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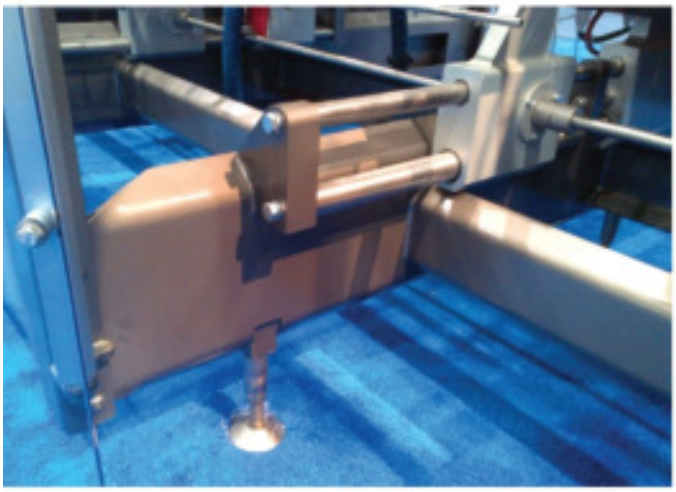
Cartoner Criteria

FLEXIBILITY ENSURES CARTONING SYSTEMS MEET TOMORROW'S NEEDS AS WELL AS TODAY'S.

BY HALLIE FORCINIO

Bradman Lake's IL250 three-flap top-load carton closer meters incoming cartons, squares flaps and applies hot melt to seal up to 250 cartons per minute.

Successful cartoning systems depend on attention to detail. "End users looking for cartoning equipment must first understand their needs and then match an equipment supplier to work with them to meet their needs," says Steve Stegora, western regional sales manager/marketing director at Langen Packaging Inc., Mississauga, Ont.



The hygienic design of the Langen C-1000H cartoner minimizes horizontal surfaces to prevent debris from collecting. The solid frame eliminates cavities that could harbor dirt and bacteria.

"There is no 'one size fits all' solution," says Nick Bishop, vice president sales and marketing at Bradman Lake Inc., Rock Hill, S.C.

"Make sure the cartoning system has the flexibility to meet current and future requirements," advises Scott Reed, vice president–sales, marketing and customer service at ADCO Manufacturing, Inc., Sanger, Calif. Factors to consider include carton size adjustability range, spare inputs/outputs, cabinet space, production speeds and surge rates.

Purchase criteria consider the product, the machine and vendor attributes. Selecting the right cartoner for the job, requires providing the original equipment manufacturer (OEM) with answers to the following questions, says Bishop.

- What are the characteristics of the product?
  - Is it cold, sticky, hot, wrapped or unwrapped, dusty, dry or wet?
  - Is it a regular, consistent shape or irregular?
- Where are the products prior to arriving at the cartoning system?
  - Freezer, oven or other process?
  - A previous packaging operation?
- Will the product arrive in rows, singulated or random orientation?
- How many products are to be loaded inside one carton?
- How much plant floor space can be devoted to this system?
  - Must it operate in close connection to another process?
- Is the cartoning process automated or is some degree of manual loading acceptable?
- How fast must products be cartoned?
- What is the budget for this machine?

Other factors include carton sizes and styles and electrical platform. Longevity also should be considered. "For example," says Stegora, "rental equipment may be adequate for a seasonal increase in volume." However, if the equipment is needed to address long-term, increasing demand, it makes sense to purchase a unit.

"High efficiency, quick changeover and durability will cost more up front, but will provide long-term payback

over the life of the machine," predicts Billy Goodman, managing director of CAMA USA Inc., Deerfield, Ill.

The needs assessment should be part of a User Requirements Specification (URS). "Having this document available to OEMs ensures all parties have a clear understanding of the cartoner requirements," explains Eric Langen, sales and marketing representative of AFA Systems Ltd., Brampton, Ont. "This document helps eliminate unforeseen surprises and makes sure the OEM has all the information required to ensure a successful project."

In return, "[m]ake sure that the cartoning system supplier provides a clear, written mechanical efficiency guarantee," says Reed of ADCO. The OEM also should validate changeover claims.

Finally, says Reed, "don't forget or underestimate the need for installation, startup and training. Make sure that you get an estimate for this work upfront and that you put it in your budget."

THE PRODUCT

The product and its environment help determine the packaging

10 GUIDING PRINCIPLES OF HYGIENIC DESIGN

Principle #1
Cleanable to a microbiological level
Food equipment must be constructed to ensure effective and efficient cleaning over the life of the equipment. The equipment should be designed to prevent bacterial ingress, survival, growth and reproduction on both product and non-product contact surfaces.

Principle #2
Made of compatible materials
Materials used on equipment must be completely compatible with the product, environment, cleaning and sanitizing chemicals and the methods of cleaning and sanitation.

Principle #3
Accessible for inspection, maintenance, cleaning and sanitation
All parts of the equipment shall be readily accessible for inspection, maintenance, cleaning and sanitation without the use of tools.

Principle #4
No product or liquid collection
Equipment should be self-draining to ensure that liquid, which can harbor and promote the growth of bacteria, does not accumulate, pool or condense on the equipment.

Principle #5
Hollow areas should be hermetically sealed
Hollow areas of equipment such as frames and rollers must be eliminated wherever possible or permanently sealed. Bolts, studs, mounting plates, brackets, junction boxes, nameplates, end caps, sleeves and other such items must be continuously welded to the surface not attached via drilled and tapped holes.

Principle #6
No niches
Equipment parts should be free of niches such as pits, cracks, corrosion, recesses, open seams, gaps, lap seams, protruding ledges, inside threads, bolt rivets and dead ends.

Principle #7
Sanitary operational performance
During normal operations, the equipment must perform so it does not contribute to unsanitary conditions or the harborage and growth of bacteria.

Principle #8
Hygienic design of maintenance enclosures
Maintenance enclosures and human machine interfaces such as push buttons, valve handles, switches and touchscreens, must be designed to ensure food product, water or product liquid does not penetrate or accumulate in and on the enclosure or interface. Also, the physical design of the enclosures should be sloped or pitched to prevent use as a storage area.

Principle #9
Hygienic compatibility with other plant systems
Equipment design must ensure hygienic compatibility with other equipment and systems, such as electrical, hydraulics, steam, air and water.

Principle #10
Validated cleaning and sanitizing protocols
Procedures for cleaning and sanitation must be clearly written, designed and proven effective and efficient. Chemicals recommended for cleaning and sanitation must be compatible with the equipment and the manufacturing environment.

(Source: ADCO Manufacturing, based on guidelines published by the American Meat Institute.)

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AFA's HD-LSP Heavy Duty Linear Servopack Cartoner runs more than 600 products per minute and features automatic 3D carton changeover.

material and influence the style of the machine: horizontal end-load, horizontal top-load (including three-flap or triseal), vertical, wraparound or combination.

Horizontal end-loading works best with uniform or solid products and situations where a carton holds multiple components, e.g., insert and bottle. End-load systems typically operate like the CH-2 automatic continuous-motion cartoner from Elliott Manufacturing, Fresno, Calif. The machine erects the carton and prepares flaps for loading. A pusher loads product through the end of the carton and retracts. Minor flaps are tucked, and major flaps are plowed shut. A compression station ensures a good seal.

Horizontal top-load systems load through the major panel and are commonly seen in the food industry for products like baked goods or frozen fish. Carton forming and closing operations may be integrated or performed on separate machines.

Vertical cartoners orient the carton with the narrow end up and are often rotary in design. Primary packaging applications typically involve filling free-flowing or granular product and related items like flavoring pouches or leaflets. For secondary packaging applications, the cartoner loads a rigid or flexible primary package into the carton.

Wraparound cartoners fold a flat blank around one or more bottles, cans, tubes or pouches, seal the side seam and tuck or seal the end flaps. Using the product as a mandrel to form the carton results in a tight pack, minimizes product shifting, requires less paperboard than traditional pre-glued cartons and can increase efficiency.

Combination equipment integrates multiple functions such as cartoning and case packing on one frame. With a single controller and operating system, combination machines save floor space, reduce wiring requirements and simplify installation and operation.

Whatever style machine is chosen, Reed of ADCO recommends, "[b]e sure to work closely with the cartoning system supplier to ensure the carton designs (material, flap designs, scoring, etc.) are optimized for machinability."

The product also governs hygienic requirements. Although standards vary, "basic levels of hygienic equipment designs span all facilities," says Stegora of Langen. Langen follows seven principles of hygienic design: fewer flat and horizontal surfaces with better water-shedding, minimal contact between components and sub-assemblies, modular assemblies, no hidden dust traps, easy-to-clean materials, simplified components and construction.

Reed recommends following 10 guiding principles published by the American Meat Institute (AMI), Washington, D.C. (See sidebar, pg. 10.) Noting that every application is different and various end users and standards organizations may not interpret hygienic needs the same way, he says, "[t]hese principles do an excellent job of objectively summing up some of the key items that end users should be looking for in cartoning systems [and] . . . provide a very good basis for review and decision-making."

Other environmental factors influencing cartoner selection include the number of shifts per day and utility infrastructure.

THE MACHINE

When selecting cartoning equipment, one of the first choices is whether the machine should be mechanical, pneumatic or servo. This decision is largely determined by speed requirements, budget and personnel expertise. "The more simple the machine, the easier it is to operate and

maintain," says Justin Kirkpatrick, export sales manager at Econocorp, Inc., Randolph, Mass.

Cartoning speeds range from a low of 0 to 60 cartons per minute (cpm) to a high of 500 to 2,000 cpm and should allow for surge conditions.

Pneumatic cartoners are cost-effective for slower applications (25 to 30 cpm), but are subject to differing air pressures and tend to involve higher maintenance costs. However, "[i]f mechanics have never worked with servo systems or don't have great mechanical aptitude, then pneumatic is the way to go because it is the easiest to troubleshoot," says Kirkpatrick.

"Mechanical machines are more effective in situations where speeds are 200 cpm or less, [there's a] limited number of carton sizes and price is a major determining factor," says Bill Bronander, president of Scandia Packaging Machinery Co., Fairfield, N.J.

He predicts wider use of servos on cartoners as the cost of the technology declines. He notes, "Servo cartoners are best suited for applications where the speeds exceed 200 cpm, where there are multiple carton sizes, where changeovers can be 'menu'-selected and also where there are limited mechanical maintenance staff."

Other cartoner selection criteria include flexibility, safety/ergonomics and ease of integration, operation and maintenance. Flexible machines handle a range of carton sizes, materials and formats such as tuck-and-glue flap and reconfigure easily as products and packaging change. Flexibility depends on the choice of mechanical, servo and/or pneumatic components, modular design and control and networking features.

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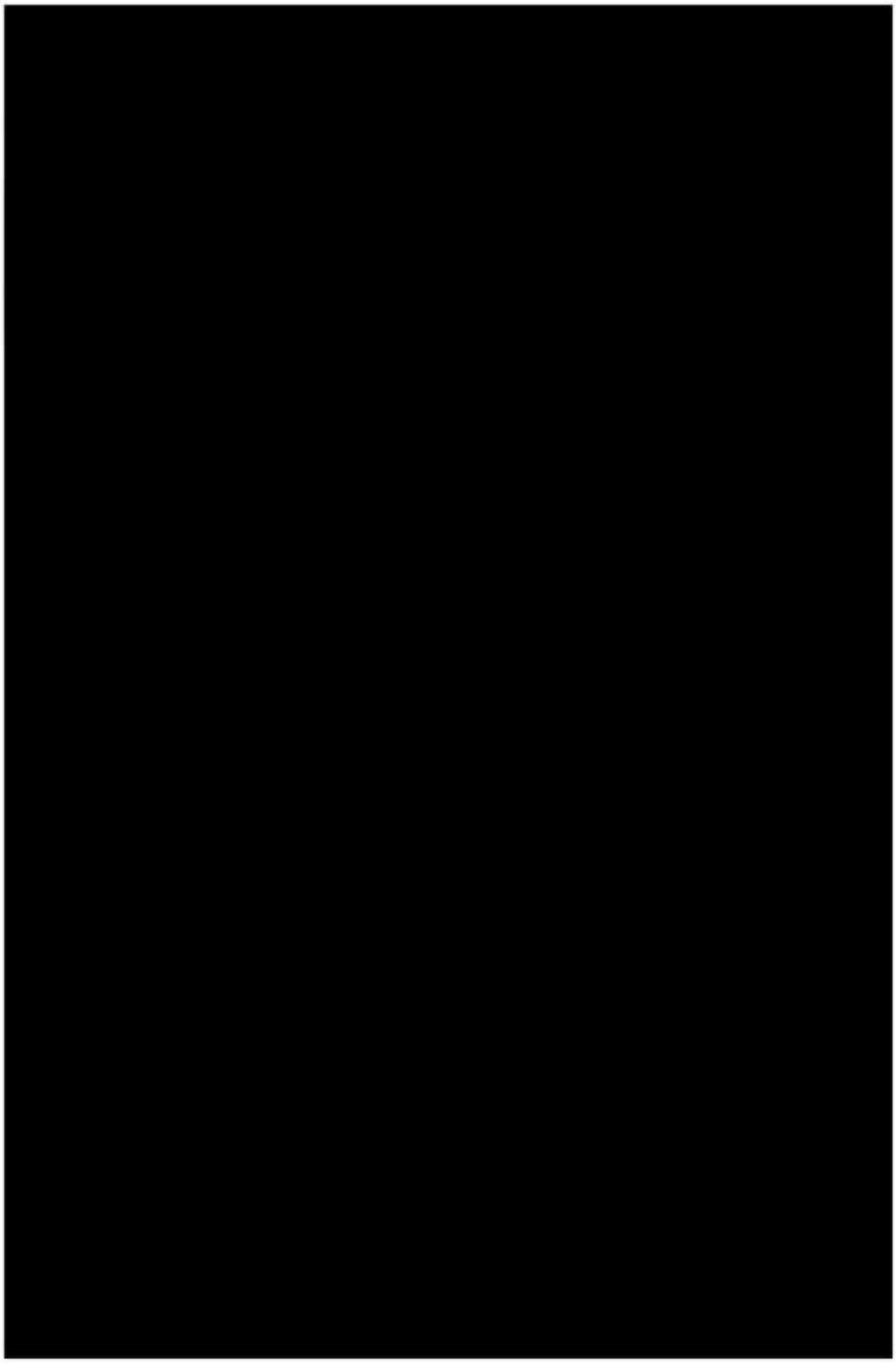
For example, different infeed, format and closure modules make it possible for the CUT 1405 cartoner from Bosch Packaging Technology, Waiblingen, Germany, to handle a wide range of carton sizes, load a variety of primary packages and form tuck, glue or combination closures. Modular infeeds handle primary packages as well as additional items like spoons or



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outserts. Other modules can provide serialization, aggregation and tamper-evident protection.

Modular design not only makes it easy to reconfigure packaging machines and lines and add functionality, but also allows reuse of proven technology, shortens engineering and lead times and lowers project risk.

Modularity is particularly helpful in adapting to market changes like product introductions or temporary contracts where ROI must be quick and the initial capital outlay low. "In such cases, a good starting point would be a modular, semiautomatic cartoner to reduce manual labor and ergonomic issues," says Vivian Woo, vice president sales and marketing at Bivans Corp., Los Angeles, Calif. "As the automation requirements increase, the modular design affords the ability to add automation in gradual, affordable and easy steps," she adds. Bivans offers a modular cartoning system, capable of handling up to 60 cartons per minute. It consists of three units. End users often purchase the Model 54L carton erector first and add the loading area and Model 82 carton closer as needed. The loading area can be any length, powered or non-powered and accommodates manual or automated loading.

The servo-based CUT 1405 cartoner from Bosch Packaging Technology maximizes flexibility via modular infeed, format and closing options.

For easy integration, controls and networking features provide connectivity to other machines on the packaging line, enable machine and line data collection and support remote diagnostics. With established interfaces, it's easy to "insert a module into the system, reconfigure motion from the controller and get up and running quickly," says Jason Nolan, sales engineer at The Aagard Group, Alexandria, Minn., another supplier of modular cartoning systems.

At Bradman Lake, wrappers, cartoners and case packers rely on the same Allen-Bradley controls, platforms and software from Rockwell Automation, Milwaukee, Wis., to provide seamless connectivity between machines. Each unit's Panelview touchscreen operator interface connects via Ethernet to Logix programmable logic controllers (PLCs), which, in turn, communicate to other machines on the line. "This permits Bradman Lake to integrate complete systems with upstream and downstream connectivity," says Bishop.

Features that support ease of use include machine accessibility for operation and service, simple, quick changeover and an intuitive human machine interface (HMI).

HMIs with touchscreens, intuitive graphics and software help operators set up, operate, troubleshoot and maintain the machine in a minimum of clicks. "Even with little to no training, operators should not have to struggle to access key machine controls or reset machines to their normal operating state after a stoppage," says Reed of ADCO. An even higher level of convenience is provided by mobile

Bivans 54L/82 modular cartoning system consists of a carton erector, loading area and carton closer, which can be purchased individually and added to as needs change.

HMIs on industrial tablets, which can be loaded with full documentation and set-up videos.

Ease of use is also supported by features like the low-level, powered carton hoppers Bradman Lake includes on its on top- and end-load cartoners to simplify loading of carton blanks.

Other cartoner selection considerations include uptime, energy consumption and cost to install/support the machine.

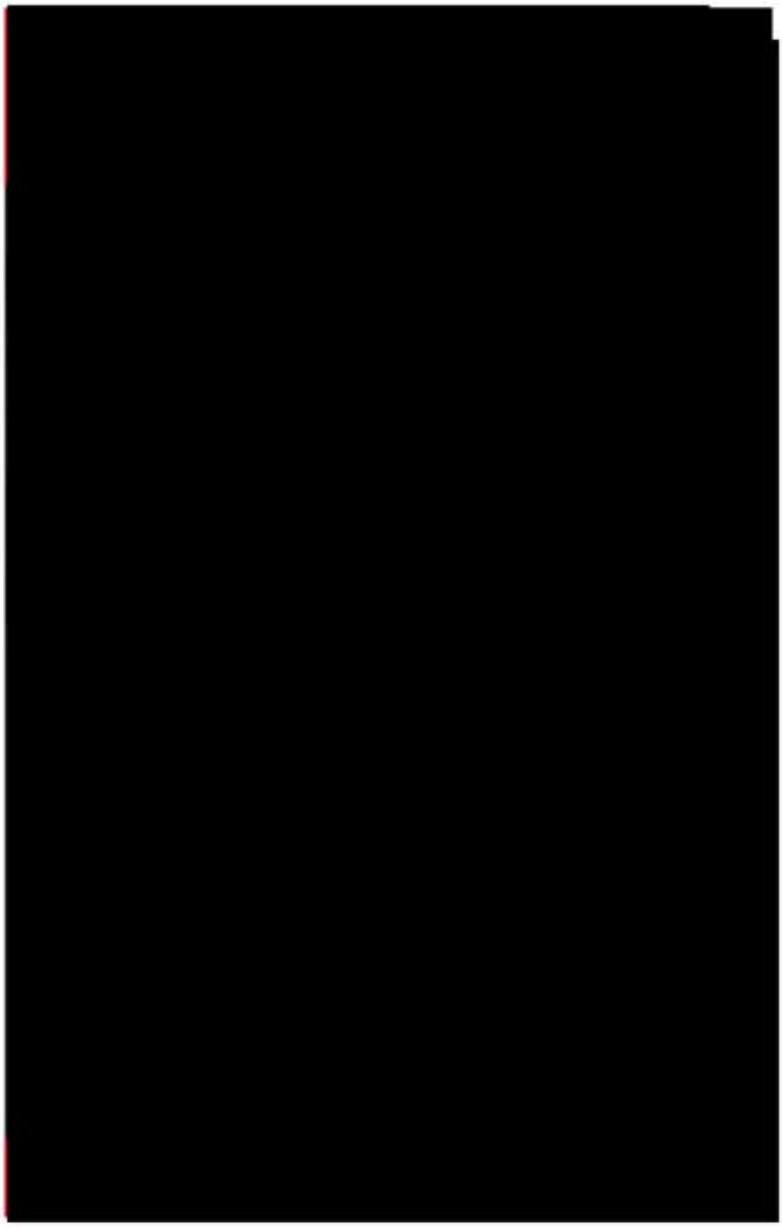
Uptime is impacted by changeover, maintenance requirements and diagnostics. Minimizing changeover time reduces downtime and increases overall equipment effectiveness (OEE). Features that shorten changeover time include toolless adjustments, digital scales and references, change part magazines and automated, servo-controlled adjustments. "Using ratchet handles instead of tools can provide a more user-friendly experience for operators during changeover," says Langen of AFA. Ratchet handles can be used on various changeover points such as top hold down rails, glue gun positions, carton magazines and carton closing rails.

Digital scales and references expedite changeover by providing reference numbers for adjustment points. Knowing the setting allows operators to improve consistency, minimize tweaking and complete changeovers faster.

On standard machines from CAMA USA, a dial with a scale provides electronic feedback to the PLC for verification and prevents jams and/or damage within the machine. "In addition," Goodman says, "we provide both machine transparency and accessibility to view and access all areas of the machine during . . . operation and changeover."

Swappable carton magazines help reduce changeover time by eliminating the need to adjust rails and tabs. To run a different carton size, the operator simply replaces the magazine die.

Installing servo motors on adjustment points automates changeover. All the operator does is select a recipe on the HMI. According to Langen of AFA, this delivers numerous benefits. "With the use of servo motors, the changeover will be 100 percent accurate . . . [and] operators can change



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over a cartoning system in under a minute, whereas traditional methods usually take around 20 to 30 minutes," Langen says. In addition, since the servo motors move adjustment points to the correct position every time, no tweaking is needed. The machine is ready to run without wasting cartons during the start-up process.

No waste means lower material costs and a positive impact on total cost of ownership (TCO). Another way to reduce TCO is to select machines with lower energy requirements. Energy-reducing tactics include eliminating dry cycling by staging product so the cartoner only runs when product is available and reducing compressed air consumption. "Since compressed air is one of the biggest consumers of energy on a cartoning system, reducing the amount of air being used or turning air off when the machine is not in actual use can have a big impact," explains John Kalkowski, director of marketing at Delkor Systems, Inc., Circle Pines, Minn.

The hot-glue sealing system can be another source of energy savings if it can be operated on an as-needed basis. "Some instant melt systems come up to temperature real fast," reports Kalkowski. However, he warns, glue heads may be more prone to plugging. "You have to be careful to strike a balance," he says.

VALUE-ADDED FEATURES

Cartoning systems can be equipped with a host of value-added features. Laser and inkjet coders apply product information including serialized codes

The CL156-169 continuous-motion cartoner from CAMA can be equipped with an air blast function to open cartons efficiently at high speed. The system accommodates a variety of loading methods and tucks or hot-melt-seals flaps.

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needed to track-and-trace products like produce and pharmaceuticals. Onboard barcode scanners verify the product/carton relationship.

Sensors and systems ensure smooth passage through the machine and identify and reject faults such as open flaps. Delkor machines, for example, check incoming items at several points along the infeed as well as after loading to verify pack pattern. To prevent downtime, "[i]t's important the cartoning system continues to run while removing any defects," says Kalkowski. It also essential to understand how rejected products will be reintroduced into the system.

No-tool change parts on Delkor's Trayfecta forming machine cut changeover time to three minutes or less per lane. The flexible system handles cartons, trays or cases made of paperboard, microflute or corrugated. If equipped with multiple heads, the unit can produce different containers in the same cycle.

On the packaging side, to prevent downtime related to jams, Delkor has patented an intelligent positioning system that detects and corrects problems in the folding process to ensure cartons are square before being locked and glued. "This allows formation of cartons with up to eight sides," reports Kalkowski.

VENDOR ATTRIBUTES

Last, but not least, end users should carefully review OEM qualifications including experience with similar applications, technical expertise, on-time delivery performance, years in business, financial strength and aftermarket support. "Having an OEM that has experience with your particular product application can provide numerous benefits such as reduced engineering time, quicker lead times and lower risk," explains Langen of AFA.

Langen also recommends researching an OEM's changeover technology, accessibility to key wear parts and support network. "An OEM with a simple methodology for changeover and replacing wear parts can reduce training costs, improve operator satisfaction and improve OEE," he says.

Although local support is advantageous, Langen notes, "there are ways to support machines remotely, such as using VPN [Virtual Private Network], so operators can connect with service technicians via the Internet."

Bishop of Bradman Lake recommends checking references and confirming where the machine will be built. He suggests, "Draw up a spreadsheet of potential suppliers and then visit a packaging show to interview all of them." **PMT**

Hallie Forcinio has been covering packaging industry trends for more than 20 years.