Port Elizabeth, South Africa - Delta Motor Corporation (DMC) meets the challenges of vehicle manufacturing in the context of a small assembly plant. The management team at DMC acquired the operations from General Motors Corporation in a leveraged buyout in the 1980s and recently had the opportunity to start fresh with enterprise-wide computing systems.

These systems have allowed DMC to link their corporate business and financial systems to real-time production operations on the plant floor. DMC can now also link to outside suppliers of components and sub-assemblies used in the Opel Astra and Corsa car lines and Isuzu commercial vehicles.

The latest enhancement to their corporate systems is a company-wide SAP R/3 enterprise resource planning (ERP) system. This included an upgrade of some existing R/2 applications to R/3, which works in concert with their plant-floor vehicle tracking system (VTS) to achieve high levels of productivity and lower cost by implementing low-level planning and shop floor production optimization. The end result is that DMC can offer accurate, integrated real-time information to all relevant areas of the company’s business with as little human intervention and paperwork as possible.

The VTS system that completes the link is based on the InTrack™ resource management and work-in-process (WIP) tracking system from Wonderware, a business unit of Invensys Systems, Inc. The VTS system was developed and installed in just nine months by DMC’s internal staff at the greenfield plant, headed by Michael Pearton, Struandale plant manager, and Gavin Allen, manufacturing execution systems (MES) specialist, with outside support from system integrators ISIS (Pty) Ltd., based near Johannesburg.

Delta Motor’s new enterprise-wide production system:

* Improved manufacturing productivity and efficiency;
* Reduced both work-in-process and stock holding;

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  MES Specialist
management buyout of the former General Motors operations in Port Elizabeth. In late 1994, DMC purchased a former Ford Motor Company plant in Struandale, stripped it to its bare bones and began constructing a completely new assembly plant. The plant was designed to produce about 30,000 Opel Corsas each year with one-shift operations and up to 85,000 on three-shift operations. The company now produces three primary vehicle body styles, with up to 17 different model derivatives, all with a capacity of nearly 30,000 cars per year.

The initial system used SAP's R/2 business system, including the Shop Floor Control module. It was subsequently determined that the latter couldn't provide all of the functionality required. So the system integration specialists from ISIS recommended the addition of Wonderware's InTrack system for tracking plant-floor production, from raw materials to finished cars. The intent was to develop low-cost but powerful computing capabilities using off-the-shelf PCs, network hardware and application software based on the Microsoft Windows NT operating system. The upgrade to SAP's R/3 system was complete by January 1999.

"We determined that our existing computer systems were not capable of handling multiple plants and that we absolutely required a link between our SAP system and shop-floor control systems, because we have to be able to track upwards of 4,000 components and every vehicle we produce has to consume all 4,000 components," explained Michael Pearton, Struandale plant manager.

"In addition to the SAP and shop-floor interfaces, the InTrack system has allowed us to set up our own parameters for level scheduling algorithms. So we can now maintain different and more efficient schedules for the body shop, the paint shop and the trim-and-assembly line," Pearton said. "It also allowed us to streamline our broadcasting procedures to lean suppliers that deliver components and sub-assemblies, such as seats or wheel assemblies, in the proper sequence to match the vehicles coming down the line. In the new system, all suppliers deliver their components directly to the production line and our team members install them. This all works together to ensure that we are able to make every variation of our vehicles all the time, as needed."

New Company & Systems

Delta Motor Corporation was created in 1987 via a management buyout of the former General Motors operations in Port Elizabeth. In late 1994, DMC purchased a former Ford Motor Company plant in Struandale, stripped it to its bare bones and began constructing a completely new assembly plant. The plant was designed to produce about 30,000 Opel Corsas each year with one-shift operations and up to 85,000 on three-shift operations. The company now produces three primary vehicle body styles, with up to 17 different model derivatives, all with a capacity of nearly 30,000 cars per year.

All the PCs used to implement the VTS system have Pentium® processors running on Windows NT (Server) and Windows 95 (client nodes), and are of a high quality for maximum availability. The database server is a Compaq dual-Pentium Pro using RAID 5 technology running Microsoft SQL Server. The system runs on both 10baseT Ethernet (3Com cards) and BitBus networks. DataLogic scanners are linked to the system via Broderson FEDs and documentation is printed using HP LaserJet printers. Barcode labels are produced using Novexx thermal transfer printers. All planning-office and shop-floor systems are backed up with UPS units that are sized for driving all critical equipment for 20 minutes in the event of a power failure.

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As the basis of the VTS, the InTrack system communicates with Delta's mainframe computer system at the head office, nearly four miles away at the Kempston Road plant. The VTS receives work orders from and provides regular feedback to both the SAP R/3 business system and the DMC vehicle distribution system to handle material-consumption data, manage dealer notification and provide after-sales support.

DMC dealers from around the country place orders for the Corsa vehicles on the Vehicle Distribution System (VDS) mainframe. Production planning takes place in a multi-level system, from 12-month forecasts down to four-day production schedules on the SAP R/3 business system. The SAP system downloads the production order data to the InTrack VTS on a daily basis. Since the InTrack VTS is mission critical and cannot be out of commission for more than a few minutes, the link between it and the SAP R/3 mainframe is redundant. In addition, data can be handled electronically or manually, using electronic media.
The InTrack VTS tracks the production of each vehicle in detail, as well as the critical components and resources used to manufacture each vehicle. This information is then returned to the SAP R/3 system and vehicle distribution systems for further business requirements, such as material consumption & production information for dealers, and ERP functions. All production reporting and analysis is conducted directly on the InTrack system.

## Extensive Bar Code Feedback

Each vehicle is assigned a unique ID by means of a bar code label that is attached to the vehicle body. This bar code is read at nine monitor points (MPs) at strategic places throughout the plant, from the body shop all the way to final inspection. As it passes each MP, the bar code is scanned either manually or by a fixed overhead scanner, and the data is transmitted back to the InTrack system, where it is compared, checked and validated against the schedule. Any problems, such as the vehicle being in the wrong place or taking too long to pass through a workstation, are immediately highlighted for corrective action.

The system automatically triggers orders to various just-in-time suppliers, advising them to deliver particular components or sub-assemblies to specific points along the production line. It also interfaces with three shop-floor machines for specific tasks. The VTS feeds the vehicle identification number (VIN) to a machine in the body shop, which then engraves the VIN on the chassis. It also transmits a message to the body-plate machine, which prints the unique body plate fitted to each vehicle. At the end of the line, it conveys data on the engine, gearbox, VIN number and ignition key number to the engine computer operating system (ECOS) machine, which programs each vehicle’s on-board computer with complete information on the vehicle.

Each MP station is also equipped with a Broderson operator interface that displays messages and allows some operator inputs. There are numerous checks and balances in the system to ensure that every possible problem is considered. Error messages are displayed locally on the operator displays, alerting the operator to a problem using a buzzer and lights on the front panel. Simultaneously, error messages are displayed on the InTrack planning workstation for corrective action by management.

The MPs also do double-duty as SAP consumption points. When a vehicle passes each point, the InTrack system automatically advises the mainframe vehicle distribution system that this event has occurred, transmitting the serial number, check-point number, special part data (engine, gearbox and key numbers), color, trim sequence number, plus the system date and time. This information is required for the NATIS...
The R/3 business system is able to update its inventory records and maintain knowledge of the vehicle status. At this stage, the SAP system does not require real-time information, so the granularity of the information in the business system is less than that in the InTrack production management system.

In any mission-critical application, fallbacks and contingencies are necessary. In the case of trim and door-line build documents, they can be completed manually at any point throughout the plant. Furthermore, if there should be a failure with the automatic broadcast fax of documents to parts and subsystem suppliers, then paper forms can be generated and faxed manually. There are more than 20 different contingency plans in place that allow for every controllable eventuality on the plant, including: local area network (LAN) breaks; planning workstation downtimes; downtimes for tag servers, operator workstations, or printers; bar code failures; electrical power or backup UPS failures; or even damaged documents.

World-Class Results

By South African standards, the plant is about 50 percent more productive than other vehicle manufacturing plants, and this is accomplished with fewer staff than most other companies. Wonderware’s InTrack system is a key enabler of this smooth-running production system and, according to management, it has significantly reduced the risk of production losses because DMC can maintain production for two-to-four days, even in the event of the mainframe-based SAP systems being down. In addition, the system is scalable, so it can grow in size and functionality as DMC grows. Results have been so good with the initial installation at the Struandale plant that the entire system will now be duplicated and expanded at the main Kempston Road Plant in Port Elizabeth.

"We've developed a lot of world-class manufacturing techniques that we have now implemented at our Kempston Road plant, with about 40 InTrack monitoring points in the VTS system, of which six are SAP link points," Allen added. "In the process of bringing up the VTS system there, we've been using newer hardware solutions and adding continuous production refinements that we can then bring back across to the Struandale plant, completing the circle."

"We were pleased with the InTrack system and InTouch HMI for many reasons, but primarily because of the tremendous ease of development they provided," explained Gavin Allen, MES specialist.