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Quality

For Better Product Assurance and Reliability

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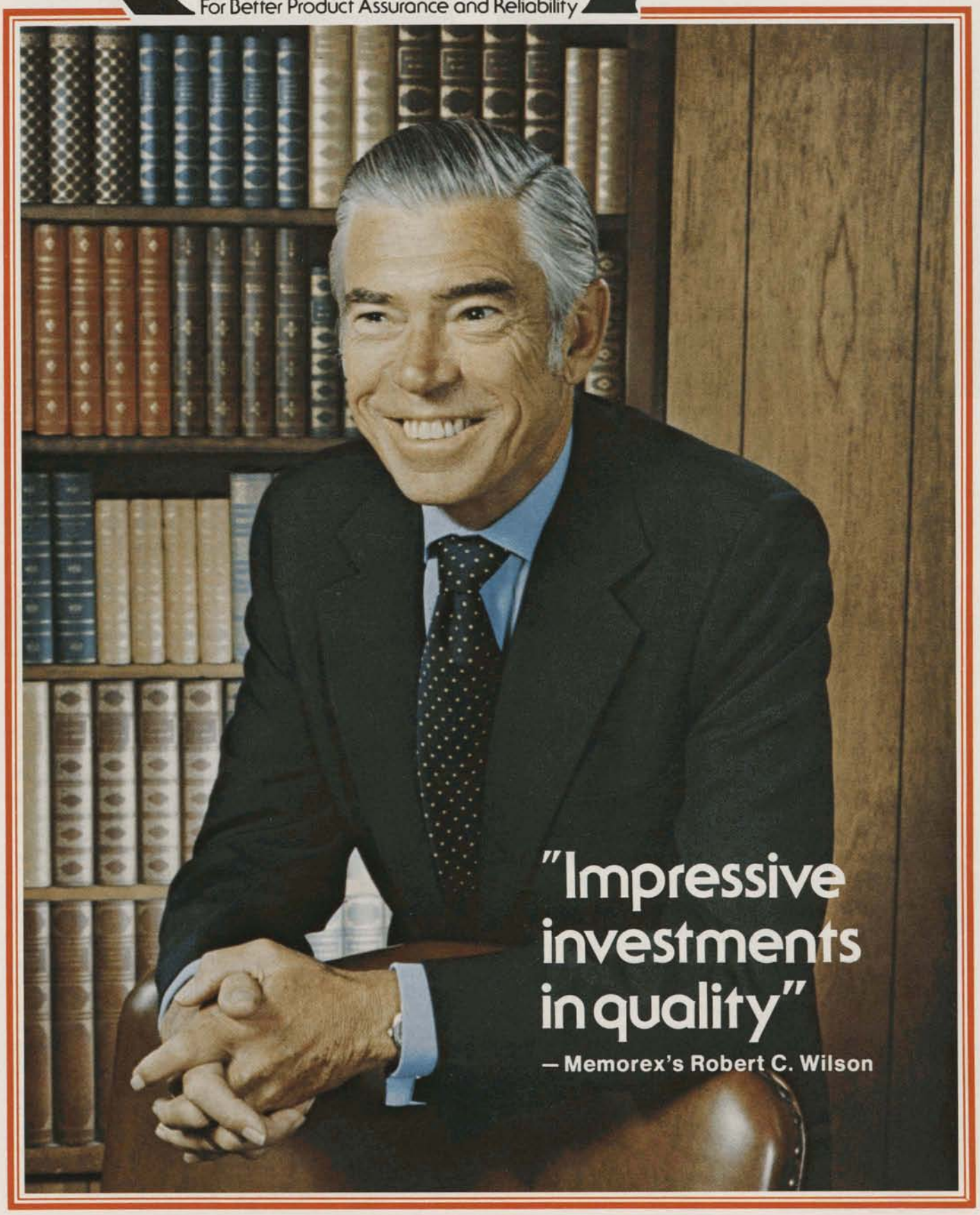

Memorex--a total quality program

Meeting the goal of managing growth while excelling in quality.

Nat Wood, Western editor

■ Memorex's financial turnaround in 1975-76 parallels in many ways its successful achievement in product integrity. The matching profiles cannot be ignored; much of the evidence seems irrefutable. Quality control has played a definite role in the company's emergence as an increasingly important contender for a major portion of the "computer pie."

The Santa Clara California company's heavy accent on high product integrity—memory excellence as its name implies—is the result of a total effort, a positive individual/team policy embraced by every one of its 11,000 plus employees. Chairman Robert C. Wilson, who has figured prominently in Memorex's "second life" and its listing among *Fortune's* major industrial companies, puts it this way: "Employee attitude is surely a most important factor in our success in achieving quality performance. The people of Memorex have quality attitudes."

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Quality systems

The quality system at Memorex is not just a system for the quality assurance organization, but is cross-functional, encompassing all activities in the company from manufacturing to marketing. It covers a product from concept to phase out, and puts every organization on the quality team.

As with most managable systems, it has standards, measurements, analyses and controls. But to this Memorex has added a most significant dimension—prevention. It is in this area of prevention that the greatest long-term dividends are reaped.

Using the book *Total Quality Control*[1] as a guide, Memorex has organized its quality approach into ten subsystems, each of which is thoroughly documented in a manual which is distributed to key individuals for implementation and training of personnel.

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These ten key areas are preproduction quality definition; product and process quality planning; incoming material planning, evaluation and control; product and process evaluation and control; postproduction service; quality training; quality information equipment; quality information feedback; special quality studies; and quality system management.

Ed LaChance, quality manager for the Large Storage Systems Group, emphasizes that the program was formed to establish a consistent total quality system throughout the organization. He notes that the system enables each division to perform "all the actions required to make a product right the first time."

Optimum product performance

Memorex points to its name as a constant spur and reminder of optimum product performance. Three of the company's operations that have major roles in reaching this goal

1. *Total Quality Control,* A.V. Feigenbaum, McGraw-Hill, 1961.

Figure 1. Materials testing in the polymers lab.

Figure 2. Memorex designed tester measures read/write head "flying heights" of ten microinches.

are the Large Storage Systems Group, the General Systems Group and the Communications Group. These three groups were formed from a single equipment products group in 1977. This major change reflects the company's real concern with providing "a more efficient organization whose challenge is to manage growth while excelling in quality."

This drive for greater efficiency has inevitably led to better quality control since each of the three groups now has its own quality assurance staff, working with similarly assigned personnel from manufacturing, engineering and marketing. Instead of having a single quality assurance manager for three divergent product divisions, as was the practice before reorganization, each group presently has a separately assigned QA manager.

Jack Payne, QA manager for General Systems, speaks of the organizational "split": "We now have our own design and manufacturing engineers, and of course, we work together with the same 'quality' people . . ."

Ed Theis, Communications QA manager, says: "Our morale is definitely higher. Motivation has improved because we now work as product focused teams."

Tony LaPine, who headed QA for the former Equipment Products Group and now is the general manager of the Disc Drive Division of the General Systems Group, observes that these new groups are ". . . contiguous, thereby providing a sense of team pride, and fundamentally, that's where quality comes from—pride in achievement."

To help make quality an overall corporate objective, the company introduced a large emblem, using the letter Q as a symbol. This emblem is reproduced throughout the plant, in literature, publications and slide presentations.

New products

Coincidental with Memorex's growth/quality drive, the firm has moved vigorously into new product development, improvement of existing products, the search for new markets and expansion of existing markets.

On a broader scale, it is the firm's plan to continue to allocate the resources necessary to expand its technical capabilities and leadership position in the information storage and communications industries it serves. Investments being made include the development of future recording technologies such as thin-film heads and media, as well as the further development of diagnostic programming and communication software.

Says Chairman Wilson: "Our new products are most impressive. Equally impressive are the investments being made in quality. These include manufacturing processes, quality assurance and field engineering."

As technical excellence continues to grow, teamwork between employee and management groups becomes increasingly important. As one executive puts it, "Quality management can be defined in one word: communication."

Quality awareness

An employee "Quality Awareness" program instituted in 1978, formally recognized individuals whose work reflects an outstanding aptitude and attitude toward achieving high

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product integrity. Each month, supervisors choose the top five "Quality Performers" from Large Storage Systems, General Systems and Communications. Every four months, the 20 winners selected during the preceding period are honored at a special award luncheon sponsored and attended by top company officials.

The company's search for quality excellence extends deeply into employee orientation and education. Memorex's employee publication devotes two of its pages to quality related news, and workers at Santa Clara headquarters are offered company paid quality-related evening courses in the

company's education center and at nearby De Anza College.

What is the present attitude of Memorex management toward this academic program? Says John Heldt, staff engineer, Communications, and a part-time instructor at De-Anza College: "Top executives, from Mr. Wilson on down, fully support this effort to raise the level of quality knowledge amongst our employees. Students not only are enthusiastically gaining new quality insight and exhibiting a high degree of professional expertise, but often end up being promoted after receiving their 'Certificate of Proficiency' or their two year AA (Associate of Arts) degree."

Consistent growth

Since the company's turnaround started in 1974, it has seen consistent growth in a number of ways. In 1977, when Memorex first hit *Fortune's* 500, corporate revenue jumped to $450 million, an increase of more than 100 percent over 1974 revenue. In terms of net income over the same period, the firm moved from a $9.4 million loss in 1974, to a $56 million net profit in 1977. Total revenues also increased by 31 percent in both 1976 and 1977, and by 41 percent in 1978.

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This definitive growth period added some 6,000 employees from 1976 through 1978, an increase of 55 percent to its worldwide operations. This considerable expansion, which included new plant facilities, posed certain management problems. These problems came into being simultaneously with the company's continuing emphasis on product quality. Management, however—by the judicious use of financial and manpower resources—met the dual challenge of both growth and product integrity with a minimum of setbacks.

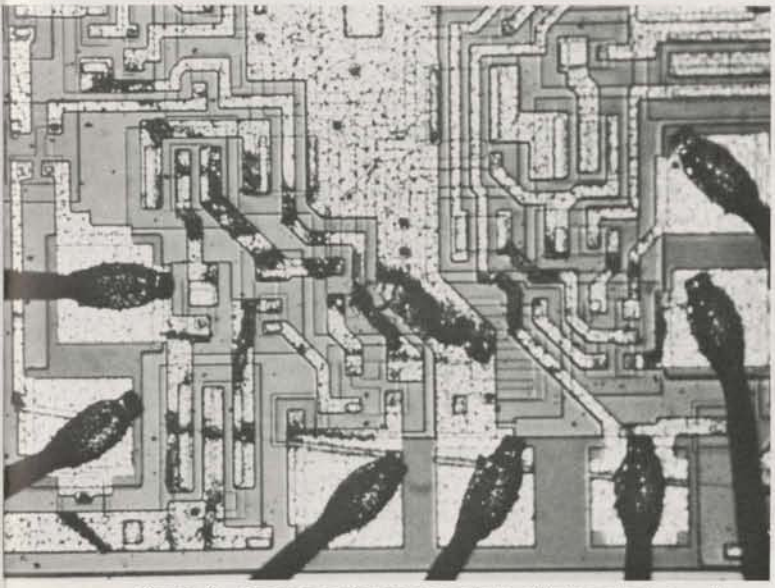

Figure 3. Electron microscope photo of integrated circuit.

Says Chairman Wilson: "Perhaps the single most important factor in determining the quality of a company and its products is the caliber of its leadership. I believe that Memorex has one of the finest management teams in the industry."

As part of its policy of excellence in product quality, the company is becoming increasingly concerned with more accurate measurement techniques in manufacturing and inspection. Current technology being applied in the company's 3650 Disc Storage Subsystems, for example, requires that the read/write heads "fly" ten μinches above the surface of the rotating discs. More graphically, these tolerances would be equivalent to a 747 jet airliner flying one-quarter of an inch above the earth's surface at 600 miles per-hour. For these reasons, the most sophisticated automation approaches to critical production and processing operations are being adopted.

A QA procedure being practiced in several groups of the company demands that each inspector at specified intervals submit at least three quality problems that deserve quick attention. All problems are then tallied, and those mentioned most are immediately taken care of. Some 90 inspectors participate in this plan. Another program being considered in the Large Storage Systems Group is to have quality control inspectors join the same training lines as the new assemblers, thereby providing valuable insight into product construction.

Large storage systems group

The Large Storage Systems Group (LSSG) is an example of how QA functions at Memorex. As with all divisions in the company, the QA organization reports directly to the general manager on an equal level with manufacturing, engineering and other major functions to assure the achievement of product integrity.

Ed LaChance describes the structure as basically a three-legged stool concept. It includes a Product QA manager, a Process QA manager and a Field Product Assurance manager. The three managers report to LaChance, and along with their staffs, represent the three legs of the stool.

"It works this way," says LaChance. "After we receive engineering specifications for a product, Product QA people join manufacturing and development engineering staffs in producing product quality plans. The plans are then implemented by Process QA personnel working with manufacturing engineers and shop management. A separate plan is set up to ensure quality integrity while the product is in each LSSG shop area."

Process QA responsibility extends right to the shipping dock and includes testing, pre-shipping inspection and quality audits. Field Product Assurance takes over then, checking products against customer requirements and seeing that accessories and other necessary materials are included in the shipment. These people also handle such things as shipping damage and performance problems at the customer site. It's their job to see that quality systems are properly developed to eliminate these problems.

Once in place, the total quality systems mechanism eliminates repetition and results in greater customer satisfaction.

Incoming material inspection

Incoming material inspection is one of the vital elements

Quality assurance manager Ed LaChance provided some further details of Memorex's total quality program.

Each division—for example, the Large Storage Systems Group—has a quality function composed of approximately one-half inspection and one-half quality engineering. The head of the quality function of each division (group) reports directly to the group's general manager on an equal level with engineering and manufacturing.

The responsibility for the *visibility* of the need for formal product-oriented corrective action rests with the quality assurance manager, while the responsibility for performing the necessary action rests with the area in which the action must take place.

General improvements in the quality of products or operations is initiated by the quality assurance manager when he influences the activities of his peers and subordinates. While the identification of opportunities for product improvement is a general responsibility of all managers, the most meaningful opportunities come from the sales/marketing area.

Quality level variations are the primary measures of quality improvement but these measurements are correlated with measurements of quality costs. Perhaps the ultimate measure of the quality system is the improvement in productivity due to improved test yields because of quality activity.

Figure 4. Printed circuit card testing on digital tester.

in the total quality systems approach. Potential vendors are surveyed and vendor performance is kept in computer files. This is closely monitored and immediate corrective action is taken when a vendor's performance falls below standards.

All materials must be inspected and verified to conform to drawing requirements. For example, integrated circuits undergo a rigorous testing process. After visual inspection for damage or workmanship type problems, the devices undergo a solderability test, then are subjected to severe thermal shock from 0 to 100C. They are put in a centrifuge and given from 20 to 30,000 G's. Afterward, they are put through a gross leak test, then a radiation test for fine leak.

Samples of semiconductors are sent to the materials lab where they undergo decapping and inspection under an electron microscope with an amplification power of 200,000X. This inspection reveals pinholes, hair particles and other contamination, such as metal smears. Photos are taken to show suppliers what went wrong. Finally, the integrated circuits are electrically tested to engineering specifications.

"We intend to be a company of complete integrity--products, services and customer relationships."

Semiconductor testing capability has been greatly enhanced with the addition of a Fairchild Sentry VII automated test system for Large Scale Integration (LSI) technology. Other electronic parts, such as diodes and transistors, motors, and transformers, also undergo rigid testing procedures. With a large investment in automatic insertion equipment for printed circuit board components, a very precise PCB artwork certification process has been developed, which is administered by the receiving inspection function.

Another segment of the incoming material quality assurance activity is the Materials Lab. Here, problems related to plating, heat treating, casting, forging and compound identification are solved. The lab includes a polymers section and a chemistry section. Additionally, it has an affiliation with Stanford University which allows formation of task force teams for any technical problem.

Quality information system

At the company's Recording Components Division, which is part of the Computer Media Group, a quality information system provides management with the accurate feedback and analysis required to make intelligent decisions related to quality assurance for preventive and corrective actions, says QA manager Leon Sarringhouse. Five basic modules designed for this purpose include: inprocess, receiving, supplier performance, production test operations and returns.

The modules have been designed to interact, making queries from module to module possible. This permits easy analysis of problems from anywhere in the system. For example, a manufacturing yield problem can be analyzed with three weekly reports covering a yield summary, defect summary and test results.

From these reports, serial numbers and sub-assembly numbers are available. The system can then be questioned as to common operators, shifts and lot numbers. the system also can provide vendor data on the defectives, such as common supplier, lots and dates. While not a complete method of prevention, analysis and corrective actions, this system gives the quality engineers and management a solid data base to accomplish those goals, says Sarringhouse.

With continued emphasis in the area of quality, management anticipates company growth to continue to average its 25 to 30 percent a year. Notes Chairman Wilson: "We intend to be a company of complete integrity—products, services and customer relationships." ■