Describe how you would design a new logistics network consisting of only a single warehouse. Provide an outline of such an analysis: What are the main steps? Specifically, what data would you need? What are the advantages and disadvantages of the newly suggested distribution strategy relative to the existing distribution strategy?

4. In selecting potential warehouse sites, it is important to consider issues such as geographical and infrastructure conditions, natural resources and labor availability, local industry and tax regulations, and public interest. For each of the following industries, give specific examples of how the issues listed above could affect the choice of potential warehouse sites:
   a. Automobile manufacturing
   b. Pharmaceuticals
   c. Books
   d. Aircraft manufacturing
   e. Book distribution
   f. Furniture manufacturing and distribution
   g. PC manufacturing
5. Consider the pharmaceutical and the chemical industries. In the pharmaceutical industry, products have high margins and overnight delivery typically is used. On the other hand, in the chemical industry, products have low margins and outbound transportation cost is more expensive than inbound transportation. What is the effect of these characteristics on the number of warehouses for firms in these industries? Where do you expect to see more warehouses: in the chemical industry or the pharmaceutical industry?
6. In Section 3.2.3, we observe that the TL transportation rate structure is asymmetric. Why?
7. Discuss some specific items that make up the handling costs, fixed costs, and storage costs associated with a warehouse.
8. What is the difference between using an exact optimization technique and a heuristic to solve a problem?
9. What is simulation, and how does it help solve difficult logistics problems?

# CASE

## H. C. Starck, Inc.

### THE ARRIVAL

Tom Carroll was a Fellow in MIT's Leaders for Manufacturing program. On June 1st, 1999, after completing a difficult academic year, Tom arrived at H. C. Starck, Inc., to start on his six-month internship. He knew that his work would involve reducing lead times, but did not know any specifics. His first meeting was with Lee Sallade, Director of Operations. Figure 3-21 presents an abbreviated organizational chart for H. C. Starck. Lee explained that the sales group was pressuring him to reduce lead times—defined here as the time from when the customer places the order, until the product is shipped. The general feeling was that this metric was running at 8 to 14 weeks, mostly due to the long

*Source:* Copyright © 2000 Massachusetts Institute of Technology. This case was prepared by LFM Fellow Thomas J. Carroll under the direction of Professors Stephen C. Graves and Thomas W. Eagar 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 LFM internship at the H. C. Starck, Inc. during July–Dec., 1999.

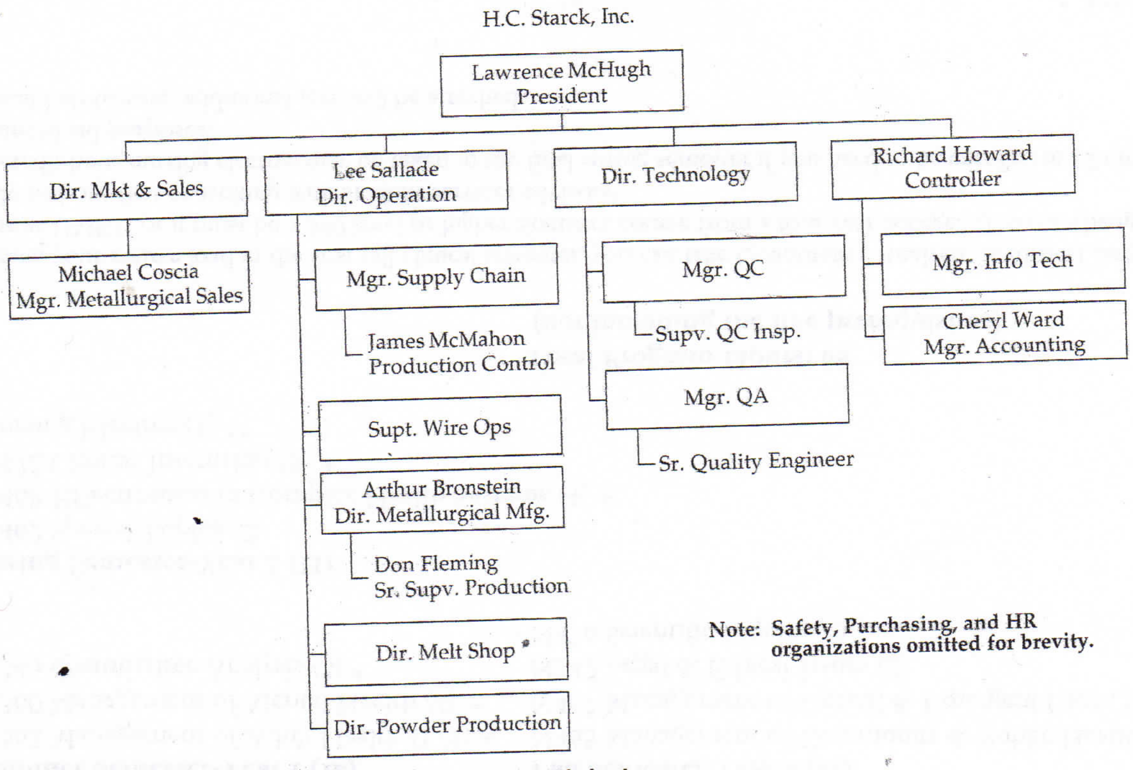



**FIGURE 3-21** Abbreviated H. C. Starck organizational chart.

manufacturing time, but there was no hard data. The sales department felt that if lead time could be reduced to three weeks, they would have a substantial advantage in the marketplace, and would realize incremental sales volume. Lee agreed that lead time was important, but cautioned about focusing solely on lead time, and not overall cycle time, which is the length of time it takes material to physically flow through the manufacturing process:

> We need to reduce cycle time as well as lead time. Larry *[the company president]* got burned once on a lead-time reduction project. The distributors ended up taking all the benefit. You should talk to him about that.

Lee explained that cycle time and inventory were important, but were difficult to influence since the company held such a high level of tantalum inventory:

> Making Ta ingot from scrap gives us a cost advantage compared to making it from good Ta powder. We have the technology to process and refine scrap that other companies do not. We buy scrap before we need it, because the supply is so erratic. We ran out once in 1996, and we don't want that to happen again. Sometimes we buy more than is needed, just to ensure an uninterrupted supply.

Lee also stressed the idea of managing with data. He was concerned that many operational decisions were based on 'industrial mythology,' and that rigorous data collection and analysis could help to break out of this mode of operation. Tom spent some more time discussing the operation with Lee, and left the meeting with a clear project goal: Reduce customer lead time to three weeks or less for all metallurgical products, without increasing inventory. While the goal was clear, the method was not. According to Lee: "We're not really sure how to achieve this. That is why we hired a smart MIT student like you!" Tom had a lot of work to do, and was eager to apply his newly learned skills.

## 2. THE COMPANY

H. C. Starck, Inc., traces its roots back to 1940, when MIT graduate Richard Morse founded National Research Corporation (NRC) as a process-development company focused on exploiting vacuum technology. The company was originally located at 70 Memorial Drive in Cambridge (currently MIT building E51). Early processes developed at NRC include 'Minute

Maid' frozen concentrated orange juice, and 'Holiday Brand' instant coffee. In the 1950's, NRC applied its vacuum technology to the production of high-purity metals, and in 1959 entered the tantalum processing business. Morse left in 1960, and the company went through a series of ownership changes, starting with the acquisition by Norton in 1963. Norton divested its interest in NRC in 1976, with H. C. Starck AG (a German company specializing in refractory metals) acquiring 50 percent, and a venture capital group acquiring the other 50 percent. Bayer AG purchased the majority of H. C. Starck AG in 1986; Bayer Corp USA purchased the remaining 50 percent of H. C. Starck, Inc., shortly thereafter. At this point, HCST was focused primarily on the reduction of tantalum, and production of tantalum powders. It wasn't until HCST acquired the tantalum mill and wire products from Fansteel in 1989 that it entered the metallurgical products market in a large way. The H. C. Starck International Group also has Ta reduction and powder manufacturing operations in Japan, Thailand, and Germany, but the Newton, MA, location is the only plant with melting and mill capability.

## 3. TANTALUM

Tantalum (Ta) was discovered in 1802 by Ekeberg, but many chemists thought niobium and tantalum were identical elements until Rowe in 1844, and Marignac, in 1866, showed that niobic and tantalic acids were two different acids. The first relatively pure ductile tantalum was produced by von Bolton in 1903. Tantalum ores are found in Australia, Brazil, Mozambique, Thailand, Portugal, Nigeria, Zaire, and Canada. Separation of tantalum from niobium requires several complicated steps. Several methods are used to commercially produce the element, including reduction of potassium fluorotantalate with sodium.

Tantalum is a gray, heavy, and very hard metal. Tantalum is almost completely immune to chemical attack at temperatures below 150°C, and is attacked only by hydrofluoric acid, acidic solutions containing the fluoride ion, and free sulfur trioxide. Alkalis corrode it only very slowly. At high temperatures, tantalum becomes much more reactive. The element has a melting point (about 3000°C) exceeded only by tungsten and rhenium. Tantalum is used to make a variety of alloys with desirable properties such as high melting point, high strength, and good ductility. Tantalum is used to make electrolytic capacitors and vacuum furnace parts, which account for about 60 percent of its use. The metal is also widely used to fabricate chemical process equipment, nuclear reactors, and aircraft and missile parts. Tantalum is completely immune to body liquids and is a nonirritating material. It has, therefore, found wide use in making surgical appliances. Tantalum oxide is used to make special glass with high index of refraction for camera lenses. The metal has many other uses, with a total worldwide annual consumption of about 550 tons.

Tantalum is very expensive, as shown in Table 3-9. Compare this to \$0.65/lb for aluminum and \$5/troy oz (\$73/lb) for silver (The Wall Street Journal, June 23, 1999). It is expensive stuff!

## 4. H. C. STARCK, INC., IN THE TANTALUM SUPPLY CHAIN

Tantalum-containing tin slags and mined ore are processed and refined to the tantalum "double salt," $K_2TaF_7$, by H. C. Starck AG. This free-flowing white powder is shipped from Germany in pallet-sized containers to the four Ta powder production operations worldwide. The "double salt" is reacted with molten

**TABLE 3-9**

**TANTALUM PRICES**

| Form | Price per pound |
|---|---|
| Tantalite ore (contained pentoxide basis) | \$ 35–45 |
| Capacitor-grade powder | \$135–240 |
| Capacitor wire | \$180–250 |
| Sheet | \$100–150 |

(Prices are from 1998 USGS data)

sodium and then cooled to form particles of elemental tantalum dispersed in a solid salt mass. The large mass is mechanically broken up, and the salts are leached out through several steps, leaving pure tantalum powder. Figure 3-22 diagrams a simplified version of the Ta supply chain. A large portion of the powder is further refined and graded, and sold for the production of sintered tantalum capacitors. Some of the powder is sintered into bars for the production of wire, also mostly for capacitors. Ta powder that is under or over the desired particle size is scrapped, and sent to the melt shop for recycling. Also, any scrap from the sintering or wire forming operations is collected and recycled.

The melt shop receives the above-mentioned scrap, as well as scrap from the metallurgical products divisions, scrap purchased on the open market, scrap generated by customers, and occasionally Ta ingots purchased from government reserves. (The United States and Russia have recently been reducing their strategic metal reserves, and periodically sell excess inventory at auction.) The scrap is processed and blended to achieve the desired chemistry, and is then melted into ingots in an electron-beam vacuum furnace. The eight-inch-diameter round ingots are cold-forged to a four-inch-thick 'sheet bar,' which is the starting material for the Metallurgical Products division.

## 5. METALLURGICAL PRODUCTS

The metallurgical products (MP) division of HCST comprises two basic functional areas, rolling and fabrication. The rolling plant has three mills that reduce the incoming four-inch-thick 'sheet bar' to the final gauge thickness, and a variety of equipment to perform functions such as cleaning, cutting to size, and annealing. The rolling plant produces only flat shapes. The fabrication area includes a sheet-metal shop, a machine shop, and several tube-welding lines. The fabrication shop takes flat stock from the rolling plant, and produces more complex finished products.

All incoming four-inch-thick sheet bars first undergo a 'breakdown' rolling process on the large mill. This mill can produce pieces up to 36 inches wide, and as thin as 0.015 inch. A 12-inch-wide foil mill can start with materials as thick as 0.030 inch, and is used for most production with a final gauge of 0.014 inch or less. There is also a 16-inch-wide intermediate mill, but it is only used for very small

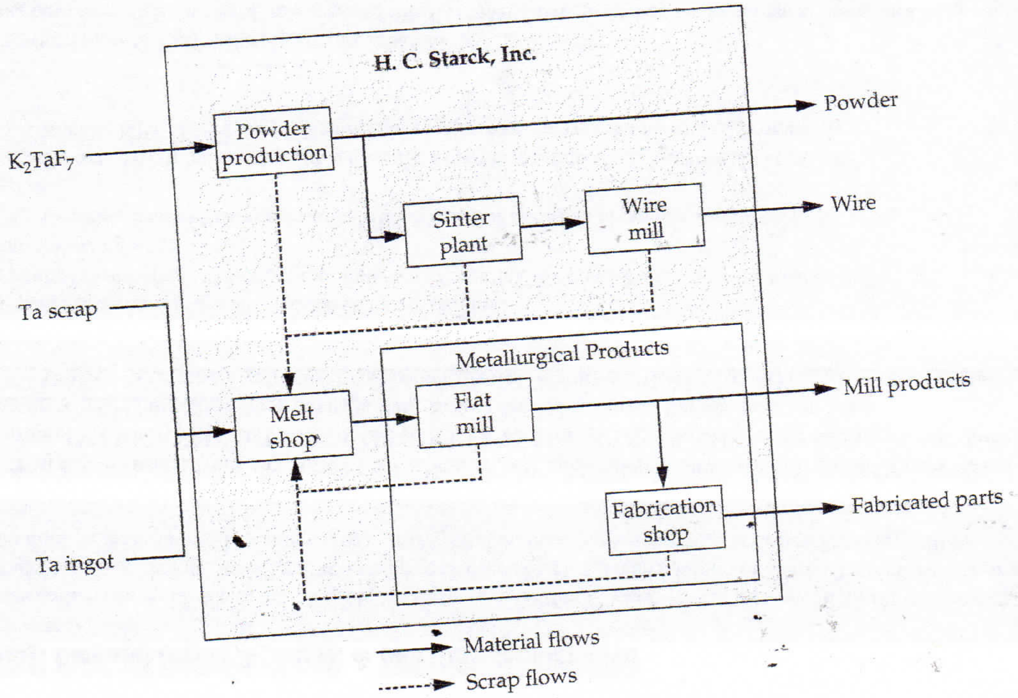



FIGURE 3-22 H. C. Starck, Inc., in the tantalum supply chain.

custom jobs. Don Fleming, Sr. Supervisor of Production for the rolling plant, has been with HCST for just over a year but has extensive experience from another rolling plant. Don describes the process:

> When we roll a bar down from 4 inches, it develops 'fishtailing' and edge cracks. We need to stop rolling and trim it all around when we get to 1/4 inch thick, to prevent these cracks from propagating. This typically results in a trim loss of 20 percent. If the final gauge is going to be thicker than 1/16 inch, we'll also anneal at this point.

As a metal is cold-rolled, it becomes work hardened. A piece of tantalum that starts out soft and ductile can be reduced up to 95 percent in cross-sectional area, but will become hard and brittle beyond this amount of reduction. By annealing the metal at over 1000° C, the grain structure has a chance to recrystallize to a stress-free state. This restores the original softness and ductility, allowing the piece to be rolled further. Before annealing, the piece of metal must be chemically cleaned. The high annealing temperatures would allow any surface contaminants (notably carbon, oxygen, nitrogen, and hydrogen from the atmosphere and hydrocarbon lubricants) to diffuse interstitially into the metal, causing embrittlement. This cycle of roll-clean-anneal may be repeated several times, as described in Figure 3-23. Don continues his explanation:

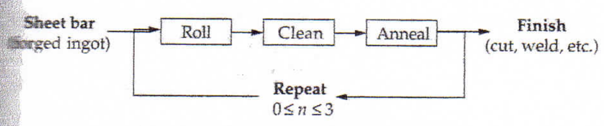
> If the final gauge will be less than 1/16 inch, then it will get rolled down to 1/8 inch before we anneal it. We can roll sheet down to 0.015 inch on the large mill. Anything thinner than that goes to the foil mill. Even though we use the same mill, the rolling process is different depending on the gauge. 'Breakdown' is done on the large mill in a free-rolling mode, and brings it to as thin as 1/8 inch. From 1/8 inch down is 'finish' rolling, which is done in tension. Also, we use a different set of work rolls for breakdown and finish—it takes a full shift to convert the large mill between the two processes.

During 'free rolling,' the workpiece moves through the mill simply by the action of the working rolls. Since the piece is not connected to anything, its entire length can be rolled. In tension rolling, a titanium 'leader' is attached to each end of the workpiece with a spiral spring (much like the pages of a spiral-bound notebook are attached together). The leader is coiled up on an arbor at each end of the mill. Tension applied to the workpiece helps to 'pull' it through the working rolls. Since the spring connection cannot go through the work rolls, there is a yield loss at each end of the piece. This yield, together with the typical side trim yields, averages 10 percent.

This series of rolling operations is the start of every product in the portfolio. By arranging the products by final gauge, and then mapping the number of individual rolling steps and standard stopping points, a generic product hierarchy can be constructed as shown in Figure 3-24.

After discussing the process with Don, Tom met with Arthur Bronstein, Director of Metallurgical Products. Arthur helped to fill in some of the details of the operation:

> The average piece of tantalum going through the large rolling mill for breakdown rolling is 570 pounds, and it takes 55 minutes to process it, including piece-to-piece setup. For finish rolling, the average piece is 450 pounds, and it takes two hours to complete. The changeover between breakdown and finish takes a full eight-hour shift. The large mill is staffed with two operators both during rolling and changeover. The fully loaded wage rate is about $25/hour, and we typically run 5 percent to 10 percent overtime.




| n | Final gauge (inches) |
|---|---|
| 0 | 0.250 – 3.99 |
| 1 | 0.060 – 0.249 |
| 2 | 0.015 – 0.059 |
| 3 | 0.000 – 0.014 |

**FIGURE 3-23** Basic production process.

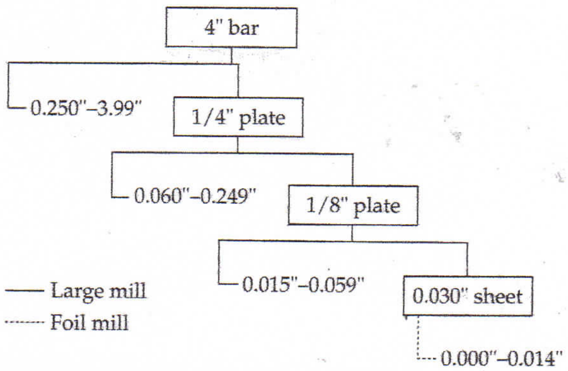



**FIGURE 3-24** Generic product hierarchy.

**TABLE 3-10**

**LARGE MILL PRODUCTION REPORT**

| (pounds) | 1998 | | 1999 | |
|---|---|---|---|---|
| | Breakdown | Finish | Breakdown | Finish |
| Jan. | 28,936 | 12,307 | 36,255 | 8,686 |
| Feb. | 68,001 | 10,828 | 46,175 | 18,106 |
| Mar. | 38,210 | 24,529 | 75,256 | 15,500 |
| Apr. | 78,514 | 22,122 | 16,978 | 14,112 |
| May | 61,782 | 20,155 | 28,539 | 18,219 |
| June | 43,176 | 24,277 | 28,103 | 25,586 |
| July | 57,216 | 15,880 | | |
| Aug. | 7,838 | 9,296 | | |
| Sept. | 28,394 | 15,981 | | |
| Oct. | 44,151 | 11,383 | | |
| Nov. | 23,73 | 16,287 | | |
| Dec. | 46,591 | 9,792 | | |
| YTD | 526,540 | 182,837 | 231,306 | 100,209 |

Arthur also gave Tom a spreadsheet with the mill's production report for last year, and the current year-to-date, shown here in Table 3-10. The large mill ran on a two-week cycle, with about one week of breakdown followed by one week of finish rolling. This schedule was run three shifts per day (i.e., 24 hours), five days per week, with just four weeks per year shut down for holidays and maintenance. The large mill averaged 85 percent uptime over the course of the year. Arthur wondered if this were the optimal schedule, or if more frequent changeovers would be beneficial.

## 6. SCHEDULING

H. C. Starck had installed a new ERP system (SAP's R/3) at the beginning of 1999, and was currently using the system to record all transactions. Production planning and scheduling, however, continued to be performed manually. Jim McMahon, Supervisor of Production Control and a 20-year HCST veteran, explains the raw material ordering method.

> I get the sales forecast, and covert it into a production forecast. I set the ingot orders by month for a year at a time, and revise the orders a few times per year. Getting the ingots is the real chore—the melt shop only has so much capacity. Also, sales orders typically come in spikes, and are very unpredictable.

In addition to the sales forecast variability, there was also some production variability. Jim estimated that the mill met its planned schedule about 90 percent of the time, and the melt shop about 80 percent of the time. Most of the schedule misses were due to equipment failures. In addition to raw material ordering, Jim also manually performed shop floor scheduling. The SAP scheduling utility was not used.

> I just know what is going on—all the orders come through me. Paul *[Jim's assistant]* or I generate a production order as soon as we get a sales order. Then I stack them up on my desk, until it is time to release it to the floor. If it isn't due for another eight weeks, I might keep it here four weeks before releasing it, depending on the loading in the shop at the time. I've been here enough years that I just know how long things will take. I don't have faith in SAP because I don't think the recipes are right.

In fact, the recipes were a problem. One indicator of the problem was standard cost. Standard costs were calculated from the recipes, and for some products these costs were lower than for the raw material used to make them—a logical impossibility. The engineering department was working to review and fix these problems, but it was a painstakingly slow process. A particularly problematic product to schedule was tubing. Tubing was produced by rolling flat sheet into a tube, and sealing the resulting seam by gas-tungsten arc welding. The plant could produce and inspect about 1,500 feet of tubing per day, working two shifts. Tube orders tended to be unpredictable and large—an order totaling 1,000 feet would be considered typical. Also, due to the extremely high material cost, nearly all orders were cut-to-length. In addition to the length, bending to a shape (for example, a u-bend for a heat exchanger application), or having caps welded on one end, further customized many orders. Jim explained the problem:

> The big problem in tubing is the erratic schedule, big peaks and valleys. This has been helped somewhat by 'blanket orders,' which allow us to do some smoothing.

In a "blanket order," a customer would commit to buy a quantity of a certain product, say 5,000 feet of $^3/_4$-inch diameter × 0.015-inch wall thickness tubing, by the end of the year. Then the plant would build the 5,000-foot tube inventory at standard 20-foot lengths. Randomly throughout the year, the customers would issue 'releases' against the blanket order. A typical release might ask for 50 tubes at 9-foot-9-inches each, to be shipped in six weeks. The tubes would be cut from stock, and shipped. In this example, the scrap rate works out well; 25 of the 20-foot standard sections could be cut to make the 50 tubes, with less than 3 percent scrap. Oftentimes, however, the scrap rate was much worse. If the above example had been for slightly longer tubes, say 50 pieces at 10 feet 9 inches each, then 50 of the standard 20-foot pieces would be cut to fill the order, with 50 pieces at 9 feet 3 inches each left over. These were set aside in the hope that they would eventually be used on another order, leading to an accumulation of odd-sized pieces. Sections shorter than two feet were scrapped.

## 7. SALES AND MARKETING

Mike Coscia, Manager of Marketing and Sales, Metallurgical Products, discussed the sales incentives:

> Our corporate profit sharing bonus is based on four goals: Sales volume, Return on Assets, Quality, and Safety. We've hit the maximum payout each of the last two years, and we're shooting to do it again this year. Reducing lead time is a great thing to do, in that it may help us make more sales, and will improve ROA, but it doesn't directly affect our bonus.

Still, he agreed that lead-time reduction was important:

> Tantalum is 4x the price of Zirconium or Hasteloy. If the customers can't get the tantalum in time, they might substitute one of the other alloys. If it works, they'll never switch back.

Mike was skeptical about our ability to achieve the goal of three-week lead time.

> I don't think we can get there. Our sales volumes are 10 times what they were 15 years ago, but the process hasn't changed. Sometimes I think the best thing sales can do is not take an order. We've just started to load the forecast data into SAP. Production planning is still done manually. There seems to be an 'information black hole'—orders go to the mill, but the demand data doesn't seem to make it back upstream to the melt shop.

There was a team started a few months ago to look at order processing, with the goal of getting all the paperwork from customer to production in less than two weeks, 80 percent of the time. Mike expressed frustration with the new SAP R/3 system:

> I don't understand why it takes so long, especially now that we have SAP. Why is there a physical piece of paper that travels from Sales to Production? Why can't this be automated through SAP? I know SAP can do this, but there are a lot of complaints about the system, and fear of doing it wrong.

As one way around the "information black hole," Sales, Production Control, and Operations had recently instituted a 'drumbeat' meeting each morning at 8:00 a.m. This meeting focused on achieving on-time delivery, by each morning reviewing the status of all the shipments that were due in the next week. Any that were at risk of being late were expedited through the plant. The meeting did keep everyone up-to-date on order status, but an unintended effect was that most jobs were bypassed until they made it to the 'drumbeat list,' then it was a race to get them completed on time.

## 8. FINANCE

Cheryl Ward was HCST's Manager of Accounting, and had led the implementation of the financial module of SAP:

> SAP has made a fundamental change in how we collect financial data. The manufacturing people used to give weekly time sheets and material tickets to accounting, who

entered the data, and made sure that it all made sense. Now, the manufacturing people enter the data directly into SAP, as a real-time transaction. This is a big cultural change.

It took a couple of months, but the operators on the manufacturing floor became proficient at making the transactions, with fairly high accuracy and reliability. While the transaction recording was going well, the behind-the-scenes calculations performed by SAP were not. One example of this involved the anneal oven. Each shop order was being charged for eight hours of oven time. Parts do take approximately eight hours to anneal; however, many parts can be in the oven simultaneously. The system was not set up to account for this, leading to errors in both allocation of overhead (and therefore product costs), and also in the scheduling system (one of the reasons it was not used). From a financial standpoint, these errors led to large cost allocation variances that were adjusted at the end of the accounting period. Even six months into the implementation, the adjustments were sometimes as large as 100 percent of the actual values. Rick Howard, HCST's Controller, discussed inventory:

> Inventory is very expensive—we seem to have years of inventory. Since scrap is such an important raw material for us, we consider it a strategic purchase—we buy it even when we don't really need it. Tantalum is a thinly traded market, so we take it when we can get it, if for nothing else than to keep it out of the hands of our competitors. Reducing inventory in the plant won't really save us money—it will just push the inventory back in the pipeline to scrap. Scrap is valued at $75 per pound, heavy gauge material (thicker than $^1/_4$ inch) at $100 per pound, and thinner gauges average $125 per pound, so, there is not a huge savings for holding material earlier in the pipeline. We're going to hold the inventory somewhere in the system; it might as well be at strategic points near the end.

Rick pointed out that as a subsidiary of Bayer, HCST's cost of capital was a favorable 9 percent. Rick also expressed concern about a Chinese company that recently started selling Ta wire. While their quality was not very good, their sales price was roughly equal to HCST's production cost. Rick was worried that the Chinese would eventually improve their quality, and then might enter the mill products market.

## 9. THE PRESIDENT

Tom also met with Larry McHugh, President of H. C. Starck, Inc. Larry described one of his experiences with cycle-time reduction at another company:

> I'm not a big fan of lead time and service level projects. These will help your business when you are supplying end customers, but not when you are supplying intermediates, like we are. We already have a majority of the worldwide chemical process industry Ta market. Some of our customers whine about long deliveries, but most would not buy more even if we improved it. I think quicker deliveries might give us an advantage in some of the smaller segments, such as furnace parts and sputtering targets. Before I came to H. C. Starck, I ran operations at another company. We spent a pile of money implementing Goldratt's "The Goal" management method. We really took it to heart, and substantially reduced cycle times, but gained no benefit. Our product was sold through regional distributors—they ended up taking all the inventory savings. You could argue that with the improved performance, we could have recruited more distributors, but with the geographic exclusions, and with others being locked up by our competitors, there was really no way to change. So we spent a bunch of money, with nothing to show for it. I don't want that to happen here. The one area where this really may help is with inventory. If you can figure a way to cut our inventories, then that may really save some money.

## 10. LEAD TIME AND INVENTORY DATA

By this time, Tom's head was spinning with conflicting opinions and advice from each of the different players. Everyone seemed to have an opinion, but few people had much supporting data. Tom decided it was time to collect some hard data on which to base his recommendation. While the SAP R/3 system was not being used for planning or scheduling, it was being used to record all the accounting transactions, including order creation and all material movements. Transactions were recorded in near real time, usually within a few hours of when they physically occurred, and often within minutes. Even though some of the values calculated by recipes were unreliable, the data resulting from manually entered transactions were quite accurate. Figure 3-25 shows lead-time data from a customer perspective—how long does it take from order to delivery? (Initial compliance for using SAP to record transactions was poor, so data for January and February were ignored.) The data showed that the average lead time was under 7 weeks, not 12, as was commonly quoted. Many of the longest orders were actually "blanket orders" with no releases against them yet.

At the start of the project, the generally accepted belief was that the customer lead time was long due to the long manufacturing time. Figure 3-26 shows this manufacturing lead time, counting the time from

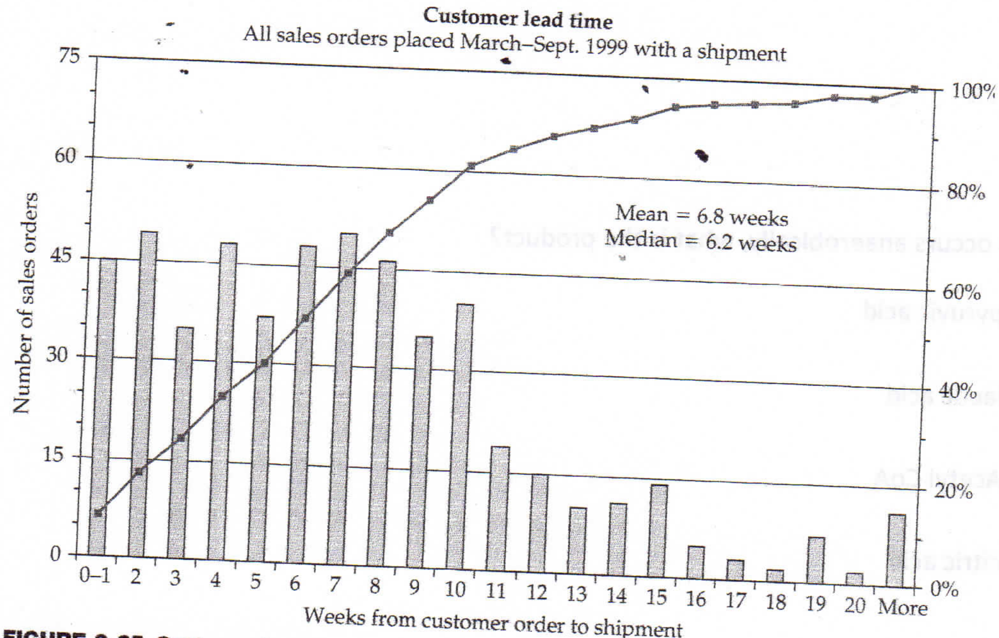



**FIGURE 3-25 Customer lead time.**

'goods issue' to 'goods receipt.' 'Goods issue' is the transaction that occurs when the input material is physically issued to the shop floor, and 'goods receipt' is the transaction that is completed after all manufacturing and inspection steps are complete, and the material physically moves to the stockroom, to be shelved or packaged for shipment. This graph shows that, on average, final items are manufactured in just over two weeks, with 75 percent complete in three weeks. How could it be that manufacturing averaged just over two weeks, but order-to-delivery averaged nearly seven weeks? What happened to the

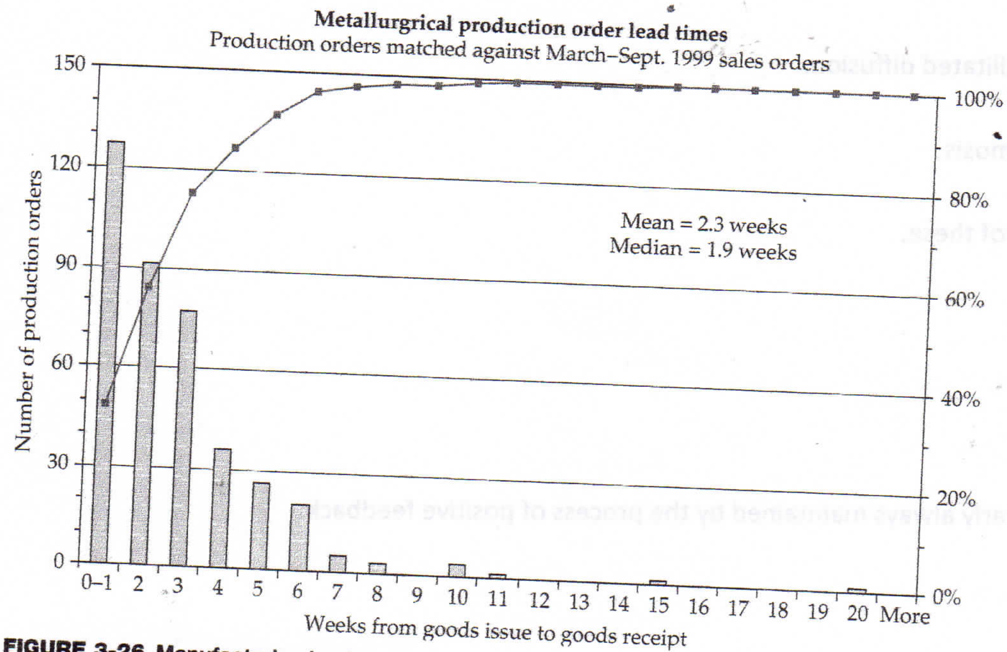



**FIGURE 3-26 Manufacturing lead time.**

other five weeks? One possibility is that there was a shortage of material, with no raw-material inventories from which to produce.

Figure 3-27 shows inventory levels. They appear to be more than adequate to ensure a high level of availability. If neither manufacturing time nor inventory levels were the cause of the long customer lead times, what could it be? Before Tom's arrival, it was felt that a lot of time was wasted getting the customers' orders to the shop floor. A group had been meeting for several weeks looking at the issue, and had started some process mapping. In theory, the information flow was controlled by SAP R/3 as shown in Figure 3-28. In reality, SAP was often ignored, and a manual paper-based process was used to transmit the order from Sales to Operations.

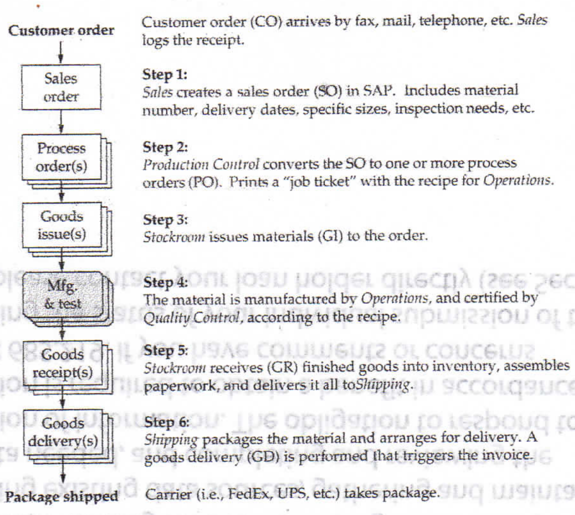
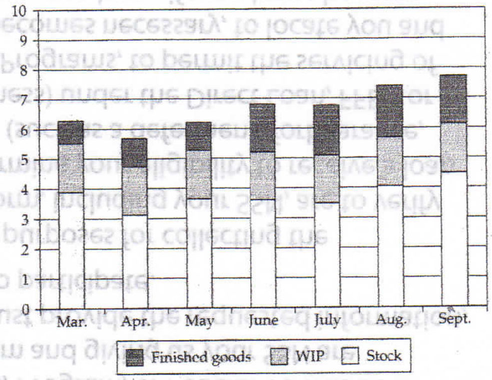



**FIGURE 3-28 Order flow diagram.**

A custom ABAP (SAP's programming language) report had been created to look at the first two steps in the process, and procedures had been implemented that reduced the first step (create the SO) to one business day or less. The second step (create the PO) was still taking up to two weeks, and there was no real data for the rest. Tom had the report expanded to include the entire delivery process, and the data is shown in Figure 3-29. This data confirmed that manufacturing time (GI-GR) was only a small portion (about 25 percent of the total lead time. The time that finished material sat waiting to be shipped was also relatively small—most orders were shipped as soon as they were built. The problem lay in the SO to GI phase—all that time between when the sales department entered the order in to SAP, and when the plant actually started manufacturing. (The large increase in SO-PO in August can be attributed to the annual two-week plant shutdown.) This long lag time can be partially explained by the slow manual process of transmitting orders, and partially by the current production policy. The typical production routing used a make-to-order policy, with either 4-inch sheet bar or $^1/_4$-inch plate from a stock inventory as the initial input. Depending on the final gauge and form, the material will likely flow through multiple process orders before ending up as the final product.




Finished goods: Material produced to a customer specification, and held in reserve for that particular customer.

WIP: Material that is assigned to in-progress work orders.

Stock: Any material in the stockroom that is neither Finished Goods nor Scrap. This could include both incoming sheet bar from the melt shop, intermediate and standard shapes, and small 'left over' pieces from customer orders.

**FIGURE 3-27 Inventory coverage.**

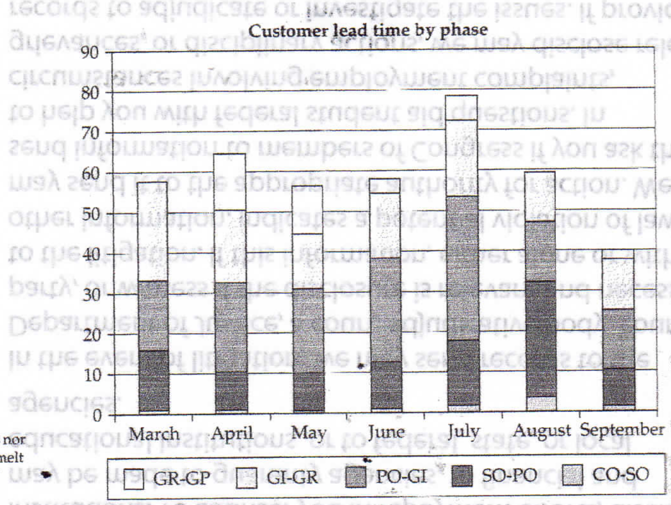



**FIGURE 3-29 Customer lead time—by order phase.**

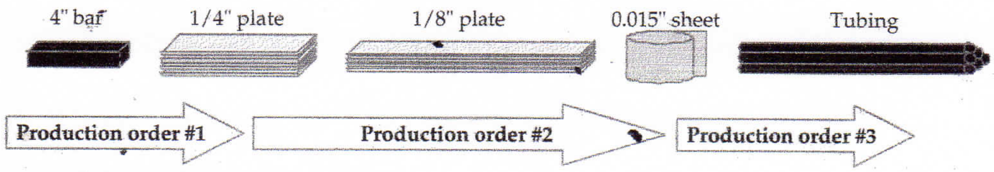



**FIGURE 3-30** **Multiple process orders.**

Figure 3-30 illustrates a typical scenario—the customer has ordered 0.015-inch wall thickness tubing, and three separate production orders are generated. The first order is to "break down" a 4-inch thick sheet-bar to $^1/_4$-inch plate. The next order takes the $^1/_4$-inch plate, and rolls it in two steps to 0.015-inch sheet. The final order—for the product that the customer ordered—starts with the wide-format 0.015-inch sheet; slits it to the proper width for tubing; and rolls, forms, and inspects the tubing. The problem with this scheme is that the final process order, the one that makes the product for the customer, cannot be started until the previous steps, that create the necessary intermediate material, are completed. Figure 3-26 measured only the manufacturing lead time for customer-ordered items, in this case, equivalent to the in-process time of production order #3, which produced the tubing from the 0.015-inch gauge sheet.

Compounding this are certain ordering and expediting schemes. As a way to cut customer lead times, the sales department enters hard orders on probable sales, so that when the actual customer order arrives, the material is already partially through the manufacturing process. Sometimes this works well, but often it causes one of two problems. Since SAP requires that orders have a delivery date, sales makes up a date. If the date is too far into the future, the order may be ignored by Operations. If the date is too close, Operations may build and ship the material before the customer wants it, or completes the probable order, only to find that the customer modified their requirements for the firm order, and the material just made is obsolete. The daily 'drumbeat' meeting exacerbates these problems. At this meeting between Sales, Operations, Quality, and Production Control, all orders due to ship in the next week are reviewed. Any orders found to be falling behind schedule are expedited. An effect of this is that until orders show up on the 'drumbeat' list, they are largely ignored. The resulting production policy effectively becomes "Expedite late orders."

## 11. SALES DATA

The primary argument for maintaining a pure make-to-order job shop was that the Metallurgical Products division sold four different alloys, with a total of over 600 unique part numbers on the books. The extreme product diversity and unpredictable line-item demand seemed to preclude any make-to-stock possibility. A review of the sales data for the first nine months of the year, however, seemed to indicate that the product diversity was actually much less than originally thought. (For brevity, we will consider only two of the four alloys—these two were chosen as illustrations because they have very different demand profiles, and together they account for 80 percent of the total demand.) While each alloy has 100 to 200 unique part numbers, Figures 3-31 and 3-32 show that less than half of these were sold over the course of nine months, and many of these only sold once or twice. Demand seems to be concentrated in just a few parts.

## 12. CASE WRAP-UP

Having spent two months learning about the operation, building relationships, and trying to make small operational gains, Tom spent a few minutes reviewing the situation. The Metallurgical Products department at HCST was scheduled as a make-to-order job shop, with customer lead-time performance averaging seven weeks. Order expediting is the rule rather than the exception, and in fact a daily meeting occurs to enable the expediting. The plant carries an average of six months' inventory, yet few items are sold from stock, or even made in a single production step from stock. Nearly all work passes through some of the standard gauges of 4 inch, $^1/_4$ inch, $^1/_8$ inch, and 0.030 inch, yet no standard stock is held at these sizes other than a small amount at $^1/_4$ inch, and small leftover pieces at the other gauges. The Sales group was pressing hard to reduce

| | | | 1999/Invoiced sales—pounds per month | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Material | Gauge | Description | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. |
| 1001 | 0.005 | Sheet - 1.0" × 23.75" | 171 | 0 | 0 | 20 | 0 | 0 | 0 | 17 | 0 |
| 1002 | 0.010 | Sheet | 20 | 56 | 287 | 179 | 41 | 204 | 560 | 143 | 276 |
| 1003 | 0.005 | Sheet | 263 | 576 | 584 | 812 | 617 | 969 | 572 | 359 | 909 |
| 1004 | 0.015 | Sheet | 68 | 611 | 1,263 | 167 | 1,917 | 803 | 321 | 377 | 404 |
| 1005 | 1.000 | Thermowell per Dwg # ABC12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1006 | 0.150 | Sheet | 101 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1007 | 0.060 | Plate | 0 | 146 | 32 | 117 | 129 | 414 | 581 | 26 | 191 |
| 1008 | 0.040 | Sheet | 321 | 101 | 191 | 486 | 8 | 98 | 263 | 176 | 690 |
| 1009 | 0.030 | Sheet | 0 | 122 | 614 | 275 | 422 | 360 | 686 | 246 | 177 |
| 1010 | 0.020 | Sheet | 0 | 54 | 102 | 183 | 45 | 54 | 126 | 92 | 119 |
| 1011 | 0.002 | Foil | 618 | 1,079 | 1,215 | 1,188 | 1,020 | 290 | 1,590 | 849 | 1,017 |
| 1012 | 0.125 | Plate | 228 | 8 | 32 | 90 | 432 | 17 | 8 | 0 | 450 |
| 1013 | 0.150 | Plate | 1,100 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 |
| 1014 | 0.250 | Plate | 6 | 12 | 0 | 770 | 0 | 752 | 0 | 0 | 174 |
| 1015 | 0.375 | Plate | 0 | 0 | 0 | 0 | 0 | 0 | 375 | 0 | 0 |
| 1016 | 0.500 | Tube—0.50" OD | 3 | 0 | 0 | 51 | 6 | 54 | 33 | 27 | 33 |
| 1017 | 0.750 | Tube—3/4" | 0 | 0 | 0 | 8 | 12 | 558 | 0 | 0 | 12 |
| 1018 | 0.015 | Tube—1.0" OD | 8 | 0 | 0 | 0 | 0 | 230 | 0 | 41 | 0 |
| 1019 | 0.020 | Tube—1.5" OD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 |
| 1020 | 0.500 | Tube—.50" OD | 44 | 3 | 0 | 0 | 0 | 0 | 35 | 0 | 0 |
| 1021 | 0.020 | Tube—5/8" OD | 0 | 6 | 0 | 0 | 0 | 8 | 0 | 0 | 0 |
| 1022 | 0.102 | Sheet | 0 | 27 | 33 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1023 | 0.010 | Sheet—1.0" × 23.75" | 0 | 99 | 14 | 18 | 0 | 0 | 0 | 0 | 0 |
| 1024 | 0.060 | Plate—7/8" × 39.125" | 15 | 0 | 24 | 0 | 0 | 0 | 0 | 15 | 0 |
| 1025 | 1.125 | Ring—6.25" OD × 4.5" ID | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1026 | 1.000 | Ring—4.0" OD × 2.5" ID | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1027 | 0.015 | Sputter Target—2.0" × 5.0" | 0 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1028 | 0.500 | Ring—10" OD × 8.5" ID | 0 | 189 | 0 | 48 | 293 | 93 | 0 | 0 | 174 |
| 1029 | 0.500 | Disk—10" dia | 275 | 0 | 353 | 0 | 581 | 0 | 530 | 414 | 1,017 |
| 1030 | 0.250 | Plate—5.25" × 10.25" | 0 | 0 | 0 | 57 | 0 | 18 | 0 | 17 | 0 |
| 1031 | 0.500 | Disc—6" Dia | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 |
| 1032 | 0.010 | Tube—2" OD | 0 | 0 | 0 | 14 | 0 | 12 | 12 | 0 | 0 |
| 1033 | 0.8 mm | Disc—314 mm Dia | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 |
| 1034 | 0.375 | Disk—9.625" dia | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 | 0 |
| 1035 | 0.015 | Tube—1.0" w/end cap | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| 1036 | 0.125 | Ring—12-3/4" OD × 9-3/8" ID | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 |
| 1037 | 0.125 | Plate—3.5" × 13.2" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |

**FIGURE 3-31 Invoiced sales for alloy #1.**

customer lead times to under three weeks. The goal seemed attainable since production orders averaged just over two weeks, but something needed to be done to speed the time between when an order was received and operations began working on producing the final product. It seemed as though maintaining stocks of some of the standard intermediate sizes would help customer lead times, since end items could be produced in a single production operation, but which items should be stocked, and at what levels? Also, not everyone in the organization was convinced that reduction of customer lead time was a priority—some were more focused on inventory reduction, while others felt that inventory levels were not that important. Tom had four months left to come up with a plan and implement it—what was he going to do?

## CASE DISCUSSION QUESTIONS

1. Why are the lead times so long?
2. How might Starck reduce or affect the lead times?
3. What are the costs from reducing the lead times? What are the benefits from reducing the lead times?

*This is a relatively long and involved case. You should use your judgment about how best to approach it, given that you have limited time. You should be able to diagnose what is going on and identify key tactics to pursue, and we do not expect you to develop an elaborate analysis of the data given herein (although this is certainly fine to do if you have the time).*

| Material | Gauge | Description | 1999/Invoiced sales—pounds per month | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. |
| 2001 | 0.045 | Repair Disc 4" Dia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 2002 | 0.045 | Repair Disc 2 1/2" Dia | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 0.045 | Repair Disc 1" Dia | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| 2004 | 0.045 | Repair Disc .75" Dia | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 |
| 2005 | 0.015 | Endcap to fit 1" OD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 0.045 | 3/4" Repair Disk | 0 | 4 | 4 | 0 | 9 | 4 | 9 | 0 | 5 |
| 2007 | 0.045 | 1" Repair Disk | 0 | 6 | 7 | 0 | 0 | 8 | 0 | 2 | 1 |
| 2008 | 0.045 | 1 1/2" Repair Disk | 0 | 4 | 4 | 8 | 0 | 0 | 4 | 0 | 4 |
| 2009 | 0.045 | 2" Repair Disk | 0 | 4 | 5 | 4 | 10 | 10 | 0 | 4 | 0 |
| 2010 | 0.045 | 2-1/2" Repair Disk | 0 | 6 | 7 | 0 | 0 | 0 | 4 | 0 | 4 |
| 2011 | 0.045 | 3" Repair Disk | 0 | 0 | 0 | 9 | 0 | 0 | 10 | 0 | 5 |
| 2012 | 0.045 | 4" Repair Disk | 0 | 8 | 6 | 15 | 0 | 84 | 7 | 9 | 8 |
| 2013 | 0.045 | 5" Repair Disk | 10 | 0 | 0 | 0 | 0 | 12 | 0 | 11 | 0 |
| 2014 | 0.045 | 6" Repair Disk | 0 | 12 | 0 | 0 | 8 | 0 | 0 | 6 | 32 |
| 2015 | 0.045 | 3/4" Patch Kit | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 3 |
| 2016 | 0.045 | 1" Patch Kit | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 3 |
| 2017 | 0.045 | 1 1/2" Patch Kit | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 6 |
| 2018 | 0.045 | 2" Patch Kit | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 |
| 2019 | 0.045 | 2 1/2" Patch Kit | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 4 |
| 2020 | 0.045 | 3" Patch Kit | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 6 |
| 2021 | 0.045 | 4" Patch Kit | 0 | 0 | 0 | 0 | 9 | 0 | 5 | 0 | 16 |
| 2022 | 0.045 | 6" Patch Kit | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 |
| 2023 | 0.045 | 5" Patch Kit | 0 | 7 | 0 | 0 | 5 | 0 | 0 | 0 | 0 |
| 2024 | 0.005 | Sheet—Annealed | 0 | 6 | 0 | 0 | 6 | 0 | 0 | 0 | 0 |
| 2025 | 0.002 | Foil Annealed | 551 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2026 | 0.010 | Sheet Annealed | 0 | 0 | 435 | 0 | 251 | 412 | 0 | 0 | 0 |
| 2027 | 0.060 | Plate Annealed | 0 | 0 | 277 | 323 | 60 | 0 | 504 | 12 | 205 |
| 2028 | 0.045 | Sheet Unannealed | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2029 | 0.045 | Sheet Annealed | 137 | 122 | 430 | 18 | 37 | 16 | 0 | 368 | 5 |
| 2030 | 0.375 | Plate Annealed | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 |
| 2031 | 0.020 | Sheet Annealed | 761 | 521 | 826 | 671 | 889 | 1,004 | 3,975 | 27 | 7 |
| 2032 | 0.025 | Plate Annealed | 0 | 69 | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2033 | 0.150 | Plate Annealed | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 0 | 0 |
| 2034 | 0.125 | Plate Annealed | 0 | 35 | 78 | 63 | 34 | 0 | 0 | 208 | 0 |
| 2035 | 0.030 | Sheet Annealed | 1,638 | 116 | 1,138 | 634 | 524 | 579 | 1,672 | 703 | 517 |
| 2036 | 0.015 | Sheet Annealed | 108 | 0 | 13 | 56 | 0 | 27 | 0 | 0 | 1 |
| 2037 | 0.015 | Welded Tube .50" OD | 0 | 0 | 6 | 0 | 0 | 23 | 7 | 0 | 0 |
| 2038 | 0.025 | Welded Tube 1.5" OD | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| 2039 | 0.020 | Welded Tube .50" OD | 0 | 0 | 181 | 142 | 0 | 0 | 0 | 0 | 0 |
| 2040 | 0.025 | Welded Tube .75" OD | 296 | 936 | 2,989 | 1,366 | 2,468 | 989 | 657 | 528 | 1,392 |
| 2041 | 0.020 | Welded Tube .75" OD | 0 | 50 | 316 | 3 | 379 | 0 | 2,856 | 0 | 0 |
| 2042 | 0.025 | Welded Tube .75" OD | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 5 |
| 2043 | 0.015 | Welded Tube 1"-1.49 OD | 0 | 0 | 480 | 444 | 0 | 77 | 118 | 343 | 0 |
| 2044 | 0.020 | Welded Tube 10." OD | 0 | 0 | 0 | 32 | 241 | 108 | 4 | 0 | 0 |
| 2045 | 0.030 | Welded Tube 1.0" OD | 0 | 0 | 370 | 0 | 0 | 1 | 0 | 0 | 41 |
| 2046 | 0.015 | Welded Tube 1.5" OD | 0 | 0 | 0 | 0 | 40 | 0 | 133 | 0 | 0 |
| 2047 | 0.030 | Welded Tube 1.50" OD | 0 | 255 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2048 | 0.030 | Custom Sheet Annealed | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2049 | 0.020 | Custom Sheet Annealed | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 |
| 2050 | 0.015 | Welded Tube 1" OD With Cap | 0 | 0 | 0 | 1,003 | 0 | 0 | 176 | 0 | 0 |
| 2051 | 0.022 | Welded Tube 1.25" OD | 0 | 0 | 0 | 1,014 | 0 | 0 | 0 | 0 | 0 |
| 2052 | 0.035 | Tube 1.25" OD | 0 | 0 | 302 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2053 | 0.020 | Disc 66mm OD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2054 | 0.118 | Tube .815" od × 3mm wall | 0 | 0 | 0 | 8 | 8 | 0 | 0 | 0 | 0 |
| 2055 | 0.118 | Tube .614" od × 3mm wall | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |

**FIGURE 3-32** Invoiced sales for alloy #2.

CASE

## The Great Rebate Runaround

Ah, the holiday shopping season: Santa Claus, reindeer—and rebate hell. Those annoying mail-in offers are everywhere these days. Shoppers hate collecting all the paperwork, filling out the forms, and mailing it all in to claim their $10 or $100. But no matter how annoying rebates are for consumers, the country's retailers and manufacturers love them.

From PC powerhouse Dell to national chains Circuit City and OfficeMax to the Listerine mouthwash sold at Rite Aid drugstores, rebates are proliferating. Nearly one-third of all computer gear is now sold with some form of rebate, along with more than 20% of digital cameras, camcorders, and LCD TVs, says market researcher NPD Group.

Hal Stinchfield, a 30-year veteran of the rebate business, calculates that some 400 million rebates are offered each year. Their total face value: $6 billion, he estimates. Office-products retailer Staples says it and its vendors alone pay $3.5 million in rebates each week.

### TAX ON THE DISORGANIZED

Why the rage for rebates? The industry's open secret is that fully 40% of all rebates never get redeemed because consumers fail to apply for them or their applications are rejected, estimates Peter S. Kastner, a director of consulting firm Vericours. That translates into more than $2 billion of extra revenue for retailers and their suppliers each year. What rebates do is get consumers to focus on the discounted price of a product, then buy it at full price.

"The game is obviously that anything less than 100% redemption is free money," says Paula Rosenblum, director of retail research at consulting firm Aberdeen Group.

The impact on a company's bottom line can be startling. Consider TiVo. The company caught Wall Street off guard by sharply reducing its first-quarter loss to $857,000, from $9.1 million in the same period last year. One reason: About 50,000 of TiVo's 104,000 new subscribers failed to redeem mail-in rebate offers, reducing the company's expected rebate expense by $5 million. TiVo says it generally sees lower redemption rates during the Christmas shopping season, when consumers may be too distracted to file for rebates on time.

Credit this bonanza for retailers and suppliers partly to human nature. Many consumers are just too lazy, forgetful, or busy to apply for rebates: Call it a tax on the disorganized. Others think the 50 cents, $50—or even $200—is just not worth the hassle of collecting.

### "I WAS FROSTED"

But many consumers—and state and federal authorities—suspect that companies design the rules to keep redemption rates down. They say companies count on complex rules, filing periods of as little as a week, repeated requests for copies of receipts, and long delays in sending out checks to discourage consumers from even attempting to retrieve their money. When the check does arrive, it sometimes gets tossed in the trash because it looks like junk mail.

These obstacles don't stop Chuck Gleason. A rebate junkie, he has redeemed dozens of rebates on the high-tech and electronics gizmos he buys. But getting his money, he says, sometimes drives him crazy.

On Nov. 7, 2004, for example, the 57-year-old director of operations for a Portland (Ore.) metal-recycling company bought a TiVo digital video recorder for $300. TiVo promised that a $100 rebate would arrive in six to eight weeks if Gleason mailed in his receipt and the universal product code on the box and kept his TiVo subscription for at least 30 days.

Gleason sent in the paperwork the very next day and nothing happened. By February there was still no sign of his $100, despite repeated follow-ups, so he threatened to file complaints with state and federal officials. But TiVo's rebate processor, Parago, left him even more exasperated: "Because your issue requires further research, your e-mail has been forwarded to a special team," said an e-mail from a customer-service agent named Sophie.

Finally, on Mar. 29, more than 14 weeks after he bought his DVR, his check arrived. "I was frosted," he says.

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*Source:* Brian Grow, *BusinessWeek Online*, November 23, 2005, www.businessweek.com/maginanial/D5_49/b3962ø74.htm.

### "BREAKAGE" AND "SLIPPAGE"

Citing privacy restrictions, TiVo officials declined to discuss the case. But the company says it regrets any inconvenience and recently changed its rebate process to include a printable sign-up form at tivo.com to cut down on handwriting errors. Parago also declined to discuss the incident but said errors are rare among the "tens of millions" of rebates it processes each year.

Indeed, processors and companies offering rebates insist that there is no intentional effort to deny them, a move that Stinchfield, who is the chief executive of Orono (Minn.) consulting firm Promotional Marketing Insights, says would be akin to "brand suicide." Rather, companies say, the rules are aimed at stopping fraud. Rebate processors won't provide estimates for the amount of fraud they encounter, but Young America Corp., the nation's largest processor, says it now monitors 10,000 addresses suspected of submitting bogus rebates.

The quest for buyers who don't end up collecting a rebate has spawned special industry lingo. Purchases by consumers who never file for their rebates are called "breakage." Wireless companies that pay 100% rebates on some cell phones, for example, rely in part on "breakage" to make money. Rebate checks that are never cashed are called "slippage."

### COMPLAINTS HAVE SOARED

One processor, TCA Fulfillment Services in New Rochelle, N.Y., published a "Rebate Redemption Guide" for its corporate customers several years ago. It cited the low redemption rates that companies could expect after hiring TCA: just 10% for a $10 rebate on a $100 product, and just 35% for a $50 rebate on a $200 product. "If you are using another fulfillment company, add 20% to these redemption rates," says the chart.

Lewisville (Tex.)-based Parago bought TCA's customer list last December and disavows that guide. It says it can't estimate current rates because clients don't provide the company with sales data. TCA founder Frank Giordano did not respond to several calls and a letter requesting comment.

Consumer-product makers such as Procter & Gamble pioneered rebates in the 1970s as a nifty way to advertise small discounts without actually marking the products down. In the '90s, their popularity soared as computer makers and consumer-electronics companies pitched them as a way to move piles of PCs, cell phones, and televisions before they became obsolete. The value of rebates jumped, too, from a couple of bucks to $100 or more.

With more companies plugging rebates—and more dollars at stake for consumers—complaints have soared. Gripes filed with the Council of Better Business Bureaus have tripled since 2001, from 964 to 3,641 last year. But processors say that number is still tiny compared with the vast number of claims they handle.

### REGULATORY SCRUTINY

David S. Bookbinder files many of the complaints. Each year the 40-year-old computer technician claims more than 100 mail-in rebates. He figures those deals save him—and customers of his computer-repair business, Total PC Support, in Revere, Mass.—as much as $2,500. After eight weeks of waiting, he usually calls customer-service numbers to hunt down his check. If the representative alleges that paperwork was wrong or asks for more time, he automatically files complaints with the Better Business Bureau, the Federal Trade Commission, and the state attorney general.

Regulators are intensifying their scrutiny of the industry. In October, New York Attorney General Eliot Spitzer settled a case with Samsung Electronics America. The company agreed to pay $200,000 to 4,100 consumers who were denied rebates because they lived in apartment buildings. Samsung's rebate program, according to Spitzer's office, allowed only one rebate per address, and the form didn't have a space to list apartment numbers. Samsung did not respond to requests for comment.

Meanwhile, in Connecticut, officials are investigating ads that list prices only after rebates—a marketing scheme prohibited in the state. Attorney General Richard Blumenthal won't disclose the names of the retailers. "If consumers are compelled to jump through hoops to receive the rebate, or are denied rebates for illogical or arbitrary reasons, that adds fuel to our investigation," he says.

### "NO INCENTIVE"

Some regulators are using novel tactics. On Nov. 7, Massachusetts officials filed suit against Young America to demand that it submit to an audit of $43 million in uncashed rebate checks. The company, headquartered in Young America, Minn., kept that amount of money from 1995 to mid-2002 in return for charging its clients lower fees, it says.

Massachusetts officials believe that keeping uncashed checks could be an incentive to deny legitimate redemption claims. "It's almost like the old bait and switch," says Massachusetts State Treasurer Timothy P. Cahill.

Young America is fighting back. In written responses to questions from *BusinessWeek*, CEO Roger D. Andersen stands by the company's policy and says retailers and suppliers sometimes prefer that it keep uncashed checks. That keeps Young America from having to send them back and then turn around and collect its fee from clients.

"Young America receives the same fees whether a submission is valid or invalid," he says. "We have no incentive to increase invalid rates."

## UNIFORM RULES

The backlash against mail-in rebates is pushing some companies to drop them. Best Buy plans to phase them out in two years. At Staples, mail-in rebates were the No.1 customer complaint for years, says Jim Sherlock, director of sales and merchandising. So a year ago, the Framingham (Mass.) company switched to an online system called EasyRebates that customers use to file for rebates and track their progress.

Staples says waiting times for payments have been cut from about 10 weeks to as little as four, and rebate complaints dropped by 25%. "Breakage" also dropped by as much as 10%, but that decline in unclaimed rebates is offset by better fraud prevention, it says.

The fulfillment houses are also overhauling their systems. While it won't disclose figures, Parago says it has invested "tens of millions" of dollars in computer technology. So now, computers, not customer-service agents, validate most of the claims. Then consumers receive e-mail updates and can check Web sites such as RebatesHQ.com to monitor claims. Before, says Parago Chief Financial Officer Juli C. Spottiswood, getting a rebate update was a "big black hole."

With billions of dollars at stake, bids to set uni- form rules for rebates have met a ferocious response. Last year, California State Senator Liz Figuero introduced a bill requiring companies to grant cus- tomers at least 30 days to apply for a rebate, m checks within 60 days of receiving an applicatio and standardize the paperwork and personal da needed for a claim.

## "REGULATION IS WARRANTED"

Telecom giants SBC Communications and T-Mob and the California Manufacturers & Technolo Assn. quickly mobilized. They argued that Figuero bill would drive up costs and increase fraud by cu down on the proof required for a rebate. After pa ing the California House and Senate, the bill vetoed by Governor Arnold Schwarzenneger.

Now, Figueroa, a Democrat, is evaluating whe to reintroduce the bill in January. "This is an where regulation is warranted," she maintains.

Despite the crackdowns and efforts at refo redeeming rebates will probably never be much "In a perfect world, consumers would love m rebates to go away," says Stephen Baker, directo industry analysis at NPD. "However, they want best price that they can get. Those two things fundamentally going to be at odds."

## CASE DISCUSSION QUESTIONS

1. This article describes one reason manufac might want to offer rebates rather than dec wholesale price. Explain why this can be v as an example of customized pricing.
2. Even if all rebates were redeemed, why manufacturers still want to offer rebates than decrease wholesale prices?
3. Why do you suppose that Best Buy, rather one of Best Buy's big suppliers such as S Panasonic, is considering eliminating rebate