Report of Survey Conducted at

CONAX FLORIDA CORPORATION

ST. PETERSBURG, FLORIDA

MAY 1992

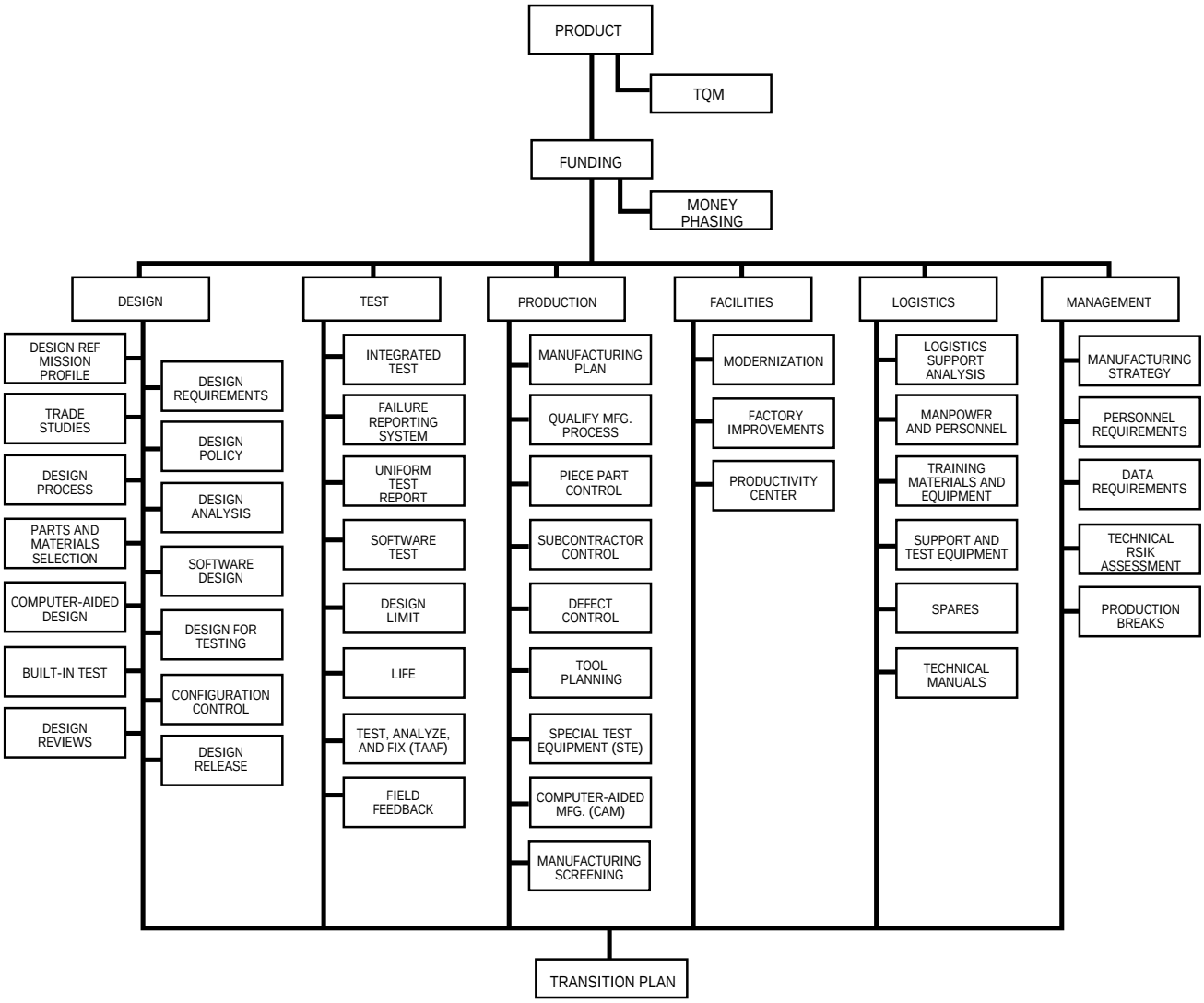
BEST MANUFACTURING PRACTICES

Center of Excellence for Best Manufacturing Practices

DoD 4245.7– M

"TRANSITION FROM DEVELOPMENT TO PRODUCTION"

CRITICAL PATH TEMPLATES



C O N T E N T S

F I G U R E S

SECTION 1

EXECUTIVE SUMMARY

1.1 BACKGROUND

The Best Manufacturing Practices (BMP) team conducted a survey at the Conax Florida Corporation. The purpose of the Conax survey was to review and document its best practices and investigate any potential industry-wide problems. The BMP program will use this documentation as an initial step in a voluntary technology sharing process among the industry and government.

Based in St. Petersburg, Florida, Conax Florida Corporation is a leader in electro-explosive technology. This 115-personnel corporation maintains a product line in mechanical release (latch pin or nut and bolt release or cable cutting), flow control (one-way or combination valving), and stored energy release (liquid or gas) devices. Conax initiated a four part, total quality plan in 1987 to address quality problems that threatened the company's profitability. As a result, Conax has successfully overcome the problems and evolved as an industry leader in quality and customer satisfaction.

1.2 BEST PRACTICES

The best practices and information items documented at Conax are detailed in this report. These topics include:

Item	Page
Employee Recognition/Appreciation There are several programs at Conax that recognize employees and superior performance while expressing general appreciation to all personnel.	**12**

1.3 INFORMATION

Item	Page
ISO-9000 Implementation Conax is pursuing ISO-9000 certification and has developed a plan to assign management responsibility, research requirements, and perform internal reviews agains the ISO-9000 document.	**13**

SECTION 2

INTRODUCTION

2.1 SCOPE

The purpose of the Best Manufacturing Practices (BMP) survey conducted at the Conax Florida Corporation was to identify best practices, review manufacturing problems, and document the results. The intent is to extend the use of progressive management techniques as well as high technology equipment and processes throughout industry and government facilities. The ultimate goal of the BMP program is to strengthen the U.S. industrial base and reduce the cost of defense systems by solving manufacturing problems and improving quality and reliability.

A team of engineers accepted an invitation from Conax to review the processes and techniques used in its facilities located in St. Petersburg, FL. Potential industry-wide problems were also reviewed and documented. The review was conducted at the Conax Florida Corporation on 19-21 May 1992 by the team identified in Appendix B of this report.

The results of BMP surveys are entered into a database for dissemination through a central computer network. The actual exchange of detailed data will be between companies at their discretion.

The results of this survey should not be used to rate Conax among other companies. A company's willingness to participate in the BMP program and the survey results have no bearing on one company's performance over another's. *The documentation in BMP reports is not intended to be all-inclusive of the company's best practices. Only selected non-proprietary practices are reviewed and documented by the BMP survey team.*

2.2 SURVEY PROCESS

This survey was performed under the general survey guidelines established by the Department of the Navy. The survey concentrated on the functional areas of design, test, production, facilities, logistics, and management. The team evaluated Conax's policies, practices, and strategies in these areas. Furthermore, individual practices reviewed were categorized as they relate to the critical path templates of DOD 4245.7-M, "Transition from Development to Production." Conax identified potential best practices and industry-wide problems. These practices and other areas of interest were discussed, reviewed, and documented for distribution throughout the U.S. industrial base.

The format for this survey consisted of formal briefings and discussions on best practices and problems. Time was spent at Conax reviewing practices, processes, and equipment. In-depth discussions were conducted to better understand and document the identified practices and problems.

2.3 NAVY CENTERS OF EXCELLENCE

Demonstrated industry-wide problems identified during the Best Manufacturing Practices surveys may be referred to one of the Navy Manufacturing Technology Centers of Excellence. They are identified in Appendix C.

2.4 COMPANY OVERVIEW

Based in St. Petersburg, Florida, Conax Florida Corporation is a leader in electro-explosive technology. This 115-personnel corporation maintains a product line in mechanical release (latch pin or nut and bolt release or cable cutting), flow control (one-way or combination valving), and stored energy release (liquid or gas) devices.

The automatically inflated life vests, Sea Water Activated Release Switch (SEAWARS), and automatic parachute releases developed by Conax are used by all U.S. Air Force and Navy ejection seat pilots, as well as NASA astronauts. Conax supplies automatic oxygen mask release devices and a one-man, vacuum packed life raft. The company is currently releasing a similar device, the Deck Crew Inflator for use in the Navy's MK-1 life preserver and All Services Automatic Inflatable Utility Life Preserver. This same technology is incorporated in several systems where drone recovery is enhanced by a Conax automatic parachute release.

Fuel pressurization, shut-off and start actuation as well as explosively actuated fuse ejectors disconnect electrical circuitry on several torpedo systems. Conax-developed flood valves are used on both torpedoes and mines where extended submersion is needed. Communication buoys launched by submarines also use a Conax cylinder assembly for inflation.

An explosively actuated high pressure nitrogen storage and release system was designed by Conax to provide ultra-pure gas for cooling an IR seeker. This system allows no contaminants or products of combustion to be released into the gas system after firing.

2.5 ACKNOWLEDGMENTS

Special thanks are due to all the people at Conax Florida Corporation whose participation made this survey possible. In particular, the BMP program acknowledges the special efforts of Mr. Kenneth Beebe for enabling this survey to occur.

2.6 COMPANY POINT OF CONTACT

While the information included in this report is intended to be descriptive of the best practices and techniques observed at Conax, it is not intended to be all inclusive. It is anticipated that the reader will need more detailed data for true technology transfer.

The point of contact for this BMP survey is:

Mr. Kenneth Beebe
Quality Assurance Manager
Conax Florida Corporation
2801 75th Street North
St. Petersburg, FL 33710
Office Phone: (813) 345-8000
FAX: (813) 345-4217

SECTION 3

BEST PRACTICES

Conax Florida Corporation initiated a total quality plan in 1987 to address quality problems that threatened the company's profitability. This four part plan has subsequently influenced all areas of business at Conax including producibility, training, team concepts, and vendor improvement. Led by management and using this four part quality strategy, Conax has successfully overcome the problems and evolved as an industry leader in quality and customer satisfaction. This dedication to total quality was evident in the company's philosophy and was frequently manifested in many of the practices presented to and documented by the BMP survey team. Each of the four elements of the TQM plan are covered separately in this report.

3.1 TOTAL QUALITY MANAGEMENT

Quality Management Approach at Conax

Conax Florida Corporation maintains a quality program goal of customer satisfaction by ensuring the company's products meet requirements and are delivered on time. This goal is achieved through employee involvement, elimination of scrap and rework, concurrent engineering, vendor improvement programs, internal and external communications, cost reduction strategies, and other actions. The program has been well implemented through commitment and management leadership. As a result, all levels of the company are involved.

The implementation of this quality program has produced numerous benefits including:

- Documented savings exceeding half a million dollars
- Improved customer delivery performance by 15% to over 90% of "promises kept"
- 96% of vendor base currently "A" rated
- Established annual vendor conferences
- 10% of vendor base certified to "ship-to-stock"
- 70% of company's machine shop vendors SPC certified
- ISO-9000 incorporation in the current quality assurance system

Other results include continued team training, regular customer surveys which identify customer needs and opportunities for the company, and a three-year planned effort to compete for the Malcolm Baldridge Award. Most importantly, the company's survival equipment products have maintained 100% reliability.

3.2 DESIGN

DESIGN PROCESS

Producibility

Producibility has been identified by industry as a major problem - specifically how it can be performed or measured. This crucial element for remaining competitive is a pressing issue for both large and small companies. Conax took a corporate approach to perform producibility reviews by defining the analytical steps involving all critical areas of the manufacturing process and continually upgrading the system to provide for a better product. This impressive program by a small company has resulted in an enhanced capability to address producibility through an extensive team effort.

Conax began using producibility reviews to improve its products and satisfy customer requirements. Implementation was generated and supported by top management, with the initial step consisting of generating a producibility policy document to define producibility, establish the producibility team, and document the analytical process. The producibility team was comprised of representatives from design, manufacturing, quality, purchasing, production control, and application engineering. The analytical process reviewed all areas of manufacturing including design, specifications and standards, documentation, materials, fabrication, joining methods, coating methods, heat treating, safety, environmental requirements, and inspection and test.

Conax applied its producibility process to internal products and has identified areas of improvements that reduced the cost, improved manufacturability, reduced fabrication schedules, and provided a more reliable product. Continually working as a team, the company is improving existing processes to satisfy its customers.

3.3 PRODUCTION

MANUFACTURING PLAN

Make or Buy

Conax has significantly impacted its products by maximizing the make-or-buy decision of its manufacturing plan.

During a product's manufacturing plan development, the company exercises a decision to make or buy a supporting product or service. Conax has amplified this effort in several areas of the manufacturing process.

In the design area, Conax has equipped an extensive model shop capability that can readily and accurately produce items in small quantities. This effort greatly reduces up-front engineering costs. An engineer works closely with the model shop personnel to produce a workable prototype that can be used to proof out a concept. Problems such as delivery schedule or quality associated with buying piece parts are identified, and the company investigates the possibility of making the part in-house.

Conax has also become virtually self-sufficient in environmental testing. It has an extensive test laboratory where almost all testing required by MIL-STD-810 can be performed. Test facilities include thermal chambers, humidity chambers, salt-fog equipment, vibration tables, shock equipment, and various gages and meters.

The ability to build prototypes, fabricate piece parts, and perform extensive qualification tests on a product has reduced scheduling and costs, as well as provided more control of the product's manufacturing life cycle.

SUBCONTRACTOR CONTROL

Vendor Improvement Program

Conax has a highly effective vendor improvement, education, and awareness program. The company established a Vendor Service Group in 1988 to initiate two-way communication, develop a vendor/Conax team concept, and improve vendor performance. This group, which assists Conax vendors in consistently meeting quality requirements, revised its format for vendor surveys and audits to provide positive feedback and the capability to lend assistance when necessary. The group categorized vendors by location and product/process type and developed a vendor rating system which issues monthly ratings to all vendors based on defects, process controls, and delivery. The vendor service program has significantly improved communication on problems and corrective action and has enhanced product/process design integrity during planning stages by involving vendors.

Efforts to continually help vendors improve include a rigorous qualification process for new vendors (**Figure** 3-1). **Figure** 3-2 illustrates Conax's yearly rating system for updating the approved vendor list. Conax also conducts extensive training programs for vendors and directs Vendor Awareness Seminars for machine shops and special process vendors. Training sessions include SPC, Conax requirements, and military specifications. The company has developed a special course on SPC for short production runs which is offered to vendors. Conax also performs a Pareto analysis of all vendor non-conformances. In addition, recognition and awards for "A"-rated performance are provided.

These efforts have produced exceptional cost savings by reducing or eliminating scrap, rework, and defects as well as by developing "A" rated vendors and potential ship-to-stock vendors. **Figure** 3-3 illustrates that Conax vendor improvement initiatives have raised the number of "A" rated suppliers from 73% in 1987 to over 96% currently. Over 10% have been certified ship-to-stock.

Conax initiated the Vendor of the Year recognition in 1987 and anticipates continuing this award on a yearly basis, celebrated during Quality Day every October. Planned future activities for the vendor service program also include additional and expanded vendor training seminars, and product reviews with vendors participating in new programs.

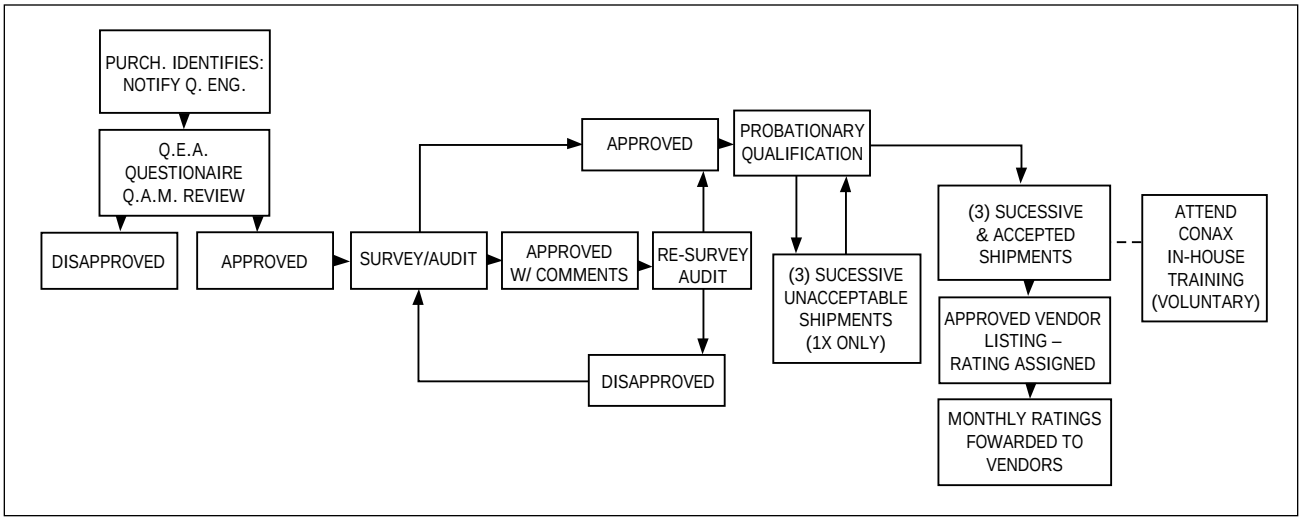


FIGURE 3-1. CONAX NEW VENDOR SELECTION PROCESS

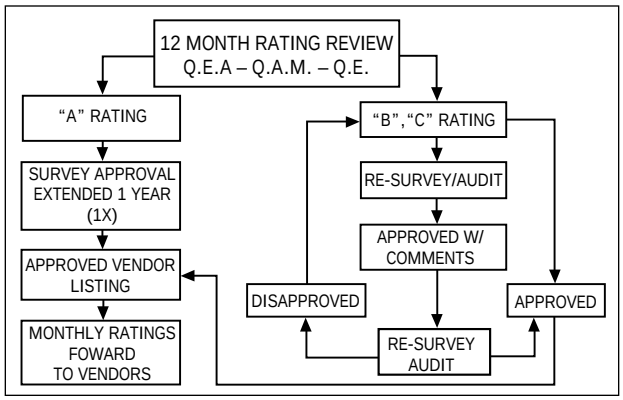


FIGURE 3-2. YEARLY VENDOR RATING UPDATE PROGRAM

SPECIAL TEST EQUIPMENT

Low Cost Bore and Ram Gaging System

Close tolerance measurements are essential when using construction techniques like interference fits or press fits. Additionally, in situations where explosive gases must be contained and ram movement distances must be accurate and repeatable, the possibility of scratches or other possible damage must be avoided. Conax utilizes a non-contact method of measurement which has proven to be a highly accurate and reasonably priced procedure.

The method incorporates an Edmunds Trendsetter Column Gage system with ring gages (traceable to the National Institute of Standards and Technology) to perform 100% inspection of all bore and ram assemblies. The system forces air through precisely-sized orifices, and the pressure is calibrated using the minimum and maximum sized ring gages. The difference in pressure between the minimum and maximum is noted, and during the measurement, the actual pressure is presented on a digital bar graph. The air gage has an accuracy down to .0001 $\pm$ .00005-inch. This system avoids using techniques such as calibrated pins which wear and can damage the component being measured if the pin has a burr. The technique also flags out-of-round conditions because the pressures will be inconsistent when the components are turned on the gage.

Initial cost of the air gage system was approximately $1,500 with each of the probe heads at $400 to $500. Other non-contact methods of measurement can cost more than 10 times that amount. Conax has developed a technique which fits their needs perfectly, and realized substantial cost savings in the process.

Special Test Equipment

Demonstrating an overall commitment to total quality and a "can-do" attitude, Conax developed test equipment to meet its specialized needs. One example of this proficiency is the nitrogen analyzer system. This system is used to analyze the nitrogen which provides the cryogenic cooling necessary for accuracy of an infrared sensor. The nitrogen must meet specific purity and particle size requirements for the seeker to perform properly.

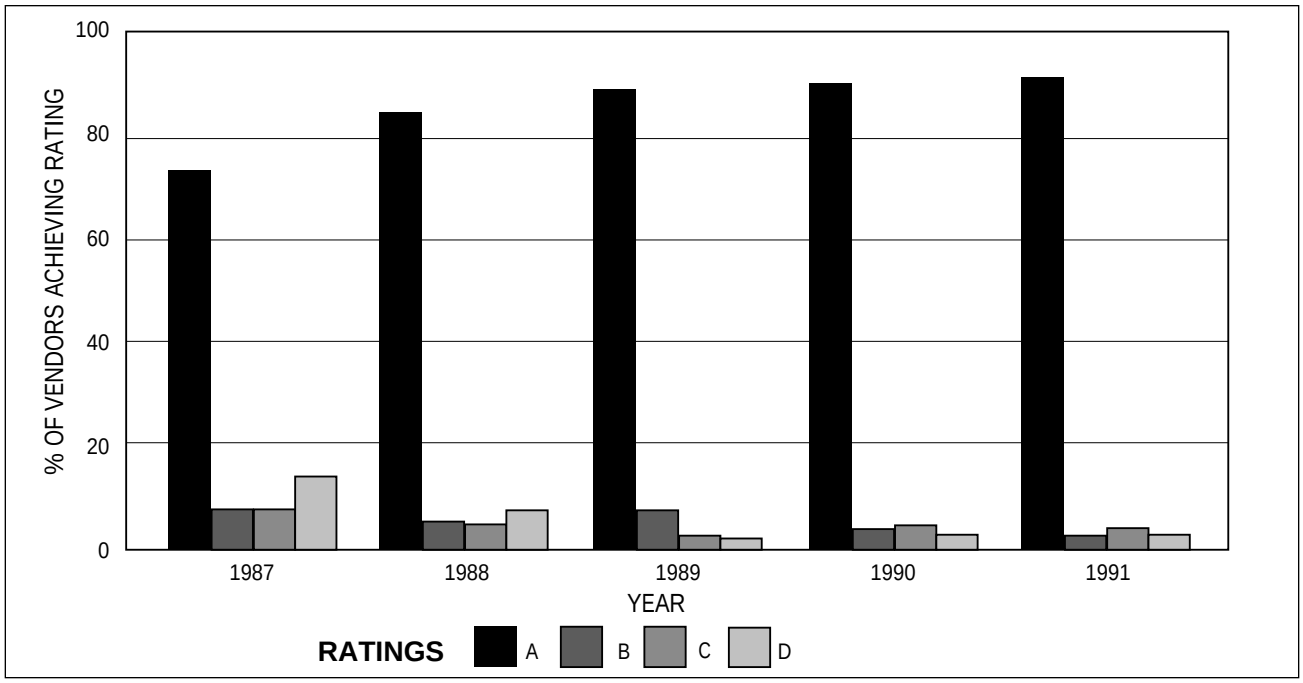


FIGURE 3-3. RESULTS OF VENDOR RATING PROGRAM

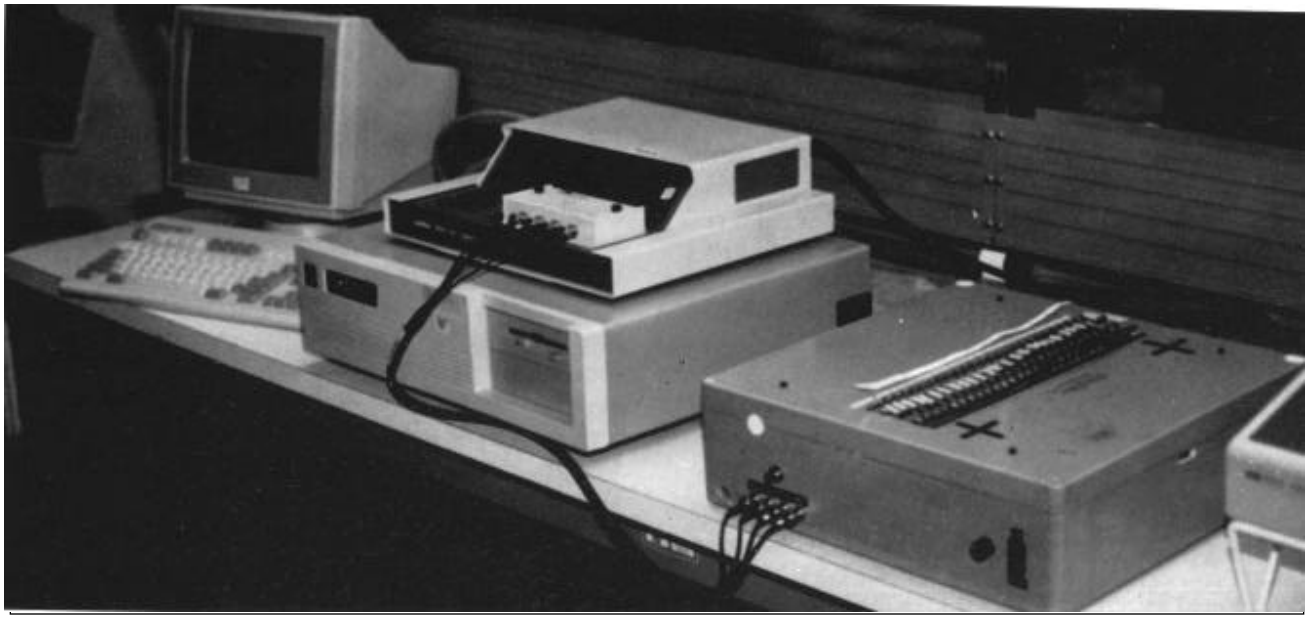


FIGURE 3-4. CAPACITOR TESTER

The analysis would have required Conax to use an outside test laboratory at considerable expense with lengthy delays. The nitrogen is contained in a sealed tube until the actuator is fired, and then metered out to the cryostat. To perform the test properly, all measurements on the sample must be made at the same time. Therefore, a special manifold was developed by Conax that allows the capture and analysis of the nitrogen in parallel. The particle size, hydrocarbon analysis, and mass spectrometer measurements are completed. Having this analysis capability in-house has saved Conax hundreds of thousands of dollars in test costs and avoided lengthy delays in obtaining the test results from an outside source.

In-House Test Capability

Conax made a corporate decision to bring necessary test equipment in-house as a means of addressing problems associated with outside test houses. These outside service providers often set their own schedules and quality standards, and these standards may not be in line with Conax needs.

By maintaining an in-house test capability, Conax can develop test procedures and acceptance test procedures around both the product and customer requirements, as well as the capabilities of the test equipment. A logical test order sequence can be determined, equipment and procedures can be approved, and acceptable test tolerances set. The specific needs of the production schedule can also be accounted for, and priorities can be resolved according to specific, current requirements. In addition, tests can be constantly monitored to ensure required test quality, and no additional travel expenses are incurred when a test witness is required.

Conax maintains an in-house test facility occupying almost 6000 square feet. Current test areas include an environmental test lab, pressure test lab, X-ray laboratory, and salt fog/rain chamber lab. These capabilities have resulted in substantial savings to both the company and its customers. For example, in 1991, the cost of two temperature/humidity/altitude tests performed by an outside test house was $31,000. Conax purchased a test system to perform this test, and anticipates the system paying for itself in less than two years. The company estimates that during 1992, it has already realized cost savings in excess of $250,000 due to the in-house test capability, not including less tangible benefits such as quality improvement, reduced schedule impacts, and shortened delivery cycles.

Low Cost Ideas

Conax has developed several unique innovations to greatly improve productivity and quality. In most cases, these innovations are low cost/low tech ideas developed on the factory floor. They have been implemented quickly and successfully due to the total quality environment at Conax which supports employee involvement and continuous improvement. These innovations include:

- Capacitor Tester – The SEAWARS product line uses wet slug tantalum capacitors that must be checked for six parameters, burned-in, and rechecked for parameter shifts. This was previously accomplished by five manual workstations in which each capacitor required a thirty minute check-burn-check cycle. Conax engineers developed an

automatic tester that holds 25 capacitors, completes the entire test cycle, and prints out a report in less than one minute (**Figure** 3-4).

- Battery Polarity Tester – 24 volt batteries for SEAWARS and 12 volt batteries for automatic inflators must be checked for proper polarity prior to installation. This was a manual operation done one battery at a time. Conax factory personnel developed a fixture which simultaneously checks 24 batteries (**Figure** 3-5).

- Product Rack – SEAWARS kits are packaged in bulky plastic packs making them easy to use but difficult to handle and pack for shipment. The packs were stacked on tables as they were moved through the factory; this arrangement was inconvenient and consumed large amounts of space for shipments averaging over 500 kits per month. To ease the operation, an employee designed a simple mobile rack for stacking the kit packages and support kitting, packaging, inspection, and movement through the factory (**Figure** 3-6).

- O-Ring Tester – Conax produces parts of a submarine acoustic device countermeasure (ADC) which has a critical O-ring that must be leakproof. Previously, there was no sufficient means of testing this seal other than a visual inspection for integrity. A Conax employee designed and built a special test fixture that checks the O-ring seal for leaks and integrity under pressure. It also has an air assist mechanism to help the operator handle the bulky ADC canister (**Figure** 3-7).

- Cylinder Rack – Conax manufactures large quantities of small, 3000 psi high-pressure cylinders with attached explosive charges. After the cylinders are pressurized and tested for leaks, they must be stored for six months, then re-tested for leaks prior to shipment. To hold and store the cylinders, Conax built mobile slanted racks with PVC piping sections. The cylinders are inserted in the PVC pipe sections and stored on the racks for the six month period.

3.4 FACILITIES

MODERNIZATION

Prototype Hardware Shop

With complex mechanical designs, a prototype is often built to test the functionality of the design concept, as well as address details such as tolerances and interference fits. The cost and schedule impact of contracting this work out on a regular basis is often prohibitive. Conax Florida Corporation uses an in-house model/machine shop to build prototypes and has consequently realized additional benefits.

The company maintains a full-scale prototype model shop that includes such equipment as a lathe, drill press, milling machines, surface and offhand pedestal grinders, and band saw. The model shop which has been in operation since 1989 provides for several needed capabilities including the ability to generate and modify prototype hardware prior to development and release of vendor quality drawings. Additional

FIGURE 3-5. BATTERY POLARITY TESTER

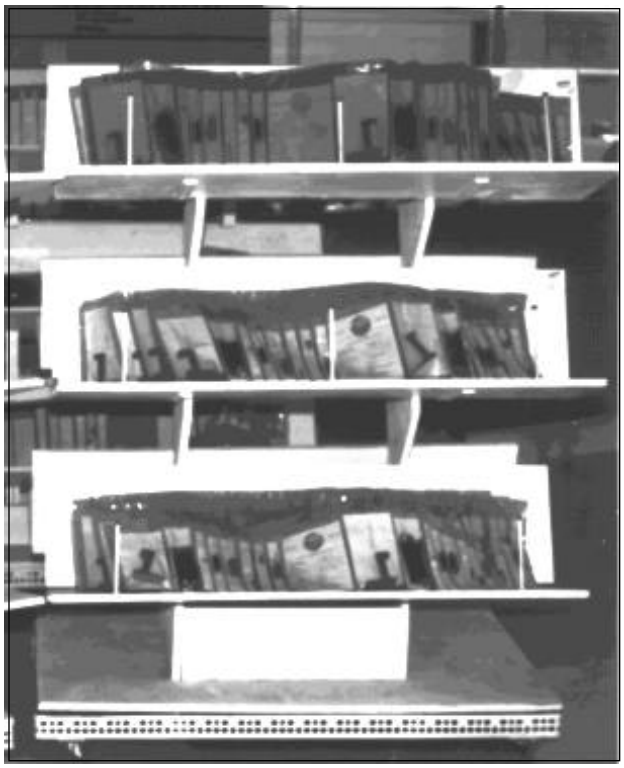


FIGURE 3-6. PRODUCT RACK

advantages include early feedback from an experienced machinist on design-related problems, the ability to cross section and evaluate assemblies, an in-house rework capability, and in-house assembly and test fixture manufacturing capability.

As an example of this model shop advantage, Conax was required to build a prototype and prove a design before the customer would enter into a commitment. If the model shop had not been available, substantial resources would have been needed to develop detailed drawings, and a lengthy procurement process would have occurred, possibly requiring several iterative steps for corrections and explanation. By utilizing the internal expertise and familiarity with the product contained in the model shop, the prototype was constructed in about three weeks and in a cost effective manner. The design was proven and Conax was awarded a contract to manufacture the product in greater quantities.

3.5 MANAGEMENT

MANUFACTURING STRATEGY

Production Teams

Conax has streamlined its production efforts by forming production teams identified by product and customer lines. Each team consists of the production supervisor with cross sectional representatives including quality engineering, production engineering, production control and design engineering. Marketing, Contracts, Purchasing personnel and Program Management support the effort.

Daily meetings provide a forum to review the previous day's production and quality results, identify future contract requirements, and target needed production goals. Because all departments are represented, actual and anticipated problems can be identified, and required actions immediately assigned. This effort has reduced product development, and planning and production lead times, while ensuring greater customer satisfaction through improved productivity and increased quality.

PERSONNEL REQUIREMENTS

Training

Training is a key element of the Conax four-part TQM plan, providing a cornerstone for the company's emphasis on continuous improvement and quality. Conax considers people the base on which the future of its business must be built. Therefore, the company developed a mission statement in 1986 that recognized the need to provide an environment to foster employee development and motivation to achieve specific business objectives and personal growth.

An in-house survey was conducted to help identify employee needs and concerns. It highlighted the need for training to provide employees with knowledge and skills to do their jobs, and with opportunities for personal growth and development. In 1987, a consultant was hired to conduct initial training in team building, time management, basic and advanced supervisory skills, selling to internal and external customers, and customer relations. These courses have been continued using company resources.

The company received a state grant to fund training courses conducted at Conax by St. Petersburg Junior College. These courses included team building, supervisory skills, motivational instruction, TQM concepts, computer courses (Lotus and dBase), MBO implementation, and interviewing skills. Inter-departmental training is conducted in management, supervisory, and administrative skills. The engineering department provides technical courses on such topics as valve design, primer application, and life support. Formal training is provided in government quality and manufacturing standards such as MIL-Q-9858, MIL-STD-1520, MIL-STD-480/481, cost of quality, and MIL-STD-1528.

Conax employs full-time industrial training specialists and has three category "C" certified personnel for soldering training. Soldering training is provided in WS6536E, MIL-STD-2000, and surface mount technology. Other process related training includes internal company process specifi-

cations, electrostatic sensitive devices, primer (explosives) handling, and test procedures for in-process and environmental testing.

The extensive training at Conax is largely responsible for the company's success in developing and retaining is employees. With a small work force, this emphasis has helped Conax attain leadership in its technical and market sectors.

Employee Involvement

In an effort to stabilize the work force and improve morale, Conax Corporation employees a two-pronged effort to directly involve its employees in both promotion selection and new employee recruiting. Job openings in the company are posted and any present employee may apply, and the employee that applies is guaranteed an interview and feedback if not selected. An employee referral incentive program was also initiated to recruit new employees for job openings. The program guarantees that any nominee recommended by a present employee will be interviewed after a job application is submitted. If the applicant is selected and successfully completes the 90-day probationary period, the recruiting employee is given a $100 reward. This method of recruiting has eliminated the need for employment agencies – an expensive service – and eliminated 90% of new employee disciplinary problems.

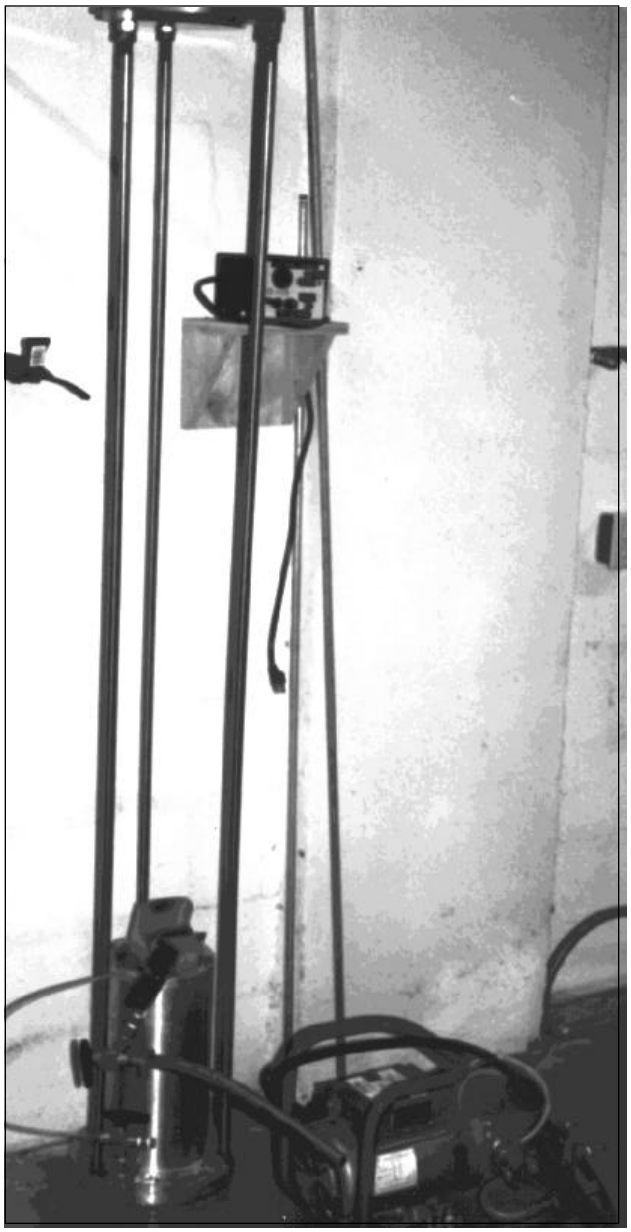


FIGURE 3-7. O-RING TESTER

Communication and Work Improvement/ Suggestion Programs

Recognizing that communication is a critical element in successfully involving employees in improving processes, and enhancing product quality and reliability, Conax implemented several tools to foster communication and promote development of innovative ideas.

One means of communicating with the employees is through the quarterly Conoline Newsletter which is used by Conax management to introduce new company initiatives. Employees are encouraged to write and submit articles on any subject for publication. Another means of communication is the quarterly company-wide employee meetings. These meetings are structured to mix hourly and salaried employees. At the meeting, the president of Conax discusses the state of the company as well as financial matters. Guest speakers are invited to speak on topics of interest to the employees, and training is also provided. These methods encourage employees to understand that they are an important part of the company. In addition to the company's open door policy for employees to discuss concerns with management, these forums give employees the freedom and desire to express their ideas in constructive ways.

Conax implemented its Great Ideas program as a way to support employees assuming a more active work role. Work improvements or suggestions are formally presented through this program. An employee first identifies a problem, then develops a possible solution, The employee must form a team from outside the department to work on the implementation strategy. A paper defining the problem, the solution, and the implementation is developed. A team of judges comprised of company employees and employees of companies in the area then approve or disapprove the idea with awards presented for all implemented ideas. The three outstanding ideas of the year are recognized with cash awards of $1,000, $750, and $500

which are based on the cost savings, team selection, solution implementation, and the final presentation.

These communication and work enhancement programs provide an excellent example of Conax's commitment to quality in the product through integrity and dedication in its work force.

Employee Recognition/Appreciation

Conax initiated several programs to recognize employee loyalty and superior service, and to express general appreciation to all employees. Employee loyalty is recognized through longevity awards which are made at appropriate intervals and consist of gifts selected by the employees from a list supplied by the company. This approach was chosen in an effort to ensure the employee would receive a meaningful gift as opposed to a non-usable award. Superior service is recognized through an Employee of the Month/Year program. This innovative program requires that any employee can be nominated for Employee of the Month by any one of his fellow employees who also provides a nominating narrative. Once a month, a selection committee comprised of management, hourly employees and the previous month's winner review all nominations and select the Employee of the Month by secret ballot. The winner is given a cash award, T-shirt, and selects a reserved parking space of his choice for the next month.

The Employee of the Year is chosen from the 12 monthly winners by a committee representing a cross section of the company as well as the previous Employee of the Year. The winner chosen by secret ballot receives a plaque and a cash prize. The winner is announced at the company-sponsored Christmas party.

Employee appreciation is also expressed by the company through a company-sponsored party at Christmas time, a picnic on Quality Day, and several impromptu employee appreciation picnics that management caters and participates in. Additional appreciation is also expressed by management for not using sick leave by buying back all unused sick leave once a year. Approximately half of all eligible employees are able to sell sick leave back each year.

SECTION 4

INFORMATION

4.1 MANAGEMENT

MANUFACTURING STRATEGY

ISO-9000 Implementation

The European community has generated significant interest by U.S. companies in regards to the ISO-9000 series quality standards. Driven by the possibility of foreign markets for its products which required ISO-9001 certification, Conax considered complying to ISO-9001 in 1989. It developed a plan which included assigning management responsibility, researching requirements, attending seminars, and performing internal reviews against all paragraphs of ISO-9000. This effort was documented and given to all levels of management to be utilized as a guide. Conax anticipates employing a third party registered activity to assess its facility for compliance.

APPENDIX A

TABLE OF ACRONYMS

Acronym	Definition
ADC	Acoustic Device Countermeasure
SEAWARS	Seawater Activated Release System

APPENDIX B

BMP SURVEY TEAM

Team Member	Agency	Role
CAPT O.B. Powell (703) 602-2128	**OASN (RDA) PI** Washington, DC	**Team Chairman**
Amy Scanlan (206) 679-9008	**BMP Representative** Oak Harbor, WA	**Technical Writer**
Larry Robertson (812) 854-5336	**Crane Division** Naval Surface Warfare Center Crane, IN	
Nick Keller (812) 854-5331	**Crane Division** Naval Surface Warfare Center Crane, IN	
Rick James (317) 226-5619	**Electronics Manufacturing Productivity Facility** Indianapolis, IN	
Rick Purcell (703) 271-9055	**BMP Representative** Washington, DC	

APPENDIX C

NAVY CENTERS OF EXCELLENCE

Automated Manufacturing Research Facility

(301) 975-3414

The Automated Manufacturing Research Facility (AMRF) – a National Center of Excellence – is a research test bed at the National Institute of Standards and Technology located in Gaithersburg, Maryland. The AMRF produces technical results and transfers them to the Navy and industry to solve problems of automated manufacturing. The AMRF supports the technical work required for developing industry standards for automated manufacturing. It is a common ground where industry, academia, and government work together to address pressing national needs for increased quality, greater flexibility, reduced costs, and shorter manufacturing cycle times. These needs drive the adoption of new computer-integrated manufacturing technology in both civilian and defense sectors. The AMRF is meeting the challenge of integrating these technologies into practical, working manufacturing systems.

Electronics Manufacturing Productivity Facility

(317) 226-5607

Located in Indianapolis, Indiana, the Electronics Manufacturing Productivity Facility (EMPF) is a National Center of Excellence established to advance state-of-the-art electronics and to increase productivity in electronics manufacturing. The EMPF works with industry, academia, and government to identify, develop, transfer, and implement innovative electronics manufacturing technologies, processes, and practices. The EMPF conducts applied research, development, and proof-of-concept electronics manufacturing and design technologies, processes, and practices. It also seeks to improve education and training curricula, instruction, and necessary delivery methods. In addition, the EMPF is striving to identify, implement, and promote new electronics manufacturing technologies, processes, materials, and practices that will eliminate or reduce damage to the environment.

National Center for Excellence in Metalworking Technology

(814) 269-2420

The National Center of Excellence in Metalworking Technology (NCEMT) is located in Johnstown, Pennsylvania and operated by Concurrent Technologies Corporation (CTC), a subsidiary of the University of Pittsburg Trust. In support of the NCEMT mission, CTC's primary focus includes working with government and industry to develop improved manufacturing technologies including advanced methods, materials, and processes, and transferring those technologies into industrial applications. CTC maintains capabilities in discrete part design, computerized process analysis and modeling, environmentally compliant manufacturing processes, and the application of advanced information science technologies to product and process integration.

Center of Excellence for Composites Manufacturing Technology

(414) 947-8900

The Center of Excellence for Composites Manufacturing Technology (CECMT), a national resource, is located in Kenosha, Wisconsin. Established as a cooperative effort between government and industry to develop and disseminate this technology, CECMT ensures that robust processes and products using new composites are available to manufacturers. CECMT is operated by the GreatLakes Composites Consortium. It represents a collaborative approach to provide effective advanced composites technology that can be introduced into industrial processes in a timely manner. Fostering manufacturing capabilities for composites manufacturing will enable the U.S. to achieve worldwide prominence in this critical technology.

APPENDIX D

PREVIOUSLY COMPLETED SURVEYS

BMP surveys have been conducted at the companies listed below. Copies of survey reports for any of these companies may be obtained by contacting:

Best Manufacturing Practices Program
Office of the Assistant Secretary of the Navy
(Research, Development, and Acquisition) PI
Attn: Mr. Ernie Renner
Washington, DC 20360-5000
Telephone: (703) 602-2128

COMPANIES SURVEYED

Litton
Guidance & Control Systems Division
Woodland Hills, CA
October 1985 and February 1991

Texas Instruments
Defense Systems & Electronics Group
Lewisville, TX
May 1986 and November 1991

Harris Corporation
Government Support Systems Division
Syosset, NY
September 1986

Control Data Corporation
Government Systems Division
Minneapolis, MN
December 1986

ITT
Avionics Division
Clifton, NJ
September 1987

UNISYS
Computer Systems Division
(Paramax)
St. Paul, MN
November 1987

General Dynamics
Fort Worth Division
Fort Worth, TX
May 1988

Honeywell, Incorporated
Undersea Systems Division
(Alliant Tech Systems, Inc.)
Hopkins, MN
January 1986

General Dynamics
Pomona Division
Pomona, CA
August 1986

IBM Corporation
Federal Systems Division
Owego, NY
October 1986

Hughes Aircraft Company
Radar Systems Group
Los Angeles, CA
January 1987

Rockwell International Corporation
Collins Defense Communications
Cedar Rapids, IA
October 1987

Motorola
Government Electronics Group
Scottsdale, AZ
March 1988

Texas Instruments
Defense Systems & Electronics Group
Dallas, TX
June 1988

Hughes Aircraft Company
Missile Systems Group
Tucson, AZ
August 1988

Litton
Data Systems Division
Van Nuys, CA
October 1988

McDonnell-Douglas Corporation
McDonnell Aircraft Company
St. Louis, MO
January 1989

Litton
Applied Technology Division
San Jose, CA
April 1989

Standard Industries
LaMirada, CA
June 1989

Teledyne Industries Incorporated
Electronics Division
Newbury Park, CA
July 1989

Lockheed Corporation
Missile Systems Division
Sunnyvale, CA
August 1989

General Electric
Naval & Drive Turbine Systems
Fitchburg, MA
October 1989

TRICOR Systems, Incorporated
Elgin, IL
November 1989

TRW
Military Electronics and Avionics
Division
San Diego, CA
March 1990

Bell Helicopter
Textron, Inc.
Fort Worth, TX
October 1988

GTE
C^3 Systems Sector
Needham Heights, MA
November 1988

Northrop Corporation
Aircraft Division
Hawthorne, CA
March 1989

Litton
Amecom Division
College Park, MD
June 1989

Engineered Circuit Research, Incorporated
Milpitas, CA
July 1989

Lockheed Aeronautical Systems Company-Georgia
Marietta, GA
August 1989

Westinghouse
Electronic Systems Group
Baltimore, MD
September 1989

Rockwell International Corporation
Autonetics Electronics Systems
Anaheim, CA
November 1989

Hughes Aircraft Company
Ground Systems Group
Fullerton, CA
January 1990

MechTronics of Arizona, Inc.
Phoenix, AZ
April 1990

Boeing Aerospace & Electronics
Corinth, TX
May 1990

Technology Matrix Consortium
Traverse City, MI
August 1990

Textron Lycoming
Stratford, CT
November 1990

Norden Systems, Inc.
Norwalk, CT
May 1991

Naval Avionics Center
Indianapolis, IN
June 1991

United Electric Controls
Watertown, MA
June 1991

Kurt Manufacturing Co.
Minneapolis, MN
July 1991

MagneTek Defense Systems
Anaheim, CA
August 1991

Raytheon Missile Systems Division
Andover, MA
August 1991

AT&T Federal Systems Advanced Technologies
and AT&T Bell Laboratories
Greensboro, NC and Whippany, NJ
September 1991

Tandem Computers
Cupertino, CA
January 1992

Charleston Naval Shipyard
Charleston, SC
April 1992

Information gathered from all BMP surveys is included in the Best Manufacturing Practices Network (BMPNET). Additionally, a calendar of events and other relevant information are included on the network. All inquires regarding the BMPNET may be directed to:

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Office of the Assistant Secretary of the Navy
(Research, Development, and Acquisition) PI
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Washington, DC 20360-5000
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FAX: (703) 602-9129