MIT Leaders for Manufacturing Program

Meditech Surgical[1]

Three years after Meditech was spun off from its parent company, Meditech captured a majority of the endoscopic surgical instrument market. Its primary competitor, National Medical Corporation, had practically invented the $800 million market just over a decade ago. But Meditech competed aggressively, developing new, innovative instruments and selling them through a first-class sales force. The combination paid off, and Meditech had become a phenomenal success in a short period of time.

Despite the success, Dan Franklin, Manager of Customer Service and Distribution, was concerned about growing customer dissatisfaction. Meditech had recently introduced several new products that were central to the entire Meditech product line. New product introductions, which were critical to Meditech's strategy of rapid product development, needed to be introduced flawlessly to protect Meditech's reputation and sales of other products. But Meditech consistently failed to keep up with demand during the flood of initial orders. Production capacity became strained as customers waited over six weeks to have their orders delivered. Poor delivery service, which is fatal in the health care industry, was jeopardizing Meditech's reputation.

Company Background

Endoscopic surgical techniques fall under a class of surgical procedures described as minimally invasive. Minimally invasive surgery, as opposed to traditional open surgery, requires only small incisions are required to perform an operation. As a result, procedures using endoscopic techniques often provide substantial benefits for the patient both physically and financially. The procedures often shorten patient recovery, which can translate into reduced surgical expenses overall. Despite the benefits and the multi-decade history of endoscopic technology, the procedures have only become popular in the last ten years.

Only three years ago, the market for endoscopic surgical instruments was expected to double its size in five years. Growth beyond five years also looked promising. Largo Healthcare Company, Meditech's parent company, decided to spin Meditech off as an independent

 This case was prepared by LFM Fellow Bryan Gilpin under the direction of Professor Stephen C. Graves as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. The case is based on the author's thesis, "Management of the Supply Chain in a Rapid Product Development Environment," supervised by Professor Rebecca M. Henderson and Professor Alvin W. Drake, from an LFM internship during July-Dec., 1994.

company focused solely on producing and selling endoscopic surgical instruments. Largo management hoped that the new company would prosper without the distractions of other Largo businesses and capture market share of endoscopic instruments as quickly as possible.

Since its inception just over six years ago, Meditech produced innovative, low-cost products. New products were brought to the market quickly and pushed by an aggressive sales force. Old products were updated with innovative features and presented to the market as new products. Consequently, the competition between Meditech and National Medical centered on the continuous development and introduction of new products by both companies. A dozen or more new products would typically be introduced by Meditech in any given year.

While the development strategies were similar, the sales strategies differed dramatically. National Medical concentrated on selling to surgeons. Meditech's sales force concentrated on selling to hospitals material managers as well as to surgeons. Material managers tended to be more concerned with cost and delivery performance. The surgeons, on the other hand, focused on product features. As the pressures increased on health care costs, the importance of the material manager's purchasing position also increased. Meditech was well positioned to take advantage of this important shift.

The success of Meditech's strategy quickly became evident. Within six years, Meditech had captured the leading share in the endoscopic surgical instrument market. This was no small feat by any market's standards, but with surgical instruments this was especially impressive. Market share changes in the professional health care industry tended to take place gradually. Surgeons and doctors often held onto preferred manufacturers. Hospitals frequently used group purchasing organizations (GPOs) which took advantage of extended contracts with suppliers. The process of "converting" a hospital to a new supplier often took months of negotiation and convincing.

Most endoscopic surgical instruments are small enough to fit into the palm of a surgeon's hand. They are mechanical in nature, typically having several intricate mechanisms to provide the required functionality. Materials used to produce the instruments include plastic injection-molded parts, metal blades, springs, etc. In all cases of use, surgeons use the instrument for one operation and then immediately dispose of it. Instruments are never re-sterilized and re-used for another patient. All in all, the Meditech product line consists of over 200 separate end-products.

Distribution

Meditech distributes all its goods from a central warehouse, using two primary channels, domestic dealers and international affiliates, to distribute its products from the central warehouse to end-customers (i.e., hospitals). The first channel, for domestic sales only, uses domestic distributors, or dealers, to ship to hospitals. The dealers order and receive products from multiple manufacturers, including Meditech, typically stocking hundreds of different products. Stocked products range from commodity items, such as surgical gloves and aspirin, to endoscopic surgical instruments. By using dealers to supply products, hospitals do not need to order directly from manufacturers for their diverse needs. Additionally, since dealers maintain

regional warehouses all over the United States, the distance between dealer warehouses and most hospitals tends to be quite small. The short distance permits frequent replenishments of hospital inventories; in some cases, trucks from dealers drop off supplies once or twice per day. Hospitals enjoy the frequent replenishments, which reduce hospital inventory and, consequently, reduce material costs.

The regional dealer warehouses act as independent entities, autonomously determining when to order new supplies and how much to order. Therefore, while Meditech only uses four or five major distribution companies, it still receives orders from, and ship to, hundreds of regional, individually-run warehouses. The warehouses in turn each ship to about a dozen or more hospitals, resulting in thousands of hospitals that receive Meditech products.

The distribution channel for international sales uses Largo Healthcare's international affiliates. International affiliates are wholly-owned subsidiaries of Largo Healthcare residing outside of the United States. As with domestic dealers, affiliates distribute to hospitals in their regional area. However, in contrast with domestic dealers, which may locate within just a few miles of customer hospitals, an affiliate ships product throughout an entire country. From Meditech's point of view, affiliates' orders essentially look no different than dealers -- international affiliates submit orders to Meditech and Meditech fills them with available product.

Internal Operations

The production processes to manufacture endoscopic instruments are composed of three major steps -- assembling of component parts into individual or "bulk" instruments, packaging one or more bulk instruments into a packaged good, and sterilizing the packaged goods. Each of these steps is described below:

Assembly -- the assembly process is manually intensive. Component parts arrive into the assembly area from suppliers following a brief inspection by Quality Assurance (QA). The parts are placed into inventory until ready for use by one of several assembly lines. Each assembly line is run by a team of cross-trained production workers who can produce any of several instruments within a product family. Line changeovers within a family are quick and inexpensive, merely requiring a warning from the production team leader and a supply of the appropriate component parts. The typical cycle time for assembly of a batch of instruments -- the time required to schedule assembly of a batch of instrument and then actually assemble them, assuming that component parts are available in component parts inventory -- is on the order of two weeks. Lead time for component parts is on the order of 2-16 weeks. Assembled instruments are moved from the assembly area into bulk instrument inventory where they wait to be packaged.

Packaging -- the packaging process makes use of several large packaging machines. The machines direct bulk instruments into plastic containers and then adhere a flexible sheet of material over the top of the container. The entire plastic container is then placed into a finished cardboard container and shipped immediately to the sterilizer. Capacity at the packaging area has not restricted output.

Sterilization -- the sterilization process uses a large Cobalt radiation sterilizer. After batches of packaged instruments (cardboard container, plastic container, and instruments) are placed into the sterilizer, the sterilizer is turned on for about an hour. The radiation penetrates cardboard and plastic to destroy any potentially harmful contaminants. The sterilizer can sterilize as much product as will fit inside its four walls. Capacity limitations have not been a problem thus far. Sterilized instrument are immediately moved into finished goods inventory.

The Operations Organization

The entire operations organization reports up through the Vice President of Operations, Kenneth Strangler (see Exhibit 1 for an organization chart of operations). Functions immediately reporting to Strangler include several plant managers (one for each of Meditech's four manufacturing facilities), a director of supplier management, and a director of planning, distribution, and customer service. Other vice presidents (not shown) exist for marketing and sales, product development, and finance. All vice presidents report to the highest officer in the company, the President of Meditech. The plant managers in the organization have responsibility for production personnel, engineering technicians, quality assurance, support services, and material supply for their respective facilities. Reporting directly to the plant managers are several business units. Each business unit has full responsibility for either the assembly of a particular product family or, in the case of packaging and sterilization, for an entire production process. The most important job of each assembly business unit is to meet the production schedule every week. Meeting the schedule ensures a constant supply of bulk instruments to the packaging / sterilization process. The process of determining assembly and packaging / sterilization schedules will be discussed below.

Also reporting to the Vice President of Operations are Supplier Management and Planning, Distribution, and Customer Service. Supplier Management works on relationships with suppliers, including establishing purchasing contracts and finding new suppliers if necessary. The Planning, Distribution, and Customer Service department does everything it can to ensure that customers receive product when needed. The positions within the Customer Service department include the Manager of Customer Service and Distribution, Dan Franklin, the Manager of Central Planning, the Manager of Inventory, and a Manager of Logistics. Customer Service deals with everything from occasional customer complaints to establishing strategies to improve delivery service to customers. Customer Service representatives work with dealers and affiliates to keep them updated on product delivery schedules and problems. Often this responsibility places the Customer Service representative in direct contact with hospital personnel.

While Customer Service handles issues concerning the movement of product out of finished goods inventory, Central Planning ensures that adequate finished goods are available to meet incoming orders. They develop monthly production plans that are used by the business units to determine weekly and daily schedules.

Charles Stout, the Inventory Manager, determines the finished goods inventory policy and establishes parts and bulk inventory guidelines for the business units. When a mandate to reduce inventory is passed down from higher levels of management, the Inventory Manager

must determine where inventory can be reduced and then begin enforcing those reductions. Through recent efforts, Stout had successfully eliminated several million dollars of obsolete and slow-moving inventory.

Production Planning and Scheduling

The production planning and scheduling process is broken down into two parts -- planning, based on monthly forecasts, of assembly and component parts orders; and daily scheduling of packaging and sterilization based on finished goods inventory levels.

During the fourth quarter of each fiscal year, the marketing and finance organizations determine an annual forecast. The annual forecast is then broken down proportionately, based on the number of weeks in the month, into monthly forecasts. As the year progresses, the Central Planners work with the Marketing organization to make forecast adjustments according to market trends and events. At the beginning of each month, the month's forecasts are adjusted and agreed upon by the Marketing organization and the Central Planners.

The planning of assembly for a particular instrument begins with the monthly demand forecasts. Based on the month's forecast, the Central Planners determine the amount of product that needs to be transferred from bulk inventory into finished goods inventory to "meet" the expected demand. This amount, termed the finished goods "transfer requirement", is determined by subtracting the current finished goods inventory level from (1) the demand forecast for the month plus (2) the required safety stock. (The current safety stock policy is to maintain three weeks' worth of demand).

The transfer requirements, once completed for all 200-plus product codes, are passed throughout the organization for approval. This process typically takes place one to two weeks into the current month. While not actually used to schedule assembly or to alter the packaging and sterilization processes, the transfer requirements provide an estimate of the required overall production for the month. Any problems in being able to deliver to the plan can then be identified and resolved.

Assembly schedules and replenishment orders for parts are based on the monthly demand forecasts and current inventory levels. By mid-month, the completed monthly plans, which contain the monthly forecasts, are sent to the assembly business units. A planner in the business unit plugs the forecasts into a Materials Requirement Planning (MRP) system, which determines weekly production schedules and component parts orders for each finished product. The MRP system determines assembly schedules and parts orders based on (1) the monthly forecasts, (2) the lead times for assembly, packaging, and sterilization, and (3) current parts, bulk, and finished goods inventory levels. Although the MRP calculation may be run several times each week, the planner is careful not to change weekly production schedules with less than a week's notice. (A schedule change often requires rescheduling workers and procuring more component parts. One week's notice for responding to scheduling changes, therefore, has been deemed adequate by the business unit managers.)

In contrast to the forecast-based scheduling of the assembly operation, the packaging and sterilization operations are scheduled based on as-needed replenishment of finished goods inventory. For purposes of scheduling, the packaging and sterilization operations are considered one operation because bulk instruments flow through packaging, into the sterilizer, and into finished goods without being inventoried. (See Figure 1 for a diagram of the entire production process.) The entire packaging / sterilization process can be completed for a batch of instruments in about one week. The scheduling of packaging / sterilization is done on an order point/order quantity (OP/OQ) basis (i.e., when finished goods inventory drops below the predetermined order point (OP), a replenishment order for more packaged / sterilized product is initiated. The size of the order in terms of number of instruments is always equal to the predetermined order quantity (OQ).)

Another way to view the scheduling process is to think of material as being "pushed" through assembly into bulk instrument inventory and as being "pulled" through packaging/sterilization into finished goods inventory. The push through assembly is based on the monthly forecast determined before the month's demand actually arrives. The pull through packaging/sterilization simply replenishes what was sold from finished goods the day before.

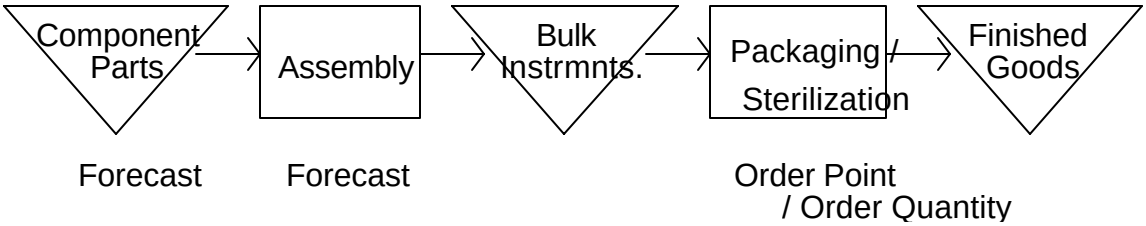


Figure 1. The Meditech production process. The method of scheduling (either Forecast or Order Point / Order Quantity (OP/OQ)) is presented below each process.

New Product Introductions, High Levels of Inventory, and Poor Service Level

Over the past several years, Meditech has introduced dozens of new products into the market, mostly by updating existing products. Meditech plans to continue this strategy of continuously obsoleting its own products by constantly introducing innovations. While the innovative products have been well accepted by the market place, each new product introduction has resulted in a nightmare of supply problems. Dan Franklin felt that customers were beginning to tire of the poor service resulting from each introduction. Through many meetings with hospital material managers, Dan began to realize the full scope of his customers' frustrations.

Franklin could not figure out why Meditech consistently had shortages with each introduction. Forecasting had definitely been a problem, but determining its extent was difficult. Data to measure forecast accuracy had not previously been tracked, nor had forecasts and demand information been kept. Data gathering requires a lengthy process of going back through hard copies of prior monthly plans and entering the information by hand into a computer. Even if a better methodology could be determined, forecasts can only be improved by so much.

In addition to new product introduction problems, finished goods inventory levels appeared to be remarkably high. A consultant had recently been hired to study Meditech's inventory. Her findings indicated that overall inventory could be reduced by at least 40% without an impact on the delivery service level[2] (see Exhibit 5). Despite the high levels of inventory, the actual service level over the past year was disappointing and below corporate objectives. Management feared that reducing inventory would further damage the already sub-par level of performance.

Another possible cause of the problem is "panic ordering" from dealers and affiliates. Panic ordering occurs when a dealer or affiliate is unsure of whether or not product will be received in time and therefore increases the size of its orders hoping that Meditech will deliver at least part of the order. The increased orders would cause demand to temporarily rise, helping to explain Meditech's problems with demand consistently exceeding supply. Familiar with past delivery problems, dealers and affiliates had every reason to want to panic order. In one conversation with a representative from Meditech's largest dealer, the representative had indicated that panic ordering was a possibility. Given the decentralized nature of the regional warehouses, the dealer has little control over what an individual warehouse actually orders. Warehouses could therefore panic order without the knowledge of the central dealer. On the other hand, the possibility of panic ordering does not mean that it actually occurs. To make matters worse, data proving or disproving its existence had been hard to find.

Dan asked one of his staff members to investigate the new product introduction problem and inventory/service level paradox. The staff member spent several months compiling information on demand patterns, production rates, and forecasts. Consistent with Meditech's decentralized nature, the information existed on many different systems in several different areas of the organization. There was no routine way to see incoming demand, inventory, or production rates for a particular instrument. Developing a common format for the data had also been difficult. Some data were expressed in terms of calendar months, other data in terms of weeks, and still other data in terms of the corporate financial calendar (alternating 4-week, 4-week, and 5-week months). Once put together, the information conveyed the following:

- New product demand after an introduction followed a consistent pattern of reaching a high peak during the first few weeks, but becoming relatively stable immediately afterward (see Exhibit 2);
- Variation in production schedules often exceeded variation in demand (see Exhibits 3 & 4);
- Monthly forecasting could be improved substantially using a simple statistical method -- generating a linear regression through past data.

With this information in mind, Dan Franklin began thinking about how to fix Meditech's delivery problems.

[2]Service level is defined as the % of orders filled directly with product from finished goods inventory.

Preparation Questions:

1. What are Meditech's problems in introducing new products? In manufacturing ALL products?

2. What is driving these problems, both systemically and organizationally?

3. Why is the Customer Service manager the first person to recognize the major issues?

4. How would fix these problems?

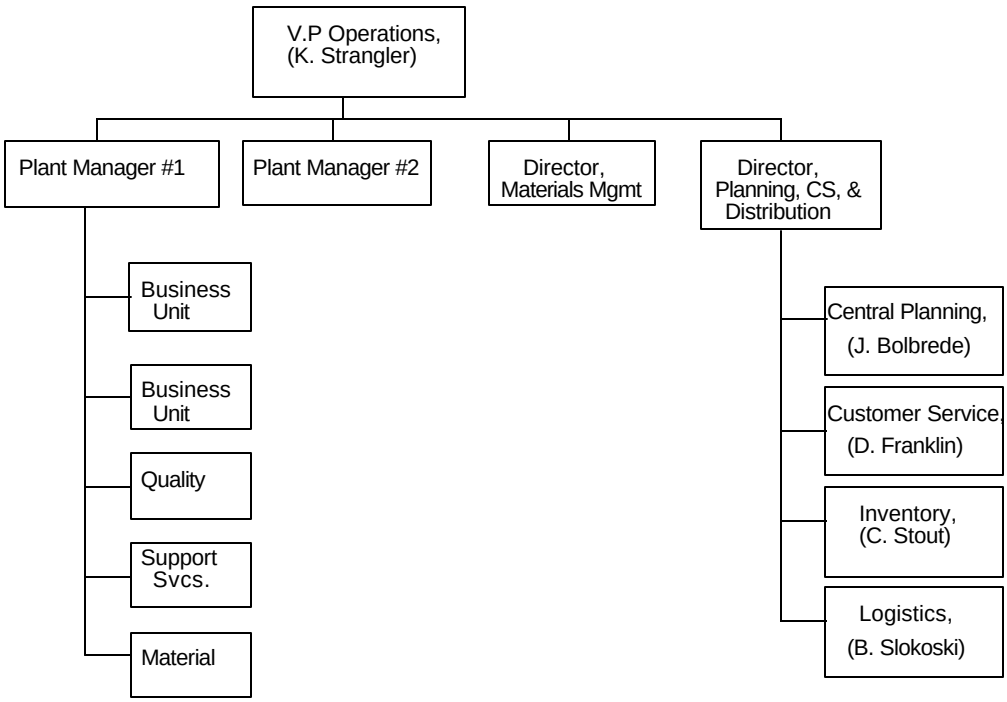


Exhibit 1. The operations organization of Meditech.

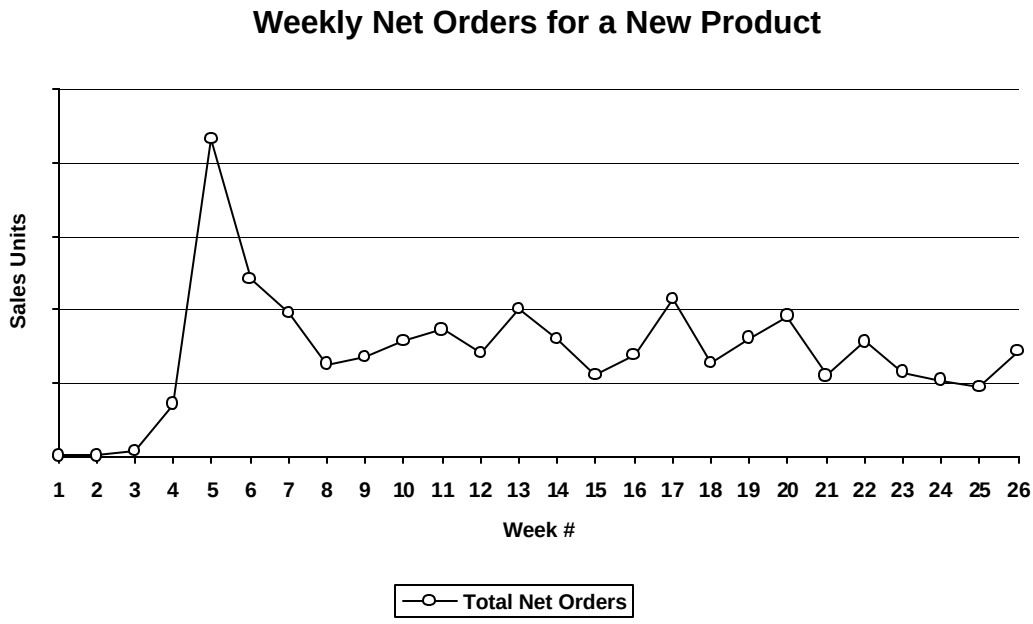


Exhibit 2. Typical demand pattern for a new product introduction. The product was officially introduced near the end of week #4.

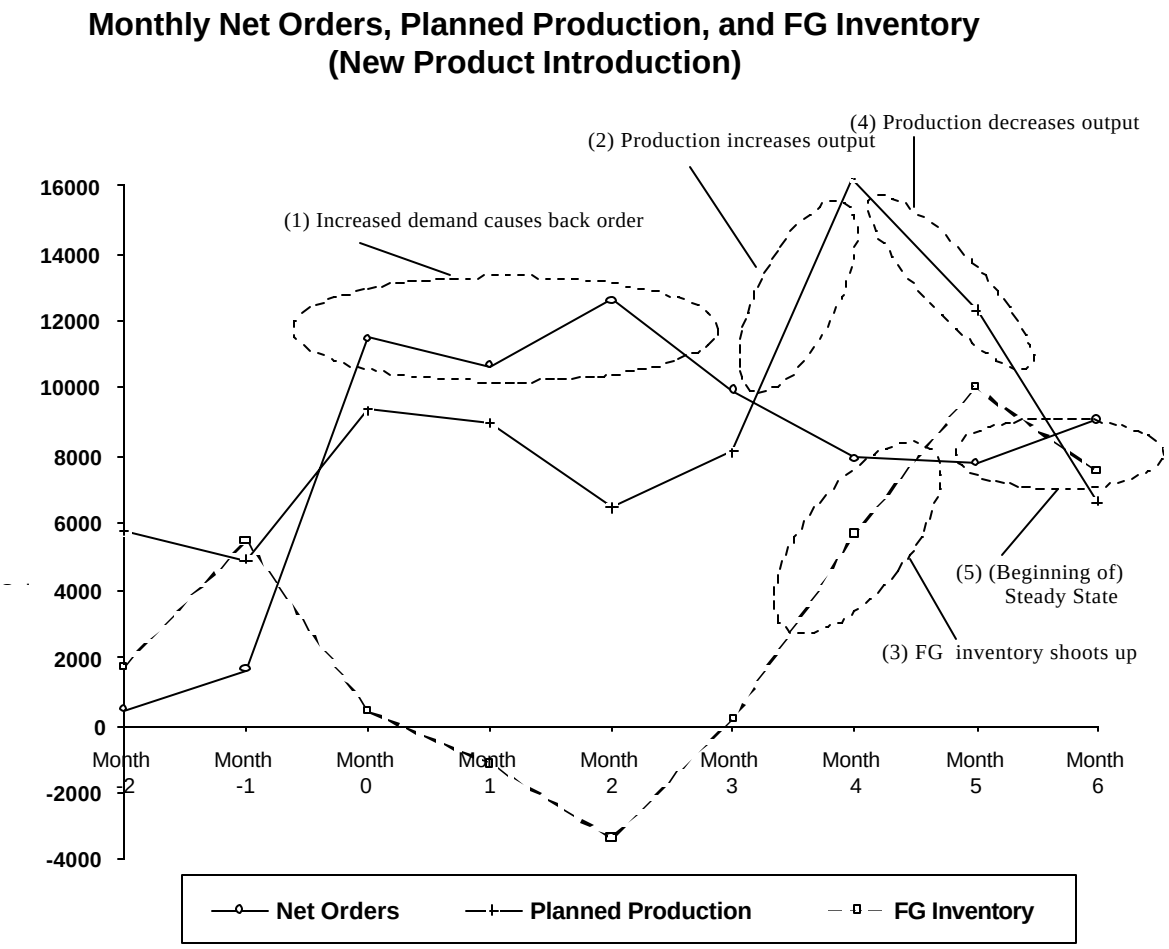


Exhibit 3. Production reaction to a new product introduction. The product was introduced in the last 2 weeks of Month 0.

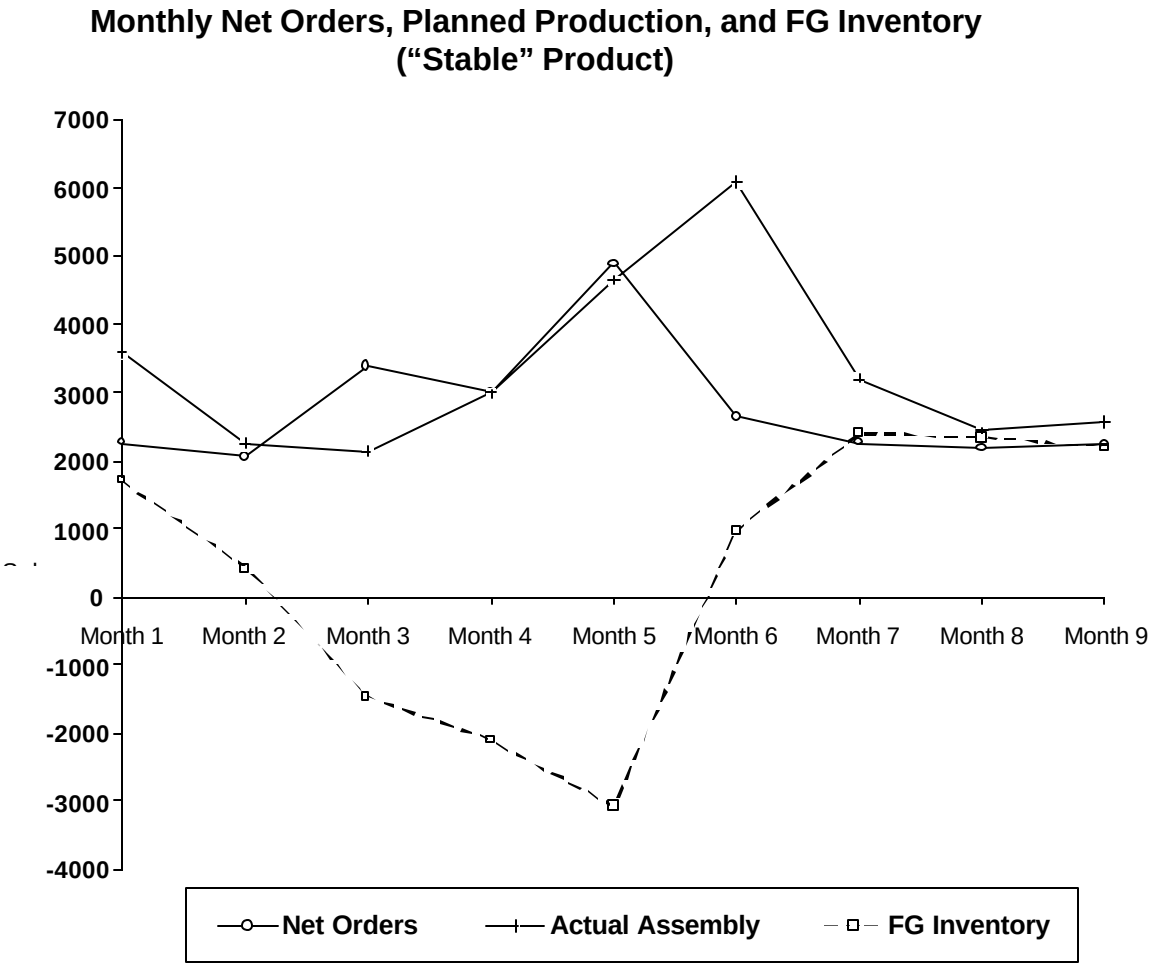
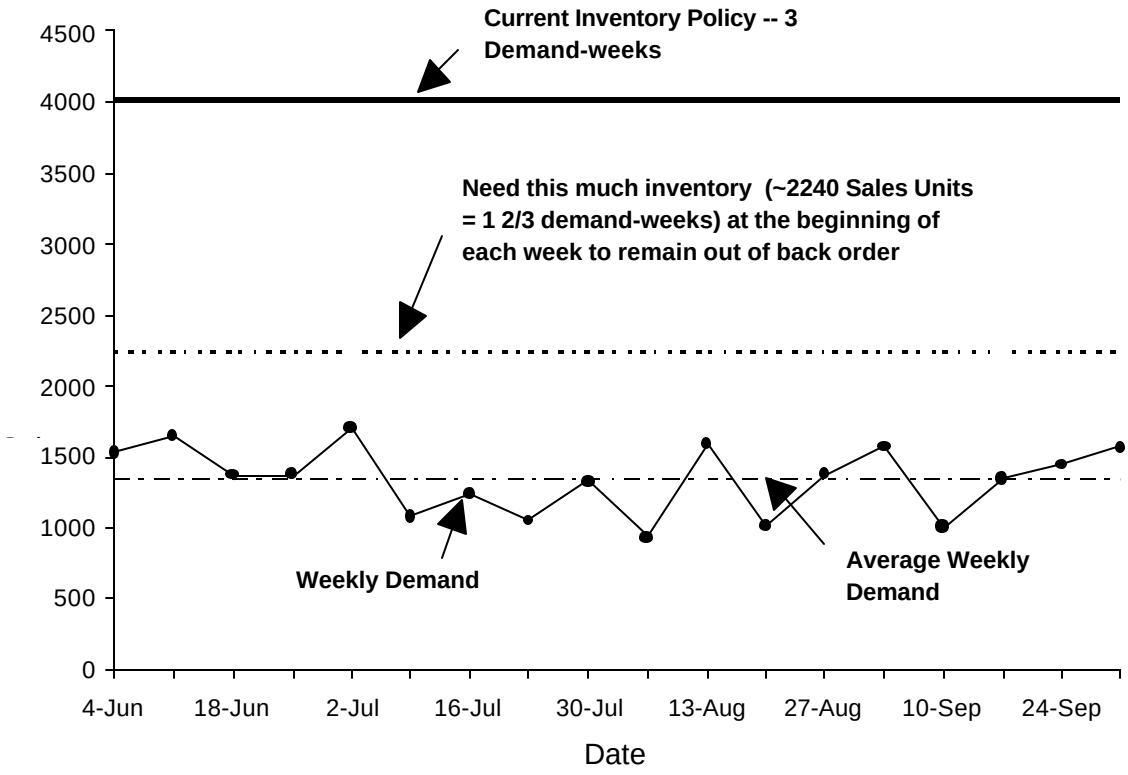


Exhibit 4. Production reaction to unexpectedly high demand (not a new product introduction). The unexpected demand occurred during Month 3, Month 4, and Month 5. Note that only monthly assembly output is shown; Packaging/Sterilization output was not obtained.



Note on Replenishment assumption: For simplicity, this chart assumes that FG inventory is replenished once per week with a lead time of one week. At the beginning of each week, enough product is "ordered" so that the "pipeline" plus FG inventory equals $2\,^{2}/_{3}$ demand-weeks of product. The pipeline in this case refers to in-process product that has not yet reached FG inventory. On average, one week's worth of demand will reside in the pipeline. This leaves, again on average, $2\,^{2}/_{3} - 1 = 1\,^{2}/_{3}$ demand-weeks in FG inventory at the beginning of each week.

Exhibit 5. Weekly demand pattern for a representative stable product demonstrating current levels of inventory versus consultant's recommended inventory policy.