PLASTICS AUTOMATION

A MAGAZINE FROM **ABB**

OCTOBER **2004**

At Hella in Mexico, robots are star players.
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"Flexible automation **is key for the future** of the plastics industry."

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ABB

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PLASTICS AUTOMATION

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International customer magazine
from ABB for the Plastics Industry.

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Editorial

Stretching the limits

> Welcome to the first issue of ABB's *Plastics Automation* magazine, covering the world of robot-based automation in the plastics industry. This issue coincides with the world's largest plastics exhibition, the K2004 in Düsseldorf. Visitors to the K2004 exhibition will no doubt see that we are entering a new era in plastics automation, where the focus is on downstream automation, quality control and the reduction of total cycle time.

As you can read in the magazine, ABB has responded to the needs of the industry in a variety of ways, such as improved software that makes 6-axis robot automation easier to use, for example. The new controller IRC5 and the plastics interface simplify programming and operator dialogue by putting the controller on the shop floor, where programming can easily be done using a touch screen and icons. Furthermore, you can read that when cycle time is improved, there is an opportunity to add value to the parts produced and do more downstream at the injection moulding machine or even further down the line.

This issue of *Plastics Automation* includes stories on everything from painting and dispensing to assembly applications, areas such as quality control, plus cutting applications around both the blow-moulding and the injection-moulding processes. The stories feature some of the best applications in the industry, which we hope will not just encourage further robot-based automation but stretch the limits for what is possible.

I am convinced that using 6-axis robots is the future for the plastics industry.

Tore Lindström
Segment Manager Plastics
ABB Automation Technologies

Faster palletizing Down Under

> A large manufacturer of PET bottles in Australia is improving its palletizing. The company has bought two systems from ABB, one with five robots and one with six, equalling a total of 11 for the two systems. The systems are capable of palletizing up to 40,000 bottles per hour, depending on bottle diameter.

Bottles come directly from the blow moulding machines for immediate palletising. Complete pallets are then shipped to the filling factories.

Installation is scheduled at the two plants in December 2004, with production set to begin shortly thereafter.

Taking care of the total paint line

> ABB designed a completely new concept to meet Peguform's new bumper paint line requirements. ABB's modular system was adapted to Peguform's current levels of production, but can be expanded as required. ABB's competitors focused on capacity and tried to sell bigger lines, but ABB opted to focus on quality, flexibility and in-depth analysis.

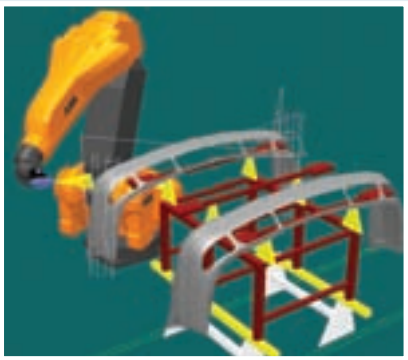
The paint line has two conveyors, one on each side of the seven robots. Around 2700 bumpers are currently painted per day. The paint line is also designed around the paint kitchen to allow optimization of the paint pipe network and can be duplicated using common equipment. System capacity can be doubled but still be run by a single operator.

One challenge was the integration of the solution into Peguform's total parts flow. The paint lines have therefore been synchronized with the bumper press. ABB was responsible for the complete system, handling the entire paint line for the customer. Where necessary, sub-contractors were hired, but ABB has controlled the whole process, something that would not have been possible without ABB's broad experience and in-depth knowledge of the entire paint process.

"Working in close cooperation with Peguform, we developed a complete line which meets their current needs," says ABB quotation manager Bernard Lauture, who was responsible for system design.

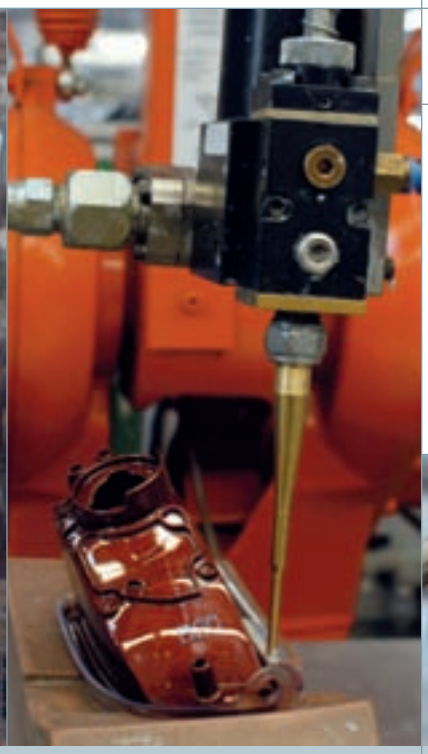
Follow the line

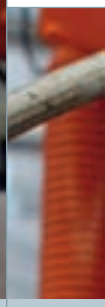
> The latest version of RobotStudio Paint now includes an important new feature, “AutoPath” which allows for automatic path generation. Using the new feature, operators can generate a path on the surface of an object automatically – or semi-automatically by point and click. The path is generated by scanning the surface of the part, and creating a path on the surface.



Big injection

> Dynamite Nobel has improved production at its facility in Spain with the purchase of a new IRB 6650Shelf robot for injection moulding. Installation took place in September. The new shelf robot is a further step for ABB to offer shelf mounted robots on larger injection moulding machines.





By Ronald Buchanan Photo: Keith Dannemiller

Teaming up with robots

Workers at a Mexican auto-parts plant welcome their mechanized workmates because they relieve them of drudgery. And factory bosses say the machines give them a leading edge in a fiercely competitive market.

> Mexico's auto and auto-parts industries are going through a lean spell. The nation's economy is recovering slowly from a prolonged recession, and consumer confidence has yet to gain strength in the United States, the destination of more than half of Mexico's exported cars.

Yet you would never guess those difficulties from the smile on the face of Rafael Lopez, technical general manager of the Hella Mexico plant. The plant, which makes headlamps, is situated in Tlanepantla, on the outskirts of Mexico City, home to nearly 20 million people. But in Tlanepantla, a cluster of hills puncture the urban landscape.

Rafael López, technical general manager of the Hella Mexico plant and Eckart Meissner, CEO and General Director.

At the Tlanepantla plant, production has been growing at about 20 percent a year. "And it's continuing to do so," says Lopez as he looks out from his office balcony onto the spotless factory floor below. Each worker wears equally spotless white overalls emblazoned with the blue logo of Hella, the Germany-based parent company.

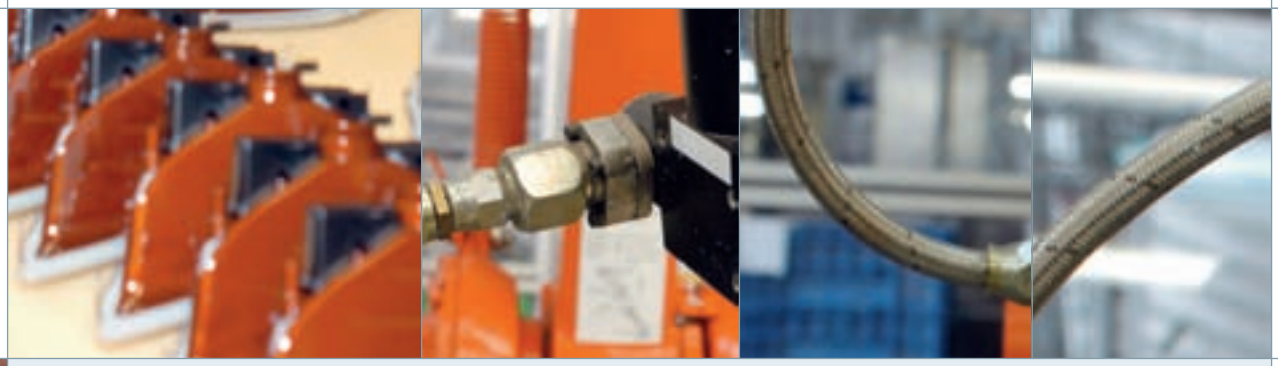
The workers form teams of half a dozen or fewer beneath large signs that proclaim the models for which they are making parts. The signs are a roll-call of auto industry leaders: BMW, General Motors, Volkswagen, Nissan, Mercedes-Benz and more.

And just as soccer squads have a star player or *libero* who provides a backbone of quality, so too do the Hella Mexico production teams. The Hella Mexico *liberos*, however, are protected by glass and steel cages, for they are robots, purchased from ABB Mexico.

Why robots in Mexico? Although Mexican labor costs have risen in recent years, they remain low by the standards of the U.S. and Europe. "That's not the issue," says Lopez. "Each robot costs 40,000 to 50,000 [U.S.] dollars, but we're looking for consistency and quality, and that's what the robots offer.

"The robots achieve a precision that no human can match, no matter how skilled she or he is," he says.

"We use the robots to take pieces out of the injection



>FACTS

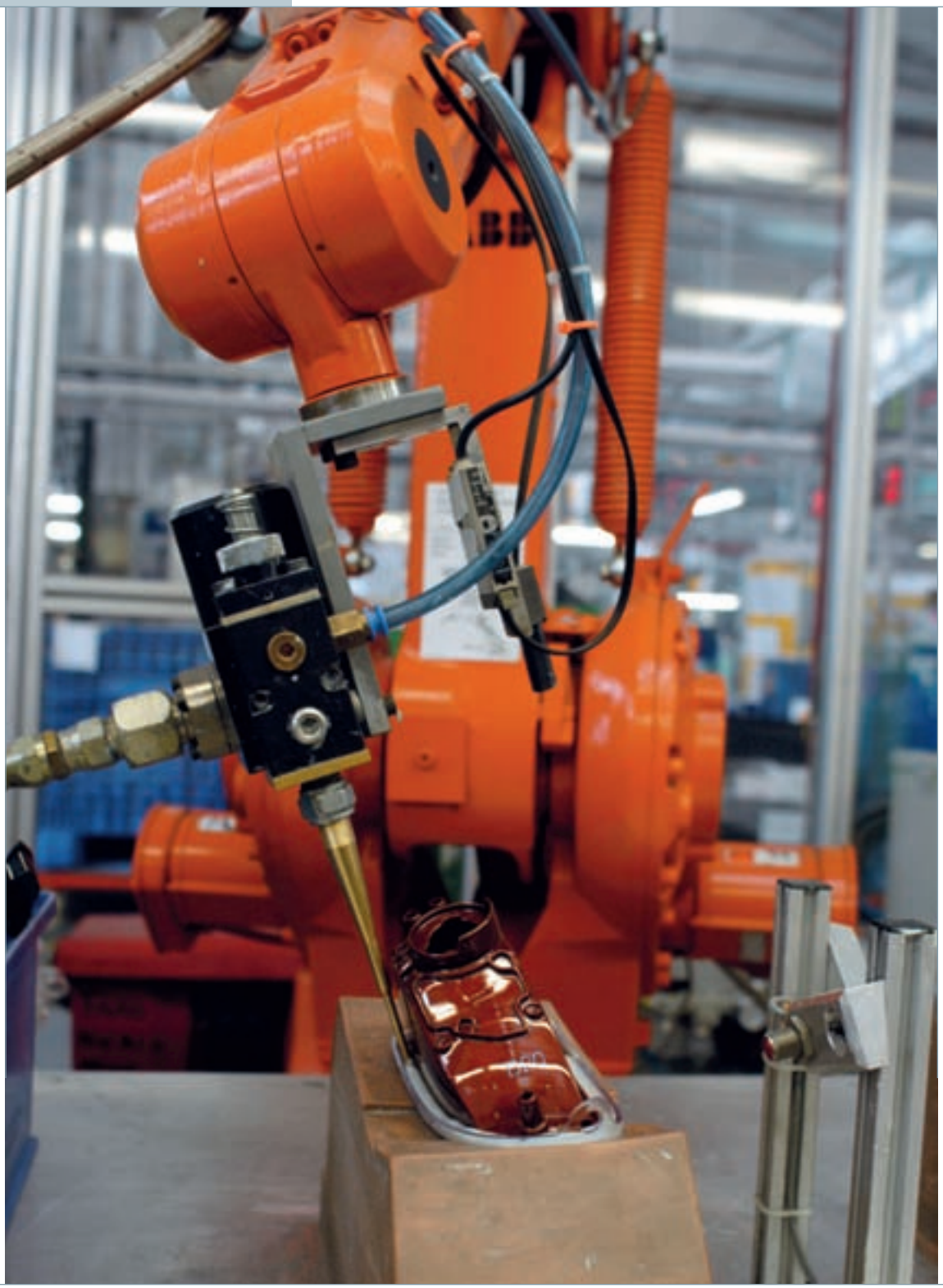
- Grupo Hemex, an affiliate of Germany-based Hella, has plants at Tlanepantla on the outskirts of Mexico City and in Guadalajara.
- Hemex bought robots because of the need to improve quality for increasingly demanding clients. Productivity increases were a plus.
- The Tlanepantla plant has 44 robots, each of which operates as part of a small human team working on an individual product.
- The robots have improved productivity by 10-20 percent thanks to less wastage and down time. Quality and consistency are much better.

moulder, and for the application of adhesives. The robot's action never varies the way a human's would. That way you get much better quality."

Hence the roll-call of prestige clients that hangs over the Hella Mexico production teams. And, of course, far fewer parts have to be scrapped for failing to meet quality standards. "Besides, with the robots, we've achieved a big reduction in downtime," Lopez says. "And productivity is up by 10 to 20 percent.

"But the main reason for getting the robots was the need to improve quality," he says.

In deciding on the purchase, it helped that Lopez's boss, Eckart Miessner, the Hella Mexico general director, is a former senior executive of ABB Mexico. "In fact, I'm the man who brought the robots to Mexico," says Miessner, who adds that Hella Mexico will be investing some USD 150 million over the next five years. A substantial slice of that is likely to be spent on yet more robots to add to the 44 already working at the Tlanepantla plant. Lopez reckons that 10 to 12 will be added in the next two years. Surely the workers must be worried about the prospect of losing their jobs? >

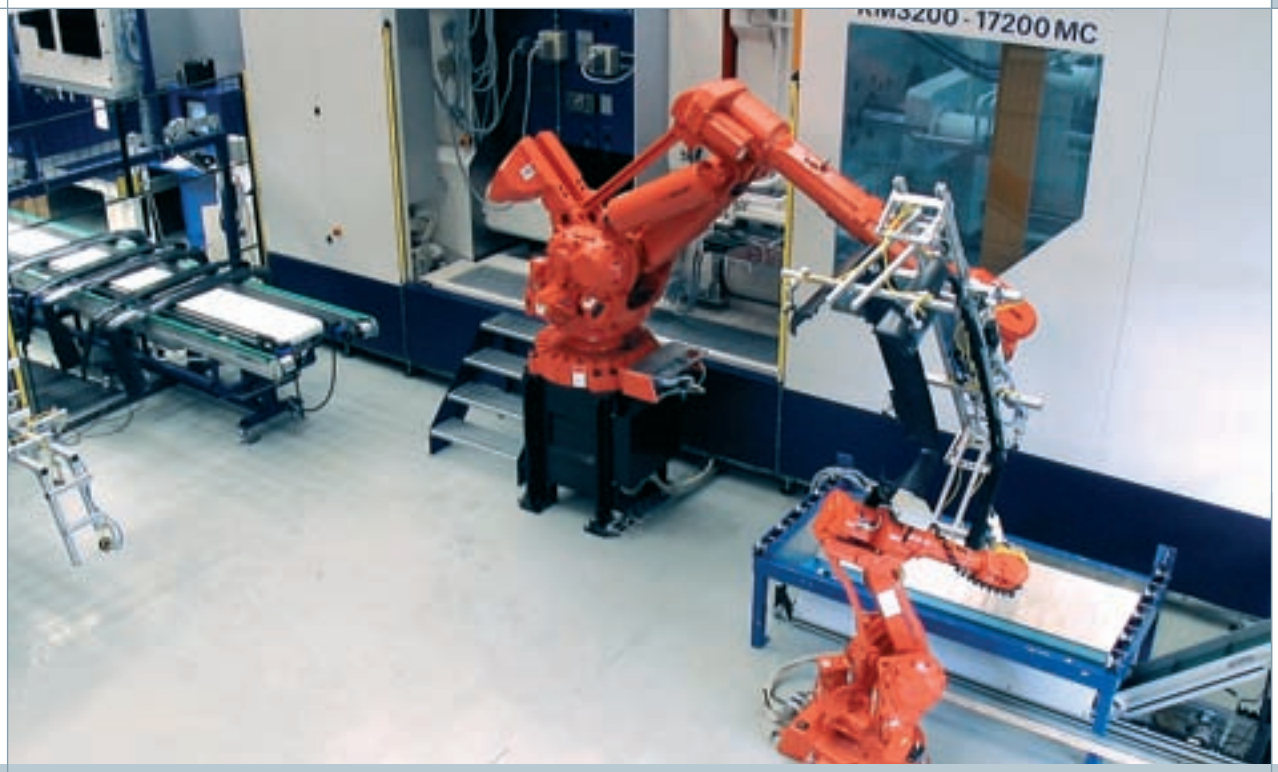


> "Not at all," says Lopez. "The robots never displace workers. We only introduce them when we launch a new line of production. Since the plant keeps growing and we continue to hire people, fears of job loss are never a problem."

Charlie Chaplin's *Modern Times* film classic posed the comic genius as a factory worker locked in a losing battle with machines. Not so at Hella Mexico. It may be going too far to speak of a love affair, but, says Lopez, the workers get on well with the robots. "After all," he says, "they save them from the boredom of meticulous but repetitive work."

The Tlanepantla plant, founded 40 years ago, has 1,000 workers, and an additional white-collar staff of 500, many of whom perform corporate duties that cover Hella Mexico's other factory, which makes electronic auto-parts in Guadalajara, in west-central Mexico.

Chief engineer Eric Monroy joined Hella Mexico five and a half years ago, shortly before the first robots arrived. "The plant then was about half the size it is now," he says. "The robots look just the same as they did when they first came." Still a young man, he sighs. "I'm the one who's getting older," he says.



Flexible robotics help pump out better bumpers – a new order every 90 seconds.

Bumper to bumper solution

> Bumpers have always been an important part of a car's character – from the earliest motorized carriages through the heavy-metal period to the current era of light, high-durability structural plastics. Riding this trend toward less steel and more plastics, Plastal has grown to become a leading supplier of surface-treated, injection-moulded plastic components to the European automotive industry. Its production plant in Gothenburg, Sweden, sequence-delivers bumper systems to Volvo Car's adjacent factory. Every 90 seconds Plastal receives a new set of specifications for a particular car. Eight hours later the completed bumper is delivered – fully painted and ready for mounting.

Plastal's first thermoplastic products were manufactured as early as 1940. Since then the company has evolved into a world-class supplier of exterior and interior modules for both trucks and cars. The factory in Gothenburg's Arendal area – previously internationally recognized as a state-of-the-art shipyard building 100,000-ton super tankers during the 1960s – was opened in 1998 when Volvo began manufacturing its S80 model there. Today, Volvo dominates Arendal, and its models V70, V70XC, S80 and XC90 require a daily production of approximately 2,000 front and rear bumpers. The bumpers are injection-moulded, masked, spray-painted, mounted and sequence-delivered according to a continuously generated schedule provided by an information system.

Plastal presently uses 18 ABB robots, 14 of which are paint spray units, in its Arendal plant. At the beginning of 2004, two additional robots were installed in a joint cell supplied by Animex, the plastics automation production specialists. The larger robot serves the injection-moulding machine and maneuvers the bumpers into positions that allow the smaller robot to reach and trim off excess plastic.

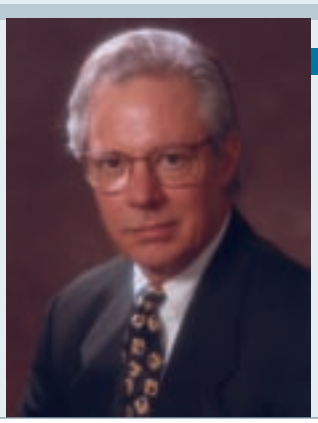
"Previously we used dedicated single-task fixtures to trim parts after moulding," says Emil Arnesson, Plastal's head of molding production technology. "But now, with these more flexible robots, it's easy to implement program changes when a model is altered or a new version is introduced. We save both time and money, compared with buying a brand new trimming fixture. Together with Animex, we've created a team that ensures smooth handling of the new versions that regularly appear. This allows us to maintain top levels of competence and competitiveness."

>FACTS

Plastal AB

Gothenburg, Sweden production unit
Surface area: 20,000 square meters
Capacity: approximately 2,000 bumpers per day
Number of models: approximately 400
Number of employees: approximately 300

Plastics guru in the American heartland



>FACTS

Peter F. Bemis
Born: 1947 Sheboygan Falls, Wisconsin.
Education: BA from Carroll College in Science, Business Administration and Economics with minor concentrations in Philosophy.
Involved in plastics since 1970.
Father of three, he enjoys skiing, pheasant hunting, reading and his work.

Text: Dick Cadwalader

New plastic solutions from a century-old company founded by an early pioneer.

> A German immigrant named Von Kaas landed in the US in 1848. He soon settled in little Sheboygan Falls, Wisconsin. In the years following, his daughter wed Albert Bemis, the founder of what would become Bemis Manufacturing Company. Nestled in the American heartland, this pioneer built a business manufacturing wood furniture, small wagons, and toilet seats. What would he think if he could see the enterprise his grandsons, Peter and Dick, have built today? Certainly old Mr. Bemis would be fascinated – particularly by all the potential in the expanding universe of structural plastics.

Peter F. Bemis is the leader of one of America's premier plastics companies. His team achieves results with polymers that others only dream of. He serves as the executive vice president and Secretary of Bemis Manufacturing, as well as President of the Bemis Contract Group. This year, the company celebrated its 103rd anniversary. Back in 1964, the family-owned business began a strategic transition toward plastics with the introduction of a few injection-moulding machines. Today, the Bemis group includes divisions for contract manufacturing, health care products, toilet seats, and other products for OEMs.

Peter Bemis and the contract manufacturing team can really express their obvious talents for combining materials to meet customer needs and aesthetic requirements. The result – often after considerable experimentation – is likely to be a product that is more than the sum of its parts.

"The challenge in contract is to create new and exciting concepts, to bring plastics innovations to customers. We're looking for ways to create significant value. What technologies can be used to give them an edge over their competitors? For instance, we cooperate with John Deere on design and optimization issues, well in advance of production," Bemis says.

His team seeks to improve appearance, durability and modulus over competing materials such as aluminum or conventional thermoset alternatives. They also examine cheaper and faster production methods. "My team embraces the teachings of Edward Deming, who believed that 'quality is the essential corporate mission.' In fact you could call me a Deming zealot," he laughs.

The Bemis Contract Group addresses a range of segments: agriculture, automotive, golf/utility vehicle, heavy truck, large appliance, marine, material handling vehicle, medical, office furniture, personal power craft, recreational vehicle, and yard care. At first glance, several of these categories would seem to overlap. However, their logic is clear when one realizes it's just another way to meet customers on their own territory.

"Relocation to Asia is no guarantee of success. Products with more complex cycles are better done in the US," says Peter Bemis.

"Our key strategy is the co-injection moulding of engineering-grade thermoplastics," Peter Bemis explains. In simple terms this means two-barrel machines injecting two different plastic materials. As an example, Bemis could combine an exterior material for ultra-violet exposure with an inner material for sound and temperature insulation.

The list of injection technologies available at Bemis includes co-injection, over-moulding, two-shot/two-color, soft touch, insert, gas-assisted, endothermic foam core, rotating-die technology, in-mould decorating, 2-position or 2-component molding. Also, multi-drop gate sequencing, 3-plate stacking dies, collapsible cores, in-mould co-injection manifolds, low-pressure moulding, and exploding cores.

Peter Bemis is also convinced that Dow Chemical's isoplast-based Fulcrum (2) Continuous Glass Extrusion is a solution worthy of much more continued R & D. Bemis is the only North American contract extruder license holder for this thermoplastic pultrusion method that uses continuous strands of glass reinforcement.

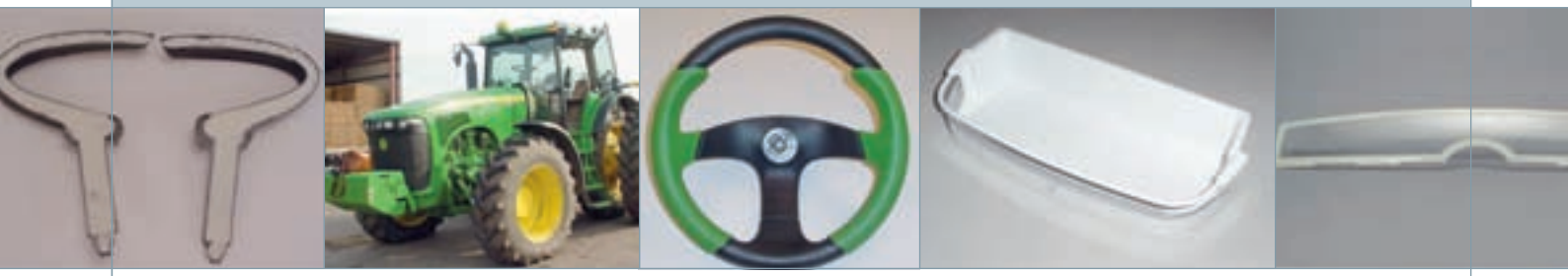
It is said to rival the strength of aluminum with the same profile while yielding class-A surfaces – all in a recyclable product with a production rate 10 to 15 times faster than thermoset materials.

What was the most interesting challenge his team had to solve and how did you do it? "That would have been the development of a liquid color strategy for short production runs. Also, dealing with the continuously increasing requirements for weather durability for outdoor thermoplastics. We work with General Electric, DuPont, PolyOne and Bayer, among other companies, to meet the future 'Critical To Quality' (CTQ) requirements of our customers. With DuPont we're working with Reflections material for outdoor weatherable applications, like golf carts. We need to be able to compete with paint and we're making major strides in this area via DuPont and GE."

What does Peter Bemis see as the positive and negative trends impacting business today? "Were facing lots of challenging issues, like the escalating costs of raw materials going into plastics. Also, the flow of labor and tasks overseas, but I liken this to the Gold Rush – everyone hurried away with their shovels to find a pot of gold, but you don't hear about the ones coming back with their tails between their legs. Going to China today is no guarantee of success. Many are now finding it is more difficult than they imagined. There has always been a historical quest by industrial nations for cheaper labor, but labor actually represents a relatively small portion of manufacturing costs in many cases. There are products >

"We're facing lots of challenging issues, like the escalating costs of raw materials going into plastics. Also, the flow of labor and tasks overseas." **Peter F. Bemis**

Bemis manufactures a wide range of products from office chair arm rests and steering wheels to refrigerator interiors.



> that are probably good to have manufactured in Asia. But others with more complex product cycles are better done here. We need to continue to drive automation and technology that brings customer value on a global basis."

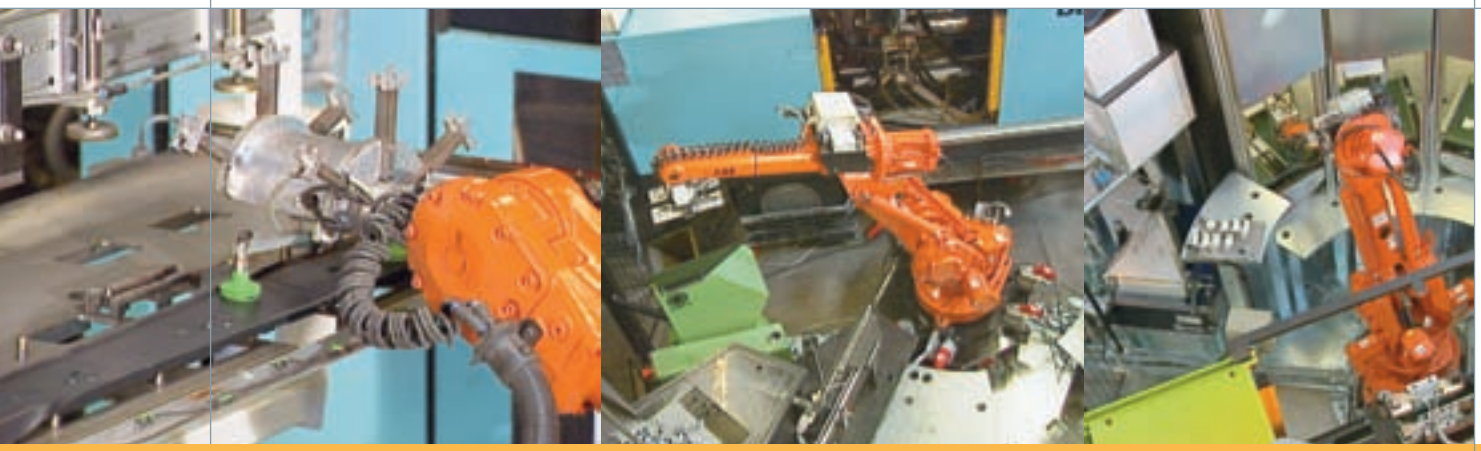
Another major direction at Bemis is the use of 6-axis robots. "People in plastics have not looked carefully at what a 6-axis robot is capable of in a production cell compared to conventional XYZ axis solutions," says Peter Bemis. "We're doing a job with Xenoy® plastics in our 6600 ton horizontal co-injection machine. It's the world's largest and can produce 27 kilogram parts with surface areas up to two square meters.

"This machine is tended by an ABB robot equipped with a 7th axis shuttle and a tool changer. The robot extracts the part from the mould to stack it in a nest, then it exchanges the gripper for a tool to remove the gate, and then changes back to its gripper to repeat the process again. It's precise and consistent and spares people from hot parts, heavy, tedious work and repetitive motion injuries, all of which yield major savings over time."

Thinking of all the segments the Bemis Contract Group serves one can sense a connection that goes beyond the obvious things-with-wheels-plus-boats description. "The common denominator joining the products we make for these OEMs is that they are all highly aesthetic and cosmetic items used in outdoor applications," Peter Bemis explains. "People of all sorts are moved by styling. We work with the industrial design community to make their dreams materialize. We combine their talents with engineering – and when it works well its usually a big commercial success."

He's right. Just check the look and feel of certain products, for instance the steering wheel for a John Deere tractor, or the futuristic mesh office chair. They are outstanding. Good design as good engineering – functional art that works both practically and emotionally. The soft contours of the steering wheel make you want to grab it and take control of the latest monster tractor. And the office chair invites you to ease down onto the web-like mesh.

The German philosopher Emmanuel Kant had an expression for this elusive quality: *Das Ding an sich* "The thing in itself." That's the genius of Peter Bemis and his team. Inherited perhaps from his immigrant great-great-grandfather?



Making the most of modules

Animex services the plastics industry, a market with high productivity requirements, where automation is a key factor.

> Animex AB constructs plants for robot-based plastics production – everything from handling raw materials to pre-packed components. Based in southern Sweden, Animex is an integrator with close to 20 years' experience operating on the Scandinavian market. It's a relatively small niche.

"But this means that our work is highly advanced. By automating the plastics industry we want to contribute to increased profitability for our customers," says Bernt Björkman, marketing manager for Animex in Bredaryd, Sweden. "We work on system solutions directly customized to suit customers' production needs."

The company bases its operations around three areas – peripheral equipment, system solutions and communications. The latter is a new area of investment that involves training in programming robots, team building and the interaction between humans and machines, via modern information technology.

X-flex is the name of the Animex module-based system for flexible automation. Each module contains a function, such as box changer, box lifter or pallet changer, among others.

When X-flex is used in a cell for injection moulding, six modules are placed in a semi-circle around an ABB robot.

"The modules dock with the robot, and air or electricity are connected using automatic couplings. Each module also has a network path for personal protection," explains Björkman.

The modules are easily moved between the various production cells to increase flexibility. In total, Animex will be developing some 30 modules, which will provide hundreds of thousands of combinations when a production cell is to be constructed.

"It only takes a few minutes to change all six modules in a cell," says Björkman.

When a robot-based plant is commissioned, Animex >

>FACTS

Animex AB

Animex AB, Sweden, founded in 1985, stocks, sells and serves a wide program of peripheral equipment to the plastics industry, in standard or customized design, including everything from handling raw materials to prepacked components.

Hands-free production

AD-Plast in Anderstorp, the whole chain from manufacturing and assembly to packaging is never touched by human hand. This is about automation at a high level.

> AD-Plast injection-moulds plastic components for the automotive and electronics industries, for household and other products. When Michael Jonsson took control of the company in 1994, he had a vision of how production could be automated, but two years passed before conversion work could start.

"We began by investing in a few basic portal robots designed for packaging. I soon realized that the possibilities were considerably greater," he says.

Today, AD-Plast has four 6-axis ABB robots working on its production lines. The latest and most advanced plant was commissioned in September 2003.

The new latest robot plant is the result of a partnership with Animex.

"We have been working together for many years on a variety of projects to do with rationalizing of our production methods. When Animex contacted ABB, the outcome was a foregone conclusion," says Jonsson, and the project started in January, 2003.

AD-Plast planned to automate the entire chain from manufacturing and assembly to packaging of a coupling for a cooling system for the automotive industry.

"The aim was for the whole production process to be completed without the touch of human hand. Looking back, we have succeeded," he says.

The robot grips the injection moulded component, mounts an o-ring, conducts a pressure test and carries out an inspection and measurement, using six vision cameras. The robot then packages the finished product. Jonsson believes the new plant has achieved the ultimate solution. Production can run all day long. Operational reliability is high and monotonous work duties are a distant memory. Quality and costs are also factored in.

"Automation for us is a must to maintain competitiveness," says Jonsson.

> believes it is important to provide in-depth knowledge on functionality and usage to the workforce.

"Understanding the new technology is vital. We have identified a loophole between the technicians and the users, which we intend to plug," says Björkman.

A thorough needs-analysis is first conducted, followed by design work of the plant, where components and suppliers are coordinated. Along with rational production methods, simple usage and safety are a key focus.

"We always handle this in project form. A wide variety of skills is required for the automation to be successful. We assume responsibility for the entire chain up to the turnkey hand-over of the plant," he says.

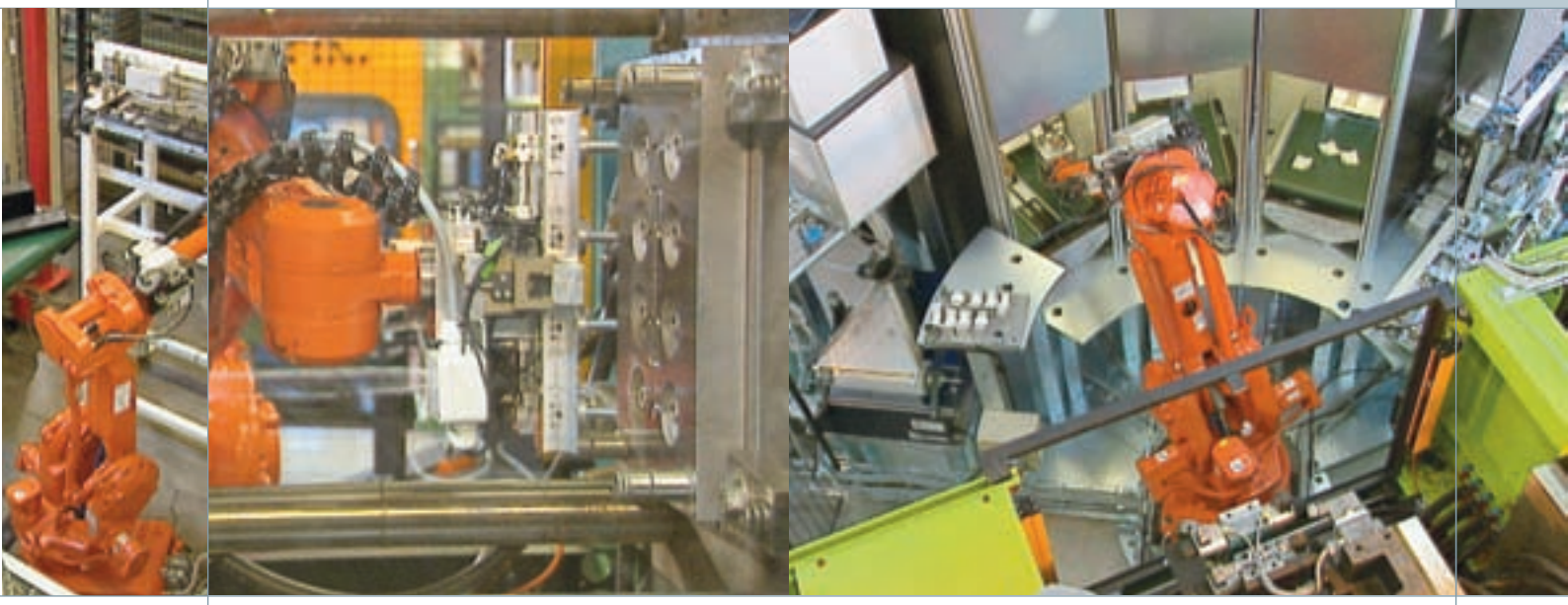
Animex works with all the leading manufacturers and suppliers of peripheral equipment. Having its own stock of standard components means a high level of availability and quick deliveries and ABB Robotics is an important partner.

"We operate as their extended arm to the plastics industry," says Björkman. "It is a partnership that has evolved in recent years. We have extensive know-how of the needs of the plastics industry and ABB has robot specialists. This makes a total solution, for the benefit of our customers."

>FACTS

AD-Plast AB

AD-Plast AB, Sweden, founded in 1963 is a manufacturer of robot cells. It employs 24 staff and has sales of around USD 6.5 milion.



Text: Julia Marshall

Wheel out the boards

Holmgrens Plast is involved in injection moulding different types of plastic products, including construction of child trolley-boards that snap onto the back of strollers – a product the global market can't get enough of.

> Holmgrens Plast manufactures two types of 'boards' for its customer Lascal: the KiddyBoard and the BuggyBoard. The boards attach to the rear of a pram or stroller and are best described as platforms on wheels, used for transporting older children behind younger ones.

Since their introduction in 1999, the boards have been in great demand in more than 20 countries, with every board produced already sold before it makes it off the production line.

In 2001, to help Holmgrens keep up with the demand, three ABB 6-axis portable robots were introduced into the production to supplement the existing 3-axis robots, says Kenneth Klint, production manager at Holmgrens Plast in Småland, in the south of Sweden.

The installation of the 6-axis robots has had far-reaching effects on the company. "We have become more technical," he says. "We have learned how to be more efficient and it has saved us a lot of money.

"Our investment in three 6-axis robot cells saves the wages of about 12 people each year," he says. "At the same time we have increased production by 100 percent, so we employ the people doing other things which are more interesting for them. It was quite a boring job, and the quality is also a lot higher than it was with manual sampling. The robot does the same thing every time." Holmgrens Plast has also improved its relations with Lascal as a result. "Our customer feels a lot safer. We feel a lot safer. They feel that production is under control," says Klint.

Since investing in the 6-axis robots, the only challenge for Holmgrens Plast has been the degree of education in programming required to operate it, but Klint says ABB is working with Holmgrens Plast to make the programming language easier to understand. Holmgrens Plast works with Animex (see story page 12) to customize its production, including plans for an improved product.

"We are now looking at the next type of robot cell to help us make the next generation of plates for trolleys going into production later this year," says Klint. "We are working with Animex on a solution."

The 3-axis robots and 6-axis robots work together, handing over the plate and assembling each trolley. The next investment will be in using robots for cutting out and packing the trolleys.

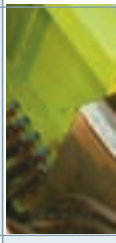
"We are now making 250,000 trolleys a year and that's as much as we can produce. Every plate coming off our production line is a sold one so we are trying to speed up capacity by 100 percent. And our customer tells us he will be able to sell them all."

>FACTS

Holmgrens Plast

Holmgrens Plast, founded in 1989, is an injection moulding company with 28 employees and sales of around USD 6.8 million.

The best-selling "BuggyBoard".



Program allows for **easy painting**

With a Paint PowerPac, it's easy to program a robot for any number of painting applications.

> RobotStudio is an offline programming system that allows users to create an exact virtual copy of a real ABB robotics system. Users can download programs from the system to the real robot without any post-processing or filtering of the robot programs. RobotStudio uses ABB VirtualRobot Technology, meaning the actual robot system software controls the robot simulation. Using VirtualRobot Technology assures that programs are accurate and ready to go once they've been programmed in RobotStudio.

PowerPacs are "plug ins" for RobotStudio to optimize the system for specific applications. PowerPacs are available for many applications – welding and cutting, for example – as well as applications particularly useful for the plastics industry, such as painting. The Paint PowerPac is a tool for programming of painting applications that will dramatically reduce installation and programming time since programming and installation of new robots can be performed offline without disturbing production.

With Paint PowerPac, program weaknesses such as singularity and speed deviations can be discovered before production start-up. Paint PowerPac opens up new possibilities for robotized painting applications. Cycle times and robot positions can be tested at an early stage instead of after installation. With Paint PowerPac you can do a virtual test to see if new parts can be produced on the existing line without having to do extensive and expensive programming and checking and adjusting.

The Paint PowerPac is easy and intuitive to use. Program positions can be easily modified by jogging in the graphic window, or by offsetting by a specific value. You can modify positions in any defined work object coordinate system, such as world or tool. Paint event positions for brush changes and paint triggers are also displayed in the graphic window. Each brush is identified by a unique color. The paint event positions can be adjusted directly by "dragging" and "placing" them on the screen.

Setting up the atomizer is also easy. Parameter values are organized into brush tables. The table wizard offers full brush editor functionality making it simple and easy to set up and edit the spray pattern of the automizer.

The color change editor makes it simple to create and edit color change sequences. Rapid code is generated automatically by working with the timing diagram.

Conveyor tracking is a function allowing the robot to automatically follow a work object that is defined on a moving conveyor. While tracking the conveyor, the robot will maintain the programmed tool center point (TCP) speed relative to the work object. Thanks to VirtualRobot Technology the conveyor tracking in RobotStudio behaves exactly as in the real controller.

In addition to all this, paint instructions in the robot program, such as Use-BrushTab, PaintL, PaintC and Set-Brush, are supported to give the programmer full control over the painting process.

In short, the new RobotStudio PowerPac can be used for controlling the full range of features of the paint process.

>FACTS

RobotStudio PowerPac includes functions such as:

- **Graphic creation and editing of paint events and positions for controlling the paint strokes**
- **Creating and editing of brush tables used for defining and optimizing spray patterns**
- **Creating and editing of color change sequences**
- **Conveyor tracking, simulation and programming**
- **Execution of special painting-related instructions**

The best robot controller is flexible, easy to use and easy to program.

Gain control over robot control

> The IRC5 controller sets new standards in user-friendly robot control with its modular concept, a completely new ergonomically-designed Windows interface unit, and fully coordinated multiple robot control through the MultiMove function.

When it comes to modularity, the IRC5 has a logical split of functions into control, axis drives and process. Each module can be housed in its own cabinet with identical footprints so they may be stacked for minimal floor occupancy or distributed up to 75 meters.

The hub of the IRC5 is the control module that performs all the control functions and path calculations for up to four 6-axis robots plus additional axes such as work positioners, with a total maximum of 36 axes. The drive module controls the position and speed of up to 9 servo axes, and the servo drive cards. Up to four drive modules can be linked to the main control module to drive up to four robots and additional axes, which is the basis for MultiMove applications. The process module has the same communications and interface arrangements as the control module, and an identical footprint, and therefore is linked in the same way to the control module.

In terms of user friendliness, a key element is the FlexPendant interface unit. The FlexPendant has only eight 'hard' fast-access buttons, four of which are fixed and four assignable, plus a unique ABB 3-way joystick for intuitive jogging of the robot, and an emergency stop.

FlexPendant software uses the Windows CE.NET operating system. The layout is identical to any Windows page on a PC and rather than being language-based, uses readily recognizable icons that are 'clickable' by finger on a full-color touch screen. One of many advantages of using Windows CE is that the system is open, and the screen can be easily adapted to new industries and languages. Plus, new RobotWare Plastics has adapted software specifically for operator handling and programming for the plastics industry (see picture above).

Another key element of the IRC5 is the MultiMove functionality, which enables the coordinated operation of up to four robots in a cell. All four robots and additional devices in an IRC5 cell may operate totally independently, totally coordinated, or semi-coordinated.

The coordinated operation of the robots and additional devices greatly expands the benefit of automation. An example is balanced operation with two or more robots working on the same workpiece. Multiple robot handling of flimsy workpieces is another potential, as is the ability to lift loads larger than the capacity of a single robot. For example, when one robot is unloading a bumper from an injection moulding machine, a second robot performs sprue cutting, clips assembly and vision inspection. The

coordinated movements reduce the overall cycletime while at the same time avoiding collisions between the two robots.

Using one robot as the workpiece handler and others to wield process tools, opens up a whole 'new world' of applications and benefits – for example, while one robot holds and rotates a part, another facing robot dispenses a gluing bead. The part handling robot becomes a flexible fixture. Rapid start as soon as the part is picked up with no waiting for the part to be positioned is possible. There can be higher relative speeds between tooling and workpiece. And full access to all positions of a part allow a process to be completed in one handling.

Better product quality is a high potential benefit of MultiMove, by for example coordinating a workpiece handling robot with one or more process robots, helping to simplify and reduce tooling and fixturing. For instance, a gantry and an arm-type robot can work together from one controller.

This can also reduce cycle time as the time to place the workpiece in the fixture has been eliminated and the process robots may be able to start their operations as soon as the part is picked.

@ More information about IRC5 can be found at www.abb.com/robotcontroller.

Keeping a grip in the constantly shifting terrain of plastics

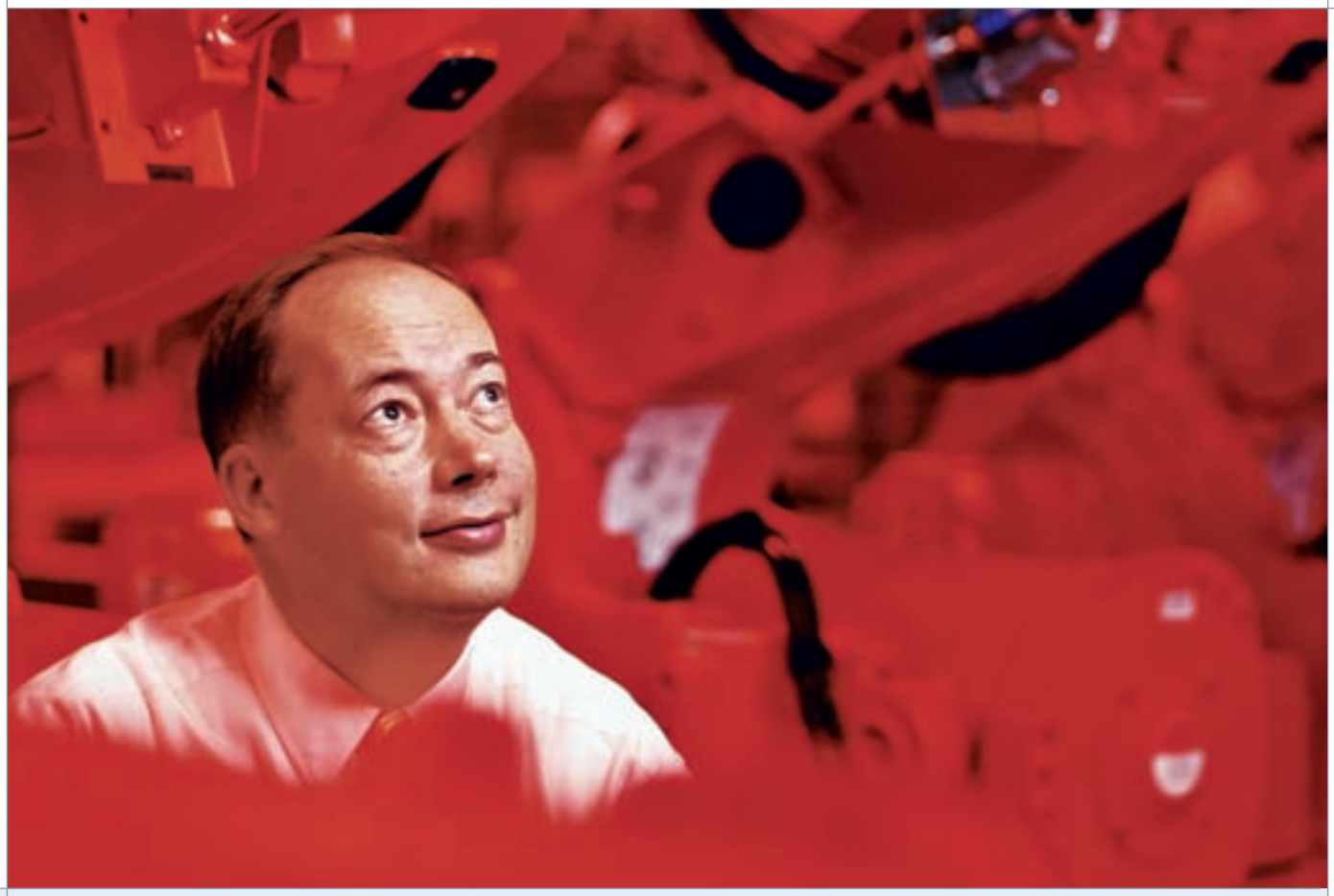


Photo: Kjell B. Persson

No matter the industrial sector or the size of the company, the pressure is on to automate, says Tore Lindström, segment manager for the Plastics unit of ABB Automation Technology. And with product lead times getting shorter, flexible solutions are key. Reporter Dick Cadwalader asked Lindström for his views on the trends in the industry, and where ABB fits in.

> To many in the plastics industry ABB might be seen as a new player. What can you say about the company's ability to serve the increasingly specialized needs of today's plastics producers?

– Our robotics business area serves five industry segments: metal fabrication, automotive, consumer industry, foundry and, recently, plastics, our newest segment. We already have more than 10,000 robots working in plastics. Most of these fall into the categories of painting, injection moulding of automotive and electronics components, blow moulding, gluing and dispensing. Plastics automation is clearly a growth area, and we aim to serve it well by further evolving our offering from standard products toward more customized solutions and software.

Give us some examples of this.

– We're improving the operator interfaces for our robots working on injection-moulding machines by simplifying the man-machine communication to make it easier for non-specialized personnel to operate and program our robots. In short, our robots are becoming operator-friendly. We also have software features such as our TrueMove and QuickMove that, through our

Dynamic model, allow for much shorter programming time and better quality. This is especially important, as downstream automation is becoming more and more crucial.

The plastics industry is highly globalized, and at the same time it is highly localized. Where does ABB fit into this dynamic?

– Our customer base reflects the diversity that typifies plastics. At one extreme, we meet customers in small shops – 10 to 20 employees and about 10 moulding machines. At the other, we meet very large customers, such as those supplying the automotive and telecom industries. The unifying factor – regardless of region, size or specialization – is that they all feel the pressure to automate. A big driver is the fact that product life cycles are increasingly short. This, in turn, drives the need for flexibility.

Define flexibility for someone in plastics.

– Flexibility is the ability to produce diverse parts with the same equipment. Greater flexibility also means moving toward more cells run by 6-axis robots and moving away from the fixed path of traditionally linear production. Ultimately, flexibility is all about software, which is one of our core strengths.

From the standpoint of production-flow planning, flexible multitasking within cells can speed overall line efficiency while also creating possibilities for clever production solutions when shifting to new products.

Flexibility means intricate and time-consuming reconfiguration. How can ABB help this process?

– We're particularly focused on making it easier to program, control and operate. We're bringing to robotics what Apple brought to personal computers – user-friendliness. All our man-machine interfaces are designed to be strongly visual, with good interactivity and feedback on what's happening. Just this year we launched our new Industrial Robot Controller, the IRC 5. It features a highly visual Teaching Pendant with a color touch-screen where even untrained users can quickly make modifications to various applications. IRC 5 also supports what we call MultiMove. This is the ability to coordinate the complex movement of two robots working together. For instance, while one robot holds and rotates a part, another facing robot dispenses a gluing bead. IRC 5 can also run four robots simultaneously, which reduces space and equipment requirements.

What about the planning stage? What happens when the specifications for a new part arrive?

– Our RobotStudio tools for offline simulation are incredible aids and time savers. They perform full-scale, off-line programming of all robot activity within a given cell. When you're finished, just plug in the program and let it run. We offer PowerPacks to simplify various applications, including cutting and painting, with additional PowerPacks to come.

Injection moulding is big and getting bigger. How are you serving this expanding horizon?

– Our robots can be ordered preconfigured for communication between the robot and the injection-moulding machine. We work with both SPI and all Euromap protocols and provide a line of robots that integrate well with machines generating 50 to 5,000 tons of clamp force. For machines of 1,000 tons and up, we also offer solutions with shelf-mounted robots situated on top of the molding machine for optimal parts handling.

How does more automation affect quality?

– Present quality requirements for injection moulding might typically accept only about 50 ppm or less in waste, which is a ratio that can only be achieved with the best automation. To help support this process we've developed advanced vision systems for in-process quality control. The Dynamic model I mentioned previously also comes into play here. Our RobotWare Dispense, a software for dispensing and gluing applications utilizes the Dynamic model's optimal track to create a consistent bead by matching glue flow with robot speed for perfect bead consistency. This naturally saves money for customers in terms of programming time and waste reduction.

What can you say about personal contact, particularly within Service and Support?

– No problem. With perhaps the world's most highly developed global automation network, we can support our partners well – anywhere.

Describe ABB's future strategy for the plastics industry.

– We can say already that we no longer simply sell robot models. Instead, we see ourselves as part of an integrated feedback loop. This loop is fuelled by market input and the ability of our talented R&D teams to deliver useful solutions that respond to the constantly shifting terrain of plastics. We have a global network of equipment manufacturers and system integrators, as well as our own ABB system houses that work together in finding the right solutions for the plastics industry. The future will bring even more integration between our systems and those created by the machine builders. We'll see more integration of interfaces, faster installation, easier programming and features bringing shorter cycle times – all bringing more added value to customers' products.

A quest for perfection

Automated production lines with robots for manufacturing fabric-covered interior components at Johnson Controls.

> At the Johnson Controls plant in Wuppertal, Germany, the pillar trims for the new Opel Astra compact car are being manufactured on fully automated, injection-molding production lines. The fabric covering of the trim components is cut using a laser robot supplied by Robot-Technology and an ABB IRB 4400 robot, which is responsible for the ultrasonic trimming process.

The new Opel Astra is characterized by its excellent driving dynamics and progressive design. But the designers of the new generation of Astras were not only concerned with the car's external appearance. Their aim was also to ensure that the interior trim would reinforce the high-quality image of the Opel brand.

Opel commissioned Johnson Controls, one of the world's leading automotive interiors companies, to design the interior of the car. Johnson Controls developed the entire seating system, the instrument panel, the roof trim and the door and pillar trims for the Astra interior project.

The pillar trims are injection molded by Johnson Controls at their Wuppertal plant using robot-based production lines. Neureder AG, which specializes in automated systems for manufacturing plastic components, was the general contractor for the construction of the four highly automated, injection-molding production lines, which use an in-mold fabric backing process.

The production lines produce the trim for the A, B and C pillars of the three-door, five-door and estate models. The three lines, which are already in volume production, are identical, with the exception of the A pillar line, which has no laser. The lines consist of an injection-molding machine, a longitudinal pick-and-place robot to load and unload the machine, an enclosed laser cutting cell with a laser robot, a 6-axis robot for material handling, another industrial robot for ultrasonic trimming and a conveyor belt to remove the completed trim components and waste fabric. The fourth production line, which will be producing pillar trims for the Astra also has a laser cutting cell.

The injection-molding systems supplied by Krauss-Maffei Kunststofftechnik GmbH have injection-molding machines with the Decoform package, which use oversize

plates for back-injecting the trim components. The production cells use a fully automated in-line process. A linear system from Wittmann, removes the plastic components from the mold and at the same time brings the textile blanks from a rack for the next molding cycle. After removing the trim components from the mold, the pick-and-place robot takes them to the laser cutting cell and puts them on a turntable fixture.

The turntable moves the components into the cell, where they are cut by a Robocut A 300 laser robot, developed by Robot-Technology GmbH. The laser robot is based on an ABB IRB 4400 robot. The CO2 laser has an inherently stable laser housing with axes 4 and 5, which replace the standard main axes of the robot.

Axes 4 and 5 can rotate through 360 degrees. As a result the components do not have to be rotated or put down during the cutting process, which allows them to be cut at a high speed. "The cutting operations follow the pace of the injection-molding cycle," explains Reiner von Prondzinski, project manager for injection molding at the Wuppertal plant. Other benefits of the laser robot include high levels of component accessibility, high acceleration and an integrated gas-supply process.

The Robocut A 300 cuts the excess fabric off two components at once (the left-hand and right-hand pillar trims are always processed in pairs) and then cuts out the hole for the seat belt, including the slots that will be edge-folded in the following application. "We have divided up the cutting jobs," says von Prondzinski. "All the visible parts are cut using ultrasonic. The invisible parts, which make up the majority of the B and C pillars, are cut with lasers to fit in with the production cycle."

Johnson Controls has to meet high processing-quality standards. "The decisive factor is production-ready precision cutting. The cuts on each component must be of consistently high quality," explains Karsten Spohn, project manager at Robot-Technology. The accuracy of the robots is particularly important in this respect. "The parts are fixed in place. During the laser cutting and the ultrasonic cutting, the robots move the cutting components past the parts," adds von Prondzinski.

Once the laser cutting stage is completed, the parts are removed from the cutting cell and an ABB IRB 4400 robot puts them in an ultrasonic cutting machine. The robot has a multi-grip, which allows it to remove the waste material at the same time and place it on the conveyor belt. In the subsequent production cell, an IRB 4400 with an ultrasonic cutting head cuts and edge-folds the trim components. The robot then removes the finished parts and puts them on the conveyor belt, which transports them to the final assembly area.

The production-line design allowed Johnson Controls to produce ready-assembled parts using a fully automated process in a relatively small area of its Wuppertal plant and to dispatch them with minimal buffering. The in-line process guarantees an optimum throughput time and high cutting quality. According to Krauss-Maffei Kunststofftechnik, the production line has the highest level of automation currently available for this type of application.

>FACTS

Johnson Controls

Professor Warren Johnson founded the company to manufacture his invention, the electric room thermostat . Since its start in 1885, Johnson Controls has grown into a multi-billion dollar corporation, with worldwide leadership in two businesses: automotive systems and building controls.
It has headquarters in Milwaukee, Wisconsin USA.



The ultimate solution

Plastics manufacturer in-step with move to fully automated production.

> A technology partnership between Kettering-based Hi-Tech Automation and ABB has led to the development of two state-of-the-art automated manufacturing cells for the East Yorkshire, England, operations of McKechnie Plastic Components, situated in Stamford Bridge. The two cells, commissioned in April this year, manufacture flagship products for Scholl Foot Care, a division of SSL International PLC.

In 2003, SSL invited McKechnie Plastic Components, which had a long history of investing in automation technology, to bid for the design, development and manufacture of two new types of foot file.

Crucial elements For the bid to be successful, McKechnie had to consider two crucial elements: a design that would eliminate risk of the product's metal foil insert being displaced during continued use and an extremely competitive unit price.

The first element was achieved when McKechnie developing a process whereby the periphery of the metal insert could be encapsulated during injection moulding.

To fulfill the second element, McKechnie needed to consider implementing a new automated manufacturing procedure, which, within tight budgetary acquisition constraints, was capable of ramping up efficiency while, at the same time, slashing manual labor costs, reducing waste and handling product throughput in a hygienic manner.

Having worked previously with ABB with surface finishing robots, McKechnie's automation manager, Allen Clovis, approached ABB Senior Account Manager Colin Jakes about the project and how the necessary automation could be implemented. ABB has a wealth of expertise in the field, having already supplied some 10,000 robots to the plastics industry.

Jakes enlisted one of ABB's preferred partners in the plastics industry, integrator Hi-Tech Automation, along with its co-founder, Gary Probert. The team had already worked together on another successful project for McKechnie, developing an automated cell for the transfer and packaging of plastic cases for razor-blade cartridges. This project was one of the first that allied a Sytrama beam robot with an ABB 6-axis robot on the same application.

For the new Scholl product cells, Probert and his team at Hi-Tech Automation, working closely with the McKechnie and ABB people, devised a fully automated solution that eventually met all customer requirements and eliminated the need for human intervention at any stage of the product cycle.

"The new process threw up considerable mechanical design and positioning problems for us, although through intense development work by our engineers, backed up by close liaison with both McKechnie's automation department and ABB, effective solutions have been found," Probert says.

The two cells, adjacent to one another at the East Yorkshire plant, are each dedicated to a single product. One cell manufactures products incorporating an abrasive coated pad, while the other cell manufactures a similar product incorporating the metal foil insert.

Hi-Tech opted for the configuration already used on the razor-blade case application, integrating a Sytrama beam robot for carrying out loading and unloading

requirements for the injection moulding operation and an ABB IRB1400 6-axis robot for downstream distribution of the product.

Since the foundation of Hi-Tech Automation in 1996, Probert has incorporated countless beam robots into his customers' production lines, but he is increasingly looking at 6-axis robots as a solution to flexibility requirements in the production of high-volume products. 6-axis robots are ideal for complex injection moulding jobs where cycle times have been reduced and post-moulding processes need to be performed rapidly — a task particularly suited to a fast and flexible robot. 6-axis robots can be quickly adapted to different applications and product design variants and can be used for a range of tasks from insert loading to assembly and packaging.

As well as the beam robot, 6-axis robot and injection moulding machinery, each cell also incorporates a bulk feed point for the inserts, a robot-to-robot transfer station, ultrasonic welding equipment and an out-feed conveyor.

Even though each cell is currently undergoing two to three months integration before being expected to realize optimum cycle time, system malfunctions are now minimal.

Says Allen Clovis: "To compete, we have to provide a superior product design and then automate, however complex or difficult that might be. To this end, the Scholl project has been a real team effort… The innovative product design and pro-automation culture within McKechnie was a driving force, ably complemented by the 'can-do' efforts of Hi-Tech Automation and its technology partner ABB. All participants have worked long and hard to bring a technically demanding application to a successful conclusion."

>FACTS

Hi-Tech Automation

Hi-Tech Automation was formed in 1996. The company specializes in automated solutions tailor-made for any mainstream make of beam or floor mount robot. Hi-Tech Automation focuses on customer support and well-designed solutions. Nearly 15 percent of the turnover comes from places as far away as India and Brazil.

From foil to car panel

Lear Corporation has become masterful at producing car panels in designs that attract buyers.




> The instrument panel is an important factor in determining a buyer's impression of a car, and consequently car manufacturers devote much attention to this detail. Some extra space, a smart coffee-cup holder or the "right" color can influence a buyer's decision.

Lear Corporation in Tidaholm, Sweden, has been a supplier to the automotive industry for more than 100 years. Every year, it manufactures some 250,000 instrument panels, with Volvo and Saab its biggest clients.

Lear's production is very much based on a combination of operator know-how, a solid awareness of quality and the latest in robotics. Robots and machines take care of the fine details and difficult tasks that are often heavy and hazardous, while operators are in charge of supply, control and inspection. Lear uses robots at every stage of production, from ultrasonic cutting, foil gluing and polyurethane foaming to milling of finished panels.

"We use ABB robots for our applications," says Anders Freding, engineering manager at Lear in Tidaholm. "We program the robots off-line. This allows us to perform simulations already at the project stage. Then, when we get the robots, we can start production fairly quickly."

The surface layer of the instrument panels is durable TPO (thermoplastic elastomer polyolefin) foil, which can be tricky to work with in the manufacturing process.

The production starts with the vacuum-forming of the foil. The foil, which is delivered in rolls, is heated to around 160 degrees Celsius and is drawn over a positive molding tool. The foil is then cooled by air, and the machine produces a finished vacuum-molded piece of foil.

"We used to die cut the molded surface, but there was a problem with smearing foil and rough sections," Freding says.

To eliminate the problem, Lear switched to an ABB robot equipped with an ultrasonic knife, which cuts the piece instead of stamping it out via a die-cut. "We have removed a major reason for scrapping, which has resulted in considerable savings," says Freding.

With ultrasonic cutting, complicated precision cuts in the material can be made with great exactitude – there is a tolerance of a few tenths of a millimeter.

"This technology is superior to laser, hot knives and such," says Freding. "There is no smoke, and the foil does not smear. Depending on complexity and type of material, we can choose different types of knives and vary the motions that are generated by the booster."

The next step in the process joins the lower foil to the upper foil. "Here it is important that the surfaces that are to be joined meet in the right way. We use robots to distribute the hotmelt that seals the partition line between the two foil pieces," says Freding.

At the next stage the panel is "foamed." In this process a 20-year-old ASEA robot, equipped with a mixing head, is used. When the foil has been positioned in the tool, the robot distributes the foam following a specific path that allows for even distribution across the entire foil.

After the foaming, two robots are used in parallel to drill holes in the panel and cut out undesirable surfaces. "One problem in this context is that milling is dirty and produces both dust particles and chips," says Freding. "Therefore the robots are placed in a well-sealed room."

The manufacturing process ends with assembly, at which time the panel is equipped with, among other things, channels for air distribution, different consoles and knee protection for the driver. Finally, operators make a visual inspection to ensure that each panel is intact, without any marks or traces of chips, burrs or dust. After this, the panels are packaged for delivery to customers.

>FACTS

Lear Corporation in Tidaholm, Sweden, is part of Lear Corporation Interior System Division Europe, one of the world's largest manufacturing groups for automotive interior components. The Tidaholm plant employs around 400 employees and produces instrument panels, door sides and glove box doors for cars.

ABB Taiwan sales manager Kimbal Lu and Cheng Yu-li, general manager of San Li, are both satisfied with increased business in notebook production.

In Taiwan, the growing laptop industry has proved a boom for San Li.

Laptop painting robot-style

> Riding on the tide of Taiwan's expanding and world-leading notebook output is a win-win partnership between ABB and San Li, a Taiwanese company doing laptop painting.

San Li was the first specialized painting company in Taiwan to use ABB's robots in notebook-case spraying in 1996. This strategic procurement decision helped grow the Taiwan company's market share for notebook coating from 25 percent in 1998 to 30 percent two years later — and to about 31 percent in 2003.

In expectation of Taiwan's robust notebook production and robot spraying orders, San Li signed an agreement with ABB in early 2004 to buy 24 painting robots, the single biggest order in ABB's history. Upon full installation by the end of 2004, San Li is expected to supply more than 40 percent of the world market for plastic casings for notebooks.

San Li's 1996 pioneer purchase of ABB robots helped ABB to open up its Taiwan business. San Li's success further helped build ABB's reputation in the worldwide notebook industry, against competition from Japanese rivals. Now, the use of ABB robots has become a standard specification by computer manufacturers.

Cheng Yu-li, general manager of San Li, attributes his company's success to ABB robots' technical strength and to the full support from ABB engineers in Taiwan since the very first order in 1996. At that time, some 10 companies in the field were bigger than San Li. And San Li, with only 20 percent of its production line automated, had to search for ways to cut costs in every possible area, including labor and materials, in order to compete.

Cheng says that using ABB robots made his company more competitive than other Taiwan conventional painting because the company was able to cut paint costs by up to 30 percent, and it had brand name support. "Many clients, knowing we use ABB equipment, feel greater assurance in giving us jobs that require robot spraying," he says.

Cheng characterizes the relationship between San Li and ABB as like brothers. "It's a partner relationship that, in my view, may never break," he says.

San Li's recent order of 24 robots will all be used for its three mainland China factories, which employ 10,000 workers, compared with only 600 now in Taiwan, who are mostly working in research and development. San Li's notebook production is expected to hit 1.55 million units a month for an annual production of 15 million laptops in 2005.