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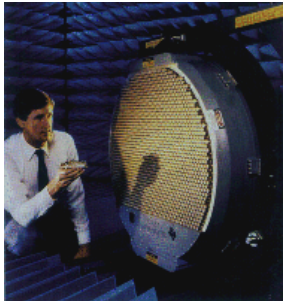
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## Malcolm Baldrige National Quality Award 1992 Recipient

### Texas Instruments Incorporated, Defense Systems & Electronics Group

*(Now Raytheon TI Systems)*

The Texas Instruments Defense Systems & Electronics Group (TI-DSEG) (*now Raytheon TI Systems*) has made total quality basic to its business. The Dallas-based maker of precision-guided weapons and other advanced defense technology believes that its full-scale conversion to total quality management (TQM) is making it a stronger competitor, one up to building market share in a contracting defense industry.



Aiming to achieve six sigma\* quality by 1995 and to reduce product development time by 25 percent each year, TI-DSEG is reaping the benefits of accelerating quality-improvement efforts that began in the early 1980s. The reliability of TI-DSEG systems exceeds the specifications of its Defense Department customers, in several instances by four or five times. Effective strategic planning, wide use of concurrent engineering methods, and strong relationships with key suppliers have helped TI-DSEG penetrate new defense markets, while increasing its share in five of the company's six existing markets.

Increased efficiency and cost-accounting measures that encourage waste reduction and recycling have reduced emissions and solid hazardous waste disposal through reclamation. TI-DSEG's printed wiring board plant has eliminated hazardous waste, and the company's initiative to phase out use of ozone-depleting chloro-fluorocarbons by 1995, 5 years before the Montreal Protocol deadline, is on track.

### TI-DSEG: A Snapshot

A subsidiary of Texas Instruments Inc., TI-DSEG designs and manufactures precision-guided weapons, airborne radar systems, infrared vision equipment and other electro-optic systems, and electronic warfare systems, which altogether accounted for 95 percent of 1991 revenues totaling nearly \$2 billion. Recently, the company won contracts to make antiarmor weapon systems and airborne computers, new markets that are expected to account for growing shares of company revenues. About 10 percent of total sales are to U.S. allies.

Formed during World War II, TI-DSEG has grown to become the nation's eighth largest defense electronics contractor. Employing 15,000 people, the company operates 11 manufacturing, testing, research, and distribution facilities at sites located in the North and Central Texas area.

### TQM Strategy

At TI-DSEG, quality goals and business goals are one and the same. Executives view TQM as the best approach to accomplish any objective – from increasing market share to controlling employee health care costs – and teams as the most effective means to execute the company's quality strategy. From a pilot group of four worker teams formed in 1983, a network of more than 1,900 teams has grown to link all units and levels, from top management to individual work teams.



The network continues to evolve, with the aim of trimming organizational levels and transferring day-to-day decision-making authority to workers. In 1987, the company began experimenting with self-directed work teams and documented significant decreases in defects and production time. As a result, the TI-DSEG Quality Improvement Team (QIT), which is made up of the company's 14 top executives, has set the 1995 goal of increasing participation on unsupervised teams to at least half of the workforce.

Chaired by President Hank Hayes, the TI-DSEG QIT initiates and guides strategic quality planning, beginning with setting company-wide long-term goals and ending with final approval of each division's annual objectives and implementation plans. Annual objectives are evaluated to ensure they will advance the company toward accomplishing its 5- to 10-year goals, a planning horizon that reflects the development time for next-generation defense systems.

Evaluations of customer needs drive the entire planning process. These draw on an extensive database assembled from information gathered from a variety of sources, including formal surveys, informal interviews and visits to military program offices and laboratories, policy statements, contract specifications, and customer-provided requirements documents. For each market segment, TI-DSEG translates key requirements, such as reducing the power demands, size, and weight of airborne radar systems, into clear improvement goals for products, processes, and services. In turn,

the paper, seminars, sites, and design or business model systems, and clear improvement goals for processes, products, and customer service, measures for tracking progress toward customer satisfaction objectives and managing internal processes are established for all units. Clear quality requirements also are set for suppliers, since up to half the content of TI-DSEG systems may consist of purchased parts.

TI-DSEG's evolving TQM approach reflects, in part, an accumulation of lessons learned from other companies. An active benchmarking program, managed by a full-time benchmarking "champion," has pointed the way to improvements in virtually every part of the company, from accounting to printed wiring board manufacture. TI-DSEG's goal to achieve six-sigma quality, for example, is based on its study of the quality program at the Motorola Co.

As the company has trimmed organizational layers to five (down from eight in 1990) and increased the number of employees per supervisor, it has increased its investment in training. With the completion of six-sigma quality training in 1992, the entire workforce will be schooled in design quality, statistical tools, and other quantitative problem-solving methods. TI-DSEG's 1992 goal is to provide an average of 40 hours of training for each employee, up from 25 hours in 1991. In addition, the company plans to spend \$11 million between 1989 and 1996 to provide continuing education to workers for reading, writing, and mathematics to meet ever-increasing job demands.

This strategy to empower individuals and teams is complemented by continuing investment in information technology and tools for diagnosing and solving problems. On-line computer systems with standardized data formats and interfaces, bar coding, and integrated data collection strategies are elements of a company thrust to make information immediately available and easily accessible at all points in the company. TI-DSEG is linked electronically to customers and suppliers, significantly reducing paperwork. Fifty-six percent of purchases from suppliers are done electronically.

Returns on these and other efforts to improve TI-DSEG performance, products, and service have been documented throughout the business and by customers. For example, a Navy evaluation of 17 missiles found the TI-DSEG-made HARM and Shrike missiles to be the most reliable, having the longest mean time between failures. An ongoing Navy study evaluates manufacturing operations at 35 defense contractors. Since 1986, 106 processes and techniques used by TI-DSEG were designated as "best manufacturing practices," more than any other company. Customers are recognizing TI-DSEG's quality improvements in other ways as well. Since 1987, the number of customer-conducted quality audits has decreased 72 percent, while formal complaints have fallen by 62 percent since 1988. In a TI-DSEG-commissioned, independently conducted survey of 2,000 company customers, TI-DSEG topped its main competitors in all 11 customer-satisfaction categories – from cost-effective pricing, deployment of technology, and product support.

Company-wide, revenues per worker have increased from about \$80,000 in 1987 to more than \$125,000 in 1991.

\* Six sigma is a statistical term indicating a defect rate of 3.4 per million.

**Baldrige Website comments:**

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