

To Err is Human.

BUT MAKING A HABIT OF IT WILL COST YOU.



Everyone makes mistakes. Nobody's perfect. We've all heard those or similar words, and if you happen to be in charge of your company's quality efforts, you've probably heard them more than most people. But the hard truth is that mistakes have consequences, and oftentimes they are costly, if not absolutely dangerous—especially in gear manufacture.

An entire industry devoted to reducing human error and shortening lead time and other quality issues in the workplace has grown proportionately with domestic and global competition for winning and retaining customers. Since the days after World War II, when the warring countries returned with a vengeance to making things again for peaceful purposes, formal quality systems such as Lean, Six Sigma and others have played a central role on the factory floor and beyond. Indeed, with all these various systems in place, in increasingly more manufacturing settings, one can reasonably wonder how mistakes are ever made.

And that, of course, is where we humans enter the picture.

Ben Marguglio, president of B.W. (Ben) Marguglio, LLC, has for the past eight years led a series of what he calls High-Technology Seminars, including a seminar on Human Error Prevention. (Other seminars include Problem Reporting; Root Cause Analysis, and Corrective Action; Measurement of Organizational/Process Performance; and Quality and Environmental Auditing in accordance with ISO 19011.) The seminars, presented by Marguglio along with eight other professionals on Marguglio's staff, are what Marguglio refers to as "high value"—i.e., information about processes and techniques "that have been successfully implemented and proven effective in one or more enterprises;" and "high content"—by which attendees "receive essentially all of the information (needed to) successfully implement a process or technique." Last, the seminars are "highly specific" in that participants are provided with "information to the appropriate level of detail necessary to fully understand" a process or technique.

Stipulating that most, if not all, error in manufacturing begins at the human level (e.g., a software program is only as error-proof as the person writing it), this article concentrates on Marguglio's Human Error Prevention seminar.

"I think that almost everything boils down to human error, with the exception of acts of nature," says Marguglio. "We tend to focus, unfortunately, on the last person to touch the process, and in the case studies that I use in my seminars, I demonstrate that many human errors occur upstream.

"Errors occur in the preparation of documents, in the planning for the creation of documents, and many of those errors are latent errors, and the hazards are only activated by what I'll call an initiating error or an initiating action. The person on the line may make an initiating error or take an initiating action, and lo and behold that initiating error or action will activate a hazard that should have been protected against, for which there should have been a barrier or barriers. And the failure to create these barriers constitutes errors upstream."

Marguglio addresses the above with what he calls "four fields of focus," which are:

- Identify hazards and create barriers against these hazards
- Identify error-inducing conditions and either eliminate them if it is possible or economically appropriate, or behave in ways by which to counteract error-inducing conditions, minimizing the probability of error
- Practice thought process and behaviors by which to prevent error, particularly with regard to decision making
- Prevent the recurrence of error

According to Marguglio, the first three fields of focus relate to preventing error, while the last—preventing repeated

continued

errors—recognizes that human error cannot always be prevented.

Inherent to the areas of focus are hazards and barriers—hazards being the minefields of potential error, and barriers serving as the preventive mechanisms put in place by management. Part of what Marguglio teaches is how best to understand and approach his four fields of focus. Much of what Marguglio imparts to client participants is based on the teachings of two significant figures in the world of quality assurance—Dr. Joseph M. Juran and Dr. A. V. Feigenbaum. Both men, says Marguglio, “almost simultaneously came up with the idea of quality of design, but still today, unfortunately, the focus for quality of design is on hardware. One of the things that I’ve been trying to get people to understand is that quality of design also applies to the design of the administrative process, which governs the design of the hardware; the design of the technical process, which converts the computer design to a physical being. So quality of design can’t only apply to hardware; it has to apply to process as well.” (Some would say that lean manufacturing, among other systems, when fully implemented, addresses this as well.)

All of this may seem a bit cerebral, but it works. Just ask Hal Finley of Cameco Corporation.

“Having attended two of Ben’s courses—Problem Reporting/Root Cause Analysis and Human Error Prevention—I found the course material well researched and presented in a manner that brought out both the underlying theory and practical applications.

“Our company continues to send employees to Ben’s courses, and has now contracted him to assist with improvements to our investigation and analysis process.”

OK—most of us will admit that human bumbling is at some point a root cause for error. But why is that? Most would probably answer, who knows? But Marguglio believes he has isolated the factors involved. And while it is tempting to refer to them as the seven deadly sins of error commission, Marguglio professionally calls them the seven human error causal factors. He bases this on his review of “literally—and this is not an exaggeration—on hundreds, if not over a thousand problem reports, incident reports, condition reports, etc.”

His seven human error causal factors are:

- Knowledge-based error—a basic lack of knowledge of requirements or management expectation, or of a customer need
- Cognition-based error—an inability to understand the requirement, management expectation or need; or inability to apply, analyze, synthesize or evaluate a requirement

- Value- and belief-based error—a lack of respect for or acceptance of the standard, requirement or need
- Error-inducing condition or situation—a lack of recognition of the condition or situation, and/or lack of counteracting behavior
- Reflexive-based error—a lack of thought processes and behavioral techniques for conservative decision making in reacting to an immediate “field stimulus”
- Skill-based error—a lack of dexterity
- Lapse-based error—nothing lacking; simply “blew it”

In Marguglio’s view, the most important conclusion ascribed to the above is that an understanding of them is paramount when attempting to identify human error causal factors and when doing root cause analysis.

Looking at these factors should prompt a question regarding training. And while training is certainly important and beneficial, it is not a panacea in Marguglio’s world.

“A large part (of human error) is due to improper selection of personnel for a given job and improper training,” says Marguglio. “An enterprise has the responsibility to train its employees for those aspects or elements of the job that are unique to the enterprise, but the enterprise is not responsible—and should not have to train—for things that are universally available through the school system.”

Whether the “school system” can be counted upon to provide the technical training and expertise needed in today’s high-tech world has been discussed in past issues of this magazine and is grist for another day. But aside from that, manufacturers might take some solace from the fact that individuals like Marguglio are out there doing what they can to at least reduce the doh! factor.

(B. W. [Ben] Marguglio possesses many years of high-technology experience at the executive level. A Fellow of the American Society for Quality (ASQ) since 1974 and an ASQ-certified quality engineer, reliability engineer, manager and auditor, Marguglio has authored dozens of technical and management papers as well as two books—Quality Systems, 1977, publ. American Society for Testing and Materials, and Environmental Management Systems, 1991, publ. Marcel Dekker, Inc.)

For more information:

BW (Ben) Marguglio, LLC
 P. O. Box 8
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 Phone: (845) 265-0123
ben@HighTechnologySeminars.com
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mG miniGears

EXPANDS HELICAL GEAR MANUFACTURING IN PADUA

mG miniGears launched a high-capacity production gear cutting, shaving and subassembly cell consisting of several Pfauter gear hobbing machines including a new Gleason Pfauter P90, which performs high-quality skiving processes. The new cell is capable of producing up to a dozen or more assembly variations including pinions and gears ranging to 200 mm diameter.

“Currently we can manufacture up to approximately 500 gear assemblies per day,” says plant manager Giambattista Teghil. “The combination of machines coupled with the selection of a dedicated team of employees has made the establishment of this new line a big success.”



miniGears had the cell up and running quickly and created about 16 factory positions for this project. “We went from placing machines on the factory floor to full production and meeting our customer’s demands in little over six weeks,” says Angelo Segato, of the technologies department of miniGears.

Mahindra

ACQUIRES METALCASTELLO

Mahindra and Mahindra Ltd. (M&M) and ICICI Venture Funds signed a definitive agreement to acquire a 100 percent stake in Metalcastello S.p.A. for an undisclosed sum upon receipt of necessary approvals.

Metalcastello is one of the top gear manufacturers in Europe, with revenues around \$100 million. The Italian company focuses mainly on the off-highway segment of the industry, producing complex gears and shafts used in vehicle transmissions and drivelines. Metalcastello’s customers include global OEMs in the tractor, off-highway and construction equipment sectors. Originally founded in 1952 and based near Bologna, Metalcastello was first a subcontractor manufacturing gears and transmission shift rails on a small scale. There are currently more than 300 employees at the company. CEO Gabriele Pierotti will continue on in his current position after the acquisition.

“Metalcastello is a company that has been part of our family for the last five decades, and I recognize that in order to facilitate its continued growth it needs a strong strategic partner,” Pierotti says. “Having interacted with M&M over the last two years has given me great comfort that both the historical traditions and the future growth prospects will be protected. I am delighted to partner with M&M in taking the first steps to create what should become one of the leading gear companies of the world that can marry our technology with M&M’s low-cost manufacturing excellence.”

Currently, financial investors hold an 84.7 percent stake in Metalcastello, including 66.5 percent held by private equity fund Development Capital, and top management holds a 15.3 percent stake. ICICI Venture is an Indian private equity firm. The Mahindra Group is among the top 10 industrial houses

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in India with over 60 years of manufacturing experience. This acquisition complements the group company Mahindra Systech, an auto parts conglomerate formed in 2004.

“I am delighted to welcome Gabriele Pierotti and his management team into the Mahindra family and look forward to harnessing their expertise in building Systech’s gear vertical to match that of MFL (Mahindra Forgings),” says Anand Mahindra, vice chairman and managing director of the Mahindra Group. “Mahindra Systech has the mandate to build globally competitive business in selected verticals and this acquisition greatly enhances our capability to do so.”

Ajax Rolled Ring

EXPANDS MANAGEMENT, ACQUIRED BY PROSPECT CAPITAL

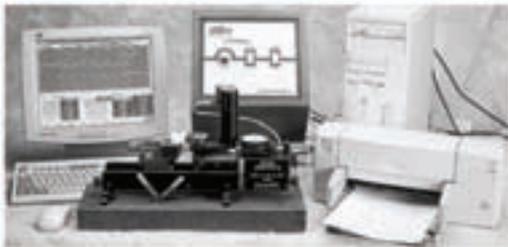
Over the past several months, Ajax Rolled Ring and Machine has grown and filled five significant positions including Ken Binford as quality engineer, Bob Komisarski as controller, Jeff Arnold as lean/sigma champion, Dan Reichard as chief financial officer and Justin McCarthy as executive vice president-sales and marketing.

“These five positions are critical to the continued growth and success of Ajax. We are assembling a team that is experienced and capable of contributing to our ongoing efforts to be one of North America’s leading producers of rolled rings for use in the most demanding applications,” says Simon Ormerod, CEO of Ajax since 2006.

The company’s sales have increased from \$34.6 million to more than \$52 million between 2005 and 2007, which is attributed to increased demand for bearing rings and gears for transmission components in wind energy, mining and off-highway/construction equipment. “Clearly Ajax has gained significant momentum in recent years that is the result of all of our employees working together to take care of our customers,” Ormerod says.

In addition to new management leaders and employees, Ormerod announced April 4 that Ajax has been acquired by Prospect Capital Corporation of New York. The current management team including CEO Ormerod, CFO Dan Reichard, vice president of operations Wil Kantus and the recently appointed executive vice president of sales and marketing, Justin McCarthy, will remain with the company under the new ownership.

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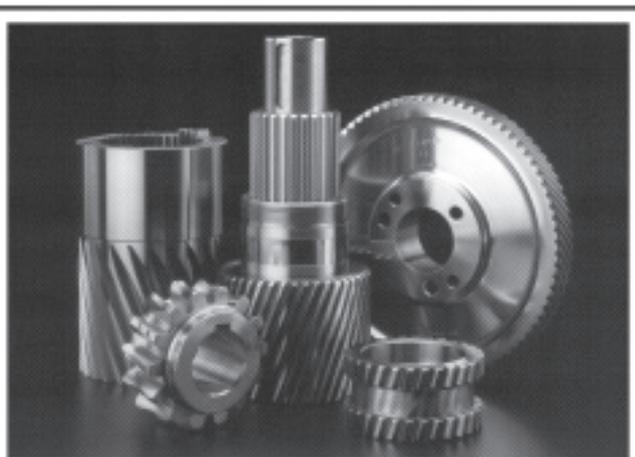
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Ajax employs approximately 100, and the company operates two ring rolling mills within the 140,000 square-foot facility. Services include engineering, heat treating, shot blasting, testing and machining, and Ajax's customers include Caterpillar, Timken and General Electric.

"With over \$550 million in assets with 30-plus portfolio companies in closely related sectors of the manufacturing economy in which Ajax competes, Prospect thoroughly understands our markets," Ormerod says. "We see this not only as a great opportunity for Ajax to grow rapidly with Prospect's support, but as a very positive development for our employees, customers and suppliers."

Lenze-AC Tech

NAMES DIRECTOR OF ENGINEERING



Jim Craig

Jim Craig joins AC Technology, a member of the Lenze Group, as the new director of engineering. He will direct the design of all new products, development and sustaining engineering activities at the company's North American headquarters in Uxbridge, Massachusetts.

"Bringing Craig on to spearhead new product development will enable our engineers to further push the envelope of our already state-of-the-art products," says Allen Ottoson, president and founder of Lenze-AC Technology.

Craig previously served as the product manager of high-power motor drives at Danfoss, and he has more than 28 years of experience in industrial automation. He received a bachelor's degree in electrical engineering from Southern Illinois University and conducted graduate work at Stanford University. Craig is credited with multiple patents.

Craig says as a goal, "I'd like to see an increase in the trend of how machinery and process control are being inter-linked—the seamless automation of the whole factory."

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NEWS

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Renold SELLS FACTORY SITE

Renold plc announced the sale of its Burton-on-Trent factory site to Morris Homes, in January, as part of a continued effort to dispose of its non-core properties. The sale will be used to pay down group debt, and balance sheet gearing will be reduced, according to the London Stock Exchange's news service, RNS.

Renold's profit and cash enhancement program (PACE) will be self-financed with completion of the sale. Bob Davies, chief executive of Renold, says, "This is another major milestone in the implementation of the company's PACE program and concludes a six month period in which we reported improved financial results for the half-year to September 2007 and completed the strategically important acquisition of Hangzhou Shanshui in China. We look forward to the future with confidence."

Renold manufactures a range of gears, couplings and industrial chains worldwide for OEMs and distributors.

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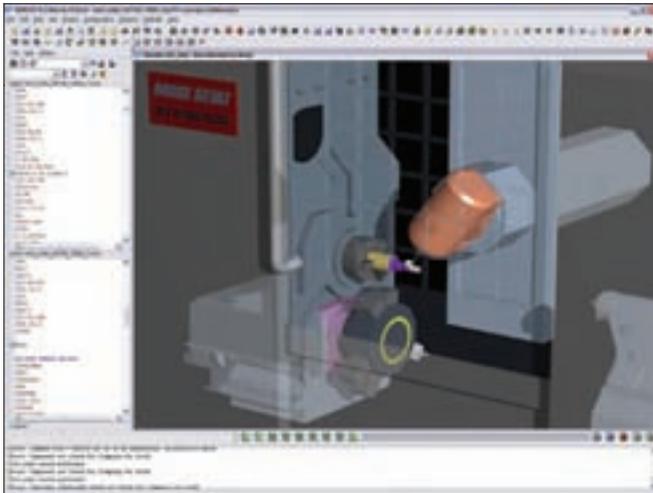
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Tooling U

LAUNCHES GOVERNMENT AND EDUCATION GROUP, PLC CLASSES

The new Government and Education Group (GEG), created by Tooling U as part of its Business Development Division, is designed to aid educational institutions, government entities and industrial associations involved in workforce development, training and education in the manufacturing sector, according to the company's press release.

"Manufacturers recognize the importance of a well educated workforce, but successfully training the workforce demands cooperation between employers, government and



the education sector,” says Bryan Knaack, director of business development for Tooling U. “We see our responsibility to facilitate communication between these groups.”

The GEG provides advice to educational institutions on how to build blended learning programs that facilitate workforce knowledge and efficiency. The group offers training courses for instructors and educators and intends to collaborate with industrial associations and education organizations on projects funded by federal grants, such as Department of Labor and Workforce Development funds.

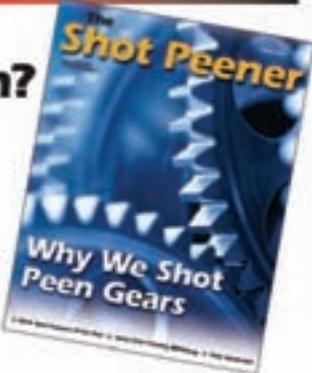
“Our expertise in government grants and public funding for education projects will help bring manufacturing associations, the private sector and public resources together, so we may develop the most effective and innovative workforce educational and training solutions,” Knaack says.

Tooling U has also developed a new series of online training classes designed to address programmable logic controllers (PLCs). They will be included with other online classes focusing on electrical systems, motor controls and mechanical systems, which are used to train maintenance professionals.

The PLC is a device driven by software that detects input signals, processes signals with a logic-based program and sends the signals to designated outputs. They are applied in a range of industrial processes in automation and electrical control such as traffic light signals, packaging processes and assembly lines.

“Many of our customers have asked about PLC training, especially for their maintenance people. As equipment gets more complicated, the people that fix it really have to keep up with the learning curve,” says Chad Schron, vice president of Tooling U. “With these PLC classes, or any of our subjects, we work with industry experts to make sure the material is relevant and up-to-date for our audience.”

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NEWS

Haas

CELEBRATES 25 YEARS IN BUSINESS



Haas Automation, founded by Gene Haas, first opened for business in 1983 manufacturing the first fully automatic programmable collet indexer. After four years of expansion, the product line included fully programmable rotary tables, indexers and machine tool accessories.

As a leading manufacturer of CNC machine tools, Haas is headquartered in Oxnard, California. All Haas products are manufactured at the one-million-square-foot facility and distributed through more than 120 Haas Factory Outlets (HFO) worldwide, each with showrooms, factory-trained service personnel, spare-parts inventories and service vehicles, according to the company's press release.

Haas supplies published prices for their machine tool solutions, which are used by job shops and contract manufacturers. The company estimates that there are more than 85,000 Haas CNC machines and 53,000 of their rotary products currently in use.

"Our 25 years of growth and success are the result of providing customers with the affordable, dependable machine tools they need, and the service and support they demand," says Bob Murray, general manager. "Haas Automation has always been a customer-driven company, and our goal is to provide them with the best machine tool value in the industry now and long into the future."