

Total Quality Management Plan

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*"Put
quality
first;
cost and
schedule
will
follow."*



MARTIN MARIETTA

Martin Marietta Electronics & Missiles Group



87C01081B-1

Aero & Naval Systems



87C003829-1:35

Electronic Systems

TQM CREED

Quality is first and foremost in all our endeavors.

Achieve total customer satisfaction for all our products and services.

Provide leadership and vision in each of our entities and be active and visible participants in TQM initiatives.

Involve all employees and suppliers in a team effort to become the best supplier of products and services to the Department of Defense.

Promote training and development of our employees to make them a most effective and efficient workforce.

Demonstrate the highest standards of ethics in all our dealings; with customers, employees, governments, and societies.

Total Quality Management is our way of life as is our goal of continuous improvement.

Missile Systems



82C00863A-10

Ordnance Systems



5-BB282800C-00

OUR COMMITMENT

Quality first....

Martin Marietta Electronics & Missiles Group is committed to Total Quality Management (TQM) as a way of life. We will continuously improve the quality of our products, involve our people in the operation of the enterprise, and set high standards of performance and measure ourselves against them.

We apply TQM concepts to all Group activities and go even further to include our suppliers. This ensures the delivery of products and services to our customers that meet all requirements and expectations.

We are committed to total customer satisfaction; to a long-term pursuit of quality improvements; to cross-divisional quality orientation and teamwork among all our employees and suppliers; to training programs that develop the most capable and effective workforce; and to the highest standards of honesty, integrity, and ethics in all aspects of our business. Electronics & Missiles Group resolves to be the best Department of Defense supplier of quality goods and services.

This TQM Plan is part of a continuing quest for excellence. It is not a program, but rather a day-to-day blueprint for excellence we want each company, employee, and supplier to follow. We can take pride in our past accomplishments, but we must continue to focus on long-term goals. Total Quality Management is a continuous process in which we involve our employees and suppliers.



A handwritten signature in cursive script that reads 'Allan M. Norton'.

Allan M. Norton
President
Martin Marietta
Electronics & Missiles Group

Key elements of Total Quality Management

Management Commitment



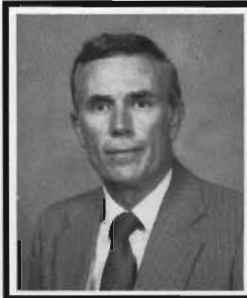
85C00101D-43

Martin M. Koshar
President
Aero & Naval Systems



85C00101D-125

J. Richard Cook
President
Electronic Systems



87C00101D-10

Leonard J. Wroten
President
Missile Systems



89C00795B-2

Bobby R. Browning
Acting President
Ordnance Systems

Outstanding leadership provides the direction and resources to employees so they can strive for continuous quality improvement. This will keep Electronics & Missiles Group competitive.

Customer Focus

84C00937B-46



The imperative behind each change for improvement is total customer satisfaction.

Process Improvement

89C00446B-1



Innovative process designs significantly reduce waste and improve efficiency.

Employee Involvement

89C00471B-1



Employees are the cornerstone of continuous quality improvement.

Supplier Involvement

89C00253B-1



The Supplier Performance Rating System ensures an efficient, high-quality supplier base.

Strengthen management commitment

Dedicated to the Concepts of TQM

The commitment of Electronics & Missiles Group to TQM is built on an evolutionary quality attitude that began with Zero Defects in the early 1960s, continued with Quality Circles in the 1970s, matured with Mission Success and Commitment to Excellence (CTE) established in the early 1980s, and culminated in the formal initiative represented by this Total Quality Management Plan.

At Electronics & Missiles Group, TQM is a total commitment — at every level of the organization. The strength and stability of our commitment are the direction, responsibility, accountability, and communication that top management provides to each element of the organization. Group and company management will uphold the key elements of TQM through their actions.

Keeping the Vision Focused

Electronics & Missiles Group will be the Government's top-rated supplier of quality goods and services through continuous quality improvement. Quality will be the first consideration in every activity, whether programmatic or operational. This culture will make our vision a reality.

Accepting Responsibility for Mission Success

Mission Success, a management

doctrine that drives responsibility and accountability down to all levels, is the responsibility of each company president. This ensures top-quality products and services that comply with all performance and functional requirements. The strength of the process is through its "second-look" technique where each program is reviewed, evaluated, and audited by other company executives. As an outcome of these reviews, root-cause corrective actions are initiated in near real-time and lessons learned are quickly disseminated to other programs.

Exercising Action-Oriented Leadership

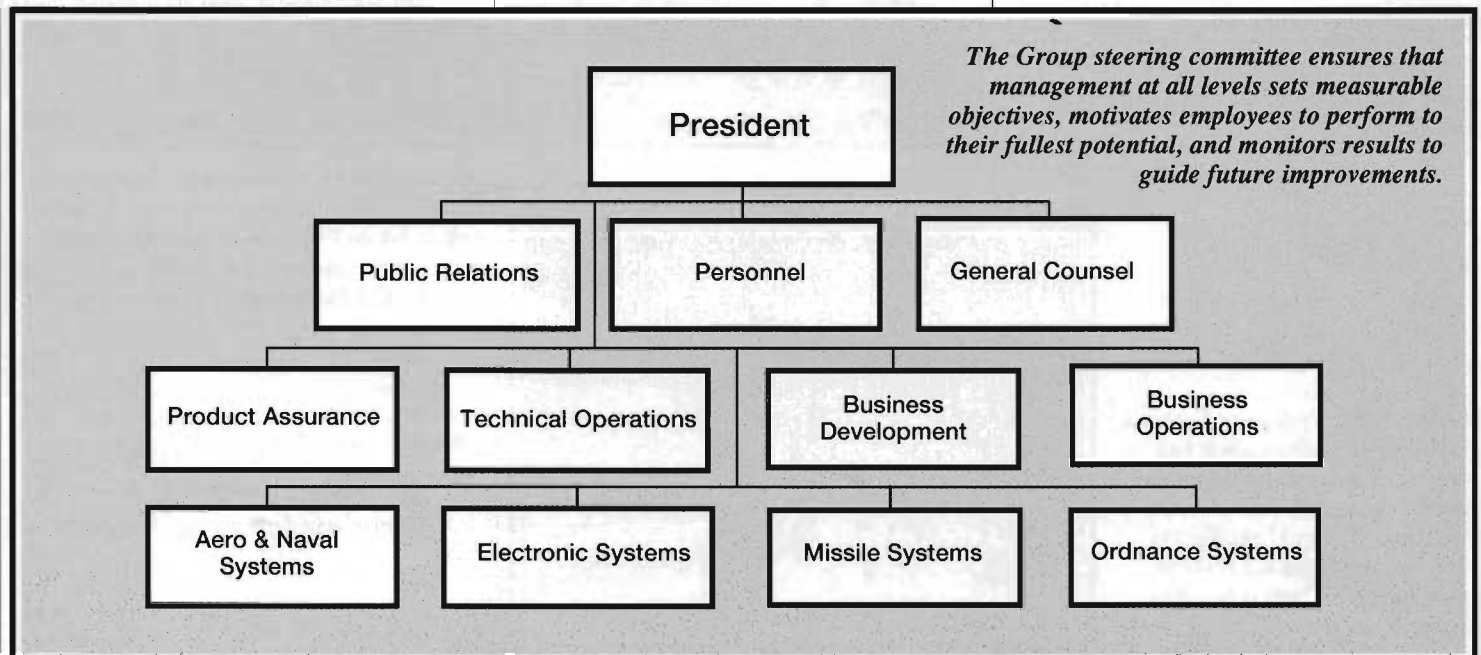
The Group TQM Steering Committee ensures that direction to the operating companies remains clear and timely. The committee establishes general goals and guidelines for continuous quality improvement throughout the Group, ensuring consistency and responsiveness of TQM actions.

Annually, the TQM Steering Committee prepares the Group's TQM Strategic Action Plan. It defines new and ongoing initiatives that offer the greatest potential payback to the Group and its customers. The Strategic Action Plan sets measurable quality-improvement goals and the methodology for tracking progress. Each company steering committee operates

under the same guidelines as the Group Committee. In this way, the companies ensure that goals set forth by the Group are met and that an unencumbered communication flow is established.

Making a Proactive Plan

Each company prepares an annual Strategic Operating Plan (SOP) as a planning tool for executive management. The SOP process develops, assesses, and updates the strategic operating goals, plans, and objectives within the current business environment. It serves as a common baseline for strategic decision making and proactive management. The SOPs provide snapshots of each company's progress against goals. TQM is the common thread throughout each SOP, thus ensuring that quality is the first consideration.



Focus on customer requirements

"You, the great team of Martin Marietta Electronics & Missiles Group, are producing world-class quality."

**S. J. Lorber
Deputy Chief of Staff
U.S. Army Materiel
Command**

Aero & Naval Systems

89C00336B-38



The Vertical Launching System (VLS) has successfully completed 165 consecutive firings.

Electronic Systems

88C00503B-6



The LANTIRN system for the U.S. Air Force has completed more than 5000 hours and over 2.1 million miles of flight testing without a flight incident attributed to a LANTIRN failure. Over 50 percent of those miles were flown at night, at altitudes less than 500 feet.

Missile Systems

84C00828B-5



Ordnance Systems

86C00354B-14



During 1988, Ordnance Systems produced 16 million ammunition items with a defect-free quality control rating of 99.99 percent. Ordnance Systems' employees have accumulated 4.5 million labor hours without a lost-time injury to date.

Through June 1989, we have delivered 9,850 Hellfire missiles with a cumulative reliability in Fly-to-Buy lot acceptance tests of 99.2 percent, including 121 consecutive successful flights.

Committed to Total Quality and always striving for excellence.



Among those attending the Memorandum of Agreement signing ceremony in May 1989 for the Contractor Performance Certification Program (CP)² for Missile Systems were A. Thomas Young, President and Chief Operating Officer designee, Martin Marietta Corporation; MG August M. Cianciolo, Commander, U.S. Army Missile Command; and Mr. S. J. Lorber, Deputy Chief of Staff, Product Assurance and Testing, U.S. Army Materiel Command.

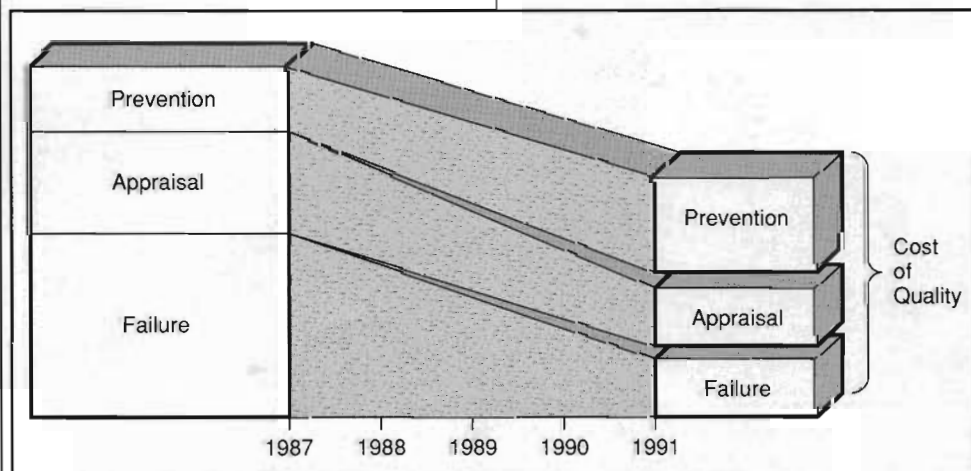
Satisfy Customer Requirements

A recent Cost of Quality (COQ) audit by the Defense Contract Administrative Services resulted in the highest possible rating for Electronic Systems and Missile Systems. The four categories evaluated were adequacy of procedures, compliance with procedures, management's use of data, and the computer software system used to collect and analyze the data.

Our cost of quality system measures the cost of prevention, appraisal, and

failure. This determines our overall effectiveness of using a proactive approach to increase quality, while reducing the cost of quality through prevention.

At Electronics & Missiles Group, we are trending the number of deficiencies reported by our customers. These data provide us with a measurement of customer satisfaction. Tracking these reported deficiencies enables our management teams to take knowledgeable and coherent corrective action.



The COQ system indicates the success of our quality improvement actions.

GP9GAC-13

Fully meeting quality, schedule, and cost performance requirements directly impacts the level of customer satisfaction we achieve. We must maintain a highly competitive posture. Continually improving our level of performance, as a group and as individuals, significantly contributes to that end.

Involve the Customer and Improve Communications

Our efforts to improve communications with the customer, especially performance reporting, have increased the merits of our management approach. We involve the customer in substantive ways to promote mutual understanding. Our joint management by objectives (MBO) initiative enhances the customers' awareness of our product and process management controls.

Electronics & Missiles Group's proactive approach to customer involvement includes joint technical audits and the coordination of workforce training and development to meet higher standards of performance. Recent high marks received in Product Oriented Surveys (POS), Quality System Reviews (QSR), Performance Assessment Reviews (PAR), and other corporate and customer audits are evidence of our continuous quality improvement.

Prevention equals:

- **Improved processes**
- **Involved employees**
- **Certified suppliers**

Improve the process

Simplicity and Quality Through Concurrent Engineering

We created an extensive computer-aided engineering (CAE) environment and integrated our tools beginning with the use of CADAM over 10 years ago. We now use computer-graphics aided three dimensional interactive application (CATIA). We created a paperless

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Concurrent engineering results in cost savings and greater product reliability.

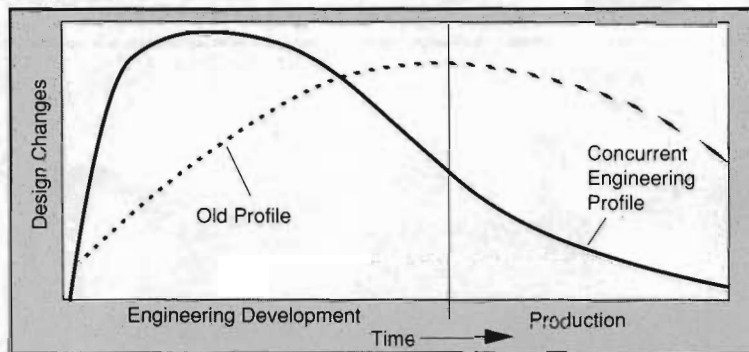
electronic design environment of circuit boards. These initiatives, resulting in an almost totally electronic product definition data base, provide the foundation for meeting the requirements of the computer-aided acquisition and logistics system (CALs).

Further, we involve all professional disciplines and customer advocacy up front in the design process to achieve a team approach in product definition.

Also, we are developing a Product Definition System (PDS) that will facilitate and control the concurrent engineering process, manage the electronic product definition data base, and be compliant with CALs Phase-2 requirements. We are implementing concurrent engineering on recently won programs and proposing it on all new programs to set and achieve aggressive productivity goals.

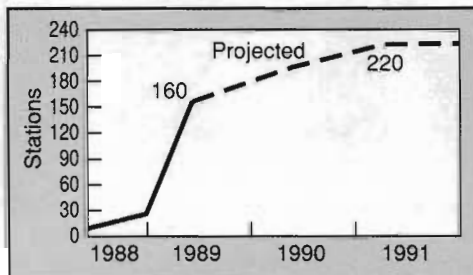
Continuous Improvement Through Statistical Controls

Statistical Process Control (SPC) and Statistical Quality Control (SQC) began in the manufacturing areas. We are now applying these proven techniques at earlier stages in product development. In manufacturing,



GP9GAC-01

Concurrent engineering incorporates life cycle requirements into product definition to improve product quality and significantly reduce change traffic.



GP9GAC-15

By mid 1991, over 200 SPC stations will be on line.

statistical controls significantly improved production by identifying deteriorating processes before defects occurred. These controls put more quality responsibility on the shop floor by providing automated, real-time process trends at the operator's workstation.

89C00092B-11



SPC significantly reduces rework, defects, and scrap to enhance efficiency, productivity, and product quality.

Electronics & Missiles Group is committed to train all managers, supervisors, and other process related employees in SPC and SQC techniques.

Migrating Automated Factory and Quality Systems

Increasingly sophisticated products demand state-of-the-art facilities, resources, and equally sophisticated quality-control tools. The declining defense market puts even more emphasis on automated systems so that we remain competitive.

Our Aerospace Planning, Execution, and Control System (APECS) is a MRP II computer-based, integrated production planning and control system that operates in a real-time, paperless mode. APECS handles manufacturing resource planning, automated process planning, work measurement, and shop floor control.

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Together, APECS and Q-NETS provide the accuracy, timeliness, and quality of process controls that will keep us at the top of our industry.

A computer-based, paperless Quality Nonconformance Evaluation and Tracking System (Q-NETS) is integrated with APECS to provide automated nonconformance tracking, dispositioning, and records distribution.

APECS and Q-NETS are operational on several large programs within Electronic Systems and will be migrated into all Group companies by the early 1990s.

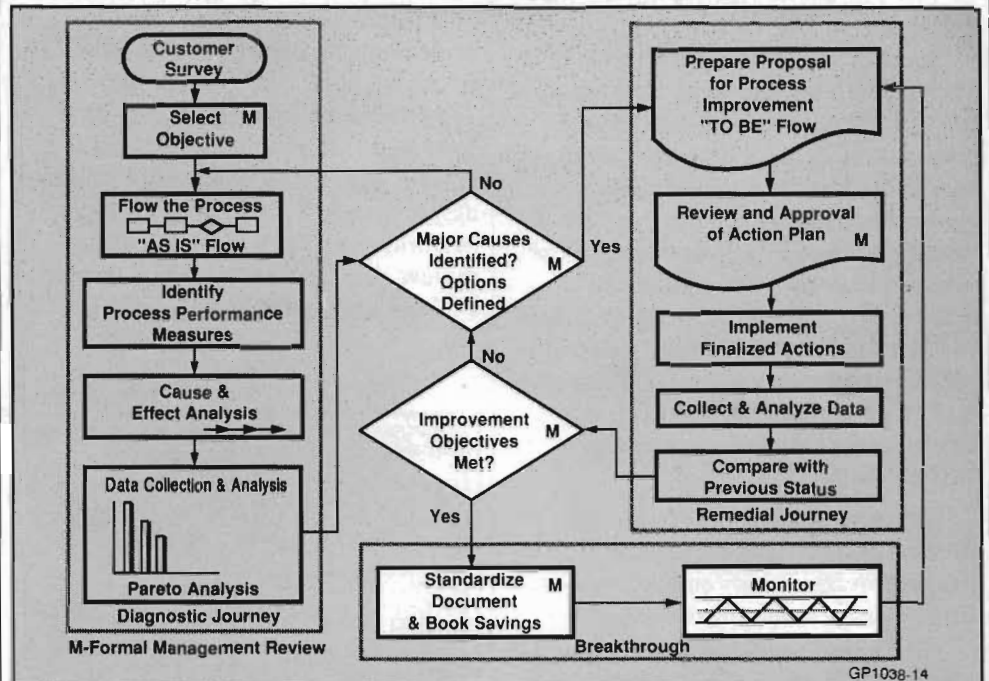
Technical Audits Provide Controlled Measurements

Key to measuring success is the ability to assess performance based on objective evidence rather than subjective opinion. Disciplined technical audits allow the companies to determine their compliance to contractual and company procedures – both internally and for vendors, suppliers, and subcontractors. The five principal audit areas are hardware compliance, software compliance, systems adequacy and compliance, functions, and house-keeping. Any deficiencies are corrected immediately after the root cause is found.

People Improve Business Processes

Employees have an opportunity to influence the way business is conducted. Two elements of this initiative are Performance Measurement Teams and process simplification.

Performance Measurement Teams (PMTs) focus on the touch labor required in the office area or the factory. Process simplification focuses on



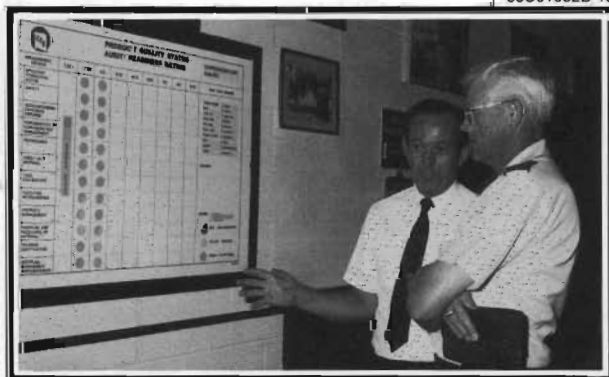
Key initiatives required of all companies are method improvement and process simplification.

all facets of how work is accomplished. The basic principles of PMTs and process simplification are:

- 1) Call upon the people who are involved to get their insight.
- 2) Organize and examine all facets of the work using analytical techniques, charts, and diagrams.

- 3) Review every aspect of the process or system to identify candidates for consolidation, elimination, or change.
- 4) Revamp the process or system.

Electronics & Missiles Group will train employees to use these tools so that continuous improvement is realized.



The Green-Yellow-Red Audit Results board provides a highly visible audit reporting system for employees, supervisors, and our customers.



Effective process design merged with state-of-the-art automation results in highly reliable, cost-effective method improvements.

Increase employee involvement

Train the Workforce

A coherent training program is essential to keep the workforce up-to-date with the increasingly high-tech products, resources, and methodologies available. Also, our increasingly sophisticated products and the processes we use to design and build those products demand that employees remain well trained. Electronics & Missiles Group provides timely, thorough, and cost-effective training and education programs designed to keep our employees — and our companies — the best in the nation.

In-house training programs are tailored to the whole workforce. For production operations and related disciplines, a range of training programs focuses on the skills required for production tasks. As we continue to migrate the “paperless factory”, directed training courses cover the new or modified skills necessary for APECS.

For the white collar workers, our training programs concentrate on keeping current with changing business tools, especially automated systems that increase productivity while reducing rework and improving accuracy. Professional training includes continuing education in the technologies of our marketplaces. Such training helps employees’ climb their respective career ladders and keeps the skill base strong.

The Group encourages and funds continuing education through colleges and universities, technical schools, and industry workshops and seminars.

Involve the Workforce

PMTs are the best example of how results are achieved when the entire workforce is involved in quality improvement. Since their inception, improvements that are a direct outgrowth of PMTs are impressive: At Missile Systems, yield has increased by 27 percent; rework costs lowered by 75 percent; scrap reduced by 60 percent; and labor content reduced by 23 percent.

PMTs operate in a very straightforward fashion. Teams are made up of

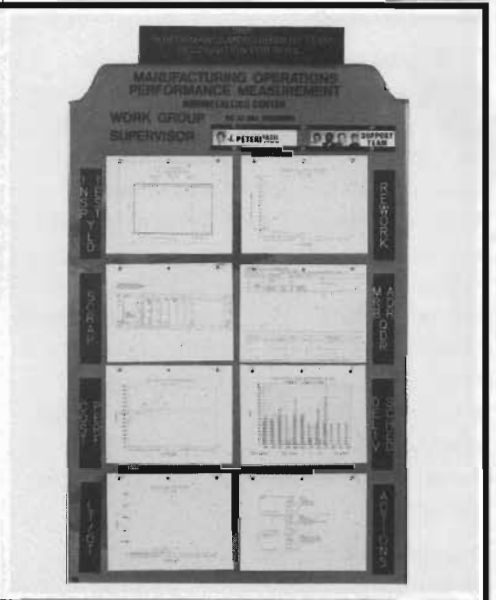
groups producing a particular line item or performing a particular process. The teams are responsible for monitoring — and improving — their quality performance. After evaluating their current performance and establishing aggressive goals, the teams track their performance. They meet weekly to review real-time performance data, evaluate their performance, discuss

ways of improving the process, and submit recommendations. Management acts promptly on their recommendations.

White collar employees are an essential element of a skilled workforce. Electronics & Missiles Group measures the performance of this component on a team and individual basis.

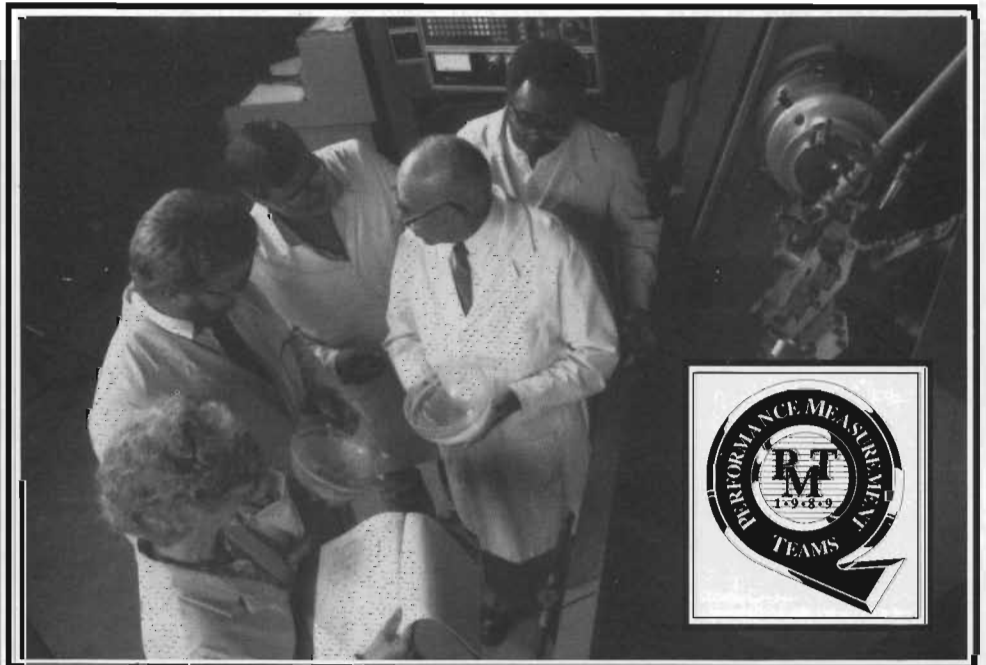
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At weekly meetings, the teams are able to develop improvement goals and can track their performance on charts displayed in their areas.

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Over 200 Group PMTs are involved in the quality improvement effort.

PMTs develop management-process improvement goals and track performance against those goals.

The PMT concept in the professional workplace results in higher productivity through improved team communications, better management information systems, and the latest in facilities and equipment.

The Group's quality track record is due to a belief that responsibility for adherence to quality standards resides with the operating team closest to the job — line supervisors, engineers, designers, machine operators, and support personnel.

Promote Pride and Excellence

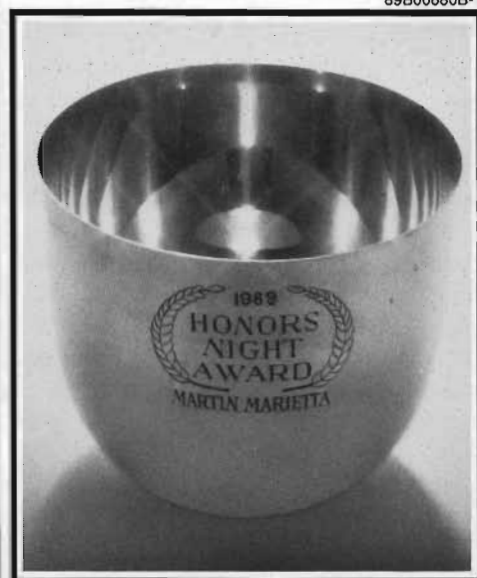
A cornerstone of Martin Marietta Corporation's dedication to excellence is its recognition programs that reward outstanding performance at all levels. Electronics & Missiles Group and its companies reward those individuals and groups who demonstrate creative and exceptional effort beyond the ordinary; who submit suggestions and ideas that result in quality improvement, cost savings, or improved productivity; and who improve the company's ability to compete in its market-places.



Frequent Group, company, and functional-level publications recognize significant individual and collective employee contributions to quality and productivity improvement.

Recognize Team Contributions

PMT awards are given to the Team of the Month, which attains the highest score on monthly audits and demonstrates other outstanding performance; and to the Team of the Year, which



Electronics & Missiles Group employees traditionally receive the most Jefferson Cup awards presented annually to the top corporate employees for superior performance.

attains the highest annual average score on audits and demonstrates consistent outstanding performance.

Recognize Individual Contributions

Spot awards are a timely way of rewarding employees who excel in one of the following six basic categories:

- 1) Productivity beyond established standards or norms
- 2) Improvement of the quality or reliability of products
- 3) Creative problem solving
- 4) Reduction of labor, material, or other costs
- 5) Elimination of hazards
- 6) Identification of conditions that could negatively impact our products or operations.

In addition to the Corporation's Honors Night, the Group honors its top employees in each company at Recognition Night and rewards individuals whose suggestions are adopted (Ideas Count program).



Team recognition reinforces continuous quality improvement.

Certify suppliers of excellence

Enhance Partners in Excellence Initiative

An important part of our continuous quality improvement program is the participation of the supplier base that provides a large percentage of parts and assemblies to the Group's companies. It is imperative that these suppliers provide our companies with consistent, defect-free parts to ensure we meet our quality, cost, and schedule commitments to our customers. Our plan is to make all of our suppliers and subcontractors Partners in Excellence.

Flow Down Product/Process Improvements

Our TQM techniques (such as SPC and PMTs) are being shared with all of our suppliers. We are working with them to improve their processes and products.

Standardize Supplier Rating Methods

We are expanding the Product Assurance Receiving Inspection System (PARIS) throughout the Group to obtain standardized supplier ratings and other required information.

Technical audits of suppliers are being increased to ensure product/process improvements to allow the Group companies to reduce receiving appraisals and other nonvalue-added actions.

Measure Supplier Performance and Certify for Excellence

Suppliers are rated on the basis of performance by part number, in-plant discrepancies, cost, and delivery. This information is used to select and create a highly reliable supplier base.

Group companies are certifying suppliers that continually meet our standards of excellence while eliminating those that do not.

Audit Compliance Improvement Program

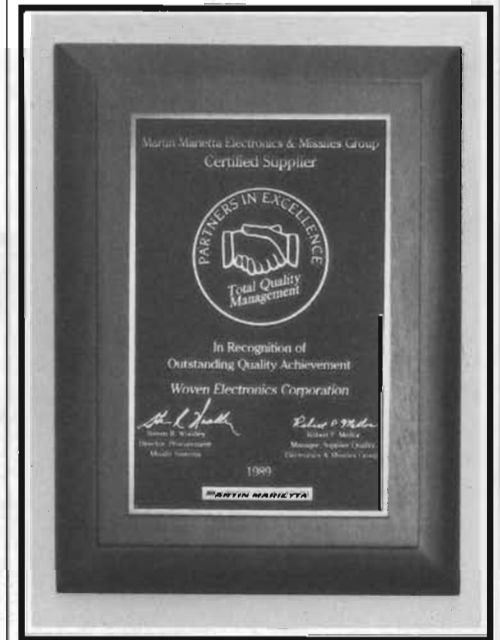
In 1988 an additional program was instituted at Electronic Systems with its suppliers – Audit Compliance Improvement Program (ACIP). This program encourages participants to become preferred suppliers through implementing and reporting the results of their

own self-audit programs. These self audits emphasize compliance to MIL-Q-9858A (or AQAP-1) and other contractual quality systems requirements. Self-audit successes coupled with 98 percent lot acceptance and 95 percent on-time deliveries result in a designation of an Electronic Systems Preferred Supplier.



"... Our suppliers are our partners ..."

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Suppliers who meet standards are awarded a Certificate of Excellence to recognize their continuous quality improvements.

89C00808B-1



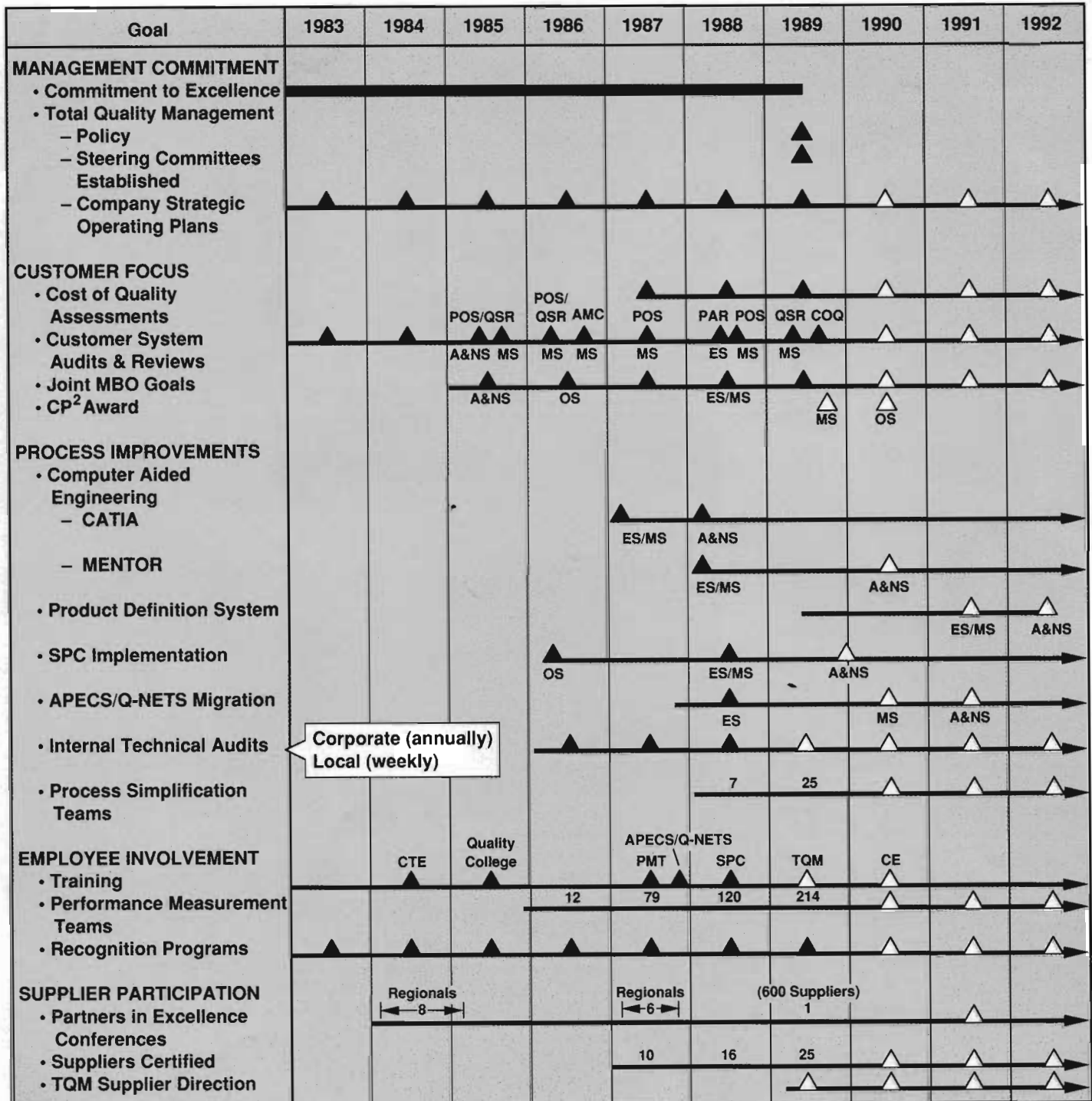
Plan for continuing Total Quality Management

Our Future as Total Quality Managers

The goals and business objectives of Electronics & Missiles Group require the combined efforts of all employees, suppliers, and customers. We must know what the customers want and need, how to precisely com-

municate that information to our employees and suppliers, and how to effectively and creatively manage the process. Our performance measurements will provide the evaluations we need to achieve continuous quality improvement objectives.

"... We involve the customer in substantive ways ..."



GP9GAC-11

The TQM Implementation Plan highlights the Group's progress to date against long-term quality goals. It is organized by key elements of TQM.

Our past performances

The results from customer audits of Electronics & Missiles Group companies during the last 4 years demonstrate significant improvement of our operations and our growing commitment to TQM. Pride in our past accomplishments does not detract from our

commitment to continuous quality improvement. We believe our increased investment in prevention will decrease the cost of quality and help us to achieve our goal to become the best Department of Defense supplier.

| | | |
|---|--------|--|
| DCAS Cost of Quality Audit – Electronic Systems – Missile Systems | Jul 89 | Outstanding |
| General Electric Audit – Aero & Naval Systems | Apr 89 | Pass |
| DCAS Quality System Review (QSR) – Missile Systems | Mar 89 | Outstanding |
| MICOM Product Oriented Survey (POS) – Missile Systems | Sep 88 | Gold Rating – one of top 3 U.S. contractors |
| ASD Program Assessment Review (PAR) – Electronic Systems | Aug 88 | Excellent |
| General Electric Audit – Aero & Naval Systems | Jan 88 | Pass |
| MICOM POS Audit – Missile Systems | Jan 87 | Good |
| General Electric Audit – Aero & Naval Systems | Aug 86 | Pass |
| AMC/PRIDE Audit – Missile Systems | Aug 86 | Pass |
| MICOM POS/QSR Audit – Missile Systems | Feb 86 | Good |
| MICOM POS/QSR Audit – Missile Systems | Oct 85 | Unsatisfactory |
| MICOM POS – Aero & Naval Systems | Aug 85 | Good |

"... a world class producer."

*MG A. M. Cianciolo
Commander
U. S. Army Missile
Command*

*"Our soldiers are proud of
equipment produced at
Martin Marietta.
[Electronics & Missiles
Group's] products are first
rate ... and represent the
team effort."*

*S. J. Lorber
Deputy Chief of Staff
U. S. Army Materiel
Command*

*"...Martin Marietta
continues to demonstrate
their commitment [to TQM]
through positive action."*

*LTG J. M. Loh
Commander
U. S. Air Force
Aeronautical
Systems Division*

*"We owe
it to our
customers
to give
them the
best
products
we can
possibly
produce
at the
best price
achievable."*



MARTIN MARIETTA