Since the opportunity to increase Sensormatic's revenues is forecasted at 30% annually, operations must improve accordingly. The company is currently experiencing severe problems of material shortages, production delays, backlogs, overruns, and high staff turnover. Solutions for reducing operational problems include vertical integration to better control the supply chain and production activities, or to outsource more - or even all - of Sensormatic's production activities. Certainly, executive management should seriously consider outsourcing the manufacturing processes in their entirety, focusing internal resources on the company's core competencies of technology research, product innovation, market expansion, and order fulfillment. Whatever strategy is eventually adopted, of immediate concern is how to ensure the efficient and economical production of high-quality alligator tags during the near-term (1980-84.) This presentation will discuss the alternatives and economics of doing so.

1. Suggestions for Improving Sensormatic's Quality during the early-1980's:

The latter decades of the twentieth century may bring sweeping innovations to quality methods and standards. Already being discussed in quality circles are such concepts as "Six Sigma", "Total Quality Management", and an international organization for standards ("ISO"), among many others. While the methods that may arise from such concepts are not yet fully mature, many of the principles being theorized are already grounded in practical reality - such as enterprise resource planning and statistical process controls - and should be adopted by Sensormatic. Quality is also a major contributor to the efficient - and therefore economical - production of the company's products. So, regardless of the extent to which products are manufactured in-house or are outsourced, Sensormatic must implement a robust quality assurance/control system for monitoring and improving its internal operations and for auditing its supply chain partners. Listed below are some of the quality principles and practices, along with implementation steps, that the company should apply throughout its organization, supply chain and manufacturing operations.

1. Enterprise Resource Planning (ERP): In efforts to cope with fluctuations in material availability and costs, market demands, and supply chain uncertainties, Sensormatic must utilize the latest information gathering/sharing technologies and methods between parts suppliers, assembly areas, and distribution facilities. Just as technology is critical to the company's R&D efforts, so it is to market forecasting, production and delivery processes. ERP is a precursor to an effective materials resource planning (MRP) system and is also necessary to effectively implement just-

in-time (JIT) delivery. The company should budget for continuous hardware/software upgrades and should retain subject matter experts in the fields of resource and material planning.

2. Statistical Process Controls (SPC): SPC are measurements to determine normal quality deviations. The results of random samplings of products are plotted on a graph. If the deviations of the performances of the products are more than six standard deviations apart, the quality of the product is generally considered unacceptable and it is assumed that because problems exist in the sample they also exist for consumers. The process's output performance is measured. The problem is analyzed in all phases of the process in order to identify causes of variation. By doing so, output processes can be improved by reducing that variation.
3. Time Value Map (TVM): A TVM helps to identify the causes of overproduction, excess transportation and motion, excess inventory, inefficient processes, and idle time. A TVM is implemented by simply observing and documenting a work item through its process and tracking where it spends its time. It follows the product from raw material to output into the customer's hands to determine where it spends valuable time and where waste time can be eliminated. The TVM is most effective when collated with the statistics gathered by SPC, and when the results are input to the ERP system.
4. Organizational Quality Standards: Company quality is about improving the nature of the workplace for the people who administer the company, evolve the technology, and make the products, since doing so can improve efficiency, productivity and product quality, thus increasing shareholder value. Steps to enhance organizational quality include: Training employees in quality methods and procedures relative to their individual tasks; enhancing the working environment (e.g., revamping the tag room); implementing administrative controls (e.g., developing an organization chart that clearly depicts the quality organization and where it fits within the company's management structure; identifying all of the resources, the authorities, and the interrelation of personnel with the quality control processes.); implementing procedures and statistical data collection methods and documents; defining the organizational and technical interfaces between different groups. For outsourced items, quality measures must include documenting procedures and auditing vendor practices for the control of materials, quantities, timely delivery, quality, and traceability of products.

2. Supply Chain Alternatives for Producing Alligator Clips, 1980-1984: Table 1, attached below, presents the advantages/disadvantages of 3 alternatives for supplying plastic parts for alligator clips, including: 1- purchasing Canon Plastics 2- bringing the process entirely in-house; or, 3- outsourcing the process.

3. Production Requirements and Capacities: Table 2 details the forecasted requirements and machine capacities for producing the plastic clip components. As the figures demonstrate, given the forecasted 30% increase in sales of alligator clips, 8 machines would be insufficient beyond 1983.

3. Financial Analysis: The financial calculations detailed in Table 3 assume production of clips only up to the machine capacities calculated in Table 2 (8 machines). Nevertheless, the table adequately demonstrates the relative costs of the Alternatives, given the production quantities listed. As such, Alternatives 1 and 2 are nearly identical, while Alternative 3, outsourcing, could be more expensive if limited to the current vendors; or might be lower, if alternative suppliers and aggressive contracting procedures are employed.

4. Ranking the Options - Recommended Sourcing Strategy: During the next 5 years, the production of plastic parts should be entirely outsourced. Alternatively, Canon Plastics should be acquired. Sensormatic should not undertake vertical integration by producing plastic components in-house. Possible positive financial results of vertical integration or expansion do not outweigh the potential risks and disadvantages. As well, volatile oil prices, uncertain future markets and products, along with historical forecasting difficulties, would favor hedging the risks by opting for acquiring new supply and manufacturing partners, rather than producing the parts in-house. The following should be undertaken to support the outsourcing Alternative: Create strategic sourcing concepts. Build good cooperation between Purchasing, Marketing & Sales, Research & Development toward improving the forecasting process, the alignment of priorities and the availability of third party goods and services. Increase competition and capacity by adding international suppliers to the vendor base. Negotiate supplier contracts that include performance penalties for delayed orders. Define preferred vendors and increase cooperation to better manage future growth. Spread the production contract/purchase orders among several vendors.

5. SWOT Analysis: As Table 4 demonstrates, Sensormatic needs to focus on the elimination of the production bottlenecks, quality issues, and supply problems, focusing instread on its technical strengths and enhancing its market leadership.

Table 1 - Advantages/Disadvantages of Alternatives:

Advantages	Disadvantages
Alternative 1- Acquire Canon Plastic's resources	
. Ownership and control of all processes, including increased flexibility of scheduling.	. 4 machines would not be sufficient to produce demand for new alligator clips, replacements, and backlog during 1980. Further, 8 presses utilized at full effective capacity would be insufficient to cover expected demand from 1983 onward.
. Possibility of cost savings through efficiencies and detailed knowledge of acquired staff.	. Significantly increased internal overhead (management, manufacturing and . technical). . Acquisition of raw materials and implementation of additional inventory control procedures would need to be supported by administrative services, such as accounting, finance, HR. . R& D staff distracted. . Poor economies of scale for raw materials.
Alternative 2 - Produce In-house	
. Ownership and control of all processes, including increased flexibility of scheduling. . Manufacturing issues are more quickly fed back into the design culture, resulting in optimized designs	. Although increased flexibility, scheduling still can be poor, since individual products still compete for attention. . High capital investment costs & ongoing overhead (management, production, technical, utilities, maintenance, material inventory carrying costs). . R& D staff distracted. . Poor economies of scale for raw materials.
Alternative 3- Outsource	
. Better economies of scale for raw materials. . Lowers internal overhead - Outsourcing can save money real estate, insurance, and utilities . Avoids the added expense of hiring enough staff to handle the peaks and then wasting time and resources between peak periods. . Reduces inventory holding costs, if contracts specify just-in-time delivery. . Access to experience and specialized facilities as required. . If work is spread across a number of vendors, risks are reduced, peaks and valleys caused by demand fluctuations can be minimized.	. Sensormatic products competing for attention. . Vendors know more about products than does Sensormatic staff. . Harder to transfer technology knowledge, so normal development issues can be very expensive to solve. . Can get stuck in a non-ideal relationship. . Sensormatic's product is always competing for the vendor's resources . if all work is done in one plant, or by just one vendor, an outage or a labor dispute could put Sensormatic out of business.

Table 2 - Production Requirements and Capacities:

Requirements for Alligator Clips	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*
New System Sales	800	1,040	1,352	1,758	2,285	2,970
Tags for New Systems	8,000,000	10,400,000	13,520,000	17,576,000	22,848,800	29,703,440
Backlog Tags		4,500,000				
Cumulative Systems in Use at yr end	5,600	6,640	7,992	9,750	12,034	15,005
Cumulative Tags Sold	56,000,000	66,400,000	79,920,000	97,496,000	120,344,800	150,048,240
Replacement Tags	12,000,000	14,000,000	16,600,000	19,980,000	24,374,000	30,086,200
Total Tag Production Forecast	**20,000,000**	**28,900,000**	**30,120,000**	**37,556,000**	**47,222,800**	**59,789,640**

Assumptions	
Tags per system	10,000
Systems in the field at start of 1979	4,800
Orders received for 1979	800
Annual increase	30%
Annual replacement needs	25%

Capacity / yr	*Deerfield*	*Canon*
Productive Capability/Machine	13,312,000	13,312,000
Effective Capacity	12,646,400	11,980,800
Effective Clip Capacity @ 4 Machines (2 for clips; 2 for straps)	**25,292,800**	**23,961,600**

Given	*Deerfield*	*Canon*
Cycle Time	27 sec's	30 sec's
# Molds	16	16
Utilization %	95%	90%
hrs/day	24	24
days/wk	5	5
Productive Capability/Machine calculation:	60 sec's/cycle time * 60 mins * 24 hrs * 5 days * 52 wks	

Conclusion: 4 Machines would not be sufficient to produce demand for new clips, replacements, and backlog during 1980. Further, if all 8 of Canon Plastic's presses are utilized at full effective capacity, production will be insufficient to cover expected demand from 1983 onward.

Table 3 - Relative Costs of Production Alternatives:

Assumption - 5 yr Demand (1980-84): 203,588,440

Alternative 1 - Acquire Canon	Material Cost	Freight Cost	Total per Unit	Extended ('80-'84)
Production Costs (+ start-up expenses of $.0025/unit @ $500,000 total)	$ 0.0521	$ 0.0003	$ 0.0524	**$10,668,034.2560**
Alternative 2 - Deerfield in-house				
Production Costs (+ start-up expenses of $.0057/unit @ $1,169,000 total)	$ 0.0515	$ 0.0003	$ 0.0518	**$10,545,881.1920**
Alternative 3 - Outsource				
Canon	$ 0.0576	$ 0.0003	$ 0.0579	**$11,787,770.6760**
Piedmont	$ 0.0504	$ 0.0003	$ 0.0507	**$10,321,933.9080**
Artek	$ 0.0461	$ 0.0003	$ 0.0464	**$ 9,446,503.6160**

Table 4 - SWOT:

Strengths	Weaknesses
Market leader; company dominates the market, accounting for 70% of US & 50% of Euro mkts.	Labor intensive mfg process; staffing problems; poor working conditions in tag room
Products are near equal in price & equal or superior in quality to those of competitors.	Supply chain unpredictable leading to schedule problems, persistent backlogs and rising costs.
Strong R&D team; heavily engaged in new-product development	Overly-dependent on present suppliers; low supplier competition
Forthcoming nonmicrowave system will lower mfg costs >30%.	Internal production processes create bottlenecks.
Opportunities	**Threats**
Substantial growth predicted, especially for alligator tags; <5% of potential mkt has been penetrated. Huge potential of hard goods outlets, served with a system solution currently in development.	Volatility of oil prices and supplies
New applications of technologies in other industries	Limited sources of supply
Growing acceptance of theft-prevention systems	Rapid product change bear the risk of having large inventories of obsolete parts and raw materials
Potential new supplier is Artek Plastics; other sources not yet identified.	Competitors: Knogo, Checkpoint, 3M
Outsourcing assembly of tags	Regulations from European or other regulation authorities, particularly with respect to microwave technology.
Alternative uses for sensors & potential to outsource production	Competitive technologies