PRESS SHOP

Industrial IT solutions for the press shop

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Globalization of the world's markets is challenging the traditional limits of manufacturing efficiency. The competitive advantage belongs to those who understand the new requirements and opportunities, and who commit to integrated solutions that span the value chain all the way from demand to production.

ABB's automation and IT expertise and the process know-how gained from its long involvement with the automotive industry, have been brought together in new, state-of-the-art software solutions for press shops. Integrated into Industrial^{IT} architecture, they allow the full potential of the shops to be realized, with advantages at every step in the supply chain.

The car manufacturing business has moved from *push-driven* to *pull-driven* production, from *mass production* to *mass customization*. The idea of an 'end' or 'final' customer, for example, tends nowadays to reflect more the older, traditional push, rather than pull, approach.

Traditionally, factories have been designed to achieve efficiency based on relatively large and homogeneous batch orders. These factories were characterized by a high inertia. However, the times when the market was able to absorb everything that was produced are now gone. Today, business requires low-inertia production systems in order to react with agility to changes in demand. This fundamental change has deep implications across the value chain.

Considering that some 30,000 parts are involved in building a car, it is easy to see that such a re-definition poses a huge challenge to the automotive industry.

What is necessary is a unified, integrated approach. It must take account of the automotive industry's dependence on highly responsive, flexible and reliable production systems and of its need for transparent and efficient information systems, seamlessly linking traceable orders from the end customer to the production of every single part.
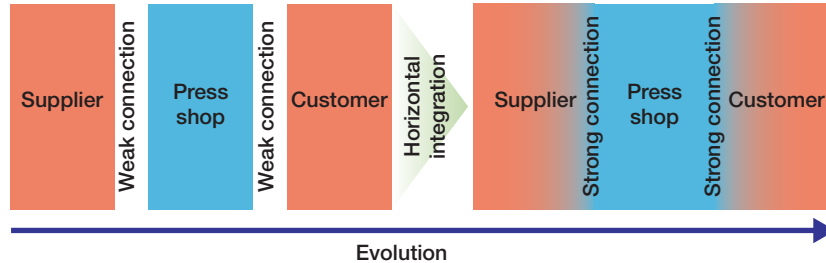
Press shop information systems – past and future

Historically, software development in the automotive industry has focused on two areas: business-level solutions, such as Enterprise Resource Planning (ERP), Manufacturing Execution Systems (MES)

1 The future of the press shop information system: vertical integration

Business layer	
Gap	Vertical integration
Production layer	

Evolution →
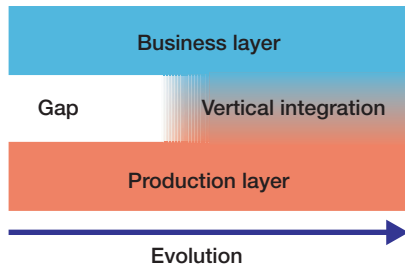
2 Press shop information systems are moving toward horizontal integration

| Supplier | Weak connection | Press shop | Weak connection | Customer | Horizontal integration | Supplier | Strong connection | Press shop | Strong connection | Customer |

Evolution →

and Materials Requirements Planning (MRP), and the machine and line control software.

No connection was provided between them, resulting in a lack of *vertical integration* **1**. At the same time, little attention was paid to the *horizontal integration* – the business layer linking the press shop suppliers and customers **2**.

Poor transparency was the result, between management and the shop floor and throughout the value/supply chain.

To provide the technological and competitive advantage that automotive press shops are looking for, the industry is going through a technological cycle that is moving the shops toward total integration of their information systems. This evolution, from machine control software to ERP/MES/MRP and, now, real-time automation and information systems, is being led by ABB with its Industrial[IT] initiative [1, 2].

The press shop challenge

Companies across the industrial landscape are investing in a whole array of systems and strategies to improve the way their operations are run. The objectives of these investments can be summed up as follows:

■ To produce to order at the lowest possible cost
■ To minimize stocks and delays
■ To maximize the Return On Investment (ROI)
■ To maintain the targeted product quality

In automotive press shops, these objectives translate into a focus on the effective allocation of resources and dynamic production planning. This is to achieve better efficiency in operations that minimize:

■ Production set-up time
■ Cycle time
■ Downtime
■ Scrap and reworking

To achieve the desired results, such investments have to be accompanied by responsive logistics for optimum in-plant and inter-plant material flow as well as close integration of the information system with suppliers' and customers' operations.

Ongoing optimization depends on a real-time diagnosis and decision support system being in place. It must enable users to manage complexity and avoid information 'overkill', allowing them to concentrate on the essentials, all the way from the business level to the shop floor.

ABB Industrial[IT] solutions for the press shop

Industry's search for total efficiency is driving the development of software solutions that enable and integrate the information flow, making it available in real time so that it can be used more effectively.

ABB set itself three objectives:
■ To develop solutions for optimizing each level in the value/supply chain and seamlessly link each level to the next.
■ To eliminate unnecessary paperwork (the dynamic nature of most information makes it irrelevant for press shop operation).
■ To enable knowledge-based management, ie provide the tools users need to make informed decisions.

Drawing on its automation and logistics systems expertise in the automotive industry, ABB has developed Industrial[IT] solutions with specific benefits for press shops. Through integration of the information systems, they enable users to optimize machine, cell and line performance, extending to the plant and

collaborative business levels and across the value/supply chain **3**.

All parties – suppliers, customers, production, maintenance and quality departments, etc – work with the same information, since they share the same 'picture'. This makes coordination in a highly dynamic business process much easier.

Software

The Industrial IT portfolio for press shops currently comprises the following four suites:

Robotics^IT Stamping Synchronization Software: The umbrella suite covering the software at the machine and cell level.

Industrial^IT Press Line Optimizer: ABB's new generation of press line supervisors.

Industrial^IT Press Shop Optimizer: This software targets plant internal efficiency.

Industrial^IT Press Shop Collaboration Platform: ABB's collaborative business solution, linking the press shop with suppliers and customers. (These could be, for example, a Tier 1 supplier and the carmaker, or the press shop and body shop.)

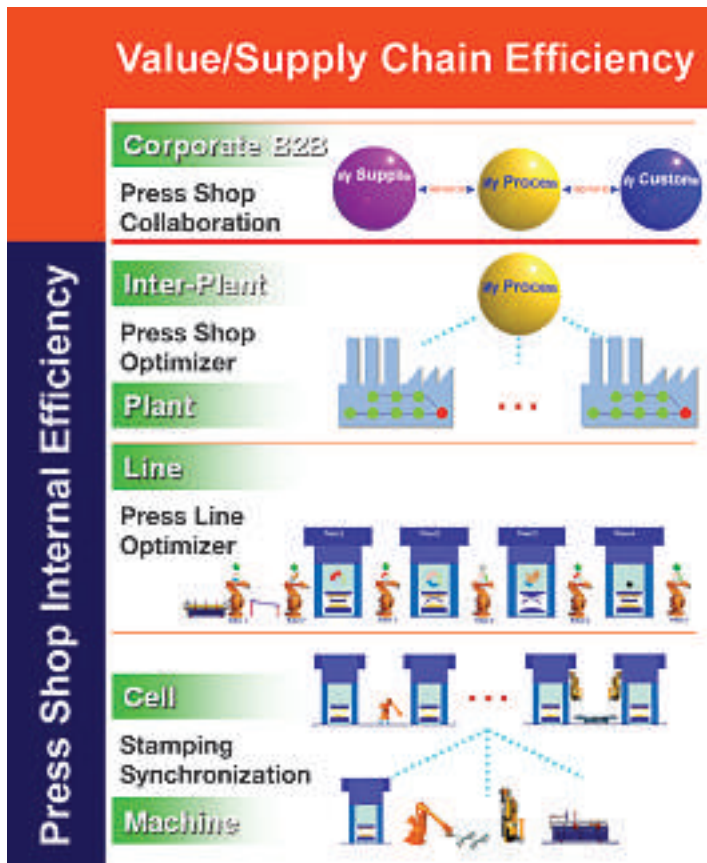### Robotics^IT Stamping Synchronization Software – for device and cell efficiency

This is ABB's suite of software applications for optimizing device and cell performance in the press line.

Robot Press Synchronization (RPS) runs in ABB's new multitasking S4Cplus robot controller, which is capable of hosting specialized applications for spot-welding, arc-welding, press automation, etc. With RPS **4** the robot follows the press movement, smoothly adapting its speed on the fly to optimize cycle time and minimize mechanical stress.
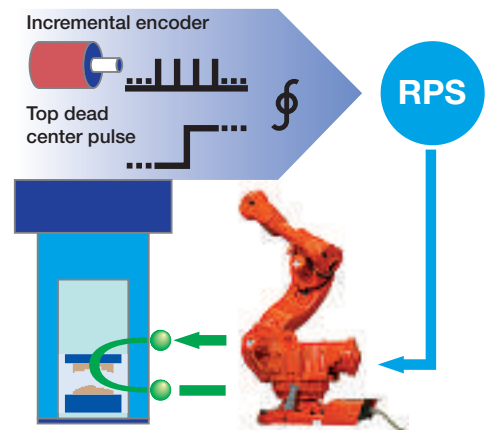
Robot press synchronization reduces the line cycle time by as much as 4 to 7%. When RPS is installed, the whole line behaves as a self-synchronizing, single-machine system.

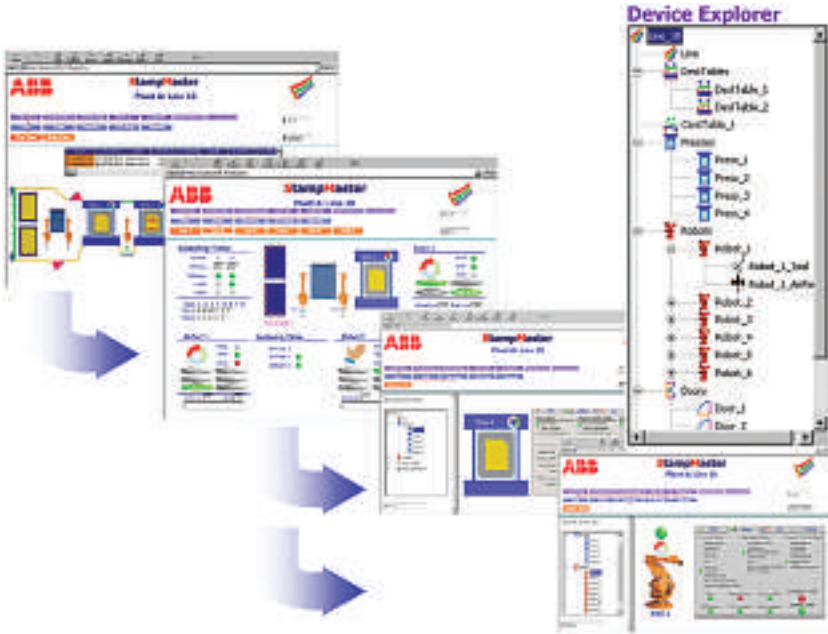Another product in the suite is *Robotics^IT Stamping Operator HMI*, a human-machine interface developed to

3 Four-layer architecture of ABB's Industrial^IT solutions for the press shop

4 Robot Press Synchronization (RPS) for device and cell efficiency

make robot programming and cell operation easier.

Industrial^IT Press Line Optimizer – for press line efficiency

Traditionally, press-line SCADAs (Supervisory Control and Data Acquisition Systems) have been used as line operator tools. However, even press lines equipped with a SCADA system typically remain isolated from the rest of the press shop.

Press Line Optimizer is a new generation of line supervisors, developed by ABB to open the press line to a 'collaborative process'. It models the press line as an 'Industrial IT Business Object', interacting with the rest of the subsystems in the corporation.

Press Line Optimizer links a whole range of activities – eg, scheduling, production, maintenance, quality, enter-

prise resource planning – in the press shop, to provide visibility, accessibility and connectivity in a true real-time client/server environment. It also brings new and unprecedented functionality to the press shop by acting as a 'cockpit' from which the line can be 'piloted' and by allowing all relevant line information to be accessed from the shop floor, the intranet or the Internet.
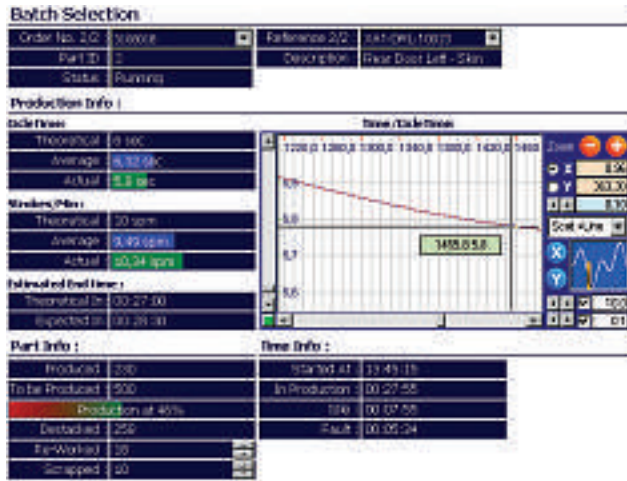
6 Production and preventive maintenance scheduler

It is also Remote Assistance Enabled, allowing ABB to provide on-line support in areas such as productivity optimization and line stop recovery.

Visibility and real-time remote access

Press Line Optimizer acts as a window to the real-world press line, making operations visible from the system and cell level down to the device level **5**.

It connects to the programmable logic controller and robots in the line via OPC[1], an open industry standard of the OPC Foundation, of which ABB is a member.

The displayed information is updated in real time. For example, a status change in a robot or press installed somewhere in Europe is typically shown on the screen of a computer accessing Press Line Optimizer in North America in less than one second.

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[1] OLE for Process Control; OLE is Microsoft's object linking and embedding technology for sharing information across process and machine boundaries.

7 Reporting and trend analysis

8 Production monitoring and control

9 Quality reporting and monitoring

Line scheduler

This tool helps users organize line activity, for example to plan production and maintenance jobs **6**. A Gantt diagram is used to edit and visualize the details.

Reporting

Production, quality, maintenance and event/alarm statistics are available as detailed or summarized reports, organized according to date/time, batch, part, etc **7**. This report and trend tool helps the user make informed decisions as well as identify the main causes of line unavailability. Pareto graphs visualize line stops, arranged in order of importance according to type, duration and frequency.

Production

With this tool, users monitor and control production to ensure high line efficiency **8**.

Quality management

Thanks to this user-friendly tool, quality inspectors and managers can now report and view part faults directly **9**. It can also be used by quality and maintenance personnel to identify problematic die areas.

Maintenance management

Press Line Optimizer records the

operating hours or cycles accumulated by all the critical devices, and shows when maintenance work was last carried out. This makes it easier to schedule preventive maintenance, for example for robots or presses.
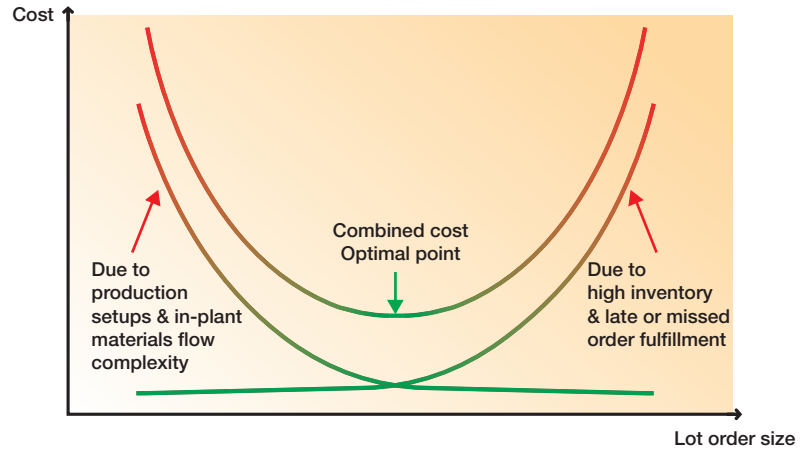
ERP connectivity

Press Line Optimizer extends Enterprise Resource Planning (ERP) to the shop

10 Press Line Optimizer as an extension of the ERP system
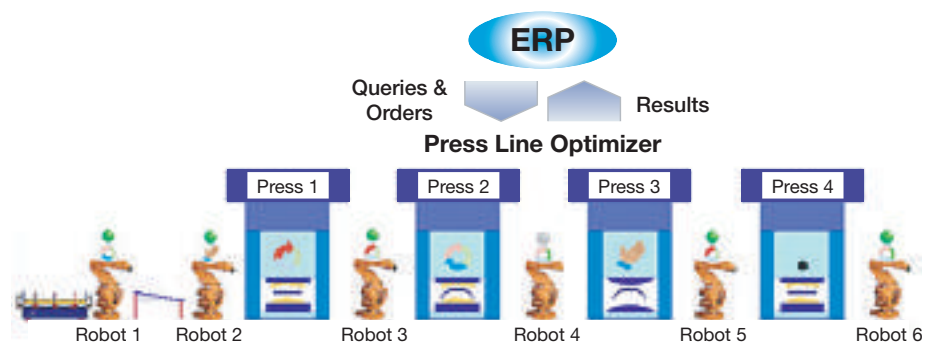
floor **10**, acting as a kind of 'nerve system' between the business information system and the presses and robots.

Personal digital assistant access

Press Line Optimizer functionality can also be accessed via users' personal digital assistants.

Other features Press Line Optimizer offers are bottleneck analysis, a robot file manager, Microsoft® Office connectivity, a documentation server and bulletin board, and live video.

Press Line Optimizer generates value for the press shop in several ways, both quantitative and qualitative. The collaboration platform, for example, adds value in the same way that a corporation intranet and e-mail service does – by supporting coordination and helping to drive business efforts in a focused manner. Improvements that translate directly into a higher return on investment include less downtime, higher productivity due to shorter cycle times, and faster recovery after line stops.

Original equipment manufacturers and Tier 1 suppliers in South and North America, Europe and the Asia-Pacific region have decided to integrate Press Line Optimizer as a key productivity resource. North American Tier 1 supplier *AG Simpson*, for example, has chosen this software to boost the performance and flexibility of a line with seven presses and fifteen ABB robots.

Industrial^IT Press Shop Optimizer – for press shop efficiency

Getting a press shop to run smoothly and efficiently is in some ways like transforming a group of musicians who have never met each other into an orchestra; just as the dynamics of a musical score make huge demands on the musicians' ability to work together, so too do the dynamic changes occurring in a press shop call for perfect coordination and visualization of all of its component parts and functions.

If the real production needs are known a long time ahead, optimization of a press shop could focus on just the press line efficiency. It would be like driving a car along a straight road: The drive would be predictable; the driver could concentrate on, say, engine performance.

Today's press shop business processes, however, are more like driving along a winding road, knowing little of what lies ahead. This is because press shop operations are typically characterized by dynamic change.

Forecasts are, of course, still necessary, but now they serve as a rough guide for the production planning. Tier 1 suppliers are especially affected, since they often receive new, urgent orders and have to quickly reschedule 'on the fly'. Batch production and stocking is one option companies have for reducing manufacturing risks, forecast risks and the cost of production changes **11**.

ABB's solution combines Press Shop Optimizer, Press Line Optimizer and Press Shop Collaboration **12**. In this solution, Press Shop Optimizer works with Press Shop Collaboration and the ERP system to align the press shop operations with the company's business objectives, and harmonizes these operations through integration with Press Line Optimizer.

Press Shop Optimizer makes extensive use of Operations Research (an optimization technology), to perform dynamic and intelligent intra- and inter-

12 Press Shop Optimizer works with Press Shop Collaboration and Press Line Optimizer to harmonize press shop operations and align them with business objectives.
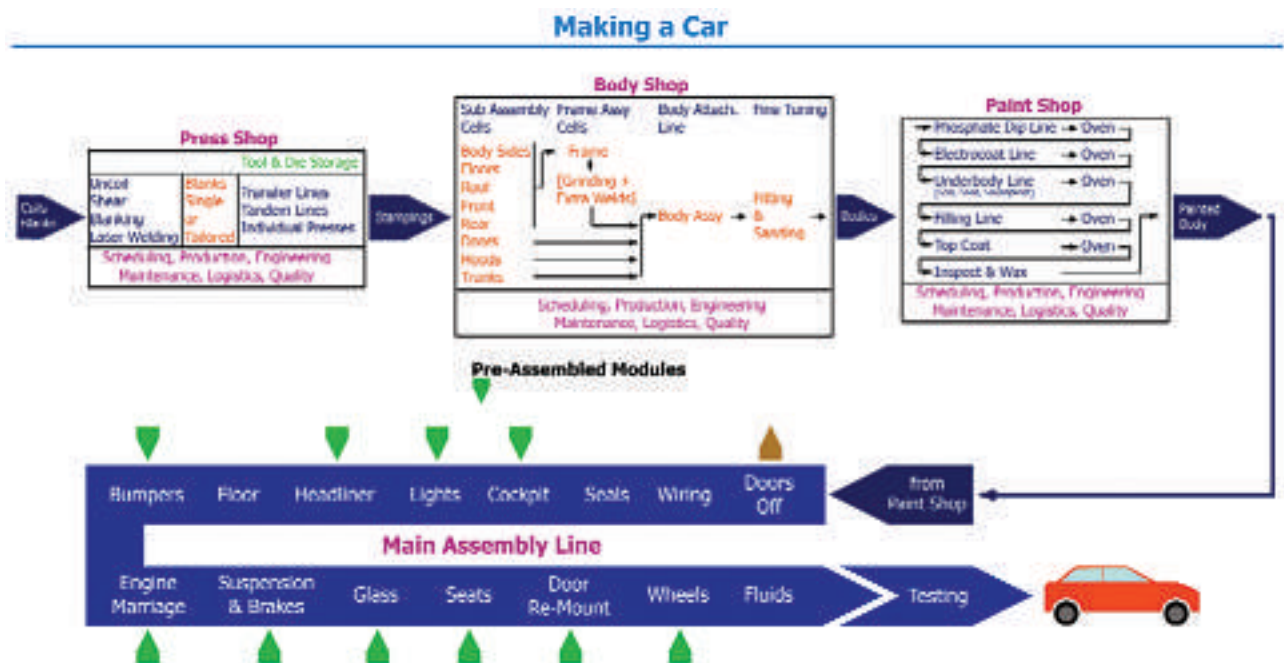
capability for 'what-if' testing as decision-making support for users confronted with different scenarios.

Press Shop Optimizer also traces the material flow and orders within the plant and between plants, and performs order-to-cost/profit mapping in real time.
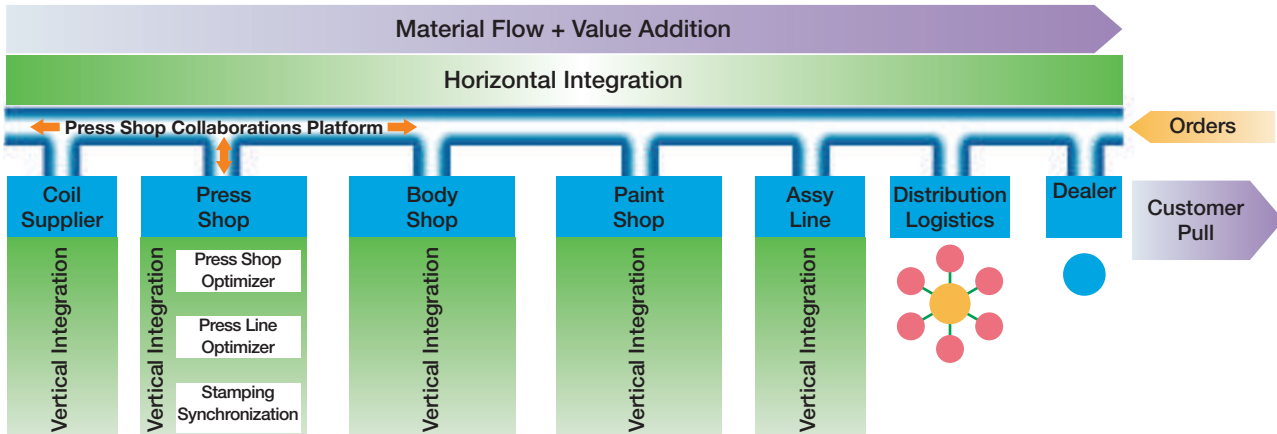
Plant efficiency is monitored by user-defined Key Process Indicators that update its value in real time.

Press Shop Optimizer sees the press shop as one system. It generates a model of the factory and provides dynamic optimization to allow the strategic cost and delivery time requirements to be met. The business logic in Press Shop Optimizer is defined according to the customer's needs. It works transparently with the legacy software, thus protecting investment in the existing information system. Press Shop Optimizer reduces

plant scheduling driven by inventory, line availability and capacity, part characteristics, and production and logistics costs. It proposes an optimal

master schedule based on these criteria to the user, who can accept or reject it, depending on the strategic needs. Press Shop Optimizer has built-in simulation

13 Car manufacturing process - the physical layer

business risk and brings responsiveness to the press shop.

Probably, the most important benefit of Press Shop Optimizer is that it allows the press shop management to concentrate on operations from a business rather than an administrative perspective.

Industrial^IT Press Shop Collaboration Platform

As already mentioned, this Industrial IT suite is designed to improve supply chain and collaborative manufacturing efficiency. Although neither Press Shop Collaboration nor Press Shop Optimizer requires the other to develop its functionality (both can integrate transparently with the existing enterprise information system) the best results are achieved when both are in place.

It is important to understand the context within which Press Shop Collaboration functions. The automotive supply and value chain has two layers:

First there is the physical layer **13**, consisting of the manufacturing and logistics/distribution systems, and then there is the information layer **14**, where communication takes place over the supply chain's 'virtual network'.

Press Shop Collaboration links the press shop to this virtual network via a so-called *automotive backbone* to provide visibility and allow the press shop to integrate its operations in a collaboration framework. SKYVA *agents*[2] gather and send all relevant information to and from the press shop, its suppliers and customers, at the same time checking for process consistency. They provide a transparent picture of the manufacturing process, showing any change in any of the process partners across the supply chain.

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[2] Press Shop Collaboration and Press Shop Optimizer share server/client and distributed execution architecture based on SKYVA's *Agent Technology*. Skyva is a collaborative Software company owned by ABB.

Customer-centric solutions

The Industrial IT philosophy is enabled by a powerful *customer-centric* architecture and is driven, ultimately, by demand for high-quality products, delivered at the right place, at the right time and at the right price.

ABB's aim with its Industrial IT initiative is to combine the company's broad automotive business and IT know-how into highly profitable, 'best in class' solutions for its customers. For press shops, this means fast, dependable and flexible automation equipment and systems, working within a planning system based on a consistent, powerful and scalable Industrial IT solution portfolio that reaches from the device level to business and company strategy levels.

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References

[1] **B. Hoffman:** Coming together under the Industrial^IT umbrella. ABB Review 3/2001, 6–9.
[2] The ABC's of Industrial IT. ABB Review 1/2002, 6–13.