Tenneco uses Wonderware Production Event Module to track its catalytic converter line

by Wonderware Southern Africa

"This ArchestrA-based upgrade has given us a solid foundation on which to base the rest of the project. It's already starting to pay dividends in terms of cost-savings and engineering effort while the Production Events Module is giving us new insights into our production processes on the catalytic converter line."

Etienne le Roux, Project Engineer,
Tenneco South Africa

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Company Overview
Tenneco SA – Port Elizabeth, South Africa
Tenneco is a $4.4 billion global manufacturing company based in Illinois end employs about 19,000 people worldwide. The company is one of the world's leading designers, manufacturers and distributors of automotive emission control and ride control products and systems for the automotive original equipment market and the aftermarket.
Tenneco meets the global sourcing, quality and engineering requirements of its customers through nearly 80 manufacturing, technical and engineering facilities in 24 countries on six continents.
The company's success in bringing useful technology to market has been recognized by both its customers and by the industry with numerous awards, including two prestigious Automotive News PACE Awards for product innovation in less than five years.

To meet an annual export target of half a million catalytic converters, Tenneco South Africa was looking to achieve a production availability of 85% while eliminating the loss of critical production information and guaranteeing product traceability throughout their Port Elizabeth plant.

With over half a *billion* cars in daily use worldwide, emission control is no longer an option. Tenneco is a world leader in this technology and was one of the first suppliers to commercialize the diesel particulate filter (DPF) technology that is 99.9% effective in eliminating emissions from diesel-powered vehicles.

As the need for catalytic converters grows, so does the necessity to streamline their manufacture. The cycle time for a single converter currently stands at 27 seconds, which doesn't leave much room for getting things wrong.

Automotive components – the global approach with local manufacturing

With South Africa having opened its borders to free trade agreements, the country has become part of the global community and as such, SA manufacturers have to compete locally against imports and internationally against domestic manufacturing in other countries (Tenneco SA exports to the USA, Europe and Australia). But with detailed and product-specific information, companies are better equipped to develop strategies for efficient growth.

To be cost effective and efficient more and more companies are utilizing software not only to monitor the plant and to provide diagnostic information but they also use real-time databases to identify each product and trace it through the entire manufacturing process. Decision-support information has therefore become product and process-specific with the focus on quality, efficiency and production availability. The ability to access databases in real time and view scheduled reports provides for an environment where constant improvement is feasible and cost effectiveness per product is increased.

Customer requirements

In order to achieve its business objectives, Tenneco SA realized that the company would need to upgrade its existing SCADA facilities in a way that would consolidate existing assets while providing for the future and

addressing pressing needs such as:

- Cost saving and standardization;
- Part traceability and tracking;
- Process control and security;
- A single platform to control the entire plant;
- Simplification of architecture, layouts and technical support;
- Complete database integrity and access;
- Full server redundancy;
- Reporting and diagnostics;
- Assurance of technical and quality standards;
- Full access to various existing databases;
- Full visual system with real-time plant-wide reporting including data analysis techniques.

The first phase of this upgrade initiative would be on a production line supplying North America and which manufactures 500 000 converters annually for export. The line operates on three shifts, five days a week. One of the goals was for this line to have a Cpk index of 1.33 or greater (Cpk is a process capability index. A process must have a Cpk value of 1 or more. The greater this value above 1, the more stable the process and the less deviation will be experienced.)

The line consists of several stations, which must assemble the converters such that the correct monolith (the active material that neutralizes emissions) is inserted into the correct case. All the various parts involved in this process can be mixed up and have to be tracked from beginning to end in a manufacturing cycle time that lasts less than half a minute.

Solution selection

Tenneco SA selected system integrator Design South Africa (Pty.) Ltd. for the implementation of the North American project. Design SA is a global company specializing in automotive and full engineering solutions. The company operates in Europe, North America, Australia, Asia and in South Africa. Design SA has branches in Port Elizabeth, Durban and Johannesburg.

Design SA selected Wonderware solutions because the existing facilities used InTouch HMI (Human-Machine Interface) applications and because Wonderware Application Server and the ArchestrA architecture would provide a single integrating platform for these islands of data and the ability to define, deploy and maintain the standard automation objects Tenneco SA was looking for. Wonderware Application Server would also fulfill the requirement for full redundancy and provide the necessary functionality for the efficient deployment of software upgrades from a central location. Wonderware Production Events Module (PEM – today part of the Wonderware Equipment Operations Module) would provide the necessary advanced functionality for material tracking and traceability and the real-time database would be Wonderware Historian (formerly known as IndustrialSQL Server or InSQL). An InTouch view client was also added. A key deciding factor in the selection of solutions was the professional local support available from Wonderware Southern Africa.

Project implementation

Figure 1 shows the topology of the production line with the dual-redundant ArchestrA Application Object Servers (AOS), the Wonderware Historian database, the various stations of the converter assembly process as well as the fixed and hand-held scanners used for part identification.

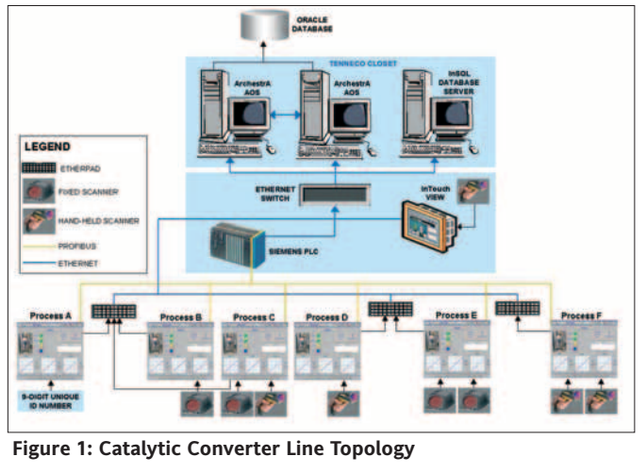

Figure 1: Catalytic Converter Line Topology

Each station will consume material supplied by other stations and produce material that will be consumed by them until the final product is completed. The PEM is an object running on the AOS, which forms part of each station and that keeps track of these 'consumed' and 'produced' items at each stage of the production process. All the PEM consumed and produced data is stored in the Wonderware Historian database with the result that the process can be 'rewound' to analyze the assembly sequence of the components that make up the finished product. The PEM stores the information in ISA-95 format, a database standard that allows for easier data integration of control systems with other enterprise applications.

"In the event that the database should become unavailable, the PEM allows for data queuing on the AOS," says Donovan Bradley, operations director for Design SA. *"Once the link has been restored, the data is sent to the Wonderware Historian. If the database becomes unavailable, however, it's not possible to read data from the queue for assembly purposes. In order to maintain production in the absence of the database, we developed a Work in Progress (WIP) array using scripting. This array resides on the AOS and is capable of storing up to 1000 parts per station. When the database becomes available, the PEM restores the data without any loss. As the work is successfully completed at a station, the WIP in a previous station is deleted and passed on to the next. When any WIP is updated, the PEM stores the information in the Wonderware Historian."*

Each converter model on the production line has

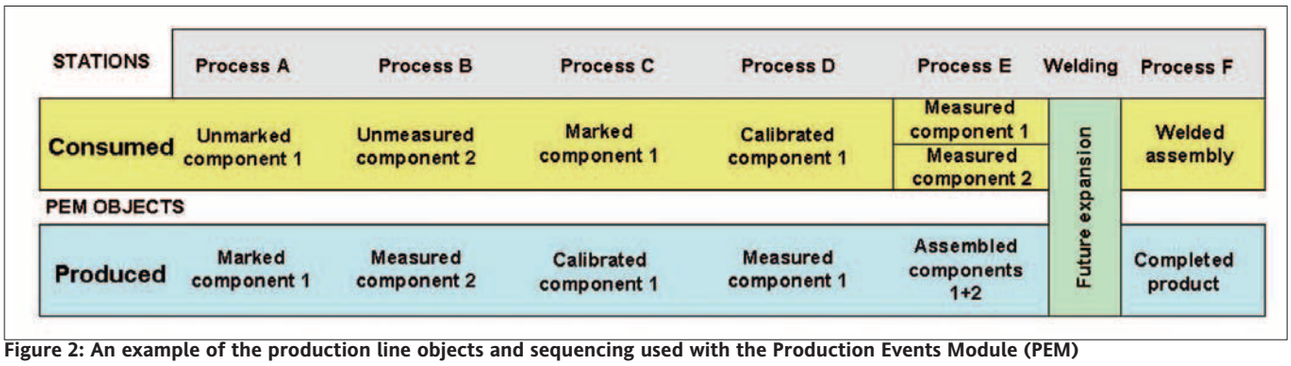

Figure 2: An example of the production line objects and sequencing used with the Production Events Module (PEM)

different setup values that need to be monitored during the production process. These variables are created, updated and stored using a Recipe Manager. This approach greatly simplifies the introduction of new models or changing specifications on current models.

"Currently under development is the reporting of production values to operators and to management alike," adds Bradley. *"We will also be installing Wonderware Information Server (formerly known as SuiteVoyager) web portal and this will be greatly simplified since the PEM has already ensured that the database is in ISA-95 format. Also on the agenda for the near future is the connection to other databases such as those used by Tenneco's suppliers."*

Derived benefits and goals achieved

- **Significant cost savings** – It is estimated that, through the use of the ArchestrA platform, a saving of 25% of the automation implementation cost per production line can be realized in the future. This is mainly due to reduced software development and maintenance costs as well as reduced hardware costs through the rationalization of resources;
- **Easy database access** - All data is available on the management workstation thereby eliminating the need to visit each individual workstation;
- **Maintenance of quality standards** – The new system facilitates the Six Sigma approach to quality, which has been adopted worldwide by Tenneco;
- **Process security and process tracking** – Effective part quality control and identification during production as well as the tracking of the individual components that make up the finished product;
- **Product genealogy** – All the data for each product is detailed and recorded throughout the process;
- **Improved control and management information** - Plant efficiencies and production availability were given detailed analysis options;
- **Improved line availability** – Callouts have been minimized, the response time to deal with problems has been reduced, downtime is lower than ever and faultfinding is simpler and faster because of operator diagnostics that support first-level corrective action.
- **Improved alarming, maintenance reporting and scheduling.**

"This project is a good example of how quality and efficiency can be improved in a competitive market by using off-the-shelf software that conforms to international standards and that has been designed to protect ROI," concludes Bradley.

This document was realized thanks to the support of:
Design South Africa (Pty) Ltd.