



REPORT OF SURVEY CONDUCTED AT

**ANNISTON ARMY DEPOT
ANNISTON, AL**

APRIL 1998



Best Manufacturing Practices

1998 Award Winner



INNOVATIONS IN AMERICAN GOVERNMENT

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Foreword



This report was produced by the Best Manufacturing Practices (BMP) program, a unique industry and government cooperative technology transfer effort that improves the competitiveness of America's industrial base both here and abroad. Our main goal at BMP is to increase the quality, reliability, and maintainability of goods produced by American firms. The primary objective toward this goal is simple: to identify best practices, document them, and then encourage industry and government to share information about them.

The BMP program set out in 1985 to help businesses by identifying, researching, and promoting exceptional manufacturing practices, methods, and procedures in design, test, production, facilities, logistics, and management – all areas which are highlighted in the Department of Defense's 4245-7.M, *Transition from Development to Production* manual. By fostering the sharing of information across industry lines, BMP has become a resource in helping companies identify their weak areas and examine how other companies have improved similar situations. This sharing of ideas allows companies to learn from others' attempts and to avoid costly and time-consuming duplication.

BMP identifies and documents best practices by conducting in-depth, voluntary surveys such as this one at Anniston Army Depot conducted during the week of April 6, 1998. Teams of BMP experts work hand-in-hand on-site with the activity to examine existing practices, uncover best practices, and identify areas for even better practices.

The final survey report, which details the findings, is distributed electronically and in hard copy to thousands of representatives from government, industry, and academia throughout the U.S. and Canada – *so the knowledge can be shared*. BMP also distributes this information through several interactive services which include CD-ROMs, BMPnet, and a World Wide Web Home Page located on the Internet at <http://www.bmpcoe.org>. The actual exchange of detailed data is between companies at their discretion.

Anniston Army Depot is the only depot designated to perform depot level maintenance on heavy-tracked combat vehicles and their components. The maintenance and storage of conventional ammunition and missiles, as well as the storage of chemical munitions, are significant parts of Anniston Army Depot's overall mission and capabilities. Among the best examples were Anniston's Closed Loop Hazardous Material System, Materials Laboratory, Partnering Initiatives, and Welder Certification Program.

The Best Manufacturing Practices program is committed to strengthening the U.S. industrial base. Survey findings in reports such as this one on Anniston Army Depot expand BMP's contribution toward its goal of a stronger, more competitive, globally-minded, and environmentally-conscious America.

I encourage your participation and use of this unique resource.

A handwritten signature in cursive script, reading "Ernie Renner".

Ernie Renner

Director, Best Manufacturing Practices

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Section 1

Report Summary

Background

Anniston Army Depot (ANAD), located in Anniston, Alabama, is a subordinate of the U.S. Army Tank-automotive and Armaments Command. ANAD performs depot level maintenance for combat tanks, tracked combat vehicles, small arms weapons, mortars, recoilless rifles, and optical and electronic fire control systems. ANAD also provides ammunition storage, renovation, modification and disposal.

Anniston Army Depot is the only depot designated to perform depot level maintenance on heavy-tracked combat vehicles and their components. The Depot is designated as the Center of Technical Excellence for the M1 Abrams Tank, and is the designated candidate Depot for the repair of the M60, AVLB, M728, M88, and M551 combat vehicles.

Additionally, the maintenance and storage of conventional ammunition and missiles, as well as the storage of chemical munitions, are significant parts of the Depot's overall mission and capabilities. The Depot's mission consists of the receipt, maintenance, storage, and shipment of all types of conventional ammunition ranging from 22 caliber bullets to large 2,000 pound bombs. This mission supports the Industrial Operations Command and the Aviation and Missile Command, as well as a wide range of U.S. Navy and Air Force missions.

In March 1940, the War Department began planning construction of an Army Ordnance Depot in northeast Alabama. Construction began in February 1941 on the first 500 ammunition storage igloos, along with six standard magazines, 20 warehouses, and several administrative buildings. From an initial workforce of four in September 1941, the Depot employed 4,339 personnel by November 1942. The land area expanded from 10,400 acres to 15,000.

In 1952, the Depot was assigned a maintenance mission for the overhaul and repair of combat vehicles. This mission continued to expand until it covered the repair, overhaul, and modification of anti-aircraft and mobile artillery, fire control material, and the many and varied aspects of the tank rebuild program. By the mid-1950s, the missions were rapidly changing as the Army upgraded its older weaponry and developed new weapon systems. With the advent of the 1960s, the Depot was involved with the

M47, M48, M48A1, and M48A2C tank programs. Reconditioning programs also included the M48A1, M56, M59, M42, M19, M47, and M48A1-D vehicles. The maintenance and storage of chemical munitions began in 1963, and will continue until all of the munitions are disposed of in accordance with the Chemical Weapons Convention.

Overhaul of the M551 Sheridan tank commenced in the early 1970s. In 1975, the Depot was selected to overhaul and convert the M48A1 to the M48A5 model. In 1979, the Depot started the M60A1 to M60A3 conversion program. As the decade of the 1980s began, missile maintenance was an added mission, as was the M1 Abrams tank, the newest addition to the Army inventory. In August 1992, ANAD's General Supply Mission was assumed by the Defense Distribution Depot, Anniston, which became a major tenant organization on the Depot. This mission consists of the storage and worldwide distribution of combat vehicles, small arms, and associated spare parts and sub-assemblies; and the receipt, storage, and shipment of both serviceable and unserviceable commodities within the Army. On average, the Defense Distribution Depot, Anniston supply operation receives more than 107,000 line items and ships over 180,000 line items annually ranging from the largest of tanks, the M1 Abrams, to the smallest of calibrated parts.

Supply storage capacity is approximately 3.1 million gross square feet of covered space, and 1.8 million square feet of open storage. The combined total inventory of the Depot and Defense Distribution Depot, Anniston amounts to more than \$7.6 billion and includes the shipping and receiving of over 400,000 tons of supplies, equipment, and ammunition, and the production of more than 600 combat vehicles annually.

In mid-April 1995, the Depot's Directorate of Chemical Operations was provisionally redesignated as the Anniston Chemical Activity under the U.S. Army Chemical, Biological Defense Command. The official transfer was effective October 1, 1995. Anniston Chemical Activity is a major tenant organization at ANAD. Anniston Army Depot stores 7.2% of the nation's chemical weapons stockpile, all scheduled to be destroyed by 2004. A new 31,000 square foot download/reconfiguration facility became operational in July 1995.

The following Base Closure and Realignment Actions (BRAC) affected ANAD:

- BRAC 1988:
The Coosa River Ammunition Storage Annex was closed; the materiel was relocated to ANAD, and the Alabama National Guard assumed use of the annex in 1990.
- BRAC 1993:
The tactical missile maintenance mission was transferred to Letterkenny Army Depot, Pennsylvania; the systems and the year of transfer were: Avenger, FY1994; Hellfire, FY1994; ATACMS, FY1994; DRAGON, FY1994/1995; TOW 2, FY1995; TOW Cobra, FY1995, LCSS, FY1997; and Shillelagh, FY1997.
- BRAC 1995:
 - The self propelled and towed artillery mission transferred from Letterkenny Army Depot to Anniston Army Depot; towed artillery transfers in the 1997/1998 timeframe and the Self Propelled transfers in the 1998/1999 time frame.
 - The M113 Family of Vehicles and the M9ACE missions will transfer from Red River Army Depot, Texas to Anniston Army Depot in the FY1997/1998 timeframe.
 - The Explosive Ordnance Detachment operation will transfer from Fort McClellan, Alabama to Anniston Army Depot in the FY1998 timeframe.
 - The Abrams recouperator A & B plate manufacturing mission will move from the Stratford Army Engine Plant, Connecticut to Anniston Army Depot in the FY1998 timeframe.

Covering more than 25 square miles, ANAD has more than 15,000 acres of woodland, as well as 40 acres of lakes and streams. Additionally, there are more than 2,100 buildings and structures, and 266 miles of roads and streets, 87 miles of fencing, and 46 miles of railroad track. The Depot covers 15,279 acres, having 8.5 million square feet of floor space; storage capacity is 2.3 million gross square feet of covered storage and 600,000 square feet of open storage.

ANAD employs 2,647 civilian and 4 military personnel. The FY1997 operating budget was \$264,589,000, with an annual payroll of \$119,120,000, and local procurement totaling \$24,200,000. Out-loading capacity (based on 24 hours per day, 250 working days per year) is 1,845 rail carloads, 2,575 truckloads concurrently, or 2,400 filled containers. Major tenants at

ANAD include the Defense Logistics Agency; Test Measurement Diagnostic Equipment; Health Services Command; Defense Reutilization and Marketing Office; Department of Army Center of Military History; and Soldier and Chemical Biological Command. The BMP survey team considers the following practices to be among the best in industry and government.

Best Practices

The following best practices were documented at Anniston Army Depot:

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Closed Loop Hazardous Material System	5
ANAD established a team to administer the Depot's Hazardous Material Management Program. The team provides centralized management and tracking of hazardous substances. The goal is to provide cradle-to-grave management for hazardous substances on the Depot.	
Data Plate Laboratory	5
ANAD's Photo Data Plate Laboratory has acquired the capability to fabricate decals and data plates on numerous materials. The processes used include silk screening, photo etching, metal photo processing, diffusion transfer copying, and metallography lithographic processing. These capabilities provide the Depot with in-house capability to support all customer data plate requirements.	
Environmental Program	6
ANAD has an active Environmental Quality Control Committee which hosts monthly meetings with the Depot commander to provide status on environmental issues. The committee is an effective tool in achieving and maintaining environmental compliance.	
Flexible Computer Integrated Manufacturing/Rapid Acquisition of Manufactured Parts	6
ANAD installed the Rapid Acquisition of Manufactured Parts system in its main machine shop and began producing parts in 1994. Using this system, the Depot has enhanced its manufacturing capabilities and flexibility. The Rapid Acquisition of Manufactured Parts system provides a proven strategy for performing in an environment where flexibility and limited resources are a prerequisite to agile manufacturing. The system has been successfully used to manufacture more than 207,000 piece parts.	

Item	Page
High Pressure Waterjet Coating and Cleaning System	6
ANAD procured a waterjet cleaning system on a best value contract. The manufacturer demonstrated the system's capabilities on actual ANAD parts. The waterjet cleaning system has proven very beneficial to the Depot. In two years, approximately 40% of the initial cost was recovered through reduced labor costs, efficient use of resources, reduced environmental costs, and reduced contamination of parts.	
Materials Laboratory	7
ANAD's Materials Laboratory serves customers both inside and outside the Depot. The laboratory hosts a variety of equipment to support four mission areas: Depot materials related processes; training and certification; reclamation procedure development, and off-Depot customers.	
Acquisition Reform	8
ANAD has developed an aggressive and varied program to take maximum advantage of the reforms allowed by regulatory changes and to proactively implement changes to the contracting process.	
ISO 9002 Certification of the Turbine Engine Facility	9
ANAD's Turbine Engine Facility received ISO 9002 certification in January 1998. To achieve this, the Depot established a team that performed the initial assessment, then developed and implemented actions to meet the certification requirements.	
Partnering Initiatives	9
As part of Government Reinvention, ANAD is partnering with private industry. The partnering relationships enhance efficiencies and increase capabilities. The Depot currently has 15 working partnerships.	
Welder Certification Program	10
ANAD's Welder Certification Program is an extensive qualification process that evaluates and certifies individuals' knowledge and skills before they can be accepted to perform welding functions at the Depot. ANAD has a world-class welding capability with 311 active certifications for 130 welders. ANAD is capable of welding in accordance with 18 separate standards for military, aerospace, ground support, industry, British, and German standards.	

Information

The following information items were documented at Anniston Army Depot:

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Chemical and Environmental Laboratories	11
The ANAD Chemical and Environmental Laboratories provide analysis for oil, chemical cleaning, electroplating, industrial and sewage waste treatment, and storm water discharge. The laboratories are well equipped and the technicians are fully certified for their duties.	
Energy Program	11
ANAD has been challenged to reduce its 1985 energy use level by 30% by the year 2005. The Depot began steam trap replacements, re-lamping, occupancy sensor installations, and heightened employee energy awareness. To date ANAD has achieved a 17% reduction in energy use.	
Ion Vapor Deposition	11
In 1991, ANAD implemented an initiative to replace the traditional cadmium plating of components with ion vapor deposition of aluminum. The ion vapor deposition of aluminum process eliminates the inclusion of zinc (cadmium) particles in the waste stream. The ion vapor deposition of aluminum process has also reduced contact with cyanide compounds, improved corrosion protection, and met all Environmental Protection Agency requirements.	
Recycling	12
The goal of ANAD's recycling program is to eliminate solid waste leaving the Depot going to a land fill. The Depot employs 16 people in its recycling program. In 1998, the Depot's recycling initiatives produced a total savings of \$60,644.	
Shelf Life Extension Program	12
ANAD has implemented a shelf life extension program for consumable materials such as paint, coatings, and lubricants. Materials are tested against a series of quality standards, and even if past the posted shelf life, can be extended by a period specific to the material.	
Tele-Maintenance	12
ANAD's Tele-Maintenance links the forward repair soldier with subject matter experts at the Depot via audio, video, and text media. The objective is to provide a seamless maintenance support system, from the fox hole to the factory, by	

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repairing in forward areas faster. Tele-Maintenance has been successfully demonstrated with significant cost benefits.	
Facility Planning	13
ANAD has a facility planning board that meets two times per year. The board reviews and prioritizes the various projects and focuses on the utilization of the Depot's 2,000 buildings and structures.	
Base Realignment and Closure Workload	13
The Base Realignment and Closure legislation of 1995 resulted in the transfer of several maintenance missions to ANAD. The Depot developed a transition plan that would ensure the successful transfer of these functions.	
Earned Value Project Management	14
ANAD has implemented Earned Value Project Management to achieve world-class industrial management. Earned Value Project Management assesses management methods, processes, and cost control systems to determine the most cost effective and efficient integration of people, processes, and information tools.	
Enterprise Management	15
ANAD has initiated an Enterprise Management system to help manage the Depot's total information management areas. With this system, the Depot will be able to monitor and manage all personal computers, routers, bridges, mini computers, workstations, Web servers, radios, telephones, and other electronic products. The Enterprise Management system will enable the Depot to manage its information management assets and control hardware and software configurations, license accountability, and inventory control.	
Material Management	15
Over the past several years, ANAD's workload has changed from large volumes of tracked vehicles to a multitude of small volume vehicles, sub assemblies, components, and other systems. As a result, the Depot has begun studying and developing management initiatives to enhance production schedules by improving delivery times to the shop floor. Quality and cost are also being closely monitored.	
Quality Management	16
ANAD's quality system is based on the Industrial Operations Command's Contractor Performance Certification Program. This system is	

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based on the 20 elements of ISO 9000. The Contractor Performance Certification Program adds the elements of customer satisfaction, quality costs, ethics, business planning, safety, environment, and continuous improvement. ANAD expects to receive Contractor Performance Certification by the close of 1998.	
Reorganization - Business Center Review	16
ANAD implemented a provisional management level consisting of General Managers for Business Operations and Production Operations. The primary advantage of this organization is having the two Business Center Managers responsible for day-to-day operations, thereby allowing the Commander and Civilian Executive Assistant increased time for strategic planning and external coordinations.	
Technical Publications	17
ANAD's Technical Publications Division is now charged with controlling technical documentation integrity by allowing only current documents to be available for use. These include the Depot's Industrial Operation Procedures used by the planners and mechanics to perform the maintenance and overhaul programs. ANAD has begun to automate the procedures for distribution on the Installation's computer network.	
Vendor Supply Policy	18
ANAD's Vendor Supply Policy provides a methodology to record and maintain vendor's past performance information for use in future source selections. Since implementation of the policy, delinquent deliveries have been reduced from 10% to 15 % to less than 2%. This improvement resulted in improved delivery times and increased customer satisfaction.	
Point of Contact	
For further information on items in this report, please contact: Mr. Aubrey Adams Anniston Army Depot 7 Frankford Avenue AMSTA-AN-PE/Manufacturing Engineering Anniston, Alabama 36201-5051 Phone: (256) 235-6008 DSN: 571-6008 Fax: (256) 235-7912 DSN: 571-7912 E-mail: AdamsA@anad.army.mil	

Section 2

Best Practices

Production

Closed Loop Hazardous Material System

Anniston Army Depot (ANAD) established a team in April 1996 to administer the facility's Hazardous Material Management Program (HMMP). The HMMP Team offers centralized management and tracking of Hazardous Substances (HSs). HS herein is taken to include hazardous material (HM) and hazardous wastes.

The mission of ANAD's HMMP is to establish program policy and guidance, requirements, time lines; establish feedback mechanisms to monitor program success and identify issues; recommend resources and new management practices; resolve technical and support issues; satisfy environmental reporting requirements; and when required, brief the chain of command.

The program's goal is the cradle-to-grave management for HSs. Oversight begins at the cradle (via prepurchase approval) and continues through the grave (which is final disposal or treatment at permitted facilities). The team applies best management practices throughout the HM life cycle to reduce risk to human health and the environment. These practices include ordering, storing, distributing, using, and disposing of HSs.

Centralized management of HM ensures full facility-wide visibility of all HM at any given time. This information is readily available via the local area network and includes the locations, amounts, and types of HM. The Hazardous Material Management System (HMMS), developed by the Joint Logistics Systems Center, was chosen to manage the HS database. This automated system is used to track HM from the time it arrives on the Depot until it is consumed or sent out as a hazardous waste.

ANAD has established the following business management practices to meet mission objectives: reuse procedures; purchases by unit of use versus unit of issue; centralized issue/storage points; program oversight by a centralized team; authorized user/use list; tracking system; prescribed inventory levels at wholesale/retail levels; and continued HS training and awareness programs.

In an earlier Army Audit Agency report, the Depot was cited for high levels of HM inventories. Inventory control equates to a reduction of costs and generation of unnecessary wastes. These HMMP business practices have streamlined and consolidated existing tasks and provided a means to collect data for reporting requirements directed by Executive Order 12856, Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements.

The HMMP has generated cost savings through reductions in HM. It has also provided for the effective control of HSs at ANAD. Additional savings have been realized by bringing HM inventories in line with usage rates at the wholesale and retail levels. Environmental report preparation times have also been reduced with increased accuracy. Net savings of approximately \$200,000 were obtained in FY1997, one year after the HMMS was implemented.

Data Plate Laboratory

ANAD's Photo Data Plate Laboratory has developed in-house capabilities that allow the Depot to fabricate almost any type of decal or data plate on any type of material. Processes used include silk-screening, photo etching, metal photo processing, diffusion transfer copying, and metallography lithographic processing.

The silk screening process can produce silk screen prints with a useable size of 15 inches long and 22 inches wide. Foreign language prints can also be reproduced from a sample provided by the customer. Finished prints can be applied to any flat surface including painted surfaces with chemical resistant coatings.

The photo etching or engraving process can produce metal data plates ranging in size from 1/4 inch by 1/4 inch to a maximum of 20 inches by 24 inches. The metal thickness of the data plates can range from a minimum of 0.005 to a maximum of 0.032. Limited to two basic colors, black or silver, any image provided by the Technical Publications Branch or an engineering drawing can be reproduced on the plates. With black as the primary color, an anodize process is used to provide a contrasting color. If silver is the primary color, a poly-color process is used.

ANAD also has a state-of-the-art automated stencil and sign system capable of producing decals on a

variety of materials such as vinyl, acetate, and foil-backed materials. The system consists of a commercial-off-the-shelf flat bed scanner, a PC, software, and color printer/cutter developed and produced by Bren Instruments, Inc. in Franklin, Tennessee. It has the capability to produce single or multiple color decals up to 15 inches wide with no restrictions on the length. Foreign language decals can also be produced if a sample is provided. These capabilities provide ANAD with in-house control and the ability to support all customer requirements, both foreign and domestic.

Environmental Program

ANAD has an active Environmental Quality Control Committee (EQCC) as required by Army Regulation 200-1. This involves monthly meetings with the Commander to raise environmental issues that need command attention and to keep the Commander abreast of the status of environmental programs. Because of problems in achieving compliance with environmental regulations in the late 1970s and early 1980s, ANAD formed a working EQCC. The working EQCC includes the environmental coordinators and otherwise varies according to the expertise needed to address the problem under review. Using line and craft workers to help identify potential problems with options being considered and to suggest options not already being considered is a sound practice that should be considered by others. The team is described as cohesive and an effective tool in achieving and maintaining compliance.

ANAD's approach to a serious large-scale ground-water contamination problem (Solid Waste Management Unit 12, facility 414) involving closed chemical waste disposal lagoons is unique. Partnering with a private company, Geo-cleanse, ANAD chose in-situ degradation of the high organic concentration contaminant rather than excavation and disposal of the estimated 23,000 cubic yards of contaminated soil. Treatment involved injection of hydrogen peroxide with trace quantities of metallic salt into the contaminated areas. Treatment is currently underway, and the concentration of organics in the contaminated soil near the treated areas has dropped by 95%.

Cost avoidance through this approach is estimated at \$10 million to \$12 million. In addition, in-situ treatment has resulted in destruction of the contaminant rather than just removal to another landfill. In doing so, ANAD no longer continues to be the owner of the disposed material, and all future liability is relinquished.

Flexible Computer Integrated Manufacturing/Rapid Acquisition of Manufactured Parts

In FY1995, ANAD successfully completed the installation of a manufacturing system capable of producing parts on demand. The Rapid Acquisition of Manufactured Parts (RAMP) system was installed in ANAD's main machine shop and started producing parts in July 1994. The RAMP system's primary purpose is to support the mission of the Depot — the overhaul and repair of tracked vehicles. Using the system developed in 1993 at Charleston Naval Shipyard as a baseline, ANAD has enhanced its capabilities and flexibility to suit its parts mix and applications.

By focusing on the up-front activities such as multifunction process planning and finite capacity scheduling of limited resources, RAMP provides a proven strategy for performing in an environment where flexibility and limited resources are a prerequisite to agile manufacturing. By incorporating the lessons learned from the Navy's program, the system developed at ANAD has systematically integrated commercial hardware, software, and communications products into a responsive, powerful, enterprise-level system capable of providing real time system control. Complete work instructions, including all necessary information relating to the successful completion of the job, are provided electronically to the shop floor. This information includes detailed operations, graphics, tooling and fixturing, quality requirements, and the numerical control codes necessary to manufacture the part.

Since its installation in FY1995, the system has been used successfully on almost 3,000 orders totaling over 207,700 piece parts. It has reduced the average in-shop production time to less than 30 days with no increase in personnel. Future plans include expansion into other areas of the Depot such as welding, heat treating, and sheet metal fabrication. It may also be incorporated into the turbine engine and transmission overhaul operations, as well as metal finishing and painting.

High Pressure Waterjet Coating Removal and Cleaning System

In 1996, ANAD procured a waterjet cleaning system to improve efficiency and reduce costs. The contract for the system was set up as a Best Value Contract. The system went through a series of tests

that culminated in the waterjet manufacturer demonstrating capabilities using ANAD parts.

The waterjet system was customized to meet the requirements of ANAD. The six-axis robotic arm is controlled by a computer system. The computer system can be programmed using keyboard entry, or it can be configured in the teach mode. The high-pressure system is capable of producing 60,000 PSI, and is typically operated at ANAD in the 7,500 to 55,000 PSI range, depending on the removal rate desired and the substrate material. By taking advantage of the robotic capabilities of the system, parts as small as two-inch diameter can be cleaned to a depth of 18 inches. The small 0.012-inch orifice and repetitive accuracy of 0.004 inch enable the cleaning of complex parts, which were previously disassembled and painstakingly cleaned by hand.

The closed loop water system enables the use of a commercial water supply. A multiple filtration system assures compliance with applicable wastewater quality standards. This filtration system's ability to filter out particles as small as five microns prevents cutting of the substrate by the water.

The waterjet system has solved several problems. Prior to its installation, sandblasting was the primary means of cleaning parts, which was both labor intensive and caused sand particles to become imbedded in expensive components. Environmental issues arose with the requirement to dispose of contaminated sand as hazardous material due to the heavy metal contaminants. Selective stripping of parts can now be done, allowing parts to be coated without masking. Any excess or extraneous spray is then removed using the waterjet system.

The waterjet cleaning system has been very beneficial to ANAD. In the two years since its installation, approximately 40% of the initial cost has been recovered due to significant reductions in labor costs and more efficient use of resources. The system has also greatly reduced environmental costs, and increased life cycle of engine and transmission components due to the elimination of embedded sand particles and the elimination of machining to remove coatings. In some instances, a labor savings of 75% has been realized.

Materials Laboratory

ANAD's Materials Laboratory is a 1,800- square foot facility built in 1988, utilized to support on-Depot and off-Depot customers and missions. The laboratory's equipment and capabilities consist of the following: Metallography (sectioning, mounting, polishing); Ste-

reo Microscopes (1-50X); Metallographs (50-1000X); Photography (1-1000X); Scanning Electron Microscope with Energy Dispersive X-Ray Analyzer (5-100,000X); Optical Emission Spectrometer (9 bases); X-Ray Fluorescence Spectrometer; Universal Mechanical Tester (Tension/Compression) shown in Figure 2-1; Charpy Impact Tester; Macro and Micro Hardness Testers; Profilometer; and Laboratory Information Management System.

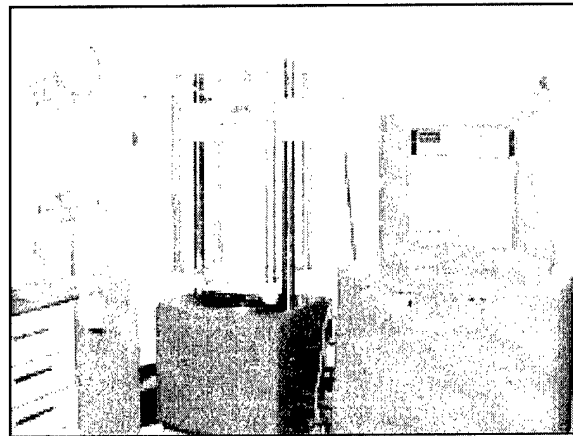


Figure 2-1. Universal Tester

The laboratory's mission can be identified in the following four categories:

1. Support of Depot Materials Related Processes

Laboratory personnel support the Depot's materials related processes consisting of welding, heat treating, plating, flame spraying, vacuum brazing, and nondestructive testing (NDT). The support rendered consists of metallurgical and mechanical testing, process procedure development and validation, trouble-shooting process problems, identification and purchase of new equipment, quality control testing, process control documents development, failure analysis, and certification of equipment as well as consumables.

2. Training and Certification

Laboratory personnel develop course material, conduct classroom training, and serve as the program managers for the welding and NDT training and certification programs. The welding program consists of welder inspection training and physical testing and certification to 18 various skill codes (i.e., specifications). The NDT program consists of training and certification in Magnetic Particle, Liquid Penetrant, Ultrasonic, and Radiography. Re-certification is required every three years for more than 100 welders.

3. Reclamation Procedure Development

The laboratory is extensively involved in the development of reclamation procedures for the repair of unserviceable components for various end items such as AGT 1500 turbine engines. Laboratories are typically considered overhead organizations and do not contribute to the bottom line. The Materials Laboratory, however, working with shop personnel and commercial vendors, has developed repair procedures that generate substantial cost savings (\$13.5 million over three years). Savings per engine reclaimed amounted to \$12,000 as a result of using the less expensive repaired components in lieu of purchasing the higher priced new components.

4. Support of Off-Depot Customers

The support of off-Depot customers by the Materials Laboratory consists of materials testing; serving as expert witnesses for fraud investigations; materials testing and failure analyses for teaming customers (ANAD joint venture partners); tours for high school and college students to introduce them to materials engineering and various engineering career options; and sharing of resources (i.e., equipment) with a local university.

The existence of the Materials Laboratory is well justified because it serves to meet many of the Depot's needs and generates significant revenue that covers its expenditures.

Management

Acquisition Reform

Over the last several years, the Department of Defense (DoD), and the Federal Government in general, have undergone a major transformation in the way it contracts for supplies and services. Acquisition reform was initiated with the Reinvention of Government efforts spearheaded by Vice President Al Gore, and flowed down through the Federal Acquisition Streamlining Act (FASA). The reform required extensive changes to the Federal Acquisition Regulation (FAR) and DoD and Army procurement guidance. These changes are all intended to simplify the way government does business, and to make the contracting process more like that used by private industry. Changes in contracting in the name of acquisition reform will continue for the foreseeable future.

ANAD developed an aggressive and varied program to take maximum advantage of the reforms allowed

by the regulatory changes, and to proactively implement changes to the contracting process to realize the benefits desired through Reinvention of Government guidance. Within the Army depot system, ANAD has been at the forefront in both implementing changes and in requesting waivers to existing requirements which were impediments to additional improvements. Local initiatives related to acquisition reform include the following:

- Best Value Acquisition procedures have been developed and used for effective and economical acquisition of supplies and services with competitive awards based on factors other than price. Waivers were requested from the parent Command and accepted to further streamline the solicitation process. As a result, all FY1999 major competitive negotiated procurements will include tradeoff provisions rather than being awarded solely on lowest price.
- In FY1999, all competitive negotiated buys over \$100,000 will include past performance factors being more important than price in making an award.
- Changes in procurement regulations allow the purchase of commercial supplies and services by using a simplified process that eliminates many unnecessary government-specific requirements; 78% of ANAD's purchases over \$100,000, excluding construction, have been made using commercial acquisition procedures in FY1997 and FY1998 with no sustainable protests.
- An aggressive program for purchasing with credit cards has been implemented. The Army's goal of 90% of all purchase actions under \$2,500 has been exceeded. A local initiative with frequently used vendors has been started to allow use of the credit cards up to \$25,000.
- Electronic data interchange is used for all buys under \$100,000, unless waivers are documented justifying not using this method to solicit vendors.

ANAD has been very aggressive and effective in implementing acquisition reform and is continuing to look for additional ways to streamline the purchasing process. Some of the plans and ongoing efforts include emphasizing the use of performance specifications instead of detailed or military specifications, and taking advantage of the recent FAR part 15 rewrite allowing more flexibility in negotiation and oral proposal presentations by vendors. ANAD is also planning greater use of a team approach, including all involved functions, to develop the requirements and solicitations for future procurements.

ISO 9002 Certification of the Turbine Engine Facility

ANAD developed a unique capability in its Turbine Engine Facility where the AGT1500 turbine that goes into the M1 Abrams tank is repaired. A highly skilled workforce inspects, repairs, reclaims, and overhauls the turbine engine as well as associated components in ANAD's 52,000 square foot facility. The workforce is equipped with state-of-the-art equipment, and it has also developed equipment that exists only at ANAD. Because of this excellent capability, ANAD chose this facility for certification to ISO 9002.

As with many military installations, ANAD is trying to reach new customers for the highly trained workforce and capabilities that have been developed over the years. ISO 9002 was viewed as a method of continuous improvement and a way of reaching new customers. It is an internationally recognized standard that ANAD realized would influence a potential overseas market.

During the planning that led to certification, ANAD found it was weak in certain elements that were required for ISO certification. ANAD developed a strategy to meet the ISO requirements. Personnel were sent to external training programs that addressed internal audit systems, lead assessor training, implementing quality systems, and designing and developing documentation. Internal training programs were developed that familiarized the workforce with ISO and identified supervisory responsibilities. An internal self-assessment system was established that could be used to gauge progress and identify areas of improvement. Services of a consultant were obtained to perform an assessment in helping ANAD's quest for ISO certification.

ANAD found that it needed to develop and improve in the areas of management responsibility; quality systems; contract review; documentation and data control; process control; inspection and testing; control of non-conforming product; corrective and preventive actions; handling; storage; packing preservation and delivery; control of quality records; internal quality audits; training; and statistical techniques. The effort required ANAD to change many ways of thinking and doing business, but the effort helped strengthen the workforce. A contract was then executed with a certified registrar, and on January 5, 1998, ANAD's Turbine Engine Facility received certification to ISO 9002.

Partnering Initiatives

As part of Government reinvention, ANAD is partnering with the private sector. Partnering at ANAD involves business relationships with the private sector to enhance system efficiencies and increase capabilities of both sectors by working together through formal partnerships.

The Combat Vehicle Industrial Base is composed of the private sector which includes Original Equipment Manufacturers (OEMs), such as General Dynamics Land Systems Division and United Defense Limited Partnership, who produce defense vehicle systems; and the public sector, which includes depots and arsenals that have the responsibility for sustaining the OEM-produced vehicle systems through repair, overhaul, modifications, and upgrades.

The Combat Vehicle Industrial Base of the past reflects a private sector and public sector operating separately and independently, which produced an atmosphere where each sector competed for, rather than shared, the workload. Because of continually shrinking defense dollars, under-utilization of resources, and privatization, both sectors realized that continuing to function separately, independently, and to compete for the same workload were no longer options. Thus, changes and new business relationships were required to remedy the problems of a past environment.

ANAD established 24 working partnerships of the following three types:

1. Workshare (or direct funded):

Co-production efforts where ANAD and the industry partner each independently contribute a pre-determined amount of resources (e.g., skills, manpower, equipment, facilities) to a program. Terms are arranged between the two partners and the Program Manager. The Program Manager directs funding to the Depot and the private partner through a contract.

2. Direct Sales (or behave like a subcontractor):

Partnering agreements where ANAD performs services for private industry as a subcontractor under the authority of various sections under Title 10. The majority of ANAD's direct sales are authorized under 10 USC 4543 which specifies that the service cannot be commercially available in the United States. The Program Manager awards a contract to private industry; private industry contracts with ANAD.

3. Facility Use:

Partnering agreements where public and private entities use underutilized ANAD facilities available under the authority of the FAR Subpart 45 and the Army's Supplement to the FAR, or through an inter-service support agreement with a Program Manager or with a major subordinate command. The private entity pays for all utilities and costs incurred. ANAD reassumes the facility when the private entity is finished with the facility.

As a result of these new partnership opportunities, the private sector established operations within the Depot fences in under-utilized facilities, employing under-utilized resources from both sectors. This reduced the overall industrial base infrastructure and maintained a skill base in both sectors. As a result of partnering, ANAD retained revenues of \$147 million and one million man hours; increased facility utilization by 14% avoiding costs of \$2.5 million; and avoided involuntary workforce separations. ANAD's business management office is responsible for marketing and managing partnership opportunities with the local, regional, and global public and private businesses.

Welder Certification Program

ANAD's Welder Certification Program is an extensive qualification process that evaluates and certifies individuals' knowledge and skills of welding before they can be accepted to perform any type of welding functions at the Depot.

Prior to the Welder Certification Program, persons with minimal skills and knowledge of welding could be classified as a welder. The integrity of the welds was not seriously challenged because of built-in safety factors. At times, the wrong filler metals were used, but still the welds were acceptable. Many welders were entrenched in their own skills and lacked a strong knowledge of welding science.

In 1994, driven by workload changes from the more forging heavy metals to more sophisticated and complex metals and a larger variety of vehicles, subassemblies, and components, the integrity of welds started to be challenged. The Welder Certification Program was developed which required that all welders at ANAD be certified. The certification assured that the welders possessed the required skills and knowledge to perform high integrity welds. To achieve certification, all welders were required to meet extensive job qualifications; be experienced journeymen or have graduated from a trade school; pass a written test; demonstrate their knowledge and use of official American Welding Society welding symbols and definitions; be able to read welding drawings; and follow weld procedure specifications. The program required that welders demonstrate their skills by welding a series of test plates which were visually inspected and radiographed for welding integrity. Applicants are either rejected or accepted, and have only one chance at re-entering the qualification tests. The criteria is sufficiently stringent so only top welders are accepted. Ninety percent of new applicants do not pass the criteria, and are therefore not accepted for certification. Refresher training is provided by ANAD to certified welders as required.

ANAD now has a world-class welding capability that consists of 130 certified welders who hold 311 active certifications. Each certification is program specific. Each welder holds at least one certificate, and some welders hold as many as six. 177 certifications involve aluminum and steel armor (e.g., tanks, armor vehicles), and 134 certifications involve support materials (e.g., subassemblies, small parts). Welders follow a Weld Procedure Specification book to ensure a good weld. All certified welders are trained as inspectors and issued an American Welding Society inspection kit, qualifying them to inspect and certify their own work. ANAD is capable of welding in accordance with 18 separate standards: military, aerospace, ground support, industry, British, and German.

Section 3

Information

Production

Chemical and Environmental Laboratories

The Chemical Laboratory coordinates and administers the Depot's oil analysis program. The Depot participates in the Joint Oil Analysis Program analyzing over 6,000 oil samples annually for spectrographic properties, physical properties, and particle count. Results are used to determine causes for equipment failure and to reduce production of waste oil by tying oil changes to oil chemistry rather than time and operating hour criteria. The Chemical Laboratory also provides analytical services for chemical cleaning and electroplating, providing over 2,000 chemical cleaning and electroplating vat analyses annually. As a result, plating bath makeup is closely regulated, saving on materials and helping ensure a quality product with fewer rejected parts requiring rework. Finally, the Laboratory provides consultant services for physical, chemical, and functional testing of materials.

The Environmental Laboratory provides sampling and analytical support for the Industrial Waste Treatment Plant, the Sewage Treatment Plant and Storm Water Discharges to meet National Pollutants Discharge Elimination System (NPDES) permit criteria. More than 2,200 NPDES-related samples are analyzed annually. The Environmental Laboratory also provides groundwater monitoring and environmental analytical support for tenant activities. The Laboratories are well equipped with the latest analytical equipment, and technicians are fully certified to perform their functions.

Energy Program

ANAD's Energy Program affects the entire Installation and consists of efforts to improve energy awareness, increase energy conservation, and reduce energy cost. ANAD is a major energy user with an annual energy cost of approximately \$4.5 million including electricity, coal, natural gas, liquefied petroleum gas, and #2 diesel fuel. In FY1985, the

Installation was challenged to reduce energy consumption by 30% before FY2005.

Programs such as steam trap replacement and re-lamping have been successfully used to reduce energy consumption. Energy awareness has been heightened for employees through contests and monitors in buildings. Occupancy sensors have been used with some success especially in restrooms and break areas. Utility partnering is being used to push down the cost of energy and as an alternate funding source for some projects through newly available energy service performance contracts. ANAD challenged electric demand charges in 1994 by changing to a time-of-use rate. This resulted in a cost avoidance of \$1.8 million since 1994. The rate change reduced the average annual electric costs by approximately \$500,000. Energy consumption has been reduced from about 135 million BTUs per thousand square feet (MMBTUs/KSF) to 111.55 MMBTUs/KSF actual usage for FY1998, or about a 17% reduction.

Ion Vapor Deposition

In 1991, ANAD implemented an initiative to replace the traditional Cadmium plating of components with Ion Vapor Deposition of Aluminum (IVDA). This initiative was funded by the U.S. Army Toxic and Hazardous Materials Agency as a more environmentally friendly and efficient means of protecting component surfaces.

The IVDA process eliminates the inclusion of Zinc (Cadmium) particles in the waste stream. Before IVDA, this waste stream typically consisted of an average flow of 1,000 gallons per day at a cost of \$91,250. It reduced personnel contact with Zinc (Cadmium) and Cyanide compounds and met Environmental Protection Agency requirements.

Several other benefits of IVDA, as opposed to Cadmium, have been realized. Corrosion protection of components was increased by as much as 400%. The components' surface temperature capabilities have doubled, and the introduction of Hydrogen and the resultant embrittlement of parts have been eliminated. Parts are loaded onto racks on air pallets that are then loaded into the sealed vacuum chamber.

The system is only being used at 30% capacity due to the reluctance of configuration control managers to use a new process. In several cases, the Cadmium plating is still a bona-fide requirement, but the IVDA process could be used on many of the parts that are currently required to be cadmium plated. The Program Manager must approve the use of IVDA on a part-by-part basis.

Recycling

ANAD's Recycling Program was initiated in 1982 and has evolved to being recognized as one of the best in the Army. The goal of this program is to eliminate solid waste leaving the Installation going to the local landfill. The program has 16 employees with equipment valued at \$377,500. The Recycling Program has diversified to include wood chipping, oil recovery, and coal ash removal.

Scrap wood products such as shipping containers and pallets amount to more than 1,398 tons annually. Faced with the closure of the Base landfill and the prohibitive cost of hauling scrap wood to the community landfill, the Recycling Organization partnered with the Chemical Command to initiate an action plan for recycling scrap wood. Chemical Command agreed to procure a Cyclone HD 12 Tub Grinder. The grinding process reduces wood volume by 90%. Scrap wood is ground into chips that are either sold as mulch or used on-site to prevent soil erosion and for landscaping.

In 1997, the Oil Recovery Program was initiated with the goal of safely and cost effectively disposing of the more than 48,000 gallons of oil collected from vehicles annually. After extensive research, a contract was put in place through which Georgia Petroleum would purchase recovered oil for 10 cents per gallon. This allowed ANAD to meet regulatory requirements and eliminate hazardous waste disposal costs. The program has actually generated more than \$4,000 since its inception.

To meet the criteria for recycling, reduce cost, and reduce the volume of solid waste, ANAD has entered into a contract with Pincelli & Associates, Inc., of Hixon, Tennessee. This contract provides a mechanism for recycling the 525 tons of coal ash generated each winter. The contractor uses the ash to produce cinder blocks. Since Hixon, Tennessee is only 78 miles from ANAD, shipping charges are minimal. Another cost avoidance has been realized by using the same roll-off trailers to transport both wood scrap and coal ash. The total cost avoidance from this program is \$11,000. In FY1998, the Recycling initiative produced total savings for ANAD of \$60,644.

Shelf Life Extension Program

Many of the materials (e.g., paints, other coatings, lubricants) used at the Depot have expiration dates set by the manufacturer. This date is more often associated with limiting the manufacturers' liability than with the quality of the product, and often does not reflect the potential for degradation of the product. Many of these materials are useable within the original specifications long after the manufacturers' expiration date. The Shelf Life Extension Program uses available information on the potential for degradation of specific materials and the materials' original specifications to extend the useful life of materials that would otherwise often be disposed of as hazardous waste.

Materials are tested against a series of quality standards, and even if past the useable life, can be extended by a period specific to each material. Multiple extensions may be approved, but testing and certification of product quality must be repeated for each extension. The results are savings in procurement costs for new materials, and in costs for disposal of useable materials.

Tele-Maintenance

The Tele-Maintenance technology is a result of an initiative developed in January 1995 by the Army Materiel Command's (AMC's) Force XXI Synchronization Office. The purpose of the initiative was to integrate several advanced technology thrusts into a single program designed to greatly improve Army maintenance and repair capabilities. This technology directly linked the forward repair soldier, working on a combat battle tank, from basically any place in the world with ANAD's Subject Matter Expert (SME) via audio, text, and video feeds. The Depot's SME is able to properly assess the problem and provide detailed voice, schematic, and text assistance to the field repairer in real time. The objective is to provide a seamless maintenance support system, from the fox-hole to the factory, by repairing in-forward areas faster and with more effective support to the combat force.

The Tele-Maintenance team first demonstrated this concept at Ft. Leavenworth, Kansas, May 10-26, 1995, in the General Headquarters Prairie Warrior/Mobile Strike Force's Advance Warfighting Exercise. Headquarters, AMC's Louisiana Maneuvers Task Force utilized the Logistics Anchor Desk as a logistics operations cell to look at new ideas, concepts, and technologies from the military and civilian sectors. ANAD's role in the exercise was to look at Force XXI Sustainment Issues through the eyes of Tele-Maintenance.

This technology was again demonstrated at the U.S. Army's 1995, 1996, and 1997 Annual Association of the United States Army Meeting. ANAD's role in the show was part of the Louisiana Maneuvers Task Force display. It featured a Synthetic Theater of War and showcased a live Tele-Maintenance Video Assisted Repair demonstration with ANAD's SME assisting a soldier at Camp Dodge, Iowa who was troubleshooting a problem with an M1A1 main battle tank. The Tele-Maintenance display was sponsored by the Commanding General, U.S. AMC. He and numerous (approximately 300 per day) U.S. Army Command and Staffers (i.e., The Secretary of the Army; Chief of Staff; Vice Chief of Staff; many Office of the Secretary of Defense civilians; international VIPs) came through the exhibit to observe how Tele-Maintenance is linking Force XXI to the maintenance expert for superior worldwide power projection.

Tele-Maintenance has the following benefits:

- Optimizes Personnel Resources: transports the knowledge not the individual; enhances split-based operations; and supports multiple contingency operations.
- Increases Readiness: compresses time of repair; reduces number of Depot-level repairs; and provides timely maintenance information to the soldier by taking advantage of the Internet.
- Cost Savings: decreases unnecessary component replacements; eliminates temporary duty travel to field locations; and eliminates printing and mailing costs.

The setup cost is approximately \$8,200 including Tele-Maintenance hardware. The cost of the Tele-Maintenance package is approximately \$155,000 which includes electronic transmission of video/audio data; remote technician field support; limited on-site visits if required; database historical information; improved maintenance technology; and Missile Command bridge support. Access to the Depot Component Repair Program will incur an additional charge. Tele-Maintenance has been successfully demonstrated with significant cost benefits. More effort may be devoted to reduce the package cost and promote wider acceptance of this technology.

Facilities

Facility Planning

Many of the facilities at ANAD were built in the early 1940s when the Facility was established to serve as a storage depot for the Army. Since that time,

ANAD has transformed into a modern maintenance facility that has earned the reputation as "The Tank Rebuild Center of the World." With more than 2,000 buildings and structures on-site, facility planning focuses on the utilization of existing facilities to meet the needs of the Depot and its tenant activities.

The Depot Commander envisions the Installation's current and future role, while a Corporate Planning Board made up of the various Directorates and organization heads, formulates, executes, and transforms those visions into reality. Meeting twice a year, the Board reviews and prioritizes the various projects for approval by the Commander. The investment decisions are based on critical needs that affect the environment, safety, security, and overall mission of the Depot. Economic payback is also considered when prioritizing the various projects.

The investment strategy used to fund these projects considers renovation of the existing buildings on-site first. These costs are measured against the costs of a new building with similar capabilities and the flexibility to meet the needs of the current and planned missions of the Depot. If it is determined that the replacement costs of the building are prohibitive without sacrificing quality in the construction, the existing building is renovated, thus providing the biggest "bang for the buck." One example of this approach resulted in a \$9.45 million savings when it was determined that renovation of an existing building would cost \$550,000, and the construction of a new building with similar capabilities would cost \$10 million. By taking this approach, ANAD continues to perform its mission and, at the same time, finds ways to save the decreasing funding provided for operations.

Management

Base Realignment and Closure Workload

The BRAC legislation of 1995 resulted in transfer of maintenance missions to ANAD. From Red River Army Depot came the medium/light combat vehicle systems, and from Letterkenny Army Depot came the maintenance missions for towed/self-propelled artillery. ANAD had to develop a transition plan that would ensure the successful transfer of these functions.

The transition plan consisted of three main phases: planning, transition, and production. The planning phase involved determining funding requirements, identifying construction requirements, developing moving schedules, identifying equipment to be moved, determining personnel requirements, acquiring technical documentation, and identifying certification

requirements. The transition phase started after funding was received. The transition phase consisted of constructing facilities, training personnel, moving and installing equipment, and establishing processes and production lines. The last phase of production was the beginning of the production programs. Pilot overhauls were done to certify the process. First article inspections and testing were performed to make sure requirements were met. Once it was known that the processes resulted in a product that met the requirements, the transition of the maintenance missions was complete.

Although the transfer of these maintenance missions resulted in work for ANAD, many challenges need to be faced. During the planning phase, there was little precedence to go by. Technical data was slow to arrive, determining funding was difficult, transition efforts were accelerated, manpower was limited, and the identification of tools and fixtures was very detailed. During the transition phase, ANAD had to deal with untimely equipment moves and trying to establish capability at the gaining facility while workload continued at the transferring facility. The production phase was challenging due to technical data being out of date, and dealing with the customer who did not expect any increase in cost. ANAD is meeting the challenges through persistent efforts and effective planning. The medium/light combat vehicles and towed/self-propelled artillery maintenance missions are being successfully transferred to ANAD.

Earned Value Project Management

ANAD has developed a strategic vision to be competitive with private industry by developing world-class industrial management. It was recognized that existing planning, work loading, and production processing systems were disjointed at the top level and not linked in implementation. Because of this, each process (e.g., program estimating) had to be recreated every time a new program was initiated. This became more evident in recent years as Army maintenance workload changed from extremely large volume programs extending for several years, to a few fairly large programs, but many small unique programs. It was recognized that a business process re-engineering effort was necessary to realize the Depot's strategic vision. Earned Value Project Management (EVPM) is the re-engineering process that ANAD management developed and is committed to implementing in order to achieve world-class industrial management.

EVPM is an effort to assess management methods, processes, and cost control systems to determine the most effective and efficient integration of people, processes, and information tools. The ultimate goals include a 30% increase in labor utilization; 25% reduction in material costs; 30% reduction in cycle times; 20% improvement in net operating results; and 95% meet or exceed delivery commitments.

The business process re-engineering program is intended to define and document a business process that provides for cost visibility during program execution. The sound business practices developed as part of this effort employ the principles of Total Quality Management, Earned Value Management, and Activity Based Costing resulting in total asset and cost visibility. The EVPM concept is intended to bring the previous disjointed systems into a framework of the following six interactive processes:

1. Strategic Planning: Establishing a Planning Review Board to review each new business opportunity and determine relative benefit to the Depot.
2. Workload Procurement: Establishing a Production Management Team to develop work breakdown structures for new work, and document estimating templates which can be used in considering subsequent work opportunities.
3. Production Planning: Using the same management team to initiate funded orders that previously did the estimating and planning for the order before it was accepted.
4. Release Work: Production Management release of work projects to the Shop Supervisor for assignment of resources.
5. Status/Feedback: Developing a single data input system for labor, production, and material management with performance metric feedback to the shop floor.
6. Program Closeout: Progressive closing of finished programs and return of excess parts to stock.

By fully integrating these six processes through EVPM, ANAD expects to not only be successful in defining a business process that provides cost visibility during execution, but also to become the first Army Depot to be Earned Value Management certified, become a Total Quality Management Army showcase, and demonstrate how Total Asset Visibility should be done. Accomplishment of this is anticipated by the end of calendar year 1998. At this time, a nucleus of key participants has been trained and a newly transferred program (M198 howitzer) identified for full-scale implementation.

Enterprise Management

ANAD has initiated a system, referred to as Enterprise Management, that will help manage and monitor its total information management areas. When the system is fully implemented, ANAD will manage and monitor all mini-computers, routers, bridges, personal computers, workstations, Web servers, radios, telephones, and other electronic products to help satisfy its mission. The system enables ANAD to effectively manage its information management assets and control hardware configurations, software configurations, license accountability, and inventory control.

The commercially available software package system being used by ANAD is called Unicenter TNG, which simplifies the task of managing today's information technology. Unicenter manages all types of resources, from one end of the enterprise to the other, and provides the data in a business perspective. Unicenter has the capability of integrating the management of security, storage, workload, service/help desk, output, performance and accounting, database, complete network, job flow, and event/status/exception control.

ANAD is striving to gain control of problem resolution with information management. This system enables ANAD to have accurate documentation and automatic elevation of priorities. The goal is to fix 80% of problems without hands-on involvement. With Enterprise Management, ANAD will have a world view of the network topology with immediate notification of system problems.

ANAD has developed a single sign-on that allows the individual to access an application across multiple platforms with a single log-in and password providing better user-friendly features. Another feature developed is the asset management option which automates the collection of hardware and software configuration for each personal computer attached to the network, and is accomplished daily when the individual logs on. Other benefits of the system include: automatic collection of appropriate data; automatic delivery of software across the entire network; overnight upgrades can be done; automatic register and tracking of software; license control; and illegal software can be purged.

When ANAD first began researching the system and looked to other military installations for lessons learned, none were found. ANAD is one of the first installations to integrate the system. With the help of the contractor, ANAD is gradually bringing the system on-line. When fully implemented, ANAD will have an

enterprise system that provides the necessary tools to compete in the ever-changing military environment.

Material Management

Material management at ANAD involves ordering, receiving, and delivery of all new and reclaimed parts and components required to support ANAD's core business of overhaul and repair of combat vehicles, artillery, and small arms. ANAD is in the process of studying and developing management initiatives aimed at meeting production schedules by getting materials to the shop floor on-time, with requisite quality, and within costs.

The importance of a high performance material management system has grown in magnitude over the past several years due to changes in customers and their requirements. The business of ANAD has changed from the overhaul and repair of a few varieties of large volumes of track vehicles to a multitude of small volume vehicles, subassemblies, components, and other systems. Currently, new materials procured through the Army supply system account for 70% of the maintenance budget. Line items have increased by thousands, placing a growing burden on ordering, receiving, and delivering materials. The number of new conditions presented to the current materials management process does not afford adequate tracking and control, resulting in an unacceptable volume of shortages, excesses, and/or misplaced materials.

Other contributing factors include the accuracy of program workload forecasting; requirements to order firm requirements; short runs; unique scopes of work; small amount of parts; and short lead times. Additionally, the 60-day level of materials maintained in ANAD's Installation Supply Depot represents the first time ANAD has physical control of the material; Management Code 9 items are not always available; and maintaining a 15- to 30-day level in the Automated Storage and Retrieval System is not 100% guaranteed.

New material management challenges include accurately defining material requirements; predicting materials for work-a-rounds; obtaining Defense Logistics Agency (DLA) support for total requirements; transferring of management from Army supply points to DLA to make buys; accurate work loading and scheduling information; handling the diversity of ANAD's workload; tracking reclaimed components; and improving use of the Automated Storage and Retrieval System.

Material management initiatives being pursued by ANAD to meet these challenges start with a study to determine the best organizational structure required for management of the material. Bench stock items, such as screws, fasteners, etc., are being reviewed for possible procurement from a prime vendor to provide all stock. A contractor study is proposed for a contractor to study an automated tracking system for reclaimed material. A study is scheduled to analyze a merger of logistics and acquisition to improve material management. A concerted effort among the depots is proposed to review methods to more accurately predict workloads for the two to five years in the future. And finally, the classification of requisition personnel is being reviewed.

Quality Management

ANAD's present quality system is primarily based on the AMC's Contractor Performance Certification Program (CP²). This system is based on the 20 elements of ISO 9000 plus the elements of customer satisfaction, quality costs, ethics, business planning, safety, environment, and continuous improvement. ANAD has not yet attained certification under the CP² program, but is very close with anticipated approval by the end of 1998.

Like many other military installations, the quality system at ANAD has evolved over the years. Prior to 1991, there were many inspectors and some system evaluation. In 1994, about half of the inspection effort was replaced with product audits. ANAD's future quality system will consist of a blend of compliance audits, process audits, system audits, work center audits, and product inspections. Reviewing the process and the system it takes to make a good product is becoming the mainstream function.

ANAD is striving to become a world-class organization with international recognition. The Depot has automated the control of all technical data, used the Maintenance Inspection Data Analysis System for products and processes, instituted a Production Planning Review Board, performed a multitude of internal audits, tracked the cost of quality, used teaming to solve problems, and performed various levels of review to ensure the customer is satisfied with the product. ANAD uses teams such as natural work teams, process action teams, employee action teams, and work center teams to solve problems. Recognition of good performance is accomplished by team awards, peer recognition, customer recognition, and the recognition store where a store voucher, which has been received for good performance, can be turned in for awards.

ANAD is changing the mind-set that quality is an organization and is making the workers responsible and accountable for their work. Each individual is responsible for the quality of products and services they produce and for meeting customer expectations. At ANAD, actions are being taken through continuous improvement to provide the customer the best product, at the lowest cost, and on-time.

Reorganization - Business Center Review

ANAD has had a directorate structure, typical of all Army depots, which reports to the Commanding Officer and Civilian Executive Assistant (CEA). This structure of numerous functional directorates (Resource, Contracting, Engineering, Information Management, Production, Ammunition Operations, etc.) has served depot installations well over the years when missions have been interrelated to all the functional areas. In recent years, however, ANAD's mission has changed from an installation that overhauled tracked vehicles to an installation with multiple missions, and multiple customers representing many different Commands. Missions for chemical demilitarization, weapons programs from BRAC-affected installations, and support to military and commercial tenants have all become part of managing the Installation. More recent trends toward partnerships with private industry have further complicated the role of strategic management essential to the future success of the Installation.

As a result of these changes in business atmosphere and mission, more attention needed to be given by top-level management in planning for future success and developing long-term business relationships. A new management level, consisting of General Managers for Business Operations and Production Operations, was proposed. In November 1997, this structure was given provisional approval by the Commanding General of the Industrial Operations Command. This was implemented on a one-year trial basis in January 1998. This new structure (Figure 3-1) aligned all Command requirements (e.g., equal opportunity, internal review, law enforcement, risk management, protocol, tenants) under the CEA. All production activities were aligned under a General Manager for Production, and all base operations and support functions (e.g., contracting, public works, resources, information management, business management) were aligned under the General Manager for Business Operations. The basic directorate structure (and management within directorates) was not changed.

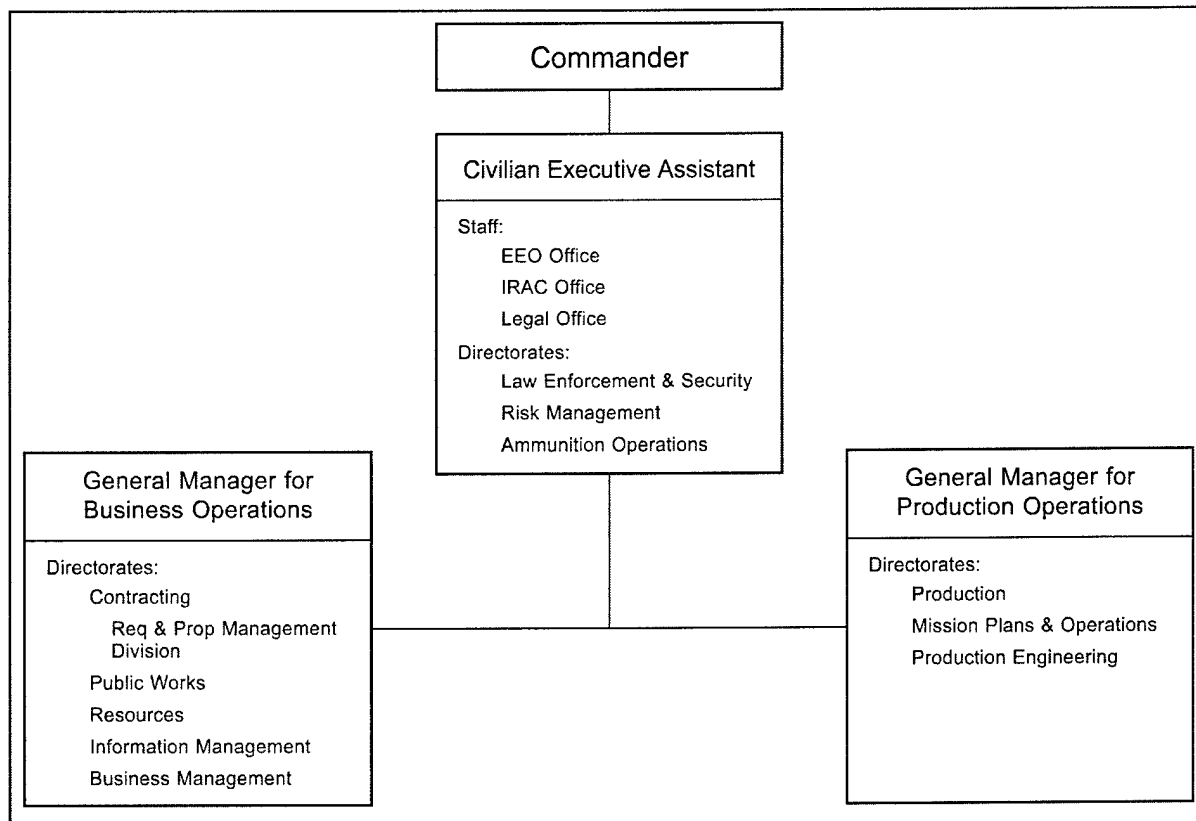


Figure 3-1. Provisional Structure Chart

The primary advantage of this organization is to have the two Business Center Managers responsible for day-to-day operations, with the Commander and CEA having more time for external coordination and strategic planning.

The effectiveness of this structure will be reviewed and monitored over the one-year trial period. A Focus Book has been assembled with key performance indicators in the areas of productivity, net operating results, quality, safety, and equal employment opportunity to provide a means of measuring success. The Focus Book is used by the Commander, CEA, and two new Business Managers on a continuing basis to monitor performance.

Technical Publications

ANAD's Technical Publications Division supports the Depot's industrial mission by managing technical data through the development, control, and storage of publications. The division, since its establishment in May 1982, has responsibility for Depot Maintenance Work Requirements (DMWRs), technical manuals,

and training manuals for major subordinate commands and program offices, as well as shop instructions, process control pamphlets, and Industrial Operation Procedures (IOPs) for ANAD's maintenance programs. The Army and ANAD both benefit by having a single location for developing and validating the publications, as well as controlling on-site access to technical information. As an example, this division has written and maintained the M1 tank DMWRs since the beginning of the M1A1 tank program.

In more recent years, the efforts of the division have been more focused on support of the Depot's internal technical needs due in part to a reduction in new Army development programs, and a tendency for the Army to contract total logistical support to prime system contractors. The Technical Publications Division is now charged with controlling technical documentation integrity by allowing only current documents to be available for use. These include the Depot's IOPs and shop instructions which are developed from the customer's technical requirements (obtained through the AMC's automated Joint Engineering Data Management Information and Control

System), and used by the planners and mechanics in performing the maintenance and overhaul programs.

Most recently, and in compliance with ISO 9002 Quality System requirements, the procedures have been automated and have started to be controlled and distributed through the Depot network. This has greatly improved the configuration integrity of documentation available to shop personnel. Conversion of documents to the standard generalized markup language has also been initiated to conform to the latest military standards guidance for technical publications. These improvements play a key role in strengthening the Depot's efforts to become certified under commercial and Army quality certification programs, and in assuring the delivery of quality products to the latest technical data configuration.

Vendor Supply Policy

Vendor Supply Policy establishes a methodology for recording and maintaining contractors' past performance information and uses it to positively impact future source selections. Prior to 1995, ANAD's Directorate of Contracting was experiencing a 10% to 15% delinquency rate among its vendors. A delinquency was any failure of a vendor to satisfy the conditions of the contract such as late delivery, parts shortages, rejected parts, delays, etc. The FAR Subpart 42.15 requires government agencies to establish procedures for recording and maintaining contractors' perfor-

mance information and data. The FAR states that past performance information is relevant information for source selection purposes regarding contractor actions under previously awarded contracts.

In 1995, the Directorate of Contracting implemented a policy concerning delinquent vendors based on the FAR language. The policy included an aggressive process improvement that set a goal of a 2% maximum delinquency rate. The process requires that a letter be sent immediately to the vendors notifying them of the delinquency; a delinquency report is published monthly to notify all ANAD buyers and supervisors; buyers and administrators call vendors to notify them of the delinquency report; prompt attention is paid to delinquencies by vendors' top-level management; no voluntary solicitation of vendors appears on the report; and review of unique circumstances surrounding delinquencies is conducted. Contract administrators are allowed to negotiate some type of consideration when vendors are delinquent, which translates to an agreed upon cash value compensation by the vendor (i.e., money, extended warranty, additional services, spare parts) in return for the cancellation of the delinquency.

Since implementation of the current policy, delinquency rates have been reduced from 10% to 15% to 2% or less for each of the past four years, resulting in increased on-time delivery of goods and services and increased customer satisfaction.

Appendix A

Table of Acronyms

Acronym	Definition
ANAD	Anniston Army Depot
AMC	Army Materiel Command
BRAC	Base Realignment and Closure
CEA	Civilian Executive Assistant
CP ²	Contractor Performance Certification Program
DoD	Department of Defense
DMWR	Depot Maintenance Work Requirement
EQCC	Environmental Quality Control Committee
EVPM	Earned Value Project Management
FAR	Federal Acquisition Regulation
HM	Hazardous Material
HMMP	Hazardous Material Management Program
HMMS	Hazardous Material Management System
HS	Hazardous Substance
IOP	Industrial Operation Procedure
IVDA	Ion Vapor Deposition of Aluminum
NDT	Nondestructive Testing
NPDES	National Pollutants Discharge Elimination System
OEM	Original Equipment Manufacturer
RAMP	Rapid Acquisition of Manufactured Parts
SME	Subject Matter Expert

Appendix B

BMP Survey Team

Team Member	Activity	Function
Larry Robertson (812) 854-5336	Crane Division Naval Surface Warfare Center Crane, IN	Team Chairman
Dan Carlson (309) 782-6475	U.S. Army Industrial Operations Command Rock Island, IL	Technical Writer

Team 1

Sam Hart (423) 574-2501	Lockheed Martin Energy Systems Oak Ridge, TN	Team Leader
Joe Phillips (205) 386-3035	Tennessee Valley Authority Muscle Shoals, AL	
Mike Lin (217) 373-3487	Construction Engineering Research Lab Champaign, IL	
Jack Tamargo (707) 642-4267	BMP Satellite Center Vallejo, CA	

Team 2

Larry Halbig (317) 306-3838	Raytheon Systems Company Indianapolis, IN	Team Leader
Bob Cale (518) 266-5300	Watervliet Arsenal Watervliet, NY	
Nick Keller (812) 854-5331	Naval Surface Warfare Center Crane, IN	

Appendix C

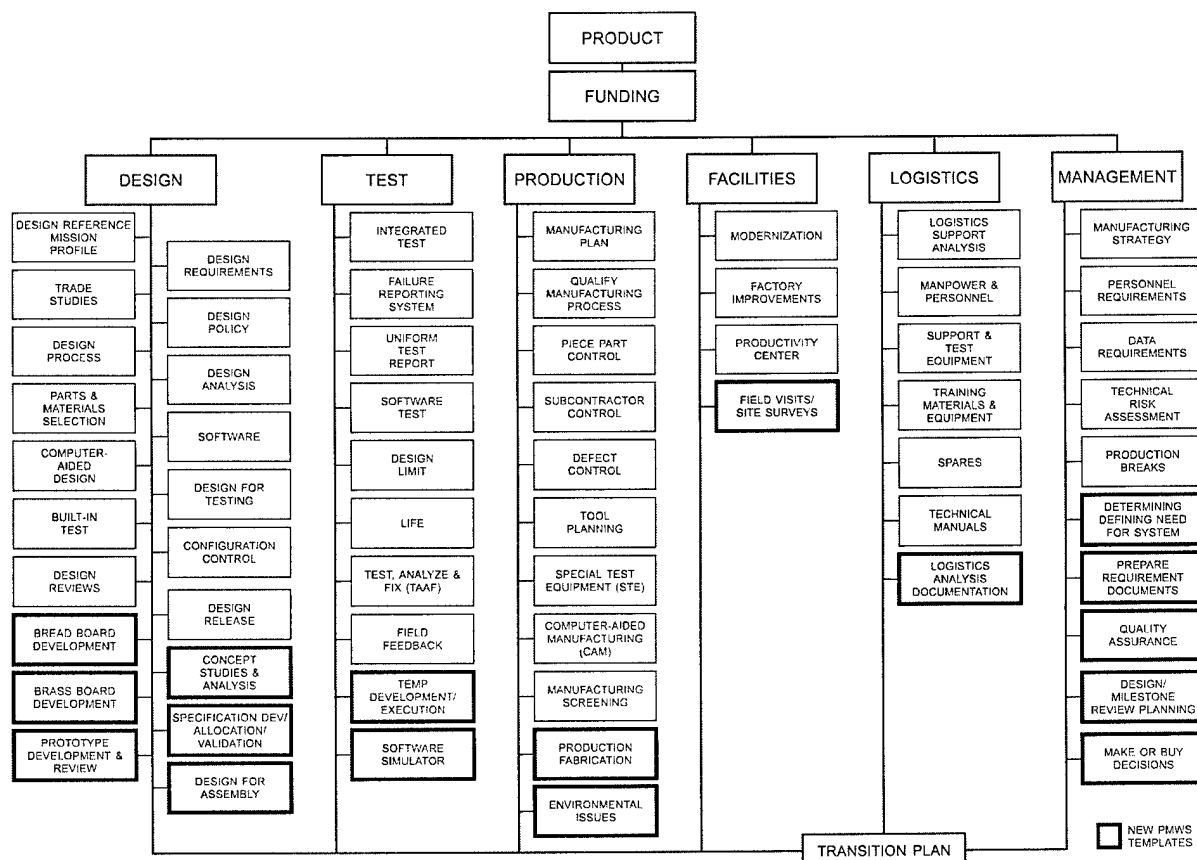
Critical Path Templates and BMP Templates

This survey was structured around and concentrated on the functional areas of design, test, production, facilities, logistics, and management as presented in the Department of Defense 4245.7-M, *Transition from Development to Production* document. This publication defines the proper tools—or templates—that constitute the critical path for a successful material acquisition program. It describes techniques for improving the acquisition

process by addressing it as an *industrial* process that focuses on the product's design, test, and production phases which are interrelated and interdependent disciplines.

The BMP program has continued to build on this knowledge base by developing 17 new templates that complement the existing DOD 4245.7-M templates. These BMP templates address new or emerging technologies and processes.

“CRITICAL PATH TEMPLATES FOR TRANSITION FROM DEVELOPMENT TO PRODUCTION”



Appendix D

BMPnet and the Program Manager's WorkStation

The BMPnet, located at the Best Manufacturing Practices Center of Excellence (BMPCOE) in College Park, Maryland, supports several communication features. These features include the Program Manager's WorkStation (**PMWS**), electronic mail and file transfer capabilities, as well as access to Special Interest Groups (SIGs) for specific topic information and communication. The BMPnet can be accessed through the World Wide Web (at <http://www.bmpcoe.org>), through free software that connects directly over the Internet or through a modem. The PMWS software is also available on CD-ROM.

PMWS provides users with timely acquisition and engineering information through a series of interrelated software environments and knowledge-based packages. The main components of PMWS are KnowHow, SpecRite, the Technical Risk Identification and Mitigation System (TRIMS), and the BMP Database.

KnowHow is an intelligent, automated program that provides rapid access to information through an intelligent search capability. Information currently available in KnowHow handbooks includes Acquisition Streamlining, Non-Development Items, Value Engineering, NAVSO P-6071 (Best Practices Manual), MIL-STD-2167/2168 and the DoD 5000 series documents. KnowHow cuts document search time by 95%, providing critical, user-specific information in under three minutes.

SpecRite is a performance specification generator based on expert knowledge from all uniformed services. This program guides acquisition person-

nel in creating specifications for their requirements, and is structured for the build/approval process. SpecRite's knowledge-based guidance and assistance structure is modular, flexible, and provides output in MIL-STD 961D format in the form of editable WordPerfect® files.

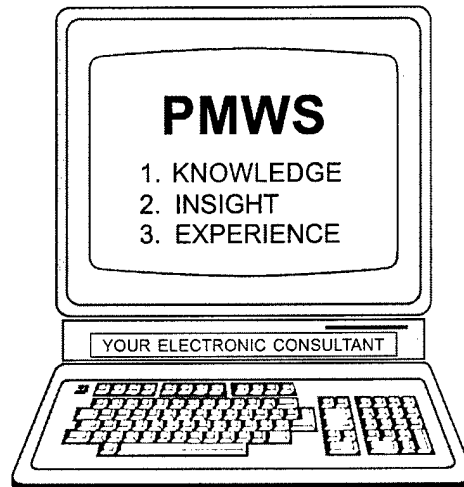
TRIMS, based on DoD 4245.7-M (the transition templates), NAVSO P-6071, and DoD 5000 event-oriented acquisition, helps the user identify and rank a program's high-risk areas. By helping the user conduct a full range of risk assessments through-

out the acquisition process, TRIMS highlights areas where corrective action can be initiated before risks develop into problems. It also helps users track key project documentation from concept through production including goals, responsible personnel, and next action dates for future activities.

The **BMP Database** contains proven best practices from industry, government, and the academic communities. These best practices are in the areas of design, test, production, facilities, management, and logistics. Each practice has been

observed, verified, and documented by a team of government experts during BMP surveys.

Access to the BMPnet through dial-in or on Internet requires a special modem program. This program can be obtained by calling the BMPnet Help Desk at (301) 403-8179 or it can be downloaded from the World Wide Web at <http://www.bmpcoe.org>. To receive a user/e-mail account on the BMPnet, send a request to helpdesk@bmpcoe.org.



Appendix E

Best Manufacturing Practices Satellite Centers

There are currently nine Best Manufacturing Practices (BMP) satellite centers that provide representation for and awareness of the BMP program to regional industry, government and academic institutions. The centers also promote the use of BMP with regional Manufacturing Technology Centers. Regional manufacturers can take advantage of the BMP satellite centers to help resolve problems, as the centers host informative, one-day regional workshops that focus on specific technical issues.

Center representatives also conduct BMP lectures at regional colleges and universities; maintain lists of experts who are potential survey team members; provide team member training; identify regional experts for inclusion in the BMPnet SIG e-mail; and train regional personnel in the use of BMP resources such as the BMPnet.

The nine BMP satellite centers include:

California

Chris Matzke

BMP Satellite Center Manager
Naval Warfare Assessment Division
Code QA-21, P.O. Box 5000
Corona, CA 91718-5000
(909) 273-4992
FAX: (909) 273-4123
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FAX: (707) 642-4267
jtamargo@bmpcoe.org

District of Columbia

Chris Weller

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14th Street & Constitution Avenue, NW
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3301 North Mulford Road
Rockford, IL 61114
(815) 654-5515
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adme3tc@rvcux1.rvc.cc.il.us

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Program Manager
Iowa Procurement Outreach Center
200 East Grand Avenue
Des Moines, IA 50309
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Louisiana

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Oak Ridge, TN 37831-8091
(423) 576-5532
FAX: (423) 574-2000
tgraham@bmpcoe.org

Appendix F

Navy Manufacturing Technology Centers of Excellence

The Navy Manufacturing Sciences and Technology Program established the following Centers of Excellence (COEs) to provide focal points for the development and technology transfer of new manufacturing processes and equipment in a cooperative environment with industry, academia, and Navy centers and laboratories. These COEs are consortium-structured for industry, academia, and government involvement in developing and implementing technologies. Each COE has a designated point of contact listed below with the individual COE information.

Best Manufacturing Practices Center of Excellence

The Best Manufacturing Practices Center of Excellence (BMPCOE) provides a national resource to identify and promote exemplary manufacturing and business practices and to disseminate this information to the U.S. Industrial Base. The BMPCOE was established by the Navy's BMP program, Department of Commerce's National Institute of Standards and Technology, and the University of Maryland at College Park, Maryland. The BMPCOE improves the use of existing technology, promotes the introduction of improved technologies, and provides non-competitive means to address common problems, and has become a significant factor in countering foreign competition.

Point of Contact:
Mr. Ernie Renner
Best Manufacturing Practices Center of Excellence
4321 Hartwick Road
Suite 400
College Park, MD 20740
(301) 403-8100
FAX: (301) 403-8180
ernie@bmpcoe.org

Center of Excellence for Composites Manufacturing Technology

The Center of Excellence for Composites Manufacturing Technology (CECMT) provides a national resource for the development and dissemination of composites manufacturing technology to defense contractors and subcontractors. The CECMT is managed by the Great Lakes Composites Consortium and represents a collaborative effort among industry, academia, and government to develop, evaluate, demonstrate, and test composites manufacturing technologies. The technical work is problem-driven to reflect current and future Navy needs in the composites industrial community.

Point of Contact:
Dr. Roger Fountain
Center of Excellence for Composites Manufacturing Technology
c/o GLCC, Inc.
103 Trade Zone Drive
Suite 26C
West Columbia, SC 29170
(803) 822-3705
FAX: (803) 822-3730
rfglcc@glcc.org

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) identifies, develops, and transfers innovative electronics manufacturing processes to domestic firms in support of the manufacture of affordable military systems. The EMPF operates as a consortium comprised of industry, university, and government participants, led by the American Competitiveness Institute under a CRADA with the Navy.

Point of Contact:
Mr. Alan Criswell
Electronics Manufacturing Productivity Facility
One International Plaza
Suite 600
Philadelphia, PA 19113
(610) 362-1200
FAX: (610) 362-1290
criswell@aci-corp.org

National Center for Excellence in Metalworking Technology

The National Center for Excellence in Metalworking Technology (NCEMT) provides a national center for the development, dissemination, and implementation of advanced technologies for metalworking products and processes. The NCEMT, operated by Concurrent Technologies Corporation, helps the

Navy and defense contractors improve manufacturing productivity and part reliability through development, deployment, training, and education for advanced metalworking technologies.

Point of Contact:
Mr. Richard Henry
National Center for Excellence in Metalworking
Technology
c/o Concurrent Technologies Corporation
100 CTC Drive
Johnstown, PA 15904-3374
(814) 269-2532
FAX: (814) 269-2501
henry@ctc.com

Navy Joining Center

The Navy Joining Center (NJC) is operated by the Edison Welding Institute and provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC works with the Navy to determine and evaluate joining technology requirements and conduct technology development and deployment projects to address these issues.

Point of Contact:
Mr. David P. Edmonds
Navy Joining Center
1250 Arthur E. Adams Drive
Columbus, OH 43221-3585
(614) 688-5096
FAX: (614) 688-5001
dave_edmonds@ewi.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC) addresses unique manufacturing processes and problems of the energetics industrial base to ensure the availability of affordable, quality, and safe energetics. The focus of the EMTC is on process

technology with a goal of reducing manufacturing costs while improving product quality and reliability. The EMTC also maintains a goal of development and implementation of environmentally benign energetics manufacturing processes.

Point of Contact:
Mr. John Brough
Energetics Manufacturing Technology Center
Indian Head Division
Naval Surface Warfare Center
101 Strauss Avenue
Building D326, Room 227
Indian Head, MD 20640-5035
(301) 744-4417
DSN: 354-4417
FAX: (301) 744-4187
mt@command.ih.navy.mil

Institute for Manufacturing and Sustainment Technologies

The Institute for Manufacturing and Sustainment Technologies (iMAST), was formerly known as Manufacturing Science and Advanced Materials Processing Institute. Located at the Pennsylvania State University's Applied Research Laboratory, the primary objective of iMAST is to address challenges relative to Navy and Marine Corps weapon system platforms in the areas of mechanical drive transmission technologies, materials science technologies, high energy processing technologies, and repair technology.

Point of Contact:
Mr. Henry Watson
Institute for Manufacturing and Sustainment
Technologies
ARL Penn State
P.O. Box 30
State College, PA 16804-0030
(814) 865-6345
FAX: (814) 863-1183
hew2@psu.edu

National Network for Electro-Optics Manufacturing Technology

The National Network for Electro-Optics Manufacturing Technology (NNEOMT), a low overhead virtual organization, is a national consortium of electro-optics industrial companies, universities, and government research centers that share their electro-optics expertise and capabilities through project teams focused on Navy requirements. NNEOMT is managed by the Ben Franklin Technology Center of Western Pennsylvania.

Point of Contact:
Dr. Raymond V. Wick
National Network for Electro-Optics Manufacturing
Technology
One Parks Bend
Box 24, Suite 206
Vandergrift, PA 15690
(724) 845-1138
FAX: (724) 845-2448
wick@nneomt.org

Gulf Coast Region Maritime Technology Center

The Gulf Coast Region Maritime Technology Center (GCRMTC) is located at the University of New Orleans and focuses primarily on product developments in support of the U.S. shipbuilding industry. A sister site at Lamar University in Orange, Texas focuses on process improvements.

Point of Contact:
Dr. John Crisp, P.E.
Gulf Coast Region Maritime Technology Center
University of New Orleans
College of Engineering
Room EN-212
New Orleans, LA 70148
(504) 280-3871
FAX: (504) 280-3898
jncme@uno.edu

Manufacturing Technology Transfer Center

The focus of the Manufacturing Technology Transfer Center (MTTC) is to implement and integrate defense and commercial technologies and develop a technical assistance network to support the Dual Use Applications Program. MTTC is operated by Innovative Productivity, Inc., in partnership with industry, government, and academia.

Point of Contact:
Mr. Raymond Zavada
Manufacturing Technology Transfer Center
119 Rochester Drive
Louisville, KY 40214-2684
(502) 452-1131
FAX: (502) 451-9665
rzavada@mttc.org

Appendix G

Completed Surveys

As of this publication, 105 surveys have been conducted and published by BMP at the companies listed below. Copies of older survey reports may be obtained through DTIC or by accessing the BMPnet. Requests for copies of recent survey reports or inquiries regarding the BMPnet may be directed to:

Best Manufacturing Practices Program
4321 Hartwick Rd., Suite 400
College Park, MD 20740
Attn: Mr. Ernie Renner, Director
Telephone: 1-800-789-4267
FAX: (301) 403-8180
ernie@bmpcoe.org

1985	Litton Guidance & Control Systems Division - Woodland Hills, CA
1986	Honeywell, Incorporated Undersea Systems Division - Hopkins, MN (Alliant TechSystems, Inc.) Texas Instruments Defense Systems & Electronics Group - Lewisville, TX General Dynamics Pomona Division - Pomona, CA Harris Corporation Government Support Systems Division - Syosset, NY IBM Corporation Federal Systems Division - Owego, NY Control Data Corporation Government Systems Division - Minneapolis, MN
1987	Hughes Aircraft Company Radar Systems Group - Los Angeles, CA ITT Avionics Division - Clifton, NJ Rockwell International Corporation Collins Defense Communications - Cedar Rapids, IA UNISYS Computer Systems Division - St. Paul, MN (Paramax)
1988	Motorola Government Electronics Group - Scottsdale, AZ General Dynamics Fort Worth Division - Fort Worth, TX Texas Instruments Defense Systems & Electronics Group - Dallas, TX Hughes Aircraft Company Missile Systems Group - Tucson, AZ Bell Helicopter Textron, Inc. - Fort Worth, TX Litton Data Systems Division - Van Nuys, CA GTE C ³ Systems Sector - Needham Heights, MA
1989	McDonnell-Douglas Corporation McDonnell Aircraft Company - St. Louis, MO Northrop Corporation Aircraft Division - Hawthorne, CA Litton Applied Technology Division - San Jose, CA Litton Amecom Division - College Park, MD Standard Industries - LaMirada, CA Engineered Circuit Research, Incorporated - Milpitas, CA Teledyne Industries Incorporated Electronics Division - Newbury Park, CA Lockheed Aeronautical Systems Company - Marietta, GA Lockheed Corporation Missile Systems Division - Sunnyvale, CA Westinghouse Electronic Systems Group - Baltimore, MD General Electric Naval & Drive Turbine Systems - Fitchburg, MA Rockwell International Corporation Autonetics Electronics Systems - Anaheim, CA TRICOR Systems, Incorporated - Elgin, IL
1990	Hughes Aircraft Company Ground Systems Group - Fullerton, CA TRW Military Electronics and Avionics Division - San Diego, CA MechTronics of Arizona, Inc. - Phoenix, AZ Boeing Aerospace & Electronics - Corinth, TX Technology Matrix Consortium - Traverse City, MI Textron Lycoming - Stratford, CT

1991	<i>Resurvey of Litton Guidance & Control Systems Division</i> - Woodland Hills, CA Norden Systems, Inc. - Norwalk, CT Naval Avionics Center - Indianapolis, IN United Electric Controls - Watertown, MA Kurt Manufacturing Co. - Minneapolis, MN MagneTek Defense Systems - Anaheim, CA Raytheon Missile Systems Division - Andover, MA AT&T Federal Systems Advanced Technologies and AT&T Bell Laboratories - Greensboro, NC and Whippany, NJ <i>Resurvey of Texas Instruments Defense Systems & Electronics Group</i> - Lewisville, TX
1992	Tandem Computers - Cupertino, CA Charleston Naval Shipyard - Charleston, SC Conax Florida Corporation - St. Petersburg, FL Texas Instruments Semiconductor Group Military Products - Midland, TX Hewlett-Packard Palo Alto Fabrication Center - Palo Alto, CA Watervliet U.S. Army Arsenal - Watervliet, NY Digital Equipment Company Enclosures Business - Westfield, MA and Maynard, MA Computing Devices International - Minneapolis, MN <i>(Resurvey of Control Data Corporation Government Systems Division)</i> Naval Aviation Depot Naval Air Station - Pensacola, FL
1993	NASA Marshall Space Flight Center - Huntsville, AL Naval Aviation Depot Naval Air Station - Jacksonville, FL Department of Energy Oak Ridge Facilities (Operated by Martin Marietta Energy Systems, Inc.) - Oak Ridge, TN McDonnell Douglas Aerospace - Huntington Beach, CA Crane Division Naval Surface Warfare Center - Crane, IN and Louisville, KY Philadelphia Naval Shipyard - Philadelphia, PA R. J. Reynolds Tobacco Company - Winston-Salem, NC Crystal Gateway Marriott Hotel - Arlington, VA Hamilton Standard Electronic Manufacturing Facility - Farmington, CT Alpha Industries, Inc. - Methuen, MA
1994	Harris Semiconductor - Melbourne, FL United Defense, L.P. Ground Systems Division - San Jose, CA Naval Undersea Warfare Center Division Keyport - Keyport, WA Mason & Hanger - Silas Mason Co., Inc. - Middletown, IA Kaiser Electronics - San Jose, CA U.S. Army Combat Systems Test Activity - Aberdeen, MD Stafford County Public Schools - Stafford County, VA
1995	Sandia National Laboratories - Albuquerque, NM Rockwell Defense Electronics Collins Avionics & Communications Division - Cedar Rapids, IA <i>(Resurvey of Rockwell International Corporation Collins Defense Communications)</i> Lockheed Martin Electronics & Missiles - Orlando, FL McDonnell Douglas Aerospace (St. Louis) - St. Louis, MO <i>(Resurvey of McDonnell-Douglas Corporation McDonnell Aircraft Company)</i> Dayton Parts, Inc. - Harrisburg, PA Wainwright Industries - St. Peters, MO Lockheed Martin Tactical Aircraft Systems - Fort Worth, TX <i>(Resurvey of General Dynamics Fort Worth Division)</i> Lockheed Martin Government Electronic Systems - Moorestown, NJ Sacramento Manufacturing and Services Division - Sacramento, CA JLG Industries, Inc. - McConnellsburg, PA
1996	City of Chattanooga - Chattanooga, TN Mason & Hanger Corporation - Pantex Plant - Amarillo, TX Nascote Industries, Inc. - Nashville, IL Weirton Steel Corporation - Weirton, WV NASA Kennedy Space Center - Cape Canaveral, FL Department of Energy, Oak Ridge Operations - Oak Ridge, TN

1997

Headquarters, U.S. Army Industrial Operations Command - Rock Island, IL
SAE International and Performance Review Institute - Warrendale, PA
Polaroid Corporation - Waltham, MA
Cincinnati Milacron, Inc. - Cincinnati, OH
Lawrence Livermore National Laboratory - Livermore, CA
Sharretts Plating Company, Inc. - Emigsville, PA
Thermacore, Inc. - Lancaster, PA
Rock Island Arsenal - Rock Island, IL
Northrop Grumman Corporation - El Segundo, CA
(Resurvey of Northrop Corporation Aircraft Division)
Letterkenny Army Depot - Chambersburg, PA
Elizabethtown College - Elizabethtown, PA
Tooele Army Depot - Tooele, UT

1998

United Electric Controls - Watertown, MA
Strite Industries Limited - Cambridge, Ontario, Canada
Northrop Grumman Corporation - El Segundo, CA
Corpus Christi Army Depot - Corpus Christi, TX
Anniston Army Depot - Anniston, AL

INTERNET DOCUMENT INFORMATION FORM

**A . Report Title: Best Manufacturing Practices: Report of Survey
Conducted at Anniston Army Depot, Anniston, AL**

B. DATE Report Downloaded From the Internet: 12/11/01

**C. Report's Point of Contact: (Name, Organization, Address, Office
Symbol, & Ph #): Best Manufacturing Practices
Center of Excellence
College Park, MD**

D. Currently Applicable Classification Level: Unclassified

E. Distribution Statement A: Approved for Public Release

**F. The foregoing information was compiled and provided by:
DTIC-OCA, Initials: __VM__ Preparation Date 12/11/01**

The foregoing information should exactly correspond to the Title, Report Number, and the Date on the accompanying report document. If there are mismatches, or other questions, contact the above OCA Representative for resolution.