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REPORT OF SURVEY CONDUCTED AT

U.S.S. CARL VINSON (CVN-70)

COMMANDER NAVAL AIR FORCE

U.S. PACIFIC FLEET

SEPTEMBER 1998

Best Manufacturing Practices

1998 Award Winner

INNOVATIONS IN AMERICAN GOVERNMENT

BEST MANUFACTURING PRACTICES CENTER OF EXCELLENCE
College Park, Maryland
www.bmpcoe.org

Foreword

This report was produced by the Office of Naval Research's 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 on the *U.S.S. Carl Vinson* (CVN-70), San Diego, California conducted during the week of September 21, 1998. Teams of BMP experts work hand-in-hand on-site with the company 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 industry, government, 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.

The *U.S.S. Carl Vinson* is one of the most modern, environmentally conscious, and formidable fighting vessels in the world. The dedication, professionalism, and combat readiness of this carrier's officers and crew ensure that it is ready to meet any challenge the future may hold. Among the best examples were the *U.S.S. Carl Vinson*'s accomplishments in high performance workforce; hazardous material spill response team; light bulb crusher; and horizontal chemical storage and dispensing station.

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

I encourage your participation and use of this unique resource.

Ernie Renner
Director, Best Manufacturing Practices

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Section 1

Report Summary

Background

Nimitz-class aircraft carriers are the U.S. Navy's most powerful and largest surface warships ever built. These floating cities operate as the central force in the Nation's forward-deployed presence around the world, and enable the Navy to project air power without relying on overseas bases. In 1975, the Newport News Shipbuilding and Drydock Company laid the keel to begin construction on the *U.S.S. Carl Vinson* (CVN-70). Third in the series of Nimitz-class carriers, this vessel became the first U.S. warship to be named after a living person. Congressman Carl Vinson (D-Georgia) served more than 50 years in the U.S. House of Representatives, and 29 years as Chairman of the House Naval Affairs and Armed Services Committee. His foresight and leadership were largely responsible for the building of today's Navy. As father of the modern Navy, Vinson influenced the development and construction of pre- and post-World War II warships; the establishment of a two-ocean Navy; the creation of a separate air academy; and the launching of the first U.S. nuclear-powered submarine. On March 15, 1980, Carl Vinson became the first person in the Nation's history to witness a launching in his own honor.

The *U.S.S. Carl Vinson* operates as part of the Pacific Fleet, and is homeported at Puget Sound Naval Shipyard in Bremerton, Washington. Nicknamed the Gold Eagle, the ship is 1,092 feet in length, 252 feet in width, and 244 feet in height from keel to mast (equivalent to a 24-story building). With its air wing embarked, the Gold Eagle can support approximately 6,000 personnel and 80 to 100 aircraft including F/A-18 Hornets, F-14 Tomcats, S-3 Vikings, and E-2C Hawkeyes. Two nuclear power plants enable the 100,000-ton warship to travel for extended periods, in excess of 30 knots, without the need to replenish propulsion fuel. Each of the ship's four deck-edge elevators can lift two aircraft from the cavernous hangar bay to the 4.5-acre flight deck in seconds. The *U.S.S. Carl Vinson* also performs launch and recovery operations via its catapult and arresting cable systems. Aircraft landing on a carrier must fly-in at full throttle and, if applicable, with their afterburners on. Pilots use the aircraft's tailhook to catch one of four steel arresting cables stretched across the flight deck. The arresting cable brings a plane traveling at 150 miles per hour to a complete stop in about 320 feet. To launch aircraft, flight deck crews lock the aircraft's T-bar (located on the nose gear) into the catapult shuttle, which pulls the plane down the catapult. Over a 300-foot distance, the steam-powered catapult thrusts a 48,000-pound aircraft from zero to 165 miles per hour in two seconds. The ship can launch two aircraft and land one every 37 seconds in daylight, and either launch or land one per minute at night.

The primary mission of the *U.S.S. Carl Vinson* is to be ready to employ its power anywhere in the world as directed by the President of the United States. In addition, the ship maintains stability in the Pacific Rim region; conducts anti-air, anti-surface, electronic, and anti-submarine warfare; provides humanitarian assistance; and has initiated a business-like approach to environmental issues and challenges. The carrier's versatility, capabilities, and philosophy enable the *U.S.S. Carl Vinson* to be a leader in upholding its core values of honor, courage, and commitment — *Vis Per Mare* or Strength through the Sea. Personnel readily display their enthusiasm and pride, knowing that their ideas and efforts make a difference. Among the best practices documented were the *U.S.S. Carl Vinson's* high performance workforce; hazardous material spill response team; light bulb crusher; and horizontal chemical storage and dispensing station.

As one of the most modern, environmentally conscious, and formidable fighting vessels in the world, the *U.S.S. Carl Vinson* has won two Battle Efficiency Awards as top carrier in the Pacific; three Meritorious Unit Commendations for support operations; three Chief of Naval Operations Environmental Quality Awards for environmental efforts; and four Admiral James H. Flatley Awards for aviation safety. The dedication, professionalism, and combat readiness of the Gold Eagle's officers and crew ensure that the ship is ready to meet any challenge the future may hold. 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 onboard the *U.S.S. Carl Vinson*:

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Aqueous Cleaning System	**5**
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AEROSOLV Can Puncturing and Recovery System	**5**
Horizontal Chemical Storage and Dispensing Station	**6**
Light Bulb Crusher	**6**
Metal Drum Crusher	**7**
Plastic Waste Recycling	**7**
Re-Issued Materials	**7**
Single Source EcoLab Cleaning Station	**8**

Aqueous Cleaning System

In 1996, the *U.S.S. Carl Vinson* implemented an automatic, closed-loop batch process to clean most metal parts with an aqueous cleaner. The system uses a biodegradable water/detergent solution, a batch parts washer, and a parts washer cage which can accommodate multiple large parts. Since implementing the system, the ship decreased its cleaning cycle time and solvent use, increased productivity by ten-fold, and realized significant cost savings.

Personal Protective Equipment

The availability and upkeep of personal protective equipment is a critical need for most areas, especially in regard to the storage, usage, and disposal of hazardous materials. The *U.S.S. Carl Vinson* addressed this issue by assigning individual personal protective equipment and secured lockers to its Hazardous Materials personnel. This arrangement promotes personal ownership as well as provides control and accountability of the equipment.

AEROSOLV Can Puncturing and Recovery System

The large volumes of paint used by aircraft carriers create an enormous amount of expended paint cans, which must be handled as hazardous waste. Since space is a premium on ships, the *U.S.S. Carl Vinson* resolved this situation by installing the AEROSOLV can puncturing and recovery system. This simple, easy-to-use system enables the ship to capture residual paint and hazardous air pollutants within an aerosol can before they can be released into the environment.

Horizontal Chemical Storage and Dispensing Station

The *U.S.S. Carl Vinson* continues to develop creative ways of overcoming its space limitation. One unique idea implemented is a space-saving, horizontal chemical storage and dispensing station. This compact station features a built-in spill containment bottom that adds safety to the unit and requires minimal floor space.

Light Bulb Crusher

One hazardous wastestream addressed by the *U.S.S. Carl Vinson* pertained to spent fluorescent light bulbs. In 1997, the ship's Hazardous Materials Division purchased a light bulb crusher which has solved many environmental and storage issues as well as saved thousands of dollars. Currently, tests are being conducted to determine if the glass is clean enough to be disposed as non-hazardous waste.

Metal Drum Crusher

Another storage issue faced by ships is the volumes of empty paint and chemical containers which can accumulate within hours of deployment. The *U.S.S. Carl Vinson* implemented a metal drum crusher to address this situation. As a result, the crusher reduced the spent containers' impact on the ship by 90%.

Plastic Waste Recycling

During a two-week deployment, the *U.S.S. Carl Vinson* typically generates more than 60 tri-wall pallets of plastic waste. The ship alleviated this situation by setting up three onboard plastic processing locations, which shred and compress clean plastic material into dense plastic disks. Each disk reduces onboard storage by a ratio of 30 to 1.

Re-Issued Materials

The *U.S.S. Carl Vinson's* Hazardous Materials Division implemented an aggressive re-utilization program which promotes the re-issue of free-use products aboard the ship. Typically, these products are discarded material from other Department of Defense activities or Base Realignment and Closures. The material is obtained free or at minimal cost to the ship.

Single Source EcoLab Cleaning Station

The *U.S.S. Carl Vinson* installed a single source EcoLab cleaning station near the Hazardous Materials Division. The EcoLab station stores the cleaning chemicals in high concentrated bulk solutions, and automatically dispenses the product in properly diluted proportions. This non-assisted method of distributing cleaners provides a win-win situation for everyone. The supply department no longer has to dispense cleaning products, and personnel can easily obtain the solutions as needed.

Item	Page
Spill Containment Pallets	**8**
The *U.S.S. Carl Vinson* uses spill containment pallets to improve the safety and aesthetics of the hazardous materials collection operations. This commercial-off-the-shelf product consists of an enclosed plastic hut which houses two 55-gallon drums, and has a containment tank built into the bottom. In addition, these low-cost fixtures are portable, durable, lightweight, and user friendly.	
Paint Issue and Use Reduction	**9**
Paint is a significant problem on any ship, especially one as large as an aircraft carrier, because the ship is constantly being painted to protect it from the corrosive marine environment. The *U.S.S. Carl Vinson*'s disciplined paint issue and reduction procedures have completely eliminated this hazardous wastestream to the environment at sea, while providing service that meets operational needs.	
Environmental Issues and Challenges	**9**
In addition to taking a proactive and business-like approach to environmental issues and challenges, the *U.S.S. Carl Vinson* prides itself on its teamwork, innovation, and involvement with the community. The ship works with the local community to identify environmental concerns and provide assistance (e.g., recycling efforts, cleaning beaches). This arrangement also helps the ship offset environmental noncompliance penalties by furnishing direct and immediate restitution to the community.	
Hazardous Inventory Control System	**10**
The *U.S.S. Carl Vinson* implemented a Hazardous Inventory Control System to track the issuing, movement, and disposal of hazardous materials on the ship. Fully computerized in 1995, this system reduced the order processing time by 400% and currently has a turnaround time of one customer per minute.	
Hazardous Material Control and Management Program	**10**
The Navy has a long-standing, Fleet-wide Hazardous Material Control and Management program. Its purpose is to establish uniform policy, guidance, and requirements for the life cycle control and management of hazardous materials acquired and used by the Navy. This program also provides a consistent baseline upon which units and activities like the *U.S.S. Carl Vinson* can build successful programs to meet their unique needs, requirements, and operating conditions.	
Hazardous Material Spill Response Team	**11**
Aircraft carriers house various fuels, oils, lubricants, and other chemicals which, if not properly contained and controlled, can create potentially lethal situations during a spill. The Hazardous Material Spill Response Team's responsibility is to rapidly get to a spill site, and then contain, control, and remove the hazard according to environmental and safety regulations. All members of the team wear a special team patch which authorizes them to work in hazardous zones, and provides quick identification to firefighters, security personnel, and other officers.	
High Performance Workforce	**11**
The *U.S.S. Carl Vinson*'s Hazardous Materials Division consists of volunteers and assigned personnel who developed their environmental skills through on-the-job training. The ship's success in attracting good performers to this area lies in its ability to create a challenging and rewarding setting. In return, the ship gets dedicated, professional individuals who work as a team to develop and maintain innovative practices and processes. The *U.S.S. Carl Vinson* serves as an excellent example of how an environmental focus can be effective and provide many benefits to the Navy.	
Waste Minimization	**12**
As part of its Hazardous Material Control and Management program, the *U.S.S. Carl Vinson* has taken an aggressive and innovative approach in attacking hazardous wastestreams on every front to eliminate or significantly reduce waste. The ship installed many new systems which reduced the total bulk of onboard trash by 80%. In addition, controlled issue and reuse of hazardous materials significantly decreased the amounts of these substances used throughout the ship.	

Information

The following information items were documented onboard the *U.S.S. Carl Vinson*:

Item	Page
Manual Paint Brush Cleaning System	**13**
The *U.S.S. Carl Vinson's* Hazardous Materials Division converted a commercial-off-the-shelf parts washer into a manual paint brush cleaning system. This simple, low-cost cleaning system reinforces the Division's efforts to promote an atmosphere of personal accountability and responsibility.	

Item	Page
Future Projects	13
The *U.S.S. Carl Vinson* is continuing to pursue new and innovative methods to reduce hazardous material usage and waste, and to lessen the environmental impact of the ship. Many systems are under consideration. Hazardous Materials personnel continually benchmark and consult with their counterparts on other ships as well as environmental experts at other locations to learn what systems are available and which ones offer the best opportunities for improvement.	
Storeroom Hazardous Material Control	13
The *U.S.S. Carl Vinson* maintains control of all hazardous materials by ordering and receiving them through the Hazardous Materials Division. This approach provides a single point of entry and exit. Most hazardous materials are stored below deck in specially configured storerooms. All items are maintained in excellent material condition, placed on shelves and in lockers, and are well organized for ease of inventory.	

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Section 2

Best Practices

Production

Aqueous Cleaning System

Metal parts require routine maintenance and overhaul including periodic cleaning, servicing, and nondestructive inspection. Previously, the *U.S.S. Carl Vinson* (CVN-70) manually cleaned metal parts with PD680 Solvent Type II, a hazardous cleaner. In 1996, the ship implemented an automatic, closed-loop batch process to clean most metal parts with an aqueous cleaner. However, metal parts which require corrosion inhibitors (e.g., bearing assemblies, aircraft wheel rims) cannot be cleaned with this Aqueous Cleaning System. In those cases, the aqueous cleaner is replaced with PD680 Solvent Type II.

The automated Aqueous Cleaning System uses a biodegradable water/detergent solution, a batch parts washer, and a parts washer cage which can accommodate multiple large parts. The parts washer pumps the water/detergent solution from a reservoir, through a manifold, and directly onto the parts. In addition, the parts washer contains a skimmer device which separates the water from the grease/oil removed from the metal parts. The water/detergent solution can be used for multiple cleaning cycles before being discharged directly down a drain. The initial equipment was donated as a prototype to all WestPac aircraft carriers that contained the automated, batch Aqueous Cleaning System.

Since implementing the Aqueous Cleaning System, the *U.S.S. Carl Vinson* decreased its cleaning cycle time and solvent use, increased productivity by ten-fold, and realized significant cost savings. The automated process takes 10 minutes per cycle to clean multiple parts and assemblies, while the manual process needed 20 minutes just to clean one part such as a wheel assembly. In addition, the ship's monthly solvent usage has been reduced from 100 gallons for the manual process to 30 gallons for the automated process.

Personal Protective Equipment

The availability and upkeep of personal protective equipment (PPE) is a critical need for most areas, especially in regard to the storage, usage, and disposal of hazardous materials. Problems typically arise when PPE is unsecured, and personnel have no clear ownership or accountability. The *U.S.S. Carl Vinson* addressed this issue by assigning individual PPE and secured lockers to its Hazardous Materials (HAZMAT) personnel.

Centrally located in the HAZMAT area of the ship, these 1' x 1' x 1' lockers are stacked on top of one another to minimize floor space. Every locker is secured with an individual lock, although a few key individuals can open all lockers with a master key. HAZMAT personnel take responsibility for the ownership, upkeep, and storage of their PPE. This arrangement provides control and accountability of all PPE used in the HAZMAT area.

The HAZMAT Division has realized many benefits since implementing the individual PPE and lockers. Equipment is secured, easily accessible by users, and kept in good working order. Individual responsibility promotes a controlled environment and empowerment in the process. In addition, the HAZMAT Division estimates that it saves $2,000 a year by reducing its consumption needs caused by replacing lost or stolen items.

Facilities

AEROSOLV Can Puncturing and Recovery System

An aircraft carrier uses large volumes of paint to deter rusting caused by the harsh saltwater environment. This huge demand requires, on average, the use of 35 aerosol cans per day. As a result, an enormous amount of expended paint cans accumulate and need to be handled as hazardous waste. In addition, space aboard a ship is at a premium, and any storage area occupied by waste will tax the space requirements needed to fulfill an aircraft carrier's primary mission of war readiness. The *U.S.S. Carl Vinson* resolved this situation by installing the AEROSOLV can puncturing and recovery system.

The AEROSOLV system is mounted on top of a standard 30- or 55-gallon drum, and works with any domed mini, standard, or jumbo aerosol can. After an aerosol can is loaded into the system and punctured, the residual paint inside the can is gravity fed into the drum and later sold to a paint contractor. The AEROSOLV system also removes the expended can's compressed gases with a two-stage coalescing/carbon

filter, which captures 99.9% of hazardous air pollutants such as chlorofluorocarbons.

The AEROSOLV system is conveniently located in the HAZMAT area of the ship so personnel can obtain fresh aerosol cans and drop off expended ones all in one trip. As a result, sailors readily bought into this process and supported the environmentally responsible atmosphere on the ship. The *U.S.S. Carl Vinson* spent less than $900 for the AEROSOLV unit (including filter) and negligible costs for installation due to the simple process. The payback time was less than three months based on life cycle costs, which included storage space for spent paint cans and disposal costs.

Since installing the AEROSOLV system, the *U.S.S. Carl Vinson* has realized significant savings pertaining to cost, space, and environmental issues. This simple, easy-to-use system enables the HAZMAT Division to capture residual paint and hazardous air pollutants within an aerosol can before they can be released into the environment. In addition, the efficiency at which the paint is removed allows the empty cans to be recycled with other metals instead of being segregated for hazardous waste disposal. The *U.S.S. Carl Vinson* achieved $20,000 in annual savings with this system, and reclaimed more than 80% of the storage space required for spent aerosol paint cans.

Horizontal Chemical Storage and Dispensing Station

Limited floor space is a major obstacle faced by aircraft carriers. The *U.S.S. Carl Vinson's* HAZMAT Division continues to develop creative ways of overcoming this challenge. One unique idea implemented by the Division is a space-saving, horizontal chemical storage and dispensing station. This compact station features a built-in spill containment bottom that adds safety to the unit and requires minimal floor space.

Previously, the ship used small metal racks to house drums for dispensing liquid chemical products. However, safety factors restricted the rack's height to a two-tier drum arrangement, and limited floor space prevented the number of drums from being expanded. Chemical handlers also had to move supplies around the small storage area to gain access to empty drums. After researching the problem, the HAZMAT Division located a commercial-off-the-shelf (COTS) product that can house 16 drums in the same amount of space as 12. This plastic, three-tiered compact station stores the drums closer together, and costs approximately $2,600. When dispensing chemicals from the station, the handler places a removable shelf underneath the container being filled. The shelf acts as a support frame during filling as well as a spill containment device to deflect splashes away from the handler. The bottom few inches of space below the drums are also designed as a holding tank to prevent escaped chemicals from creating an environmental or safety problem. With this added safety feature, the HAZMAT Division was able to install larger diameter valves to the drums to increase the pouring rate and reduce operator time.

Since implementing the horizontal chemical storage and dispensing station, the *U.S.S. Carl Vinson* gained numerous labor-saving and safety benefits. However, the most significant benefit of this station is its ability to provide more dispensing opportunities in an environmentally friendly manner with less floor space.

Light Bulb Crusher

The *U.S.S. Carl Vinson's* day-to-day activities generate several wastestreams. One hazardous wastestream addressed by the HAZMAT Division pertained to spent fluorescent light bulbs. Every year, several thousand light bulbs are replaced on an aircraft carrier, creating numerous pallets of spent bulbs that must be stored until on-shore recycling can take place. Proper disposal of the spent bulbs can also be expensive. Flourescent bulbs are regulated as a hazardous waste due to the mercury and other contaminants they contain.

In 1997, the HAZMAT Division purchased a light bulb crusher which has solved many environmental and storage issues as well as saved thousands of dollars. This compact crusher fits atop a 55-gallon, open-topped drum, and features a long tube that angles out the top of the unit. As the spent bulb is fed through the tube, the crusher breaks up the bulb and removes the mercury and other contaminants through a specialized filter. The remaining glass falls into the drum and is processed as hazardous waste. Currently, tests are being conducted to determine if the glass is clean enough to be disposed as non-hazardous waste. The light bulb crusher costs approximately $6,200 and has a payback time of less than one year. Replacement filters are $250 each and need to be changed after every 1,200 bulbs.

The light bulb crusher enables the *U.S.S. Carl Vinson* to reduce costs, minimize labor, and maximize storage space. This method of recycling bulbs saves the ship approximately $17,200 per drum in disposal fees and reclaimed floor space. One drum of crushed glass costs $1,200 for disposal whereas one pallet of spent bulbs costs $2,300. In addition, a 55-gallon drum can hold 2,600 bulbs — the equivalent of eight pallets. After returning from a two-month de-

ployment in April 1998, the *U.S.S. Carl Vinson* disposed of seven drums of crushed glass at a savings of $116,900.

Metal Drum Crusher

Another storage issue faced by ships is the volumes of empty paint and chemical containers which can accumulate within hours of deployment. Every week of deployment generates approximately eight tri-walled pallets (4.5' x 4.5' x 5' corrugated transportation boxes) of spent metal containers. In addition, the ship's stringent space limitations compound the labor needed to store this material. The *U.S.S. Carl Vinson's* HAZMAT Division addressed this issue by implementing a $9,000 metal drum crusher in 1995.

The metal drum crusher is a self-contained unit with a hydraulic ram. A hinged door allows the operator to position an open-topped drum inside the unit underneath the ram. Disposable metal containers are then placed into the drum. Once the crusher is activated, the ram travels down into the drum, compacts the material, and returns to its starting position. The crusher can compress a 55-gallon drum of empty containers into eight inches. The procedure is repeated until the drum is filled with the compressed metals. The on-shore disposal cost is $20 per drum.

The *U.S.S. Carl Vinson* gained immediate benefits by implementing the metal drum crusher. The impact from empty paint and chemical containers on the ship has decreased by 90%. However, the true savings of this device are in the reduction of labor and space requirements.

Plastic Waste Recycling

Every day, the *U.S.S. Carl Vinson's* mess hall prepares 22,000 meals, creating a very large wastestream — primarily of plastics. During a two-week deployment, the ship typically generates more than 60 tri-wall pallets of plastic waste. The Maritime Plastic Pollution Research and Control Act prohibits plastic disposal in all U.S. waters and by ships under U.S. jurisdiction. However, storing the plastic waste onboard would greatly affect the battle readiness of the ship. In March 1997, the Chief of Naval Operations (CNO) informed all afloat Commands that as of December 31, 1998 absolutely no plastic would be discarded into any waters. Any violation of this order would be considered a federal offense.

The *U.S.S. Carl Vinson* alleviated this situation by setting up three onboard plastic processing locations. Overall, the ship uses 14 plastic compression machines and three plastic shredders. Of these, three compression machines and one shredder are designated as back-up units. Processor operators can only accept clean plastic due to odors/potential health concerns that would be created by storing food waste for extended periods on the ship. As a result, the waste generator is required to clean or remove excess food or other materials from the plastic waste prior to it being delivered to one of the three processing locations. The clean plastic is ripped apart by the shredders, and loaded into the compression machines. These machines then heat and compress the material into dense plastic disks. Approximately three bags of plastic trash can be compressed into one disk. The compressed disks are then placed inside 55-gallon drums, and stored on a designated mezzanine in the hangar bay. Over a two-month deployment, the ship generates approximately 1,200 plastic disks weighing approximately six tons.

Since implementing the plastic processing equipment, the *U.S.S. Carl Vinson* decreased its labor and space requirements needed for storing plastic waste. Each disk reduces onboard storage by a ratio of 30 to 1. However, the current design of the processing equipment has some drawbacks. These include the amount of time needed between runs to clean out the plastic that drips into the equipment control cabinet, and a weakness in the cylinder walls of the compression piston that leads to scoring.

Re-Issued Materials

The *U.S.S. Carl Vinson's* HAZMAT Division implemented an aggressive re-utilization program which promotes the re-issue of free-use products aboard the ship. Typically, these products are excess material from other Department of Defense (DOD) activities or Base Realignment and Closures. The material is obtained free or at minimal cost to the ship.

The re-utilization program enables the *U.S.S. Carl Vinson* to obtain essential materials while decreasing the cost to the ship. Some savings from re-issued materials include:

- $80 each from 55-gallon drums
- $100 per five-gallon issue of paint cans, when factoring in the life-cycle costs
- Thousands of dollars worth of savings from solvents in regard to new procurements and hazardous waste costs
- $100,000 from aircraft engine oil in 1997

In addition, the re-utilization program promotes further reductions and savings via cost avoidance.

One example is the free issue of floor rejuvenation products. The availability of these products reduces the frequency of application of expensive floor waxes, allowing the ship to reduce maintenance costs.

The re-issue of free-use products enables the *U.S.S. Carl Vinson* to reduce various costs such as procurement, hazardous waste, and landfill. In addition, the ship's usage of re-issued materials has reached 80% for the past two consecutive years, resulting in a savings of $220,345.

Single Source EcoLab Cleaning Station

Previously, the *U.S.S. Carl Vinson* relied on a labor intensive, single source issuing of cleaning chemicals by the supply department. The department stocked, handled, and distributed a large selection of cleaners, often in aerosol cans. Personnel usually waited in long lines to obtain the products. These high concentrated chemicals could also create problems if personnel did not dilute the cleaner or if the product was used in an inappropriate area, such as the flight deck where incompatible chemicals corrode the metals used in flight operations. The *U.S.S. Carl Vinson's* HAZMAT Division resolved this situation by installing a single source EcoLab cleaning station in the HAZMAT area of the ship.

The EcoLab station stores the cleaning chemicals in high concentrated bulk solutions, and automatically dispenses the product in properly diluted proportions. This non-assisted method of distributing cleaners provides a win-win situation for everyone. The supply department no longer has to dispense cleaning products, and personnel can easily obtain the solutions as needed. In addition, the EcoLab station eliminated many of the aerosol cans and plastic containers previously used for cleaning, resulting in tremendous savings in cans, plastics, and metals.

Since implementing the EcoLab station, the *U.S.S. Carl Vinson* significantly reduced its solid wastestream, decreased labor requirements by several hundred hours, and saved $500,000 in annual operations costs. This method eliminated 61 toxic cleaning compounds from the ship's inventory and replaced them with 11 environmentally safe cleaning products. The EcoLab also minimized valuable storage space, a critical factor aboard all ships.

Spill Containment Pallets

Unlike land-based facilities, aircraft carriers face unique challenges (e.g., limited storage space, battle readiness requirements of the ship) in the collection and storage of hazardous waste materials. Not too long ago, securing several drums together and fastening open funnels on top was a common sight. Today, the *U.S.S. Carl Vinson's* HAZMAT Division uses spill containment pallets, a COTS product which improves the safety and aesthetics of the HAZMAT collection operations.

A spill containment pallet (Figure 2-1) is an enclosed plastic hut which houses two 55-gallon drums, and has a containment tank built into the bottom. These low-cost ($365 each) fixtures are portable, durable, lightweight, and user friendly. Initially, the Division bought one self-contained pallet as a test unit, but soon purchased nine more. The spill containment pallets enable the user to segregate oxidizers and petroleum products in a consolidated storage area, and offer individual spill containment. The lid over the huts easily lifts up high and out of the user's way, and then closes securely over the two drums inside. This feature decreases the opportunity for accidents and minimizes the release of odors. Ample room also exists above the drums so the user can place an open funnel on top of the drum, reducing the chance for spillage. Bright colored labeling, located

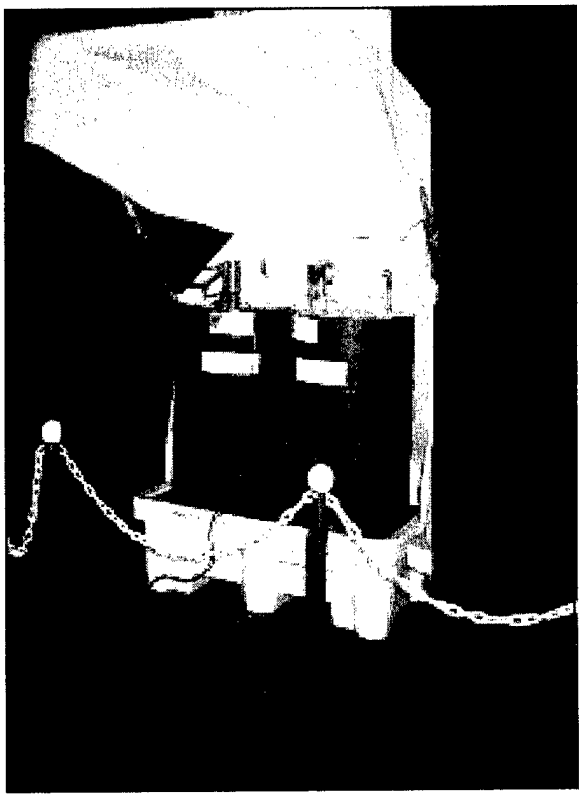


Figure 2-1. Spill Containment Pallet

outside on the lid and inside on the drums, alert the user from mixing incompatible chemicals.

The spill containment pallets have proven to be a low cost, simple improvement to the *U.S.S. Carl Vinson's* HAZMAT collection operations. The mobility of organization, safety, and compatibility opportunities of this COTS product offer easy, convenient self-containment.

Logistics

Paint Issue and Use Reduction

The *U.S.S. Carl Vinson's* HAZMAT Division deals with all the hazardous materials aboard the ship including spent paint. Paint is considered hazardous because it is oil based. Dumping used or waste paint overboard into the ocean has the same environmental impact as dumping lube or fuel oil. Paint also poses a potential fire hazard to the ship, if not regulated properly.

To deal effectively with these hazards, the HAZMAT Division initiated disciplined controls and practices to manage paint use and the resulting wastestreams. Bulk supplies of paint are kept in controlled access storerooms below deck, while a small bulk storage locker is maintained by the HAZMAT Division in the hangar bay. Paint is issued on demand to users based on square footage of the area to be painted. The amount issued cannot exceed more than what can be used in a 24-hour period. Paint is issued in plastic zip-lock bags to prevent spills and waste. Paint containers/cans are labeled to ensure material contents can be identified by the user and when the container is returned to HAZMAT for disposal or reuse. Customers provide their own paint cans and containers into which the issued paint is placed, still in the zip-lock bags. Customers are required to account for all the paint they draw, and to return excess paint and containers to the HAZMAT Division upon the completion of the job or within 24 hours. By using these issuing procedures, the amount of wasted paint is significantly reduced. Customers draw and use only as much as they need for a specific job, which encourages them to be more responsible for waste. This approach is also a more cost-effective way to issue paint. The cost is shared throughout the ship, and is significantly lower for individual users than by buying paint in bulk and using it inefficiently.

The HAZMAT Division ensures that as much paint as possible is recycled. When customers return their leftover paint, HAZMAT personnel pour it back into its original storage container, if it is not contaminated. Whatever cannot be used or scraped out of the can is slowly drained into a 55-gallon drum. The can is then inverted on a grate and left to dry. Once dried, the paint is no longer considered hazardous waste, and the paint can is crushed in the metal drum crusher. The 55-gallon drums used to collect the residual paint are stored onboard and offloaded to a shore waste disposal facility when the ship is in port.

Paint is a significant problem on any ship, especially one as large as an aircraft carrier, because the ship is constantly being painted to protect it from the corrosive marine environment. The *U.S.S. Carl Vinson's* disciplined paint issue and reduction procedures have completely eliminated this hazardous wastestream to the environment at sea, while providing service that meets operational needs.

Management

Environmental Issues and Challenges

The *U.S.S. Carl Vinson's* HAZMAT Division takes a proactive and business-like approach to environmental issues and challenges. The Division's success comes from its resourcefulness, strong commitment, and conscious effort for continuous improvement. Among the factors faced by the ship are space constraints, battle readiness requirements, and environmental compliance with federal, state, and local laws.

The HAZMAT Division also prides itself on its teamwork, innovation, and involvement with the community. The *U.S.S. Carl Vinson* works with the local community to identify environmental concerns and provide assistance (e.g., recycling efforts, cleaning beaches). This arrangement also helps the ship offset environmental noncompliance penalties by furnishing direct and immediate restitution to the community. Other issues being addressed by the HAZMAT Division include:

- Waste minimization efforts such as a washing system for soiled hazardous rags
- Logistics for transporting hazardous materials to/from the ship in domestic and foreign seas
- Balancing storage requirements between hazardous materials and mission critical needs
- Investigating opportunities for a regulatory partnership between industry and government to support mutual issues

The *U.S.S. Carl Vinson* is dedicated to quality environmental stewardship and has been the recipient of three consecutive CNO Environmental Quality Awards. The ship's proactive approach enables the HAZMAT Division to identify environmental issues and challenges, implement corrective actions, and achieve effective solutions.

Hazardous Inventory Control System

The *U.S.S. Carl Vinson* implemented a Hazardous Inventory Control System (HICS) to track the issuing, movement, and disposal of hazardous materials on the ship. Fully computerized in 1995, HICS reduced the order processing time by 400% and currently has a turnaround time of one customer per minute. Previously, supply personnel distributed the hazardous materials by manually logging the items in and out of storerooms. This tedious process (e.g., locating and logging items, capturing pertinent data) required numerous hours per customer before the hazardous material could be issued, resulting in inaccurate status data.

HICS was developed at the Naval Air Weapons Station in Point Mugu, California, in response to a need to track the life cycle of hazardous materials. Today, the Naval Inventory Control Point in Mechanicsburg, Pennsylvania is responsible for the system. HICS features many capabilities such as tracking, issuing, and receiving items; allocating cognizance of products; and producing detailed reports. The system's data has been instrumental in identifying the toxicity of each product and reducing total inventory. The *U.S.S. Carl Vinson* decreased its hazardous material inventory to about 400 products — an 80% reduction. HICS tracks delinquent returns (DINKs) of hazardous materials as well. At the time of issue, each product is given a unique tracking number, which identifies the recipient's name and department. In cases of a DINK, no new material will be issued until the outstanding item is returned. In addition, the system's controls are designed to prevent the issuing of hazardous chemicals to those individuals or departments that have not demonstrated environmental accountability.

Since implementing HICS, the *U.S.S. Carl Vinson* realized significant savings by reducing waste disposal costs; increasing the number of recycled and re-utilized products; and decreasing the hours needed for operation and control. In FY97, HICS issued 48,181 containers of hazardous materials. Of these, only 10% reached a landfill for final disposal, while the remaining 90% were recycled or re-utilized onboard the ship.

Hazardous Material Control and Management Program

The Navy has, in place, a long-standing, Fleet-wide Hazardous Material Control and Management (HMC&M) program. This program's purpose is to establish uniform policy, guidance, and requirements for the life cycle control and management of hazardous materials acquired and used by the Navy. In addition to requiring all Navy activities to comply with all federal, DOD, and applicable state and local regulations, the HMC&M program specifies the Navy requirements for controlling and reducing the amount of hazardous materials used and generated Navy-wide. These requirements are flowed down from the CNO to all levels of command in the Navy, and form the basis for the *U.S.S. Carl Vinson's* HMC&M program.

The HMC&M program's major elements include: an HMC&M advisory committee for each activity; an inventory and authorized use list; Material Safety Data Sheets (MSDSs); container labeling; safety; acquisition controls; receiving, distribution, issuing, and shipping controls; storage; management; emergency response planning; program plan and documentation; and record keeping and reporting. As guidelines, these elements provide sufficient details for setting up a framework, and building an effective program that incorporates local/regional considerations and special requirements. The HMC&M program also provides guidelines for developing a training program including basic requirements and suggested curricula outlines. Specific guidance is offered on how to establish an effective communication plan to ensure that all employees, who routinely work with or are exposed to hazardous materials in their work places, are familiar with the hazards involved and the precautionary measures needed for protection.

The program requires Navy activities to use the DOD's Hazardous Material Information System (HMIS) to acquire, store, and disseminate manufacturers' data on hazardous materials. The HMIS system provides a means to share and communicate information on hazardous materials (procured by a single DOD activity) with all other commands, activities, and units within the entire DOD organization.

The Navy's HMC&M program provides a consistent baseline upon which activities and units like the *U.S.S. Carl Vinson* can build successful programs to meet their unique needs, requirements, and operating conditions. The guidelines are flexible enough to allow for the range of differences in operating environments of Navy units. In addition, the program enables units and activities to develop effective practices and processes which can be transferred and adopted throughout the Fleet. The *U.S.S. Carl Vinson* has been a leader in developing and adopting innovative HMC&M practices and processes that can be used by other ships within the framework of the Navy's HMC&M program.

Hazardous Material Spill Response Team

Recognizing a need for specially trained HAZMAT spill response personnel, the Navy set up regulations for the Fleet. As a result, the *U.S.S. Carl Vinson* established a HAZMAT Spill Response Team to handle all spills. Previously, spills on ships were flushed or otherwise discarded into the open sea. This practice, however, damaged the environment and exposed response personnel, who often were inexperienced in regard to MSDSs, hazard warnings and symbols, and personal protective equipment, to hazardous chemicals.

Aircraft carriers house various fuels, oils, lubricants, and other chemicals which, if not properly contained and controlled, can create potentially lethal situations during a spill. The HAZMAT Spill Response Team's responsibility is to rapidly get to a spill site, and then contain, control, and remove the hazard according to environmental and safety regulations. The ship's team is comprised of 15 volunteers who have an interest in environmental issues, and have successfully completed comprehensive HAZMAT training. All members of the team wear a special HAZMAT Team patch (Figure 2-2) which authorizes them to work in hazardous zones, and provides quick identification to firefighters, security personnel, and other officers.

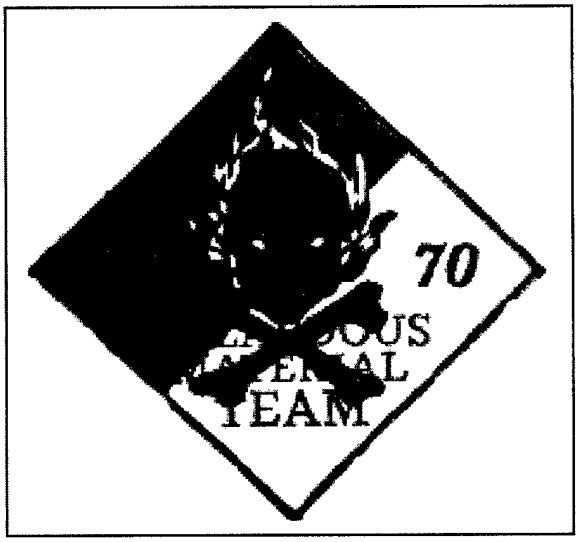


Figure 2-2. Hazardous Material Team Patch

In addition to a HAZMAT officer who oversees the team's responsibilities, the ship uses several empowered HAZMAT leaders who can initiate a response without losing critical spill response expertise. The HAZMAT team follows a step-by-step spill response process: discovery; initiation of action; evaluation; containment and damage control; dispersion of gas/vapor; disposal of contaminated materials; certification for safe re-entry; and follow-up reports.

The *U.S.S. Carl Vinson's* proactive approach has resulted in a highly trained and well-equipped HAZMAT Spill Response Team. This professional team can address any spill emergency in a safe and environmentally responsible manner.

High Performance Workforce

Rank is an incorrect term when referring to Naval enlisted personnel. Instead, the Navy uses *rate* to denote pay grade, and *rating* to indicate occupational specialty. Currently, there is no rating in the Navy to classify an environmental specialist and, thus, no established career path. Those interested in this discipline must pursue other paths for promotions, including non-military avenues.

The *U.S.S. Carl Vinson's* HAZMAT Division consists of volunteers and assigned personnel who developed their environmental skills through on-the-job training. The ship's success in attracting good performers to this area lies in its ability to create a challenging and rewarding setting. Mutual respect between managers and crew, as well as offshore support, also greatly contribute to this atmosphere. In return, the *U.S.S. Carl Vinson* (Figure 2-3) gets dedicated, professional individuals who work as a team to develop and maintain innovative practices and processes. HAZMAT personnel readily display their enthusiasm and pride, knowing that their ideas and efforts make a difference. Another contributing factor is the ship's business-like approach in managing hazardous materials and eliminating wastestreams. Waste is a cost, and is viewed by the HAZMAT Division as a misuse of taxpayer dollars. The Division seeks out environmentally responsible ways to maximize its limited resources and funds; free up labor and space; and contribute to the battle readiness of the ship. As a result of these efforts, the ship has won three consecutive CNO environmental awards and is recognized as a leader in the Fleet for environmental management.

Commander Naval Air Force, U.S. Pacific Fleet (COMNAVAIRPAC) is looking into the possibility of the Navy creating a rating for environmental specialists. The *U.S.S. Carl Vinson's* HAZMAT Division serves as an excellent example of how an environmental focus can be effective and provide many benefits to the Navy.

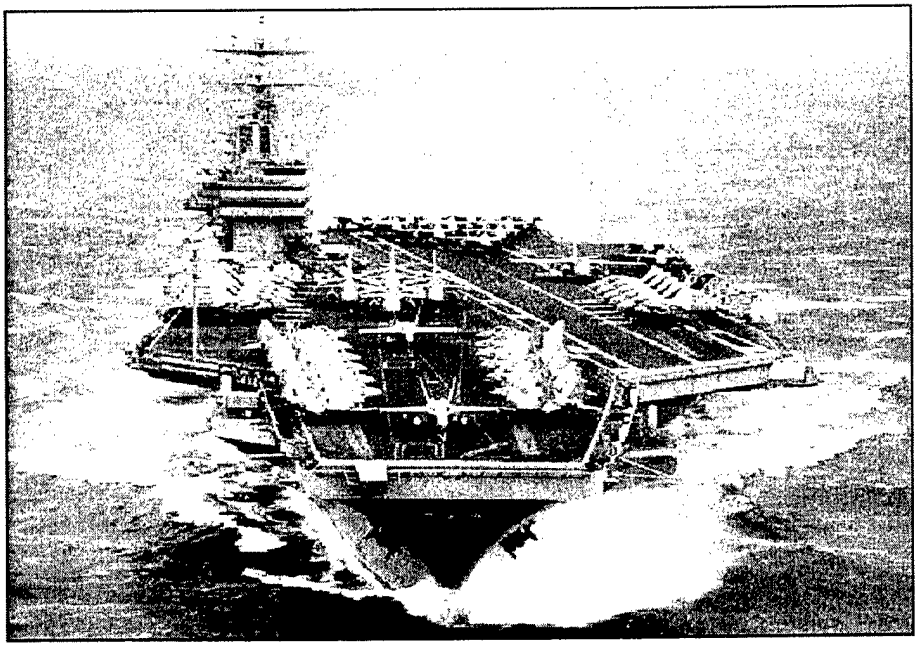


Figure 2-3. U.S.S. Carl Vinson

Waste Minimization

As part of its HMC&M program, the *U.S.S. Carl Vinson* has taken an aggressive and innovative approach in attacking hazardous wastestreams on every front to eliminate or significantly reduce waste. The ship installed many new systems (e.g., metal drum crusher, light bulb crusher, plastics waste plants) which reduced the total bulk of onboard trash by 80%. In addition, controlled issue and reuse of hazardous materials significantly decreased the amounts of these substances used throughout the ship. Cooking grease, lube oils, general purpose oils, and used paints are recycled in lieu of disposal. These measures cut costs and add value by freeing up manpower and reducing material handling requirements.

Many of these systems are designed to reduce the total variety of hazardous materials and the need for bulk issue. A good example is the EcoLab system which allows the *U.S.S. Carl Vinson* to replace 61 toxic cleaning compounds with 11 environmentally safe items, and eliminates the need for customers to draw bulk quantities or dilute concentrated materials. This system alone saves the ship more than $500,000 a year.

The HAZMAT Division has also worked diligently and effectively to change the culture of the crew, and ingrain the concept of personal responsibility and accountability for wastestreams. This effort has had a dramatic effect in reducing hazardous waste. Some of these measures are as simple as getting personnel to separate trash (e.g., cans, paper, plastic) in their work centers and living spaces for disposal. Individuals must clean all plastic waste before delivering it to the plastic disposal centers for processing. Everyone takes responsibility for their own waste, and helps others to be environmentally conscience. Painters immediately clean their brushes and rollers, so the equipment is ready for use the next time. Personal accountability and responsibility are encouraged and reinforced by the HAZMAT Division through example. Since no rating for environmental specialist exists in the Navy, the HAZMAT Division consists of individuals who either volunteered for this duty or were assigned because they developed their skills through on-the-job training. This proud and dedicated group works as a team to develop and maintain innovative practices and processes on the *U.S.S. Carl Vinson.* Their effects have helped the ship win three consecutive environmental awards and be recognized as a leader in the Fleet for environmental management.

Additionally, a business-like approach is another contributing factor of the ship's success in managing hazardous materials and eliminating wastestreams. Waste is viewed as a cost and an inefficiency as well as a misuse of taxpayer dollars. Environmentally responsible practices such as those adopted by the *U.S.S. Carl Vinson* result in direct savings to the ship. These savings allow better use of limited resources and funds, and also free up labor and space for operational purposes which contributes directly to the war fighting capability of the ship.

Section 3

Information

Production

Manual Paint Brush Cleaning System

Ships rely on many corrosion control and maintenance methods to combat the harsh saltwater environment. One of the most widely used practices is the frequent application of paints and primers to various surfaces. In the past, paint brushes and rollers were considered consumables. Personnel either disposed of them after a single use or left them in a five-gallon drum for HAZMAT personnel to clean or toss. Recently, the *U.S.S. Carl Vinson* adopted a new process which places the responsibility of recycling paint brushes and rollers on the user.

The HAZMAT Division converted a COTS parts washer into a manual paint brush cleaning system, and placed it in a central location in the hangar bay. The system provides a continuous circulation of paint thinner solvent which aids the users as they manually agitate the brushes during rinsing. The user quickly learns the value of immediately washing brushes while they are still damp.

This simple, low-cost cleaning system reinforces the HAZMAT Division's efforts to promote an atmosphere of personal accountability and responsibility. Since implementing this system, the ship has significantly increased the number of recycled paint brushes and rollers, and decreased its disposal and procurement costs.

Facilities

Future Projects

The *U.S.S. Carl Vinson* is continuing to pursue new and innovative methods to reduce hazardous material usage and waste, and to lessen the environmental impact of the ship. Many systems are under consideration. HAZMAT personnel are continually benchmarking and consulting with their counterparts on other ships as well as environmental experts at other locations (e.g., Naval centers, military organizations, COMNAVAIRPAC) to learn what systems are available and which ones offer the best opportunities for improvement.

Several new projects are scheduled for implementation in the near future. An automated paint brush and roller scrubber that significantly reduces emissions and waste, and recycles brushes and rollers for reuse is due for installation in the near future. An aluminum can recycling program will be started in October 1998. All aluminum will be recycled and the money generated will be given to the crew's welfare and recreation fund. In an effort to reduce waste disposal costs and reduce hazardous material soak rags from being landfilled or incinerated, the Type Commander requires rag recycling. Food pulpers and wood pulpers are also planned for installation when the ship undergoes a scheduled Planned Incremental Availability in October 2000.

These projects and others will contribute to the *U.S.S. Carl Vinson's* continuous improvement efforts in hazardous material management and pollution prevention. They are representative of the spirit and commitment shown by the crew and their leaders at all levels — applying all available resources toward environmental improvement initiatives to the maximum extent possible.

Logistics

Storeroom Hazardous Material Control

The *U.S.S. Carl Vinson* maintains control of all hazardous materials by ordering and receiving them through the HAZMAT Division. This approach provides a single point of entry and exit. Most hazardous materials are stored below deck in specially configured storerooms. Items such as acidic and corrosive materials are housed in designated lockers and cabinets which sit in spill trays to contain any leakage or spills. The storerooms also have safety systems including emergency spill kits, carbon dioxide flooding systems, and safety lights that eliminate the risk of explosion or arcing. Access to these storerooms is tightly controlled. Bulk material issues are tracked through the ship's Hazardous Inventory Control System.

All storeroom items are maintained in excellent material condition. They are neatly placed on shelves and in lockers, and are well organized for ease of inventory. Careful and frequent inventories are conducted by the HAZMAT Division. A monthly report

identifies all items which must be surveyed due to shelf life expiration, or need to be physically examined and tested to determine if a shelf life can be extended. Those items whose shelf life has expired and cannot be extended must be removed and disposed of properly. Janus 2020 smart barcode scanners manufactured by Intermec are used to perform the inventory. These scanners have data entry capability, are programmable, and can download information to the ship's hazardous material tracking systems and databases.

The HAZMAT storerooms provide a safe and secure means of storing and controlling hazardous materials. Effective inventory procedures have enabled the *U.S.S. Carl Vinson* to consistently exceed all goals for inventory and location accuracies. Future improvements planned include the addition of a refrigerated locker which will significantly extend the shelf life of certain short-life materials.

Appendix A

Table of Acronyms

Acronym	Definition
CNO	Chief of Naval Operations
COMNAVAIRPAC	Commander Naval Air Force U.S. Pacific Fleet
COTS	Commercial-Off-The-Shelf
DINK	Delinquent Return
DOD	Department of Defense
HAZMAT	Hazardous Material
HICS	Hazardous Inventory Control System
HMC&M	Hazardous Material Control and Management
HMIS	Hazardous Material Information System
MSDS	Material Safety Data Sheet
PPE	Personal Protective Equipment

Appendix B

BMP Survey Team

Team Member	Activity	Function
Larry Robertson (812) 854-5336	**Crane Division** Naval Surface Warfare Center Crane, IN	**Team Chairman**
Cheri Spencer (301) 403-8100	**BMP Center of Excellence** College Park, MD	**Technical Writer**
Rick Purcell (301) 403-8100	**BMP Center of Excellence** College Park, MD	**Team Leader**
Darrel Brothersen (319) 295-3768	**Rockwell Collins Avionics & Communications** Cedar Rapids, IA	
Mark Hancock (301) 403-8100	**BMP Center of Excellence** College Park, MD	
Becky McKelvey (972) 344-4281	**Raytheon Systems Company** Dallas, TX	

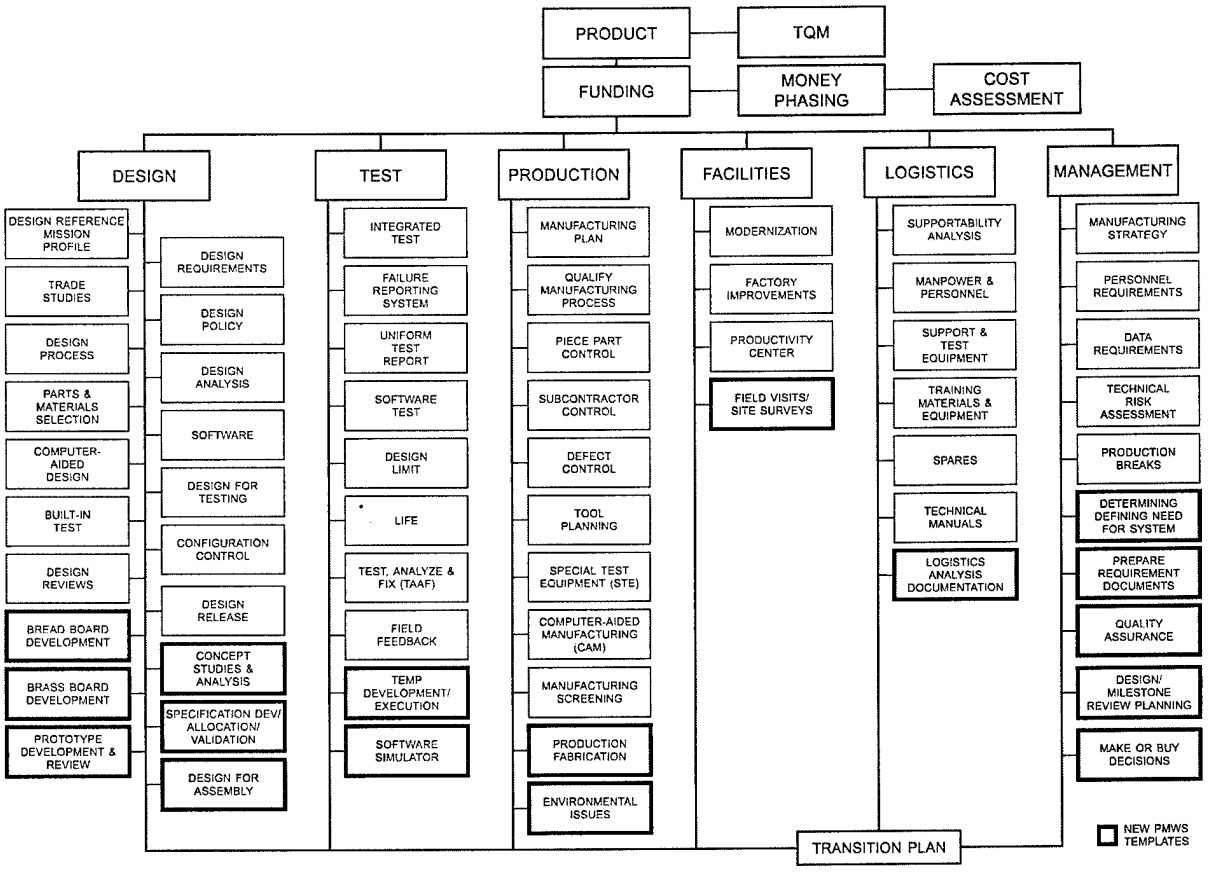
Appendix C

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.

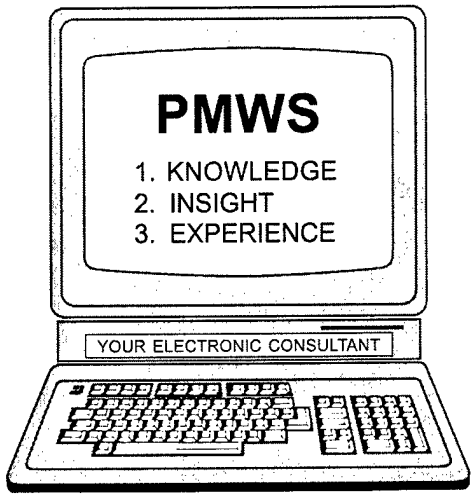
"CRITICAL PATH TEMPLATES FOR TRANSITION FROM DEVELOPMENT TO PRODUCTION"



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 personnel 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 throughout 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 ten 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; and train regional personnel in the use of BMP resources such as the BMPnet.

The ten BMP satellite centers include:

California

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BMP Satellite Center Manager
Naval Warfare Assessment Division
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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:
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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:
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Center of Excellence for Composites Manufacturing Technology
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West Columbia, SC 29170
(803) 822-3708
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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:
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Electronics Manufacturing Productivity Facility
One International Plaza
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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
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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
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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:
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Energetics Manufacturing Technology Center
Indian Head Division
Naval Surface Warfare Center
101 Strauss Avenue
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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 Labortory, the primary objective of iMAST is to address challenges relative to Navy and Marine Corps weapon system platforms in the areas of mechnical drive transmission techologies, materials science technologies, high energy processing technologies, and repair technology.

Point of Contact:
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National Network for Electro-Optics Manufacturing Technology

The National Netowork 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:
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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:
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University of New Orleans
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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:
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Appendix G

Completed Surveys

As of this publication, 111 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	*Resurvey of Litton Guidance & Control Systems Division* - 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
	Resurvey of Texas Instruments Defense Systems & Electronics Group - 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
	(Resurvey of Control Data Corporation Government Systems Division)
	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
	(Resurvey of Rockwell International Corporation Collins Defense Communications)
	Lockheed Martin Electronics & Missiles - Orlando, FL
	McDonnell Douglas Aerospace (St. Louis) - St. Louis, MO
	(Resurvey of McDonnell-Douglas Corporation McDonnell Aircraft Company)
	Dayton Parts, Inc. - Harrisburg, PA
	Wainwright Industries - St. Peters, MO
	Lockheed Martin Tactical Aircraft Systems - Fort Worth, TX
	(Resurvey of General Dynamics Fort Worth Division)
	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
	Naval Air Warfare Center, Lakehurst - Lakehurst, NJ
	Sierra Army Depot - Herlong, CA
	ITT Industries Aerospace/Communications Division - Fort Wayne, IN
	Raytheon Missile Systems Company - Tucson, AZ
	Naval Aviation Depot North Island - San Diego, CA
	U.S.S. Carl Vinson (CVN-70) - Commander Naval Air Force, U.S. Pacific Fleet