Sequenced Delivery A True Application Of Just-In-Time

By Al Bukey
Production Modeling Corp.
Bill Davies
CAMI Automotive Inc.

Addition of sequenced delivery to JIT principles realizes the goal of zero inventory. The ultimate benefit is attained when the supplier and customer synchronize their production. The supplier must also commit to the zero defect policies and establish telecommunication with the customer.

Some North American auto manufacturers are now requiring their suppliers to be able to comply with this new concept and have implemented successful examples.

In the following, this changing business environment, its integrated communications, sequenced delivery, its advantages, disadvantages, some of' its applications and requirements are reviewed.

Even though this article is based on the studies in the U.S. and Canada, it is safe to say the concept is universally applicable.

Trends in manufacturing

More and more we see a trend developing in industry - the formation of "organized industrial regions." Eliminated trade restrictions and the development of worldwide markets have prompted many manufacturers to build new facilities outside of their original sphere of operation and closer to new markets. Governments at all levels are offering substantial incentives to attract these major manufacturers. Policy makers recognize that this will then lead to satellite development of supplier plants.

Obviously, all of this activity will require support - houses, schools, hospitals, shopping centers and the like, hence, the creation of a very large community.

A major manufacturer requires many suppliers; it makes a lot of sense for these suppliers to be located as close as possible to their customers. They are then able to reduce their shipping costs but more importantly, as both manufacturer and supplier carry less and less inventory their JIT objectives become achievable.

We are now dealing with Supplier pipelines which are only hours long as opposed to days or even weeks that we used to experience. Technical advancements in the communications field have given us more flexibility in the way we do business. With real time communications, on line database access and update questions like; What are we going to require over the next shift'? What are we actually building right now'? What is being delivered'? are easily answered. The flow of information like this allows for simultaneous production within an integrated manufacturing community.

Communications

Ideally, the information flow would be between the customer's database and the suppliers' databases. Today, it is technically possible to integrate the different hardware and software so that the information flows from one computer system to another.

Although the above process is part of the long-term business plan and its consequent master production schedule, it is not our intent to explain how it is derived. Rather, we will try to arrive to sequenced delivery starting from a six month forecast.

- **Forecast:** Six month forecast developed from the master production schedule, 17-26 weeks.
- **Committed:** The lead time that required for receipt of parts/raw materials the customer must commit to purchase, 5-16 weeks.
- **Confirmed:** Customer has entered the schedule into its production line, 4 weeks.
- **JIT Schedule:** Fine-tuned con--firmed production with minimal variation, 10 days.
- **Shift Schedule:** Customer's production schedule for that shift.

Sequenced delivery

The figure on the following pages is an illustration of the sequencing process. It explains the relationship between the major points and the information required to successfully implement this JIT application.

Advantages

- Principle JIT goal of zero inventory is attained.
- Minimal handling with a resultant decrease in damage.
- Elimination of picking and selecting time.
- Partnership and cooperation between customer and supplier develop to the highest level.

Point A

Start of the manufacturing process, which includes stamping, welding and painting. Generally, these steps do not include ordering specific parts, so no real application of sequenced delivery exists. However, they are covered by the general order/delivery system of JIT.

While the product may just be starting in the OEM's plant, activity is well advanced or even completed in the furthest satellite suppliers.

Point B

It is at this point that the shift schedule is issued. The 1st tier supplier now knows what is going to be built in the immediate future - all that remains is to determine the exact sequence.

PBS areas vary significantly in size. Some plants may have not more than 2 hours of inventory. In this case, the paint shop's throughput becomes more critical to the accuracy of the plan for the remaining 6 hours. A plant with a PBS equal to one shift's worth of production will obviously provide a very accurate plan.

Point C

This is the point at which production sequence is set and no further changes can be made. The vehicle is identified to the assembly computer system and this information is broadcast to the plant devices (printers for vehicle riders, computer sub-systems, electronic display boards) and to the sequence suppliers.

The sequence suppliers now know exactly how long they have to get that particular part/sub-assembly to the customer's point of installation.

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Point D

The part is installed at this point. It is far enough along (2 to 5 hours) in the assembly process to give the supplier time to assemble, sequence and ship. The supplier, knowing this point, determines the quantity to be shipped on each load balancing the cost of frequent shipments against the penalties incurred by late delivery.

Parts must arrive at the assembly pint in such a manner that the assembler merely takes the next available part with the knowledge that it is the correct part for the vehicle in the work station.

Point E

This is an optional point but one that significantly enhances the accuracy of the operation. By receiving feedback as to what is actually happening, the supplier is able to adjust its production line accordingly

This feedback also serves as the pay point. In other words, every car passing this point creates a record of receipt and consequently a record (request) for payment.

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Point F

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Point G

At this point the supplier begins its sequencing activity. The location of this point is determined by the maximum available time calculated backward from point H. This time may be sufficient to allow for sequenced production or it may only allow for sequencing of items previously produced using the JIT schedule.

obviously provide a very accurate plan.

Point H

The time from H to D is the fixed delivery time. The time from G to H is what is used to determine shipment size and shipment frequency

T: the time between Point C and Point D

t: the supplier's sequenced lead time including:

a) sequenced production time
b) packing time
c) loading (with preparation)
d) transit time
e) unload time
f) move time

i: incremental time to add one more part
(the largest of a, b or c)

Then the maximum delivery quantity (Q) is: Q=(T-t)/i Although the maximum delivery quantity would also be the desired shipment quantity, there are three considerations:

- space restrictions,
- economics of shipment frequency, and
- safety precautions.

Loading of product must be in reverse sequence; the part for the first car is loaded last so that it becomes the first off at the customer's dock.

This type of frequent delivery lends itself very well to the use of returnable bins, racks, pallets, etc. obviously provide a very accurate plan.

- Concept can be applied to various parts and suppliers.

Disadvantage

- Very dynamic environment, which requires constant attention. There is little room for error.

Applications and requirements

Sequenced delivery can be applied to many parts that are used on the assembly line. Some of the most common are: bumper sets, grilles, carpets, glass, seat sets, transmissions and engines.

The need to have all the requirements in place and being sure that the suppliers understand the degree of commitment before the operation starts cannot be emphasized enough. In general, the following requirements are vital parts of the sequenced delivery concept:

- Commitment of "Total Quality Control."
- Reliable production and delivery equipment.
- Integrated telecommunications.
- Contingency plan.

As a true application of JIT, sequenced delivery is becoming an integral part of modern manufacturing operations. The benefits of this application are tremendous when one considers zero level inventory, space utilization, high quality and increased productivity and flexibility.

A challenge for the 1990s will be the expansion of this concept to include more and more industrial applications.

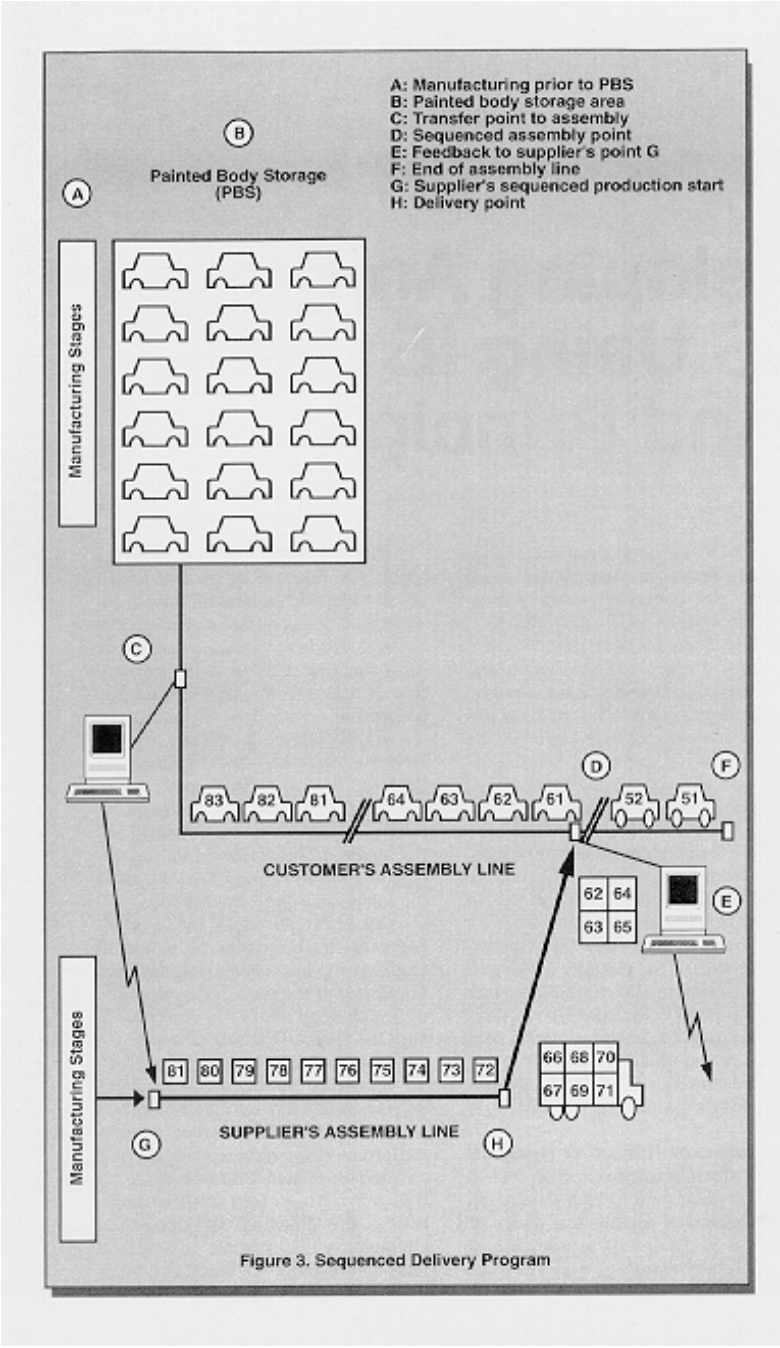

Figure 3. Sequenced Delivery Program

Al Bukey is a consultant with Production Modeling Corp. Bukey has over 10 years of experience in MRP II and JIT system implementations. He holds a MSIE from NC State University and is a senior member of IIE and CPIM. **Bill Davies** is employed in the systems department of CAMI Automotive Inc., a joint venture automotive manufacturer. Davies is a graduate of Ryerson Polytechnical Institute.