrate digital factory with guaranteed security.

#### DMG MORI Digital Factory



We developed Technology Cycles as a comprehensive solution to make complex and advanced machining easier and faster, replacing the conventional complicated and time-consuming procedures. They are new machining solutions that integrate ① Machine tool body, ② Cutting tools and peripheral equipment as open innovation, ③ Embedded software, and ④ HMI (Human Machine Interface) such as CELOS. With Technology Cycles, machining, setup, and measurements which used to be done with specialized machines, software, and tools, can be performed with general purpose machines and standard tools and fixtures. This allows any operator to start up machining operations easily and quickly, while ensuring high-quality cutting performance. For example, with one of the Technology Cycles "gearMILL," all the processes including turning, milling and gear machining can be completed on a single machine, instead of the combination of specialized machines and programs required in a conventional method. Technology Cycles are classified into four groups by function: Handling (to support machine setups); Measuring (to make high-accuracy measurements); Machining (to support complex machining); and Monitoring (to monitor and detect machining procedures using sensors). A great variety of functions is available according to customer's production needs.

MATRIS, our newly-developed robot system, requires no expertise in daily operation. This system links modularized peripherals, robots and machines via dedicated control system MAPPS connected, which replaces complicated programming for setup change with simplest operation.

The modularized peripherals, including transfer equipment, workpiece stockers and in-machine measuring equipment, ensure quickest installation and flexible and easier retrofit.

# A total solution combining four elements



# New automation system with no expertise required



# Our technologies

### Turning



With micrometer precision and durability — that's how precision components and tools for the fields of aerospace technology, precision mechanics, the automotive industry, optics, medical technology, electrical engineering and oil & gas production have to be manufactured. Turning technology is used in machine tool engineering and plastic



and metal processing. The workpiece spins continuously at a high rate of speed while the turning tool is applied to the proper position and excess material is removed from the workpiece in a precise and targeted fashion. The technology of turning is almost as old as the wheel itself. Without turning, there would be no other machines or plants. Today almost any material can be processed with hundreds of different tools, which are often made of carbide.

As the innovation leader in metal cutting, DMG MORI has worked to perfect the craft of turning since its inception. The company offers a comprehensive product portfolio, encompassing machines for all industries and practically all materials.

While in the early days turning machines only had a single tool, later machines with automatic tool changing were added to the mix - making machines more useful every step of the way. One driver of innovations was the growth of the automotive industry. They required a cost-effective means of producing components on a mass scale. DMG MORI developed highly productive multi-spindle automatic machines for this purpose, in which up to six spindles can work simultaneously. Most workpieces are further refined with other technologies as well. To achieve that without changing machines, over recent decades DMG MORI has continuously improved and adapted its turning machines to the latest requirements with additional milling spindles or grinding functions, for example, which can be switched in just seconds with a tool changer. The company also offers increasingly customized products tailored to customer requirements, offers complete solutions and equips the processing centers with automation solutions. With the app-based control and operating environment CELOS, the machines can also be integrated into digital factory scenarios.



### Milling



When the tool in a machine rotates —rather than the workpiece —this is, roughly speaking, referred to as milling.

In milling, the tools, of which there are dozens to choose from, and the product that is currently being processed, are moved in relation to each other along at least three axes. In many machines, turning and swiveling movements are included as well: This 5-axis machining enables the creation of highly complex geometries. In many machines, turning and grinding tools can be used which allow workpieces to be processed in a wide variety of ways. From pure milling applications and 5-axis simultaneous machining to turn & mill machines and the integration of grinding, DMG MORI has played a major role in the development of the technology.

Our versatile machines are used in a variety of industries: structural components for the aviation industry and blisks for turbines and drive systems, deep-drawing molds for radiator grilles and lamp housings and planetary carriers for gear stages attached to servo motors. Our milling machines are used to manufacture dental implants and bridges. transmission housings and gear wheels, engine blocks and ships' propellers. Milling technology, in contrast to drilling and turning, has only been in wide use since the 19th century. Since that time, the simple machines of the early days have been transformed into true all-rounders—as 5-axis machines, vertical or horizontal machining centers, or even XXL machines for exceptionally large components weighing up to 150 metric tons. DMG MORI continuously develops its milling technology. The products are characterized by the highest stiffness, accuracy, productivity and precision. In the years to come, they will increasingly be equipped with automation solutions and Industry 4.0 capabilities, ready for everything in the completely digital factories of the future.





### Advanced Technologies

#### Additive Manufacturing

[Universal solutions from CAD and CAM up to combined machining to finished part quality]





In Additive Manufacturing, the latest Advanced Technology with which dental components, drill bits and deep-drawing tools are produced, a workpiece is builtup over a series of small steps. This technology employs two fascinating procedures: in Selective Laser Melting (SLM) —also referred to as a powder bed method —a laser melts a metal powder step by step. This is how delicate geometries such as lattice and honeycomb structures —as well as any other imaginable shape, in one piece and without seams, are created. In Additive Manufacturing of metal components, Selective Laser Melting has a market share of 80 percent. With the acquisition of Realizer, DMG MORI has brought this expertise directly into its own portfolio. The company has had another Additive Manufacturing technology in its portfolio for some time: powder nozzle technology. In this method, aluminum or titanium powder, for example, is applied by the argon gas flow through a nozzle and melted into a strand of liquid metal. This builds the desired geometry step by step. DMG MORI is the first full-liner worldwide for Additive Manufacturing of metal components and offers the two most important Additive Manufacturing technologies from a single source.

#### Ultrasound technology

They set standards with their innovative quality. DMG MORI has been using ultrasound technology for decades. Under the name ULTRASONIC, complex geometries can be manufactured in sophisticated materials in an economic manner—components such as watch housings, circuit boards, gear wheels and blade wheels, orthopedic implants and rotor blades for helicopters and windmills. The milling or turning processes are overlaid by a high-frequency oscillating motion. This makes the machining process faster, more precise and, with some hard materials, even possible in the first place.







The ceramic material for dental bridges is extremely hard. That's why a very special procedure is used. The workpiece is ground with a diamond-coated tool stimulated by ultrasound in order to shape the surface. In this manner, the material can be processed in a very economical manner.

# Sales activity

## From SMEs\* to major companies diversity in our customers

DMG MORI receives orders in a geographically well-balanced manner in general, and 50% are from the three technology-leading countries, Germany, the United States and Japan. We also have customers from a broad range of industries, such as the automotive and aerospace fields, which we consider as our strength. The size of our corporate customers varies as well; approximately 60% of our customers are companies with 100 or less employees. It shows that our products are chosen from diverse regions, industries and company scales.



(2017)



# A sales system matching regional characteristics and commercial distribution

DMG MORI has a solid sales system that matches the characteristics, culture and commercial distribution of each region. As we completed the transition of our sales system in Europe and the Americas in 2015, from sales through distributors to a direct one, we are making necessary personnel allocation and enhancing sales and service bases. Under the renewed organization, we provide service support within 2 hours upon request. In Japan and Asia, we will continuously maintain and strengthen cooperation with regional communities and distributors.

### Trade shows and exhibitions to connect us with customers

Every year DMG MORI holds exhibitions and seminars all over the world aiming to directly show our products and technologies to our customers. It is a good opportunity for us to present practical and technical know-how with the latest technologies in live-demos, as well as the industry trends. We put a full effort into each and every exhibition, from private shows at major regional cities to big international shows across the world. This maximizes the opportunities to interact with customers.



DMG MORI at EMO 2017, Hannover

# Engineering activity

# Experiencing the cutting-edge machines and machining technologies live at any time

DMG MORI showcases state-of-the-art machine tools and equipment in our clean and spacious solution centers to study and solve various machining issues together with customers. At our solution centers around the world, professional engineers who speak English, German or Chinese are always available to show our cutting-edge machines and machining techniques in live demonstrations and test machining. The solution centers also play a role as an experimental center to develop new technologies through joint research of workpieces and tools with customers.



Global solution center in Iga (Japan) has 3,500m² areas

### **Global Engineering Support**

#### Best solutions for customers

DMG MORI's excellence centers for "Aerospace", "Automotive", "Medical", and "Die & Mold" are located in major factories. Engineers with specialized knowledge and expertise in industry's specific requirements and machining processes make suggestions for optimized solutions to each customer.

Aerospace industry demands extremely high level of quality and reliability of complex parts for engines and landing gears. Automotive industry needs machine tools to produce many kinds of parts including cylinder blocks, crank shafts, and gear boxes. Medical industry deals with a variety of materials, for example reinforced plastic, titanium, and cobalt-chrome alloy. Die & Mold requires handling of various types of geometry.

Engineers at excellence centers work closely together with DMG MORI's 1,000 application engineers all over the world to make optimized solutions for every customer's requirements.





# Service and Parts

### Service centers supporting customers' production 24/7

More than 75% of the problems are solved by telephone support

(as of March, 2018)

All service call functions are centralized in service centers, which is in constant operation. Information of delivered machines and repair service history are all stored in a secure database on a daily basis so that our staffs can provide customers with optimal solutions in the shortest possible time. In case of machine troubles, our employees can remotely operate the machine from the service center for quick recovery. More than 75% of the problems are solved by telephone support.



# Substantial service and support with 157 bases in 43 countries / regions

Technical centers are our bases to provide field service to customers. As soon as receiving calls from service centers, service engineers at each technical center start preparing for on-site repair. They visit the customer's site immediately upon request, listen to their needs face-to-face and offer them meticulous and speedy service as highly skilled engineers.



### Parts Centers serving the entire globe

# 95% of the spare parts are shipped within 24 hours ${}_{\scriptscriptstyle (as of March, 2018)}$

DMG MORI has established 3 global spare parts centers around the world to provide reliable post sales service for customers. Global parts centers in Nara (Japan) and Geretsried (Germany) store more than 100,000 parts, while the one in Dallas (U.S.A.) has over 50,000 parts in stock. This ensures prompt parts shipment across the world.



Parts center in Geretsried (Germany)

# Our Plants



Opened in	1970	
Campus area	577,000 m <sup>2</sup>	
Core competencies	Turning centers & milling centers	
Excellence Center for Die & mold		
Assembly capacity of over 3,500 machines per year		
Approx. 1,600 employees at the location		
Products	NLX、NTX、NZX、CMX V、NVX、NHX、NMV	

### IGA(Japan)

In 1970 Mori Seiki opened its plant in Iga — an initial high point in its enormous expansion. Iga would become a key component at the heart of the group. Today, DMG MORI in Iga is one of the largest machine tool factories in the world. With some 1,600 employees, it is also the largest facility within the group. In addition to turning and milling machines, the location also produces components for other plants.



Iga At 577,000 m², the Iga campus is the largest in the entire network of plants.

### $\mathsf{NARA}\left(\mathsf{Japan}\right)$

Mori Seiki (now DMG MORI Co., Ltd) was born in the city of Yamatokoriyama, Nara in 1948. Today DMG MORI is an inextricable part of the fabric of Nara. The historic plant manufactures turning and milling machines, but also handles automation solutions for which it built a dedicated hall. It is delivering systems solution to such industries as automobile production, aircraft and energy and so on. Global spare parts center is also located there to deliver spare parts worldwide.



Founded in	1948	
Campus area	60,000 m <sup>2</sup>	
Core competencies	Turning centers, milling center and automation	
Excellence Center fo	r Automotive	
Assembly capacity of	up to 2,000 machines per year	
Approx. 600 employe	es at the location	
Products	NLX, G/GG, A/AA, NZX-S, J/JJ, NRX, CMX V,	
	i-Series NMV	



Production of the horizontal machining center "i 50" at the Nara. With the i 50, DMG MORI offers an ultra-compact, horizontal machining center that considerably increases productivity in large-scale series production of engine components such as cylinder blocks and cylinder heads in automobile manufacturing.



Founded in	1870
Company grounds	180,000 m <sup>2</sup>
Core competencies	Universal turning, production turning (horizontal / vertical), turn & mill (Gildemeister company), additive manufacturing (Realizer company)
Assembly capacity of	up to 1,000 machines per year
Approx. 1,000 employ	yees at the location
Products	NEE CTX_CTX_TC_CTX_4A_CTV_LASERTEC_30_SLM

### BIELEFELD (Germany)

The new district of Sennestadt is home to the headquarters of DMG MORI AKTIENGESELLSCHAFT. Also produced there are the additive manufacturing machines from the Realizer company. The Sparrenburg sits high above, yet still at the center of the city. This landmark attraction in the largest city in East Westphalia is a popular destination for excursions with a spectacular view of the city and its 330,000 inhabitants.



Founded in	1920	
Company grounds	149,000 m <sup>2</sup>	
Core competencies	More than 50 machine types in the milling segmen (Deckel Maho) LASERTEC (Shape, PrecisionTool, PowerDrill) and Additive Manufacturing (Sauer)	
Excellence Center Aer	rospace and Die & Mold	
Assembly capacity of u	up to 1,500 machines per year	
More than 1,500 empl	oyees at the location	
Products	DMU/DMC monoBLOCK, DMU/DMC duoBLOCK, DMU P/DMC U Portal, DMU Gantry, NHX, DMC H linear	

### **PFRONTEN** (Germany)

Back in 1920, when five engineers decided to join forces, no one could have predicted that one day the firm would become one of the leading machine tool manufacturers in the world. The guintet named their young, ambitious company Maho, and in 1950 the firm started building machine tools for its own purposes. Larger companies soon took notice and began ordering specially constructed machines from Maho. In 1970, the company therefore decided to focus exclusively on this aspect of the business, acquired Graziano in Italy, went public with the company, merged with Deckel and ultimately joined Gildemeister in 1994, which today is DMG MORI. Pfronten is an important development location and largest production location in Europe as well as a specialist for milling. 50 different machines are produced here. The location also houses the headquarters of the Sauer company, the leading manufacturer of LASERTEC and additive manufacturing machines.

### $\mathsf{DAVIS}$ (The United States)

DMG MORI opened its first production location in the United States here in 2012—thereby creating one of the most state-of-the-art factories in the entire group. For DMG MORI, Davis is the company's foothold in North America. The location produces turning and milling machines, but also ideas for the future — conceived both by developers at the plant and the students at nearby universities.



Campus area	110,000 m <sup>2</sup>	
Core competence	milling machines	
Assembly capacity of up to 1,200 machines per year		
Nore than 180 employees at the location		
Products	CMX V, NHX	

### TIANJIN (China)

In 2013, DMG MORI established Tianjin plant in China. Today, Tianjin produces horizontal machining centers (NHC series) and vertical machining centers (CMX series) for customers in China. At the same time, the factory is an important location for the group to meet growing demand for automation and machining of casting, one of the key components of machine tools.



Opened in	2013	
Campus area	90,000 m <sup>2</sup>	
Core competence	milling machines	
Assembly capacity of up to 1,200 machines per year		
More than 120 employees at the location		
Products	CMX Vc, NHC	

# Group Companies

### TAIYO KOKI

In 1989, TAIYO KOKI developed the first vertical grinding machine with improved operational efficiency. TAIYO KOKI's grinding machines ensure high precision and high rigidity, and continue to offer various advantages such as spacesavings, flexibility and automation.

TAIYO KOKI has introduced many models from small machines for mass-production parts to large machines for high-mix, low-volume production.

Customers have given very positive feedback from all over the world.

Commercialization of products is effectively accomplished by incorporating both market analysis and customer requests into product planning.







TAIYO KOKI CO., LTD.

221-35, Seiryo-machi, Nagaoka City,Niigata, Japan Phone : +81-258-42-8808 Fax. : +81-258-42-8810



### Magnescale Magnescale

The products of Magnescale Co., Ltd continuously contribute to the advancement of machine tools with excellence in environmental resistance, accuracy and resolution. In addition, the LASERSCALE is indispensable in fields where the highest resolution is required for next generation technological innovations, for instance, cutting-edge semiconductor manufacturing systems and die & mold production of optical components such as digital camera lenses.

Magnescale was launched as a wholly owned subsidiary of DMG MORI in April 2010, after DMG MORI's acquisition of the measuring instrument division of Sony Manufacturing Systems Corporation, which had operated for nearly half a century in the magnetic measuring technology field.

The Iga production facility with a building area of 4,800 m<sup>2</sup> (51,667.2 ft2) was established in 2011 with a production goal of 3,000 units per month. In 2017, a full production line for new SmartSCALE was furnished in the facility.

DMG MORI will continue to offer customers products with even higher precision by installing Magnescale technology on our machine tools, and fulfill customer needs for innovative inspection by introducing new measuring instruments and measurement control systems.



#### Smart SCALE

The world's first water and dust proof, open-type, high-accuracy, high-resolution absolute Magnescale that requires no air-purging was launched. Featuring the simple structure with the head and the scale separated, it achieves a high resolution of 0.005  $\mu$ m despite the large mounting tolerance of  $\pm 0.1$  mm.

- Achieved a protection class of IP67 for dustproofing and waterproofing
- Max. resolution of 0.005 μm
- Max. response speed of 200 m/min
- Vibration resistance of 250 m/s<sup>2</sup>

http://www.magnescale.com/mgs/language/english/

Isehara Plant Research and Isehara Plant Development Base Iga Plant Vibration-free precision plant







Shipping from Iga plant for Pfronten plant



The scale will be attached to DMC 340 FD

Magnescale Co., Ltd

45 Suzukawa, Isehara City, Kanagawa, Japan Phone : +81-463-92-1011

Fax. : +81-463-92-1012

## DMG MORI B.U.G.

DMG MORI B.U.G. CO., LTD. was established in 1980 in Sapporo as an IT start-up company of Hokkaido University. Since then, DMG MORI B.U.G. has been developing cutting-edge computer technologies

by utilizing its extensive technical expertise in both hardware and software.

In 2008, DMG MORI B.U.G. joined the DMG MORI group. DMG MORI B.U.G. makes significant contributions to improving operator-friendliness and increased productivity of machine tools through the development of the next generation

operation software such as CELOS and MAPPS V. Both products were jointly developed with DMG MORI, and they are easy to operate and highly competitive. Moreover, DMG MORI B.U.G. strongly promotes research and development projects for IoT, as demand for such technology is expected to grow further. DMG MORI B.U.G. is a key part of the group for achieving that goal, given its abundance of experience in the development of network devices and embedded software.

DMG MORI B.U.G. CO., LTD.

1-1-14, Shimonopporo Techno Park, Atsubetsu-ku, Sapporo City, Hokkaido, Japan Phone : +81-11-807-6666

Fax. : +81-11-807-6645



### Saki Corporation Saki

#### http://www.sakicorp.com/en/

With a solid foundation in automatic visual-inspection technology, Saki Corporation has developed automatic inspection equipment for electronic parts mounting processes, utilizing two-dimensional, three-dimensional and X ray CT images, since its initiation in 1997

and X-ray CT images, since its initiation in 1994. Internal development of hardware and software allows high-resolution, high-speed and high-accuracy inspection in line with technology advancement of electronic equipment. With the recent smart factory trend in electronic parts mounting process, Saki Corporation will further promote worldwide M2M collaborations with major manufacturing equipment producers and continuously provide pioneering total solutions.

Saki Corporation 3-1-4, Edakawa, Koto-ku, Tokyo, Japan



### REALIZER GmbH REALIZER

REALIZER GmbH is located in Borchen, Germany. The company has more than 20 years of experience and knowhow in selective laser melting, or powder bed, which is one of the technologies of Additive Manufacturing.

In February 2017, DMG MORI acquired 50.1% of shares in REALIZER GmbH and consolidated a framework of cooperation to develop additive manufacturing technology. In 2017, DMG MORI launched LASERTEC 30 SLM, a new powder bed type additive manufacturing machine. DMG MORI and REALIZER continue research and development to provide new solutions for powder material and complex metal parts production to maintain strong competitive edge.



http://www.realizer.com/en/





REALIZER GmbH Hauptstraße 35, 33178 Borchen, Germany

LASERTEC 30 SLM

# CORE COMPETENCE

Machine tool's accuracy is  $5 \,\mu$ m, or 5/1000 mm.

It is so tiny that human eyes can hardly see.

What is more, machine tool must guarantee repeatability of this accuracy.

The uncompromising pursuit for accuracy of machine tool is the foundation

of the manufacturing industry.

And that is why machine tool has an enormous impact and responsibility for the entire society.



# Developments in our society



DMG MORI keeps pace with changes in our society - shift to EV (electric vehicle), development of AI (artificial intelligence), and aging society. EV-shift will boost demand for new components such as motor and battery, and for production equipment with new machining technologies to handle new types of materials. AI-shift will lead to increased demand of semiconductor components, and of production equipment to machine ultra-high precision parts. Aging society will change the existing production equipment and environment to more automation, and generate greater demand for medical parts such as socket for knee and hip joint, bone screw, and implant. All of them are new business opportunities for DMG MORI. DMG MORI offers machining solutions to produce complex work pieces and handle a wide range of materials by utilizing its sophisticated Multi-axis, automation, and integrated solutions, as well as advanced technologies such as laser- and ultrasonic machining and Additive Manufacturing.

# Multi-axis, automation, and integrated solutions Expanding business domain

In semiconductor, aerospace, and medical industries, our customers need to produce complex parts in small lots. Against this background, we expect a growing demand for 5-axis machining centers to facilitate integration of multiple work processes and machining of complex work pieces. With more than 30 years of experience in 5-axis machining centers, DMG MORI has the most accumulated technology and knowhow in 5-axis machining throughout the industry.

Among all, DMU series are the bestselling 5-axis machining centers of DMG MORI. More than 10,000 units have been installed worldwide.



DMU 50 3<sup>rd</sup> Generation



### Expanding business domain

Source : Company estimation based on statistics by VDW(2015)

A combination of DMG MORI's 5-axis machining center with Technology Cycles starts to replace specialized machines designed for limited purposes. In aerospace, medical, and semiconductor industries, Additive Manufacturing and ultrasonic machining will gradually override the conventional forming technologies. With the market of cutting machines consisting of conventional turning and machining centers being almost saturated, DMG MORI will pro-actively develop new business domain for mid- to long-term growth.

### Automation System



10 NHX 5000 connected with each other

Automation is a priority issue for both DMG MORI and customers. Automation is especially important in the age of digitalization where we are today. DMG MORI is in the process of providing standard automation solutions to all of its machine tools. – A system to connect peripheral equipment for work piece storage with machine tools, to load and unload work pieces automatically in- and outside of the machining area without human intervention. Our goal is to connect machines and automation equipment in the most intelligent and smart way. This will lead to improved efficiency of pallet as well as work piece handling.

DMG MORI has developed an all-new robot system MATRIS that requires no special knowledge for its operation based on the wealth of experience and expertise DMG MORI has cultivated over the years. With modularized peripherals, a robot and MAPPSconnected, a dedicated system to connect peripherals and machines, MATRIS eliminates complex program editing and achieves easy system setups on a simple operation screen.

In addition to being able to install in a short period of time, it is a robot system which can complete layout change in a short time after installation, due to module-based design of peripheral devices.



#### MATRIS



# Digitalization

#### Common user interface with intuitive touch functions

DMG MORI invested enormous efforts to develop CELOS. This operation system makes it possible to transform ideas into products by quick and simple processes. CELOS covers a wide range of areas with its unique functionalities. For example, a variety of applications tailor made for every process, multi-touch operation panel that is innovatively easy to use, security control by DMG MORI SMARTkey to define access rights individually. CELOS is a future-oriented user interface that continues advancing at customer's factory.

#### **Operation system CELOS**



#### New solutions to make complex machining easy and quick Technology Cycles are new solutions that consist of the following 4 elements:

1) Machine tools, 2) Open innovation of cutting tools and peripheral equipment, 3) Embedded software, 4) HMI (Human Machine Interface) such as CELOS. Technology Cycles make it possible replace specialized machines, specialized programs, and special cutting tools by standard machines, cutting tools, and fixtures in machining, set-up, and measurement processes. Anyone can start production quickly and achieve high quality. DMG MORI offers total solutions around machine tools, including peripheral equipment and software.

### Technology Cycles



"Gear skiving" A Technology Cycle to support programming of gear machining (power skiving).

The future of manufacturing is digital: Material supply, machine operation and process control are increasingly connected—from individual machines to assembly lines and even entire factories. ADAMOS—a strategic alliance of partners in the mechanical engineering and software fields —was established in 2017. The objective: shared global industry standards for the "digital factory."

With DMG MORI, customers can make an incremental and individualized start into the world of digitized manufacturing. The basis for this is the app-based operating and control software CELOS, which fully integrates the machines into the sales organization and simplifies and accelerates the process from the idea to the finished product.

On a high-resolution display, CELOS visualizes the current processing status of the machine and the production process, provides indicators on the current job and provides information to the operator through special apps, icons and text messages. CELOS is as easy to operate as a smartphone.

By accessing to the open platform ADAMOS through CELOS, customers can connect their machines and peripheral devices, regardless of the different network protocols. That's the realization of an open connectivity. In many industries, digitization has only just begun. DMG MORI, by contrast, already has a comprehensive



#### Digitalization by CELOS and ADAMOS

foundation from which to lead its customers around the world into the digital future with CELOS and ADAMOS.





## Advanced element technology

We offer 5 types of MASTER spindles; speedMASTER for high-speed machining, powerMASTER for heavy cutting, 5X torqueMASTER for large-sized 5-axis machines, compactMASTER for mill-turn centers and turnMASTER for turning centers. MASTER series conceives accumulated technology and knowhow of the entire DMG MORI group, and assumes optimized design for each applicable model. We started producing in-house spindles along with turning centers, and the rich experience serves the quality of this internallymanufactured spindles.

# 3-year warranty service for MASTER spindles



speedMASTER

powerMASTER

5X torqueMASTER

compactMASTER

turnMASTER

To produce parts by machine tools, material will be machined from different angles, and that requires repeated movement of axes either straight or rotational. Controlling the movement of multiple axes of machine tools quickly and precisely, or in other words, controlling the positioning accuracy is the key to achieve higher productivity and machine's accuracy. Measurement devices such as scales and sensors are key components of machine tools where high accuracy is required. Scales and sensors will become even more important in the future to know the status of every part of machine tools, for example by attached sensors which measure position, pressure, temperature, and vibration, to feedback the measured results to machine's control, and to utilize the data for optimized control and preventive maintenance.

DMG MORI's group company Magnescale Co., Ltd. produces smart scales. DMG MORI is currently in the process of mounting smart scales on all models as standard.

# Mounting smart scale as standard in progress



# In Pursuit of Quality

In January 2018, DMG MORI started 3-year warranty service for all the MASTER-series spindles mounted on DMG MORI's machine tools regardless of locations of production and sale. This is to guarantee safer and better usability of our products by our customers worldwide. Warranty service for "MASTER" spindles



#### PPR system

PPR (Product Problem Report) is DMG MORI's quality management system to share information of product problems at customers' factories and to make improvements in DMG MORI's design and production processes. DMG MORI Co., Ltd. has more than 20 years of experience in quality improvement by PPR. This system was expanded to DMG MORI AG, too, to accelerate problem solving of AG's product quality.

