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EDUCATION AND TRAINING

August 1990  
NSRP 0320

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **1990 Ship Production Symposium**

**Paper No. 3B-2:  
Shipbuilding and the  
Malcolm Baldrige  
National Quality Award**

U.S. DEPARTMENT OF THE NAVY  
CARDEROCK DIVISION,  
NAVAL SURFACE WARFARE CENTER

## Report Documentation Page

*Form Approved*  
*OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>AUG 1990</b>	2. REPORT TYPE <b>N/A</b>	3. DATES COVERED <b>-</b>		
4. TITLE AND SUBTITLE <b>The National Shipbuilding Research Program, 1990 Ship Production Symposium, Paper No. 3B-2: Shipbuilding and the Malcolm Baldrige National Quality Award</b>		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Naval Surface Warfare Center CD Code 2230-Design Integration Tools Bldg 192, Room 128 9500 MacArthur Blvd, Bethesda, MD 20817-5700</b>		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	<b>SAR</b>	18. NUMBER OF PAGES <b>11</b>
			19a. NAME OF RESPONSIBLE PERSON	

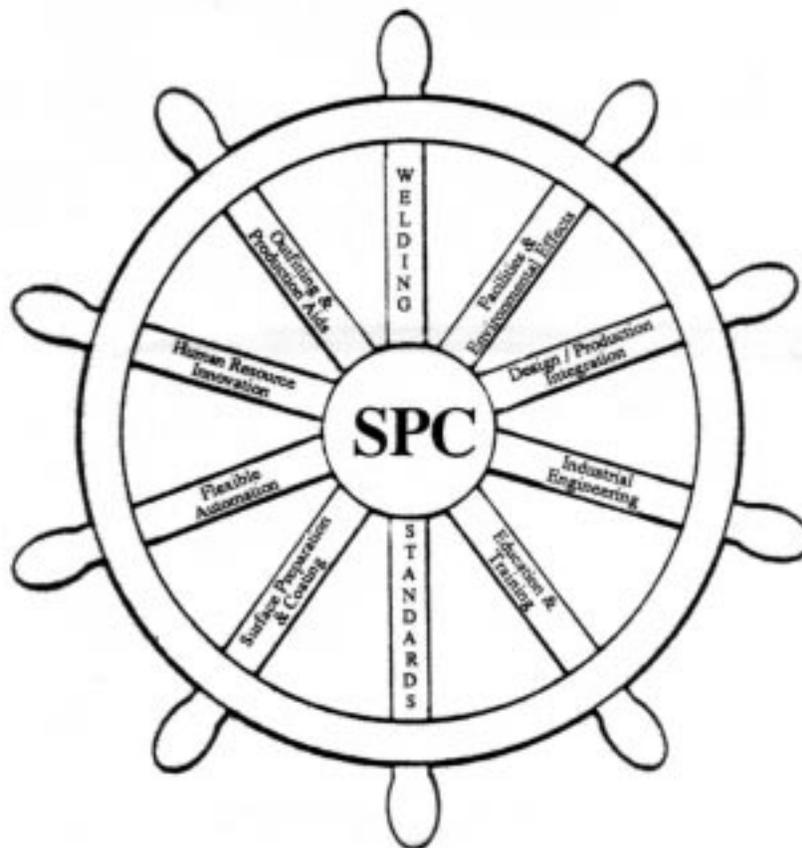
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August 22-24, 1990  
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601 Pavonia Avenue, Jersey City, NJ 07306

Paper presented at the NSRP 1990 Ship Production Symposium,  
Pfister Hotel, Milwaukee, Wisconsin, August 21-24, 1990

# Shipbuilding and the Malcolm-Baldrige National Quality Award **3 B - 2**

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## Abstract

This paper examines how shipyards in the U.S. can benefit from participation in the Malcolm Baldrige National Quality Award program. Although shipyards may be years away from meeting the criteria of the award, a long term plan to address these criteria will lead the yards to a more competitive position in the world. The Malcolm Baldrige Award is highly respected and is the highest level of recognition that a U.S. company can receive. The paper focuses on the application and examination of the seven categories of the Malcolm Baldrige Award selection criteria as they apply to shipbuilding. By using this structure, shipyards can greatly improve their management of quality. Ultimately, a shipyard that applies for and succeeds in winning the award would have a clear competitive advantage in the marketplace, both domestically and world-wide.

## Introduction

The 1980s was a decade of change for U.S. shipbuilders. Subsidies disappeared; commercial orders disappeared; and the Navy became the only purchaser of U.S.-built ships. Many shipyards went out of business while those that survived modified their operations considerably by:

- Downsizing
- Renegotiating labor contracts
- Adopting advanced shipbuilding techniques promulgated by Japanese consultants and by the National Shipbuilding Research Program.

This new and improved U.S. shipbuilding industry has yet to prove itself in the commercial market and still carries a reputation with commercial operators for providing a marginal quality, high priced product in a too long total construction cycle time.

In the first half of 1990, global shipbuilding demand has 'exploded due to higher freight rates; an aging fleet, improved economic conditions, and anticipation of stringent pollution regulations. Japanese shipyards have full order books through 1992; the Koreans are similarly booked; and the Europeans are getting more orders. Clearly, there is potential for U.S. shipyards to benefit from this market, and the technological and labor relations improvements of the 1980s will contribute to U.S. yards' ability to market their product. However, there still remains the perception among ship owners that U.S. shipyards are difficult to work with and produce inferior quality ships.

To overcome that negative perception, U.S. shipyards have a number of options. This paper proposes the Malcolm Baldrige National Quality Award framework as one possible way for U.S. shipbuilders to improve quality and to communicate that improvement to their potential customers.

## What is the Baldrige Award?

Malcolm Baldrige served as Secretary of Commerce from 1981 until his death in 1987 and contributed to long-term improvement in efficiency and effectiveness in Government. Congress passed the Malcolm Baldrige National Quality Improvement Act of 1987 (Public Law 100-107) to address the following issues:

- U.S. quality and productivity have declined relative to foreign competition
- U.S. businesses are only beginning to understand that poor quality costs companies as much as 20 percent of sales revenues
- Strategic planning for quality improvement programs is essential

Quality improvement programs must be management-led and customer-oriented.

In creating the Award, Congress commissioned the National Institute of Standards and Technology (NIST) to administer the Award and to develop the evaluation criteria. The NIST found developing the award guidelines quite challenging because it required:

- Defining what constitutes "quality"
- Measuring qualitative aspects of quality
- Maintaining flexibility in determining appropriate quality practices for different approaches (e.g., Deming, Juran, Crosby), industries, and company sizes.

Ultimately, the NIST came up with Award framework categories to emphasize management-driven, data-based, customer-focused, flexible, and continuously improving quality programs. The framework has seven categories, which are listed in Figure 1 with their corresponding maximum award point values. Three factors are used to evaluate a company's quality improvement efforts in each of the seven categories: approach, deployment, and results. Approach involves the degree to which the company's methods:

- Are prevention-based
- Are systematic, integrated, and consistent
- Embody self-evaluation, feedback, and adoption of cycles to sustain continuous improvement
- Are based on quantitative, objective, reliable information.

Deployment is the extent to which the approach is applied to all relevant areas and activities, including all transactions with customers, suppliers, and the public: all internal processes, activities, facilities, and employees; and all products and services. Results reflect the extent to which quality has been improved due to effective deployment of the approach.

The award creators addressed the issue of comparing companies in differing industries and of different sizes by offering six awards each year, two each to manufacturing companies, service companies, and small businesses. Once the framework and criteria were developed, reviewed, and revised by leading quality experts, the first applications were distributed in early 1988. In the first

Figure 1:

## Baldrige Framework Categories

Leadership	100 points
Information and Analysis	60 points
Strategic Quality Planning	90 points
Human Resource Utilization	150 points
Quality Assurance Systems	150 points
Quality Results	150 points
Customer Satisfaction	300 points
	<u>1,000 points</u>

year, two manufacturers, Motorola and the Commercial Nuclear Fuel division of Westinghouse, and one small firm, Globe Metallurgical, won the prize. In 1989: the only winners were Milliken & Company and the Xerox Business Products Systems division. Clearly the award criteria are difficult to meet: only five of twelve possible awards have been captured in two years, and no service companies have won yet.

The Baldrige Award has received significant attention from American businesses since its inception. While only a small number of companies have actually applied for the prize (66 in 1988 and 40 in 1989), the number requesting applications from the NIST has grown dramatically (12,000 in 1988, 65,000 in 1989, and over 100,000 as of April, 1990). Companies are finding that the detailed evaluation criteria makes an excellent checklist for total quality improvement whether or not they intend to actually apply for the Award.

The following sections describe each of the seven categories and their applicability to shipbuilding. These discussions are followed by a case study of Motorola, which won the prize in 1988, and its winning approach to the seven categories.

### Category 1.0 LEADERSHIP

This category examines senior executives' leadership in creating quality values, building the values into the way the company does business, and how the executives and the company project the quality values outside the company. Areas addressed include:

Senior Executive Leadership: Personal involvement and leadership in quality related activities, such as goal setting, planning, review of quality plans, training, competi-

- tive analysis, and customer relations; communication of this leadership inside and outside the company
- Quality Values: Policy, mission or guidelines that set the company's quality values and the internalization of those values in the company
- Management for Quality: Integration of quality values into day-to-day management at all levels of the organization; strategies for involving all levels of management in quality and their cooperation across divisions
- Public Responsibility: Extension of the company's quality values into the community, assuming its fair share responsibility for public health, safety, environmental protection, and ethical business practices.

To be successful from a quality perspective, top shipyard managers will have to both internalize high quality standards and lead management toward those standards. While this is not an easy task, some yards have stepped forward in some of the above areas, despite the costs. A good example is shipyards' stand on the double hull/double skin tanker issue. Of course a good portion of this stand is self-serving, but with proper communication, the yards' contribution to environmental protection can improve their image with the public and with some of their customers.

Leadership within shipyards is a delicate issue and one can always say it needs to be better. In this case as it relates to quality improvement, it is easier to find fault across the shipbuilding industry. The leadership intent may be there, but a cohesive and clearly communicated strategy is missing. How many senior shipyard executives can say they include quality as a key attribute of their management style?

#### Category 2.0 INFORMATION AND ANALYSIS

The information and analysis category examines the scope, validity, use, and management of data and information in support of the company's quality management system. Areas addressed include:

- Scope and Management of Quality Data and Information: The foundation of planning, management, and evaluation of quality

- Analysis of Quality Data and Information: The use of information in support of the company's quality leadership objectives.

At first glance, this category may seem impossible to most shipyards. However, shipyards do routinely collect and use much of the data needed to support this objective; they merely need to look at it in another way. Compared to most industrial manufacturing firms, shipyards have a much greater range of information available for analysis, particularly those yards involved in Government work. Shipyards must learn to sort out from this data usable information regarding the performance of processes and the quality measurement of interim products, and to augment it with more specific data to facilitate statistical process evaluation. Further, sorting this information to examine employee performance, education and training, quality teams, and recognition is probably a new perspective for shipyards.

#### Category 3.0 STRATEGIC QUALITY PLANNING

How does the company plan for retaining and achieving quality leadership and how is quality improvement planning integrated into overall business planning? Also examined are short term and longer term priorities to achieve a high quality position, including:

- Strategic Quality Planning Process: Short term (1 to 2 years) and longer term (3 to 5 years) planning for quality leadership and customer satisfaction, such as process capabilities, competitive and benchmark data, customer requirements and supplier information
- Quality Leadership Indicators in Planning: The company's approach to selecting quality related competitive comparisons and world class benchmarks
- Quality Priorities: Prioritization of objectives for quality leadership and the resources committed to reaching them.

This category alone should get every U.S. shipyard's attention, because it is essential to competing on a global basis. By understanding and planning for the quality needs of the world-wide marketplace, U.S. yards can begin to penetrate those markets. Setting quality improvement programs only to compete domestically will secure a share of a small market but will not begin to touch the much larger global marketplace.

Shipyards are beginning to use formal strategic planning processes and could factor quality planning into them. The Shipbuilders Council of America has been compiling information on the global shipbuilding industry which can be useful; however, establishment of specific quality-based goals, augmented by statistical processes, is necessary for strategic quality planning to be effective.

#### Category 4.0 HUMAN RESOURCE UTILIZATION

This category examines the effectiveness of work force development, including management. Areas of interest include:

Human Resource Management: Human resource plans to support the company's quality objectives, both short term and longer term, and strategies for increasing the involvement, effectiveness, and productivity of all levels of personnel

Employee Involvement: Total commitment to the company's quality objectives from top to bottom

Quality Education and Training: Definition of education and training programs by employee category

Employee Recognition and Performance Measurement: Strategies for encouraging contributions to the company's quality programs

Employee Well-Being and Morale: Safeguards of the health and safety of employees and encouragement of a supportive work environment.

Due to the labor-intensive nature of shipbuilding, shipyards have long recognized the value of their work forces and typically have extensive human resource programs, but these programs can be improved in terms of total quality awareness. Some yards are expanding their use of employee involvement groups and shared decision making, education and training (often a necessity due to skilled labor shortages), and providing a greater stake in the future of the company to the work force through various economic incentive programs such as profit sharing. However, traditional personnel management methods and problems persist, including reliance on annual performance reviews and failure to deal effectively with traditionally high accident rates. Shipyards must continue to work on these and other "old school" issues if quality-based management backed by the entire work force is to succeed.

#### Category 5.0 QUALITY ASSURANCE OF PRODUCTS AND SERVICES

This category deals with systematic approaches toward quality control of goods and services based primarily on process design and control. Products and services are viewed broadly, since most companies have both product and service characteristics to consider. Areas to address include:

- Design and Introduction of Quality Products and Services: How new or improved products and services are developed, including test and evaluation processes and minimizing introduction time
- Process and Quality Control: Approaches used to ensure that production processes are controlled and that problems are identified and corrected
- Continuous Improvement of Processes, Products and Services: Principal approaches to identifying and implementing improvements, developing alternatives, evaluating new technology, and using competitive and benchmark data
- Quality Assessment: Assessment types and frequencies, who conducts them, and how they are interpreted
- Documentation: System that supports quality assurance, assessment, and improvement
- Quality Assurance, Quality Assessment and Quality Improvement of Support Services and Business Processes: Support services can include finance and accounting, software services, sales, marketing, information services, purchasing, personnel, legal services, maintenance, plant and facilities management, research and development, and other administrative services
- Quality Assurance, Quality Assessment and Quality Improvement of Suppliers: How the quality of materials, components, and services provided by other businesses is assured, assessed and improved.

Theoretically, shipyards should excel in this area since the QA function has been formally institutionalized due to Navy requirements. However, the QA functions present in most yards rely on mass inspection (often due to customer requirements), do not emphasize statisti-

cal techniques, and do not have the requisite organizational power to enforce quality-based change. In addition, the typical shipyard quality assurance function frequently misses the non-production side of the business, e.g., engineering and purchasing. While the Navy has forced quality improvements on the shipyards through the recent inclusion of "TQM" clauses in its contracts, it has simultaneously retarded the process through use of competitive bid contracting which in turn forces yards to use lower cost second-tier suppliers without emphasis on quality. As the budding commercial ship market strengthens, longer-term supplier relationships can be fostered.

#### Category 6.0 QUALITY RESULTS

The quality results category addresses quality levels and quality improvement based on customer requirements and business operations, both within the company and compared to competitors.

Quality of Products and Services: Trends in quality improvement based on customer needs, including delivery and after-sales services, which together can predict customer satisfaction

Comparison of Quality Results: Comparison with industry averages, industry leaders and world leaders

Business Process, Operational and Support Service Quality Improvement: Measurement of use of manpower, materials, energy and capital, relating to lead times, yields, waste, inventory levels, rework, first-time success rates, environmental improvements, and other areas

Supplier Quality Improvement: Trends in improvement of quality of goods and services provided by other companies.

In general, the shipbuilding industry has the systems in place to measure overall improvement. But it lacks the specific understanding of where it is with regard to specific processes, and, as noted above, needs to collect and analyze current performance data before embarking on a systematic program of improvement. Shipyards will need to take particular note of the customer focus of this category: true quality improvement will only be recognized when the needs of the customer are fulfilled. The yards probably have the information to internally quantify quality results but will face a greater challenge in bringing a customer and worldly spin to the information.

#### Category 7.0 CUSTOMER SATISFACTION

This category reviews the company's knowledge of the customer and customer satisfaction, including:

- Knowledge of customer Requirements and Expectations: Processes for determining current and future customer needs by market segments
- Customer Relationship Management: Understanding customer service requirements, providing easy access for customers to communicate with the company, solving customers' problems, and instilling a customer orientation among the employees
- Customer Service Standards: The company's standards governing the direct contact between employees and customers
- Commitment to Customers: Product and service guarantees and warranties and other commitments that the company makes to promote trust and confidence in its products and services
- Complaint Resolution for Quality Improvement: How the company handles complaints, formal or informal, and uses the information to improve quality and prevent further complaints
- Customer Satisfaction Determination: Objective and valid procedures to assess satisfaction by customer segments
- Customer Satisfaction Results: Customer satisfaction trends, including adverse indicators such as complaints, claims, refunds, recalls, returns, repeat services, replacements, downgrades, repairs, and warranty work
- Customer Satisfaction Comparison: Comparisons with industry averages, industry leaders, world leaders, and other competitors through surveys, awards, recognition, ratings, and market share analysis.

This examination category carries twice the weight of any other category and represents 30 percent of the total. Shipbuilders will argue that this is because the award is meant for consumer markets in which thousands of customers can be identified and their responses analyzed. However, the typical reaction of a customer of a U.S. shipyard is that "they don't understand or appreciate my needs." For this reason, this category

is probably the most relevant of the seven as the U.S. shipbuilding industry moves into the global market.

In this industry, the number of customers is small and their needs similar. This should make it easier to achieve high customer satisfaction, but the opposite has occurred over the last two decades. With a resurgence in the commercial market imminent, yards should begin to understand and appreciate how customers can be satisfied. They can begin by looking to other industries that have experienced similar challenges and draw parallels. They must talk to potential customers and find out what they want. Then the yards can devote the appropriate design and marketing resources to meet customers' needs. All aspects of the business need to be addressed, including marketing and sales, engineering and design, and finance resources .

### CONCLUSIONS

Increasingly, leading companies are turning to the highly adaptable framework established for the Malcolm Baldrige National Quality Award as an effective alternative to the guru approaches. The Baldrige framework:

- . Is management-led, data-based, and customer-driven
- . Reflects the combined experience of quality experts in both the manufacturing and service sectors
- . Is more comprehensive than but still compatible with the traditional guru approaches and affords companies the flexibility to tailor their initiatives to best meet their needs (i.e., use the best of the best)
- . Provides companies with a mechanism to quantitatively evaluate the effectiveness of their quality initiatives
- . Is continuously improved based on input from leading quality practitioners, academicians, and consultants.

United States shipbuilders can and should aspire to becoming one of these leading companies. Adopting a comprehensive program to address all aspects of the business from a quality improvement perspective can lead to a vastly improved market position as U.S. yards enter the lucrative global market of the 1990s. Whether any U.S. shipyard ever attains the award is not the issue; the real

Figure2:

### Uses of Baldrige Framework

- Assessment
  - Award candidate assessment
  - Self-assessment
  - Supplier assessment
- Developing a total quality system
  - Quality improvement process
  - Checklist of issues
  - Interrelationships among issues
- Education and training
  - Major issues management must understand
  - Context for training specialists
- Communications
  - Within companies
  - Between companies and suppliers
  - Among companies seeking to share information
  - With current and potential customers

benefits come from trying. As shown in Figure 2, there are many potential uses of the Baldrige framework. There are also significant rewards.

# Case Study: Motorola

Motorola, Inc.

*The company's quality goal: 'Zero defects in everything we do.'*

Criteria	Major Quality Initiatives
Leadership	<ul style="list-style-type: none"> <li>■ Senior management "crusade" addresses quality improvement as a company issue and, through speeches and full-page ads in major publications, as a national issue.</li> <li>■ Top-level meetings to review quality programs, with results passed through the organization</li> <li>■ CEO quality awards recognizing outstanding achievement within the company</li> <li>■ Managers carry corporate objective of "total customer satisfaction" on printed card in their pockets</li> <li>■ Corporate officials and managers wear pagers to make themselves available to customers and participate in a formal program of customer visits</li> </ul>
Information and Analysis	<ul style="list-style-type: none"> <li>■ Extensive network of customer surveys, complaint hotlines, field audits, and other customer feedback measures</li> <li>■ Benchmarking programs used to analyze all aspects of competitors' product-service performance; 125 companies have been measured against Motorola standards</li> </ul>
Strategic Quality Planning	<ul style="list-style-type: none"> <li>■ Chief quality officer heads formal program of quality system reviews</li> <li>■ Specific quality goals and standards established that drive key operational initiatives</li> <li>■ Quality given priority on meeting agendas and in reviews, plans, compensation, and rewards</li> <li>■ Quality planning a part of every employee's job</li> </ul>
Human Resource Utilization	<ul style="list-style-type: none"> <li>■ All employee levels involved in quality improvement</li> <li>■ Participative Management Program (PMP) teams assess progress toward meeting goals, identify new initiatives, and work on specific problems</li> <li>■ PMP bonuses average between 3 percent and 4.5 percent of total payroll</li> <li>■ Motorola training center established</li> <li>■ \$44 million spent on worker education in 1987; about 40 percent of 1987 training (2.4 percent of payroll) was devoted to quality matters ranging from establishing quality principles to designing for manufacturability</li> <li>■ Suppliers included in quality training and programs</li> </ul>
Quality Assurance Systems	<ul style="list-style-type: none"> <li>■ "Six Sigma Quality" statistical measurement process - employees record defects found in every function of the business</li> <li>■ 'Total cycle time' reduction process-ongoing examination of the total system including design, manufacturing, marketing, and administration</li> </ul>
Results	<ul style="list-style-type: none"> <li>■ Achieved goal of improving product and service quality 10 fold between 1987 and 1989</li> <li>■ Service and product quality levels are approaching 99.9995 percent level</li> <li>■ Cellular telephone operations achieved               <ul style="list-style-type: none"> <li>- 30:1 reduction in factory cycle time</li> <li>- 4:1 reduction in defects per unit</li> <li>- Reduced part counts from 1,378 to 523</li> <li>- 10:1 improvement in reliability</li> </ul> </li> </ul>
Customer Satisfaction	<ul style="list-style-type: none"> <li>■ Recognized by customers as the leader in quality; company earned the highest number of supplier awards and certified supplier citations among 800 electronics companies</li> <li>■ Over past two years, received nearly 50 quality awards and certified supplier awards, highest among 600 electronics companies</li> <li>■ 1987 survey results indicate that among all semiconductor suppliers, Motorola provided the best coverage and customer support</li> <li>■ Formal customer visit program for offices</li> </ul>
Other	<ul style="list-style-type: none"> <li>■ 1988 Malcolm Baldrige Award Winner</li> <li>■ Twenty-three percent sales growth to \$8.25 billion</li> <li>■ Achieved largest market share of Japanese telephone paging market</li> </ul>

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