

# REPLENISH ON TIME, IN SEQUENCE

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*A White Paper on the Benefits of Implementing the QAD JIT Sequencing Solution*

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## EXECUTIVE SUMMARY

Competition for a growing percentage of sophisticated consumers in the global marketplace is driving automotive original equipment manufacturers (OEMs) to offer products with an ever increasing number of features and options. Allowing buyers to uniquely configure their own vehicle and delivering their order within a reasonable timeframe requires a radical departure from the traditional methods of mass production. This new process identifies the unique, individual requirements of each vehicle and synchronizes its assembly with the Just-in-Time (JIT) delivery of specifically configured components from suppliers. These components are then delivered to the OEM assembly plant in the exact sequence that each car or truck goes down the assembly line. This allows the OEMs to produce a tailored vehicle for each consumer while at the same time operating within acceptable production and assembly cost parameters.

The profusion of available car features and options has caused the number of possible vehicle configurations to explode. Today, suppliers are confronted with the dilemma of guaranteeing high levels of customer satisfaction measured in on-time deliveries and high product quality at reasonable costs while simultaneously striving to maintain low levels of inventory. An example of this is found at BMW. Their car buyers are allowed to select or modify options, such as changing the color of leather seats, in the vehicles they order until just one week before that vehicle starts production. However, it takes the supplier 12 weeks to buy the leather that goes onto the seats. Furthermore, within the supply chain itself actual requirements and projected demand for component parts are typically out of synch. Historically, these problems have been overcome by maintaining additional quantities of raw or finished material as a "buffer" against requirements that exceed projected amounts. This extra downstream inventory, along with the attendant time lags and postponements in delivery caused by spikes in demand, conspire to add to the overall levels of inventory carried by suppliers.

That's all changing. The QAD JIT Sequencing Module (JIT/S) helps suppliers execute the JIT delivery of configured components while simultaneously coordinating supply and demand to minimize inventory levels and reduce the amount of extra costs caused by expediting activities in the supply chain. To do this, the module integrates the mid-range / long-term planning and supply chain communication functions of its MRP processes with execution processes focused on manufacturing configured products that are delivered at the exact time they are needed. In JIT/S, planning becomes well-executed production.

## INTRODUCTION

Individual tastes vary. This fact is becoming the key to success in the competition for mature automotive markets and for up-scale product segments. Today, from the perspective of pure functionality, cars and trucks are becoming a commodity. Competitive product differentiation therefore is achieved through offering unique colors, fabrics, styles, features and option packages. These create thousands of potential combinations for any given type of vehicle. Stocking all of these combinations is price-prohibitive. Discovering whether a particular vehicle combination was produced - the proverbial needle in a haystack - is much too time-consuming. Add to this the customers' delivery expectation for immediate availability of unique vehicle features and option sets with the underlying threat that they might very well shop at the dealership across the street. The perplexing side of this conundrum is delivering that customized, idealized finished vehicle-quickly and profitably.

Welcome to today's competitive automotive OEM market.

Call this build-to-order (BTO), configure-to-order (CTO), order-to-delivery, demand-driven production, or mass customization with lot size of one, the mandate is the same: Production must suitably meet configuration and delivery requirements of the customer rather than deploy make-to-stock operations. This is the next step in automotive production management.

QAD is addressing these requirements with its JIT Sequencing Module (JIT/S). This module fully integrates to any enterprise resource planning (ERP) solutions - providing automotive suppliers combined planning and execution capabilities not seen until now.

The fundamental process is the capability to translate the real demand originating from the OEM assembly - in the form of a Broadcast EDI signal - into the configured item(s) required, along with the delivery sequence and the location where they are to be shipped. JIT/S provides a direct link with the assembly line, taking into account last-minute changes to the production schedule while still operating within acceptable delivery parameters. The visibility of JIT/S into OEM requirements then allows it to compare them with its execution plans and adjust them as necessary. These changes in requirements are rapidly identified, planned for and communicated to production and down through to the lower tiers of the supply chain. This has the immediate effect of minimizing the amount of inventory buffer stock. The speed of the overall process provides the additional time needed to react and take effective action. The bottom-line benefit of JIT/S is that shortened lead times and reduced buffer stocks reduce capital inventory investments with their attendant carrying costs and obsolete material write-offs.

## THE GRANULARITY OF INFORMATION

The closer an automotive OEM gets to BTO, the more two things happen. First, the overall stock of finished cars sitting on dealer lots goes down. According to AMR Research, "making inventory vanish can give a huge boost to the bottom line." In the automotive industry alone, AMR Research estimates the excess inventory costs are \$700 billion.

Second, reducing the time from order to manufacturing reduces the capital investment in material "within" the overall production supply chain. The faster the communication from the consumer to the OEM to the suppliers, the more "granular" the time increments become. That is, as the time between order and delivery becomes shorter, the individual planning horizons at each level in the supply chain are reduced from weeks to days to hours and even minutes. This has a huge impact on the

application and use of planning information. Planning for activities that are only minutes away is not planning anymore. It is execution.

The ability to achieve this level of planning / execution has, to date, been hindered by several factors. First, the communication of data is arduous and expensive; moving large packets of data is more cost-effective than transmitting small information elements. Second, manufacturing has historically focused on a hybrid of discrete batch operations, work order processing, and flow-like production (mostly repetitive). Last, traditional production management is awash in large amounts of data-sales forecasts, production numbers, logistics information, and more.

## **LEAN MANUFACTURING IS A START**

Having the right information at the right time is the foundation to Lean Operations and, specifically, to JIT production and delivery in the automotive industry. These two concepts are components of the Toyota Production System, which uses this fundamental premise: Eliminate waste wherever it exists. Lean is about doing more with less .less time, less effort, less space, and less money. Within this, JIT is about delivering just the right amount of products at the right time. It reduces inventory investment and carrying cost, improves material throughput, eliminates excess and obsolete charges and therefore has direct impact on improving profitability.

Such benefits come from the radical approach to planning and manufacturing responsiveness invoked by JIT manufacturing. The conventional approach typically supported in enterprise resource planning (ERP) software is to "push" products into finished inventory and on to the customer. The production quantities are based on anticipated demand typically found in a sales forecast and long range planning scenarios. Because of this, push-based manufacturing typically yields extra inventory for which there is no demand (for example, the forecast was wrong). In contrast, lean JIT manufacturing uses "pull" processes. The production of a product is pulled through production as it is consumed by a person, production process, or trading partner. Production starts when the downstream customer or process asks for it-and not a moment earlier.

Unfortunately, the pull processes that support manufacturing operations based on intelligent buffering, with effectively managed inventory and Web-based event-triggered systems, have been limited by their inability to quickly receive, process and distribute supply and demand information. New tools were needed to execute as well as plan production. Enter JIT Sequencing.

## **SEQUENCING THE JIT RESPONSE**

Automotive production - in fact the entire automotive business model - becomes far more responsive when customer demand is the actual signal that pulls products through the supply chain. In manufacturing, the signal "straight from the customer" means directly from the assembly line that requires materials for production. The signal triggers product delivery-no more, no less. The delivery is on-demand, which by definition also means in-sequence. According to AMR, by 2010 more than 70% of vehicle content will be sequenced. Today, that figure is 40%. Delivering configured items in time and in sequence eliminates the need for automakers to maintain excess inventory in the form of buffers, safety stock, or finished goods. The key is how the suppliers of these items can avoid maintaining this inventory that has been displaced by the OEM.

To accomplish this, the supplier's production environment must be just as responsive and capable as the OEM. They can do this through several strategies. Moving their manufacturing plants close to the OEMs is a common one. If the time to manufacture the product JIT is too short, another strategy is to build potential requirements to earlier "signals" from the OEMs production line and then store the resulting production in inventory for a couple of days before delivering JIT from finished stores when actual demand is established. However, this assumes a relatively finite number of potential configurations from these early signals. Automotive supplier Johnson Controls Inc. (JCI) offers over 1,600 versions of customized door panels for Daimler-Chrysler E-Class cars, which precludes maintaining a projected assortment in stock. So they have organized to produce the door panels between the time of receiving the demand signal from the OEM's assembly line and when it must be placed in the car. This window for production and shipping is 180 minutes.

OEMs are not all the same either. Most of the North American OEMs produce their products to schedules measured in weeks and months, meeting customer requirements as best they can with vehicles "on the lot". Meanwhile, in Europe, several automakers want to create BTO environments that respond to car buyers' direct orders in three to five weeks. For suppliers, using inventory to buttress their responsiveness (although a classical approach) is hardly an effective solution. As mentioned above, BMW lets its customers modify specific options within the vehicles they order until one week before that vehicle enters production. Meeting these challenges of on-demand, in-sequence responsiveness requires constant vigilance. Monitoring customer demand and properly executing production in response to that demand requires a robust execution system.

Kanban and lean manufacturing techniques and JIT sequencing are both execution oriented. Both respond to demand in real time. However, lean manufacturing tends to focus on the production of commodity parts; that is, parts that are shipped in standard packs by the dozen or as case lots. JIT sequencing is focused on unique (or "configured") parts shipped individually or shipped with other configured parts of the same kind. In operation, kanban communicates a fixed quantity of demand over a variable time frame or a variable quantity of demand over a fixed time frame. Neither of these processes adequately addresses the configuration requirements seen in sequencing. In other words, kanban systems typically manage the production of items with low variability; sequencing manages the production of highly configured items.

JIT sequencing is different. In a JIT sequence, the statement of demand expresses the exact configuration of the needed item. If the requirement is for a seat, the demand statement will be to "deliver tan, leather, left front seat, with heater and electronic motor lumbar support mechanism, by 14:15 for Vehicle Number 12345."

## **WHY NOT JUST ERP?**

Delivering such a uniquely defined product exactly when needed requires a level of planning detail that is outside the scope of traditional ERP systems. ERP systems schedule activities using the calendar not a clock; they typically plan for demand stated in terms of requirements for a day or a week. However, when integrated with the execution processing found in JIT/S the combination is very powerful. JIT sequencing, when fully integrated with ERP, provides the best of both worlds: The dynamic crossover from long-term forecasting of monthly, weekly and daily requirements is combined with an execution plan broken down to the minute.

In practice, long-term forecasting based on electronic data interchange (EDI) supplier forecasts and 10-day production provide demand information, which is then exploded into material replenishment, production and assembly requirements. From this, suppliers and planners can perform the planning for items with long lead times, communicate to their suppliers longer range intentions (allowing them to optimize their own procurement and production processes) as well as analyze the impact on potentially constrained production capabilities. JIT sequencing can then use this information in concert with its demand signals (measured in hours and minutes) to generate a minute-by-minute execution plan for the sequential and JIT delivery of configured goods to the source of the demand signal.

## **INTRODUCING THE QAD JIT SEQUENCING MODULE**

The QAD JIT Sequencing Module (JIT/S) helps automotive suppliers produce and deliver configured vehicle components in the exact sequence to vehicles moving down the OEM's assembly line. It balances the forecasts and production schedules received from the OEM with real-time customer requirements, on-hand balances and production plans to manage activities from manufacturing to JIT sequential delivery. The QAD module contains its own mechanisms for receiving demand information then processing this demand into discrete product information. It schedules production and collects data from the execution of this activity. Finally it stages, packages or racks the items produced and ships them in the mandated sequence to the customer. This activity is continually monitored through validation checks and error-proofing tests of data, processes and product configuration.

It primarily responds to Broadcasts transmitted directly from the OEM customer's assembly line (although it can also process EDI-based broadcast information in the form of Daily JIT requirements). This Broadcast point (or points) is triggered as a vehicle passes it. The information in the Broadcast usually includes sequence number, vehicle identification number (VIN), and specific configuration attributes data to provide the appropriate part or subassembly description.

JIT/S explodes this incoming customer demand (and every subsequent demand signal) to identify the item or items the supplier produces and that are to be delivered. As required, the module either allocates existing inventory for delivery in response to the customer demand or generates a series of production orders for new configured parts and assemblies. Each order is for the production of one configured item, specifying the exact configuration that is required.

The module then breaks these production requirements into work orders for the manufacturing / assembly operation. These work orders initiate production (manual and automated through industrial controllers), poke yoke and other quality control processes, as well as drive and control lot traceability.

As required, JIT/S will schedule the production of the items, taking into account the manufacture of sub-assemblies and constraints for sequential production (for example work cell loading constraints). It also manages the palletizing, racking, marriage checking (i.e. front and rear car seats are the same color, type and family) and sequence shipment validation.

As necessary, the module activates alerts regarding exceptions to customer orders, inventory availability, production overload, scheduling conflicts, and other planning

and production constraints. The module also reads and writes to industrial controllers, quality verification systems, automatic identification and traceability systems. Finally it triggers required ERP-based functions associated with the backflushing of inventory, shipment and ASN processing as well as financial processes.

## **QAD SOLUTION ADVANTAGES**

The QAD JIT Sequencing module synchronizes the sequential production and delivery of parts and assemblies to customer demand triggered directly from the customer's production line. If used with QAD's ERP solution, MFG/PRO, the module complements on-time, real-time, right-time inventory management, eliminating waste and streamlining production and delivery cycles throughout the supply chain.

### **STRATEGIC ADVANTAGE**

JIT/S is the first system to integrate - as a standard module - Just-in-Time / Sequential delivery functionality with a full, world-class ERP system. It synchronizes the execution oriented JIT/S processes with the macro planning capability of MRPII and EDI communication with customers and suppliers. It is able to manage and control demand from multiple customers and replenish from multiple sources with integrated long-term planning and Just-in-Time execution. It is seamlessly tied to financial and costing applications for management reporting as well as processes such as evaluated receipts settlement and self-billing for cash application.

### **ALERTING CAPABILITY**

To respond effectively to changes in customer demand and OEM production operations, JIT/S continuously monitors EDI, production broadcasts, and manual data entry for changes in customer demand and production schedules. It then adjusts in real time the relevant production parameters in its execution plan to maintain the JIT sequence of configurable items and assemblies delivered to the customer.

### **100% PARTNER CONNECTIVITY**

JIT/S couples assembly line Broadcasts with EDI and real-time execution algorithms to ensure the proper sequencing and delivery response to OEM production demand. This eliminates the delays inherent in traditional EDI, phone, fax, and e-mail communications, making information available to everyone simultaneously.

### **FACILITATES COLLABORATION**

JIT/S, fully integrated with the ERP systems, makes near real-time collaboration possible with all trading partners, large and small, without the usual manual effort or paperwork. The module supports traditional EDI, XML, and Web-based visualization and alerting for exception-based management. Even for the very smallest of trading partners, effective communication is possible through the module's ability to automatically generate messages, including alerts, advance ship notices (ASN), kanbans, faxes and receipts for inventory replenishment, production schedules, and financial settlement.

### **COST AND TIME SAVINGS**

JIT/S can be used as a stand-alone module; or integrated with QAD's base ERP solution, MFG/PRO or other ERP system. This integrated system that incorporates inventory management, lean operations, and enterprise resource and financial management eliminates the need to implement individual solutions for specific customers, suppliers, or business and manufacturing processes.

## GLOBAL FOCUS

JIT/S is a standard product with regional configurability. It can be installed in multiple sites worldwide, incorporating multiple languages and multiple currencies. And QAD's support is global, 24x7.

## A COMPLETE MANAGEMENT SYSTEM

The QAD lean supply chain solution supports all inventory replenishment methods (discrete purchase orders, schedules, vendor managed inventory, kanban, and just-in-time sequencing), consignment inventory, warehouse management, shipping and receiving (including ASNs, automatic identification, inventory traceability), customer and supplier performance monitoring, shop floor activity, process monitoring, business intelligence, and financial settlement (including evaluated receipt settlement, accounts receivable self-billing, and retro-billing).

## QAD JIT SEQUENCING MODULE FUNCTIONALITY COVERS ALL AUTOMOTIVE PRODUCTION

### Base JIT/S product

- Basic functions for setting up items, their attributes and configurations
- Manages and processes and validates customer orders
- Prints production and shipping labels
- Processes shipments. prints shipping documents and generates status reports
- Updates information to ERP systems

### Broadcast module

- Receives and validate customer broadcasts
- Sends "as-build" and lot tracing information to customer
- Sends broadcasts to suppliers with forward echo information or discrete requirements

### JIT Production module

- Processes demand signals
- Schedules production for exact requirements
- Supports internal replenishment
- Supports "line-side" replenishment
- Defines configurations for product sets or families of parts
- Report production
- Packaging
- capability to configure and control racking of finished products
- rack configuration
- shipping labels and unit labels to meet and support customer requirements on shipping racks / containers)
- Supply Chain
- Provides Real-Time MRP functionality
- Supply Chain Workbench
- Links to Supplier Schedules in MFG/PRO
- Planner support and control of day to day management of plant's replenishment functionality.

To find out more about the QAD JIT Sequencing module, visit [www.qad.com/jits](http://www.qad.com/jits)

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