

John Argitis, president of G&F Industries, was considering an unusual request he had received from Bose Corporation. G&F produced plastic components for Bose speakers. Bose, one of G&F's biggest accounts, had recently requested that Argitis station a representative full-time at Bose headquarters, completely changing the way in which the two companies worked together. The rep would be paid by G&F but would work, in essence, as a plastics buyer for Bose, placing orders to G&F on Bose letterhead, monitoring materials requirements on the plastic components that G&F supplied to Bose, and becoming involved in manufacturing planning at Bose.

Lance Dixon, director of Purchasing and Logistics for Bose, had conceived the idea and was hoping that the program could start in January of 1991, which was only three months away. However, Dixon knew that Argitis had reservations about adding staff to his small company. And several Bose executives, including Tom Beeson, vice president of Manufacturing at Bose, had expressed concerns. Dixon's plan, if implemented, would provide the G&F representative full access to Bose facilities, personnel, and computer systems, and some Bose managers worried that the company would lose control of its own procurement process. Others wondered whether plastics was an appropriate area for this type of relationship. If Argitis agreed to the idea, there would be many details to attend to before January.

### Company History

Bose Corporation was founded in 1964 by Dr. Amar Bose, a professor of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology, where Sherwin Greenblatt was earning a master's degree in electrical engineering. Greenblatt and Bose shared a love of music, but recognized that the high-fidelity (hi-fi) products then

available did not accurately reproduce sound. Greenblatt became Bose Corporation's first employee; the two planned to build a company based on innovations in acoustics and electronics. For three years, virtually all of the company's revenues were earned by developing portable, battery-operated equipment; hi-fi was considered "the hobby side of the business." In 1968, however, Bose Corporation launched the 901® speaker, which incorporated proprietary Direct/Reflecting technology, simulating the feeling of live sound by radiating sound waves to the listener directly and via reflections off walls, ceilings, and floors. This speaker was a huge success, lauded by a growing market of audio enthusiasts. Two years later Bose introduced the 501® speaker, which also had Direct/Reflecting technology but was half the size of the 901 speaker. In 1973, Bose introduced the 301® speaker, which produced true hi-fi sound but could fit on a bookshelf.

During the 1970s, sales of Bose speakers grew rapidly, and Bose executives approached the Delco division of General Motors with a proposal to develop a car stereo that would produce exceptional sound. The Cadillac Seville first offered an option for a Delco-Bose sound system in 1982; by 1990 sound systems were available in cars made by General Motors, Honda, Acura, Audi, and Nissan.

### Bose Strategy

In 1990, Bose was privately held, with revenues estimated at \$720 million. Amar Bose was chairman of the company, and Sherwin Greenblatt was president. Approximately one-third of the company's sales were in Japan, one-third in Europe, and one-third in the United States. The company's motto was "Better Sound Through Research," and Bose Corporation was widely considered the world's largest manufacturer of component-quality speakers.

The company's mission, to "provide outstanding sound experience to everyone in the whole world," was manifested in three aspects of the company's strategy. First, the company constantly sought new markets around the world and had exceptional perseverance in opening markets. For example, Bose entered Japan in 1970 and weathered substantial losses as it tried to establish the Bose brand name among Japanese consumers. The company received its first order from a Japanese car manufacturer in 1982, and by 1990 was the highest selling manufacturer of component-quality stereo speakers in Japan (as well as in Holland, France, Australia, and other countries). Management at

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*Doctoral Candidate Bruce Isaacson prepared this case under the supervision of Professor Roy Shapiro as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. Some information has been disguised to maintain confidentiality. "JIT II," "Direct/Reflecting," "Better Sound Through Research," and "Acoustic Wave" are registered service and/or trade marks of Bose Corporation.*

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Bose believed that the desire for good sound was universal, and planned to continue opening new markets around the world.

Second, Bose Corporation sought broader channels of distribution. Originally, Bose speakers were sold exclusively in high-end specialty stores that served audio enthusiasts. Throughout the 1980s, Bose added new channels, including electronics retailers including Lechmere, Circuit City, Sears, and Montgomery Ward. Also, Bose began to sell some products by direct marketing.

Third, the company produced systems as well as components. In the early days, true high-fidelity sound had been available only to consumers willing to invest time, money, and patience in their stereo systems. By 1991, consumers expected hassle-free sound and the market for integrated audio systems and portable audio equipment had grown to be more than twice as large as the market for separate audio components (see Exhibit 1). Analysts expected the trend toward integrated systems to continue, driven by advances such as home theater television, which linked big-screen video with surround-sound audio, or “plug and play” equipment, which required minimal setup by the consumer. In 1989, after 14 years of development, Bose had introduced the Acoustic Wave Music System, an integrated, portable, high-performance music system incorporating speakers, an AM/FM receiver, and a cassette tape deck. The product was oriented towards the high end of the portable audio market.

#### Manufacturing at Bose

It was well-recognized that speakers were among the most important parts of any audio system—if they were of poor quality, even the best sound systems would not produce high-quality sound. Speakers were judged on their ability to reproduce sound accurately, and sound reproduction depended on speaker design, the quality of materials used in construction, and careful attention to detail in production processes. Speakers were one of the most competitive

segments of the audio business, with dozens of manufacturers in the United States, Europe, and the Far East producing a diverse array of designs and technologies. Three subassemblies were the critical components of all speakers:

- **Transducer:** This part of the speaker produced sound waves when electrical signals from a stereo system caused a magnetic assembly to vibrate inside a paper or plastic voice cone. The traditional speaker had at least two transducers—a “woofer,” generating low-frequency bass sounds, and a “tweeter,” producing higher-frequency sounds.
- **Electronics:** Bose speakers had come to incorporate increasingly sophisticated electronics, including integrated circuit (IC) boards, that managed amplification and maintained a balance between bass and treble.
- **The cabinet:** As the speaker’s exterior, the cabinet had to both direct sound waves from the speaker and be attractive in a home or car. Whether the speaker had a wooden or plastic cabinet, Bose maintained unusually high standards for exterior surfaces on its speakers. As one vendor said, “You can have absolutely no defects, and when I tell you no defects, I’m telling you not a tiny imperfection or a small speck of dirt. Nothing.”

Bose headquarters were located 23 miles west of Boston in Framingham, Massachusetts. The company had three manufacturing facilities:

- **Westboro, Massachusetts:** The Westboro plant, located approximately 15 miles west of Framingham, was fully integrated—the plant manufactured printed circuit boards and transducers, and assembled finished speakers using electronics and transducers produced at Westboro as well as parts procured from outside vendors. The Westboro facility was the company’s largest and most advanced production facility.

#### Exhibit 1

Annual Factory Sales of Consumer Electronics in the United States (in millions of dollars)

	1984	1985	1986	1987	1988	1989
Audio systems	976	1,372	1,370	1,048	1,225	1,217
Portable audio equipment	1,191	1,140	1,389	1,469	1,547	1,595
Separate audio components	913	1,132	1,358	1,715	1,854	1,871
Autosound equipment*	2,500	2,761	3,135	3,523	3,937	4,125

Source: *Consumer Electronics in Review*, by Electronics Industries Association, Consumer Electronics Group.

\*Car stereo equipment

- **Ste-Marie, Quebec:** The Canadian plant produced wooden speaker cabinets, and had world-class woodworking capabilities. Rather than assembling six separate pieces into a cabinet's sides, top, and bottom, Bose speakers used a complex construction which joined two three-sided, U-shaped pieces. This construction improved the sound quality of Bose speakers but required precise tolerances during production. The Ste-Marie plant had made sizable investments in computer-controlled machining centers for woodworking.
- **Carrick-Macross, Ireland:** The Ireland plant assembled finished speakers to support Bose sales in Europe.

Due to the company's rapid growth, two other manufacturing facilities were planned:

- **Hillsdale, Michigan:** The Hillsdale facility would specialize in making speakers for the automotive market, providing quick response to car makers, who were prone to tight schedules with frequent changes and who demanded short lead times.
- **San Luis, Mexico:** A facility was planned in Mexico to produce small, inexpensive "bookshelf" speakers as well as wiring harnesses, transducers, and circuit boards for other Bose plants.

In addition, the increasing success in the Japanese market caused some managers to wonder whether a manufacturing facility would soon become necessary in or near Japan.

### Manufacturing Strategy

Tom Beeson saw a natural evolution in the products produced by each Bose plant; initially plants often only produced components only for other plants, but then became increasingly self-sufficient. Over time, plants were expected to expand their range of manufacturing capabilities, integrating forward to produce finished products and backward to produce as many of the components required for those products as possible:

*If we were big enough, we'd do everything ourselves. Obviously, there are some areas we'd never integrate into, such as owning the steamships or the trucking lines that transport our speakers. However, if it's fundamental to the quality or performance of Bose products, then we want to control it.*

Even when sourcing parts from highly capable vendors, Beeson saw three potential problems:

1. The vendor and Bose each had their own priorities and agendas. Consequently, Beeson believed that vendors usually wanted to provide parts that fit their capabilities and schedules, which were not necessarily the components that Bose needed.

2. A long-term relationship with a vendor producing components for Bose would allow that vendor to acquire whatever specialized capital might be desirable and develop particular expertise in manufacturing those parts. On the other hand, however, Beeson felt that relying on the vendor would preclude Bose from developing that expertise, and delay the process of establishing internal capabilities in manufacturing those parts.
3. Beeson believed that vendors would never understand the company's needs or organization as well as Bose employees, and that, if all the components of cost could be tracked accurately, it would almost always cost more to source a part externally than to make it in-house, as long as the volume was sufficient.

### Corporate Procurement

In 1990, Corporate Procurement at Bose purchased materials totalling \$300 million. As shown by the organizational chart (see Exhibit 2), Corporate Procurement was headed by Lance Dixon, director of Purchasing and Logistics. Dixon reported to Tom Beeson, vice president for Manufacturing; Dixon's background is described in Exhibit 3.

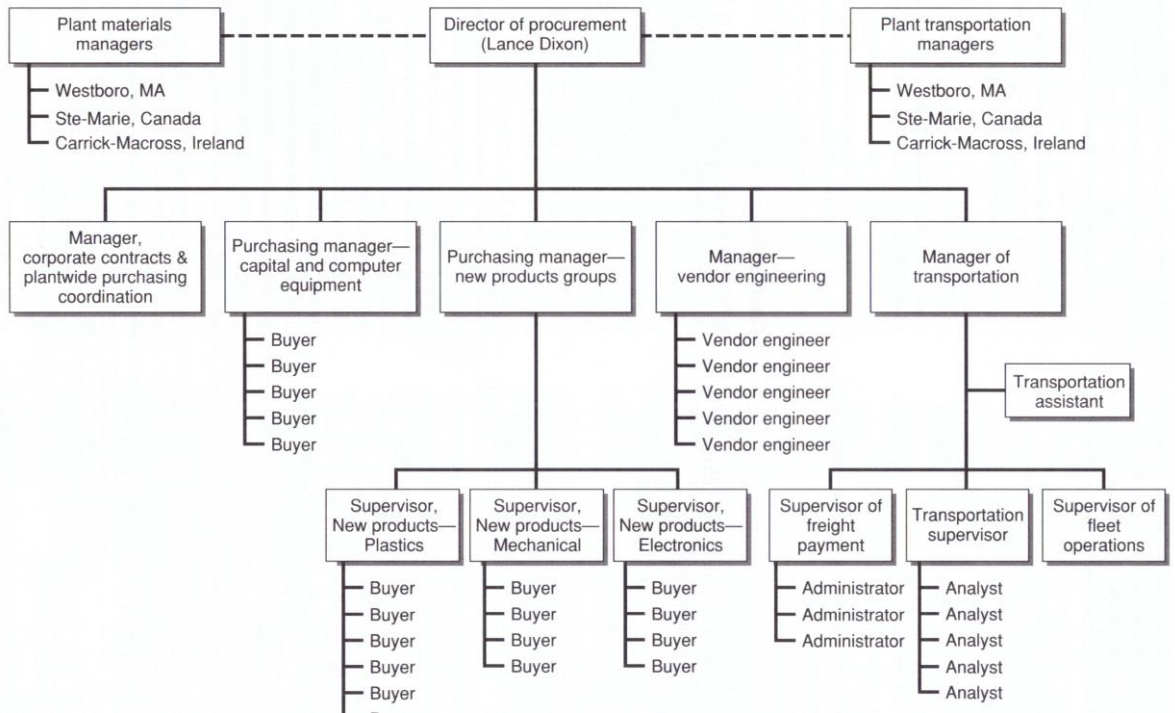
Corporate Procurement was responsible for locating new vendors and sourcing new parts. Vendors were typically involved early on in new product development efforts. For example, when Bose began to develop the Acoustic Wave Music System, Corporate Procurement contacted vendors of AM/FM tuners to obtain design advice and product specifications. Once tuner specifications were set, Corporate Procurement solicited bids, selected and qualified the best manufacturer (on the basis of quality, delivery, and price), and negotiated contracts specifying a variety of performance characteristics. After close supervision of an initial pilot order, the day-to-day management of purchases against the contract was turned over to the plant-level purchasing departments. According to Wayne Sauer, purchasing manager in Corporate Procurement, purchasing managers at the plants had the authority to change suppliers but,

*We do our homework up front, and after screening we usually believe we've chosen the right supplier for them. But, if we haven't chosen right, the vendor isn't going to send them many bad parts and stay a Bose vendor for very long.*

In 1990, four types of personnel were typically involved in the procurement process:

**Design engineer:** Design engineers established the specifications for new items, often in concert with vendor personnel.

**Materials planner:** Materials planners maintained factory inventories at appropriate levels, primarily by



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## Dixon's Background

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After his discharge from the Marines, Dixon worked in a printing company and then went to Honeywell Corporation, where he managed an engineering support facility that performed printing and photographic lab work. Although Dixon was not in Honeywell's procurement department, he occasionally bought printed materials and noticed that these materials were often procured by people who did not work in Purchasing. As he recalled, "We had fragmentation in dollars, and Purchasing not carrying out its full charter in this area. We know that's done at a lot of companies, but that's not right."

Responding to his suggestion, management put Dixon in charge of centralizing the purchasing of printed materials. Later, when Honeywell bought General Electric's computer division, Dixon established a network of 12 warehouses to provide promotional support for the combined GE/Honeywell sales force. Dixon then was asked by Honeywell's corporate procurement department to help integrate the procurement policies of Honeywell's 14 divisions. Dixon recalled that "I spent three years there helping tie together procurement—a classic corporate procurement job, which I enjoyed."

While in this role, Dixon proposed to change the way nonproduction items were purchased. Honeywell management accepted the proposal and placed Dixon in charge of creating and managing a consolidated function to buy all non-production material for 12 Minneapolis-area Honeywell divisions. Dixon standardized prices with vendors and established consistent procurement practices.

After 14 years at Honeywell, Dixon became director of Purchasing at General Mills' Kenner division. In 1982, Dixon joined the Bose Corporation. In all his procurement assignments, Dixon had sought to establish more uniform procurement policies in all areas of spending activity. As he stated,

*In production buying, Purchasing normally carries out the procurement role. However, in non-production buying, for half the companies of the United States the true purchasing department is not the formal procurement department, it's the department heads that have the budget money and take an interest in their lifeblood stuff, which includes items like printing. These department heads are merchandising managers, printshop managers, advertising managers, marketing managers, and sales managers.*

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indicating to the buyers when reorders would be needed. Materials planners worked closely with production planners, who scheduled production in Bose factories.

**Buyer:** Corporate buyers located items requested by design engineers, placed first-time orders for new items, and made one-time purchases of items such as capital equipment or computers. Plant-level buyers placed orders against contacts negotiated by corporate.

**Vendor salesperson:** Vendor salespeople visited Bose hoping to obtain orders from buyers, then met with their own manufacturing organizations to ensure that the orders were produced on time and to specifications.

The New Products groups, who monitored the supplier base to find technologies and components, were at the heart of Corporate Procurement. Engineers developing new products relied on them to find components that could meet design, performance, and cost standards. New Products also provided a conduit to incorporate vendor input in products under development.

Each New Products group was responsible for a specific set of commodities. *New Products-Plastics* focused on parts or components made of plastic, *New Products-Electronics* focused on electronics, and *New Products-Mechanical* focused on metal or mechanical items. Each buyer within New Products specialized in one of 37

commodity groups, such as aluminum extrusion, packaging, gaskets, stamping, die castings, or magnets.

The organization of New Products-Mechanical was representative of the New Products groups. Wayne Sauer, a mechanical engineer with experience in metalworking, was manager of New Products-Mechanical. Wayne supervised several buyers, including a mechanical engineer with expertise in manufacturing and mechanical assembly, and an electrical engineer with expertise in computer hardware.

### Purchasing at Westboro

Until 1988, no purchasing had been done by the plants; instead, all items had been purchased by Corporate Procurement but delivered to the plants. By 1990, purchasing at Bose Corporation was more decentralized. The plants in Westboro, Canada, and Ireland did their own day-to-day purchasing, typically against contracts negotiated centrally. It was expected that the planned facility in Michigan would also manage its incoming material flow.

Each production line at Westboro had its own operations manager (see Exhibit 4) and support organization (see Exhibit 5). Jim Tabor, plant materials manager, reported formally to Walt Hussey, plant manager, and informally to Lance Dixon. (This was similar to the arrangement at other Bose plants.)

Westboro spent about \$140 million per year on items purchased from an active base of about 200 vendors. About

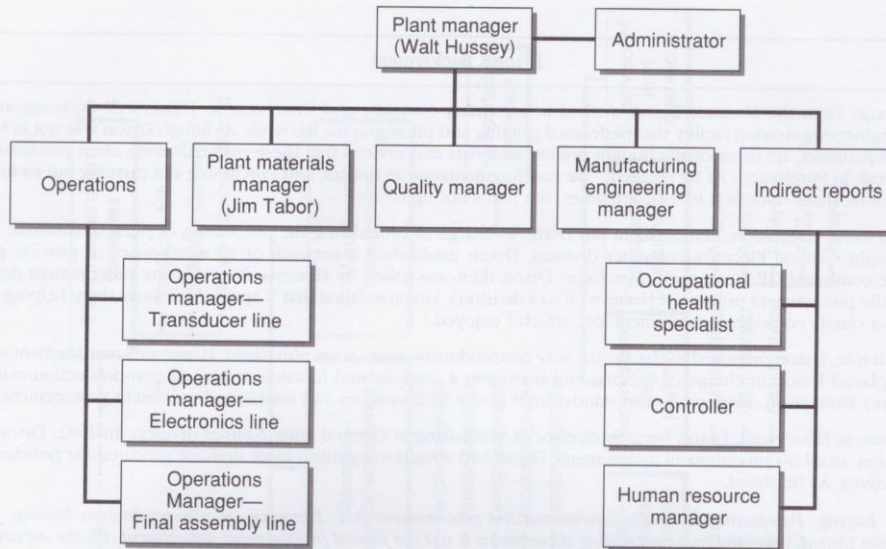


Exhibit 4 Westboro Plant Organization

50% of the plant's purchasing dollars were spent in five categories: electronic components, plastics, printing, corrugated boxes/packaging, and cables/cords. Purchasing was planned in a three-stage cycle:

- **Stage I: Business planning.** The marketing department at Bose Corporation prepared multi-year business plans.
- **Stage II: Aggregate production planning.** Based on the business plan, Westboro prepared a production plan that specified the capacity, tooling, and material volumes that would be needed over the next one to two years.
- **Stage III: Production scheduling.** Based on the aggregate production plan, schedulers at Westboro prepared a detailed "master schedule" outlining requirements for capacity, personnel, and material over the coming 12 months. Production for earlier months was scheduled at a greater level of disaggregation than for later months.

As Westboro materials manager, Jim Tabor coordinated scheduling, purchasing, and inventory. As shown by Exhibit 5, five people reported directly to him: an inventory manager, a warehouse manager, and three materials managers. The inventory manager was responsible for tracking and managing overall inventory levels at Westboro, while the warehouse manager oversaw the operation of the plant warehouse. Each materials manager performed the planning and purchasing to support one production line, and was

assisted by a production control supervisor, a master scheduler, and a purchasing supervisor.

Purchasing supervisors supervised a group of buyers who procured all materials for one production line. Buyers were responsible for managing quality, cost, and delivery. Unlike Corporate Procurement, most buyers at Westboro were not engineers, and instead had come up through the ranks as administrators or expeditors. Buyers at Westboro typically started on easier commodities such as hardware or operating supplies, and then moved on to more difficult categories such as plastics and electronics.

Most of a buyer's time at Westboro was taken up by inventory planning which encompassed three activities: deciding what to order, placing new orders with vendors, and adjusting delivery schedules to accelerate or delay delivery on ordered parts. Another 15% of buyers' time was spent on revisions to existing parts; usually this entailed updating documents or ensuring that revised parts met quality levels. The remaining 10% of buyers' time was devoted to renegotiating contracts with existing vendors or, occasionally, switching to new vendors.

Westboro buyers preferred vendors who maintained a secure financial position, were located close to Westboro, could provide fast delivery, maintained consistent production processes (as measured by the use of statistical process control and a quality rating system); and provided good references through Corporate Procurement or other customers. The average lead time on purchase orders placed by

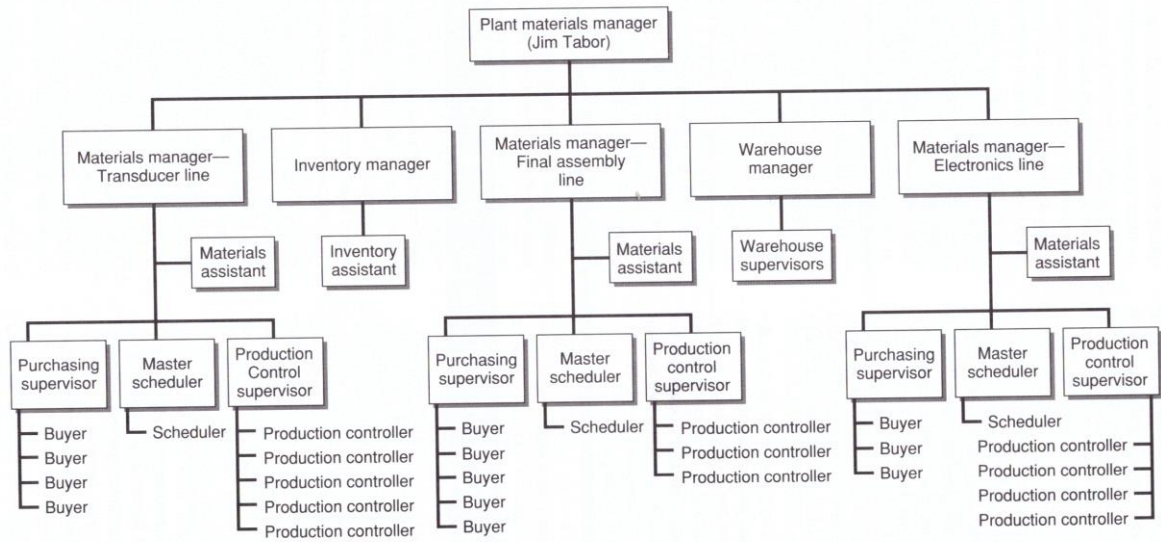


Exhibit 5 Support Organizations at Westboro

Bose Corporation was four to six weeks, but one-third of all purchase orders had less than 10 days' lead time. About 35% of all orders were changed within 30 days after placement.

### The Evolution of JIT II

In the early 1980s, shortly after he had been hired by Bose, Lance Dixon requested that Corporate Procurement's budget be increased significantly to add more experienced buyers, upgrade the department's information systems, and develop global sourcing programs. Dixon promised a one-year pay-back on the funds requested, but his request was turned down because company resources were focused on efforts in Japan. As the company grew, Dixon found that every year he needed more people in procurement, and every year at budget time he fought with management over staffing levels.

Dixon and Joe Giordano, vice president for Finance, developed an alternative solution: put purchasing into "profit center mode." Wherever Dixon could drive expenses below standard costs, he would be allowed to reinvest half the savings back into the department's budget. If Dixon did not generate any savings, Corporate Procurement would maintain a level budget. As Dixon said, "I can get the people I need to do the job and not add anything to the payroll."

Dixon also instituted a program to pay cash incentives to buyers. Any time a buyer saved the company money on purchased items, the buyer received a cash reward, typically \$100 to \$300. This arrangement was patterned after incentive programs commonly found in sales departments. Awards were given for keeping monthly expenditures under standard cost, for unique ideas that led to cost savings, and for other exceptional efforts.

In 1990, Dixon proposed to change the relationship between Bose and certain vendors under a program he called "JIT II." Under JIT II, a vendor representative (the "rep") would replace the vendor salesperson, the Bose buyer, and the Bose materials planner and would be authorized to decide what, when, and how much to order for a particular range of products or services. Reps would determine order quantities, placing orders to their companies to supply Bose without Bose carrying unnecessary inventory. Reps would also provide engineering expertise in their commodity area and help solve problems on the production floor, much as a Bose buyer would. The reps would be stationed full-time at a Bose facility and would be empowered to use the Bose computer systems, but would be hired, evaluated, and paid by the vendor.

Dixon had recommended the commodity areas of plastics and printing as initial candidates for the JIT II program.

*Plastics* In 1991, Bose Corporation expected to spend close to \$14 million on purchases of plastic components. Producing plastics to meet Bose quality standards required considerable experience and skill. Bose used 10 vendors for

plastics; the top five vendors received 60% of the dollar volume. Dixon had recommended G&F Industries to be a JIT II vendor in plastics.

G&F's headquarters and plant were located in Sturbridge, Massachusetts, about 40 miles west of Bose headquarters. The company employed about 60 people and had total annual revenues of \$12 million. Of G&F's 50 active customers, Bose was the largest account, providing about \$2.1 million in annual revenues. The plastic components sold to Bose typically generated a 10% before-tax profit margin. G&F was owned by John Argitis, who served as president and CEO. Argitis had 15 years' experience molding plastic parts at American Optical; in 1978 he moved to G&F as vice president, and in 1986 he purchased the company.

G&F specialized in the production of injection-molded plastic parts. In injection molding, pellets of plastic resin were heated to a liquid state; the liquid was then injected into a mold where it solidified in the shape of the mold's interior. A typical injection molding machine cost up to \$200,000; molds cost \$75,000–\$150,000. Molds were made to produce a part of a specific size and shape, although minor alterations were possible. Molds were typically paid for and owned by the customer.

On any particular job, set-up costs for injection molding could often be greater than the cost of machine operation. Set-up times averaged four hours to change resin colors (keeping the same resin material), six hours to change molds, and 17 hours to change molds, colors, and resin material. The set-ups were performed by highly-skilled technicians who were supervised by plastics engineers; after set-up, machine operation required less skill.

Even if G&F became the JIT II vendor for plastics, it was not clear that G&F would supply all the Bose plants. The facilities planned in Michigan and Mexico would use considerable volumes of plastics, particularly in speaker enclosures for Michigan. The two facilities could either source locally, or use parts that were purchased by Corporate Procurement but shipped directly to the plants.

*Printed materials* Printed materials included items such as instruction booklets, warranty cards, and promotional materials. In 1990, each Bose department sourced its own printed materials, with 12 vendors supplying printed materials to Bose Corporation. Dixon was concerned that the current decentralized arrangement allowed vendors to charge each manager a different price according to that manager's price sensitivity, and wished to establish United Printing as a JIT II vendor. United received only 12% of the company's overall printing business in 1990, so this would necessitate centralizing the procurement of printed materials. Dixon was concerned that the individual departments might object:

*In terms of human relations, the consumer of printing has traditionally insisted that "I run an advertising department or merchandising department and I buy my own printing. Purchasing isn't going to tell me who to buy from." I expect*



*we'll settle that down, and then a department manager will change and we have to go back to war for the next six months. The basic conflict is not with the JIT II program—the basic conflict is the fact that Purchasing's interested enough to want to buy printing.*

### The Management of JIT II

Neither Beeson nor Dixon was sure that vendors would be interested in participating in JIT II. A qualified rep might cost the vendor \$80,000 per year (fully loaded). Dixon and Beeson planned to approach United after they knew whether G&F would participate.

Even if G&F did agree to participate, several issues remained to be resolved. Dixon felt that vendor representatives should be treated, in every respect, as Bose employees—to be listed in Bose telephone directories and have access to all Bose facilities, people, and computer systems. However, several Bose managers had voiced concerns about this arrangement. Some buyers felt that certain information, such as quantities and prices of parts bought from other vendors, should remain confidential—at least to provide an advantage during negotiations.

In the past, vendor representatives had typically worn badges that identified them as vendors, and were permitted

access only to approved locations within Bose facilities. Dixon proposed changing this policy; he advocated that the reps for JIT II vendors be issued badges just like Bose employees and be free to come and go as they chose.

There was also debate about how to ensure that vendors supplied goods at fair prices over the course of the relationship. Dixon felt that the company's previous purchases in a given category provided experience to evaluate vendor prices, but others argued that inflation or changes in raw material prices could quickly render this information obsolete. Finally, although Dixon wished to start the program with G&F and United, formal criteria for determining when and with whom to establish JIT II relationships had not been developed.

Finally, there were questions about how long a JIT II relationship would last in a company growing as rapidly as Bose. As Tom Beeson said,

*There's always a conflict between purchasing and manufacturing. Lance wants to buy everything and I want to make everything. However, I don't want vendors assuming responsibility for what we should be doing ourselves. Does the JIT II program facilitate the process of moving into self-control, or does it delay that process?*