



UNITED STATES AIR FORCE

**2003 SECRETARY OF
DEFENSE
ENVIRONMENTAL
EXCELLENCE
IN
WEAPON SYSTEM
ACQUISITION TEAM
AWARD**

AERONAUTICAL SYSTEMS CENTER
POLLUTION PREVENTION TEAM

WRIGHT-PATTERSON AIR FORCE BASE, OHIO



INTRODUCTION

The Aeronautical Systems Center (ASC) is headquartered at Wright-Patterson Air Force Base (WPAFB), Ohio. The largest center within Air Force Materiel Command, ASC has a workforce of 9,000 people and an annual budget of nearly \$13 billion. The center's acquisition community manages several missions supporting the development of aircraft, missiles and related equipment programs for the Air Force (AF) and many joint development efforts involving the Army, Navy and Marines.



ASC has over 100 programs including:

- the F/A-22 Raptor, the AF's air-dominance stealthy fighter of the future;
- the F-35 joint strike fighter in cooperation with the Navy and Marines;

- the B-1B Lancer;
- the B-2 Spirit bombers; and
- continued development and acquisition for the F-16 Fighting Falcon, F-15 Eagle, F-117A Stealth Fighter and C-17 Airlifter.

In addition, ASC is the development and acquisition center of reconnaissance vehicles, including the Global Hawk and Predator unmanned vehicles that will give United States battlefield commanders unprecedented "eyes in the sky." These vehicles can transmit, in real time, via several types of sensors, the most accurate intelligence data possible. ASC also has an Aeronautical Enterprise Program Office that deals with issues involving aging platforms such as the B-52 and KC-135 aircraft.

All of ASC's diverse activities support the overall mission of rapidly developing, acquiring, modernizing and sustaining the world's best aerospace systems. ASC accomplishes this complicated mission by emphasizing speed and innovation, rapidly transitioning technology into systems and business processes, developing and retaining a high performance technical work force and forming strong partnerships with weapon system operators and the community.

ASC's complex industrial base and operations include Government Owned Contractor Operated plants valued at over \$3 billion, Contractor Owned and Operated plants, System Program Offices (SPOs) as well as depot maintenance and repair activities. ASC is also a vital component of joint cutting edge technology and research opportunities in support of national defense, in conjunction with the Air Force Research Labs, academia and industry.

BACKGROUND

The ASC Pollution Prevention (P2) Branch, located within the Acquisition Environmental, Safety and Occupational Health (ESOH) Division, Engineering Directorate, excelled in developing alternatives that improved the environment by decreasing or eliminating pollution while enhancing production operations and improving weapons systems' performance. The ASC P2's unrelenting focus is to support the overall ASC mission by reducing the ESOH burden to the weapons system acquisition process and ensure compliance with all ESOH laws, rules and regulations throughout the weapon system life cycle.

The P2 team's myriad of successes are attributed to innovative, cost effective and environmentally friendly initiatives. The team addresses the cost of pollution as part of overall life cycle cost and makes program decisions to minimize expenditures. The team resourcefully created numerous partnerships with various Air Force, joint service organizations, industry, academia and research organizations to develop and transition new environmentally friendly technology for use in weapon systems. Each technology is intended to reduce pollution, improve system performance, ensure worker safety, reduce costs and enhance production efforts. The P2 team employs "outside the box" thinking and team members are integrated throughout the acquisition process to ensure pollution prevention is addressed at every stage of the weapon system.

The ASC P2 team consists of 23 dedicated full time government employees who are supported by more than 20 contractors. The branch is organized with 12 of the 23 government personnel, known as collocates, assigned to the SPOs, ensuring the home office is involved in acquisition. The remaining 11 employees are in the home office and provide outstanding support to the

collocates and industry partners. This unique structure ensures P2 is integrated in the weapon systems life cycles of over 100 programs and production operations.

The SPO collocates ensure every program is covered by a newly developed Programmatic Environmental Safety and Health Evaluation (PESHE) review that incorporates a six stage operational risk management process.

The collocates established environmental working groups consisting of designers, production leads and project managers to ensure that Air Force development efforts have an environmental review. This rare management configuration results in a comprehensive ESOH review of Operational Requirements Documents, Acquisition Strategy Panels, System Acquisition Management Plans, and designs and procurement plans.

In addition to the deployment of collocates into the SPOs, the home office proactively established Integrated Production Teams (IPTs) to work with Government Owned, Contractor Operated partners in reducing pollution and ensuring compliance at Boeing, General Electric, Lockheed-Martin, Raytheon, Pratt-Whitney and Rolls-Royce.

The team diligently partnered with contractors to identify pollution prevention opportunity assessments and justify P2 opportunities. Over 20 contract personnel representing Anteon, Battelle, SAIC and others, were critical to developing requirements, identifying opportunities for transitioning innovative technologies into ASC P2 results and creating solutions data bases that share P2 success stories. The resulting products are cross-fed to assist others in leveraging information to reduce pollution.

This dynamic team approach involves all players from design through production, interfaces contractor expertise and results in

maximum use of limited P2 funds. Most importantly, it guaranteed incorporation of environmental considerations in all weapons systems throughout the Air Force as well as initiatives that apply throughout the Department of Defense (DoD).

Expert management of more than \$50 million in P2 research and qualification efforts over the past two years will result in at least a 6-to-1 payback. An incredible \$300 million in savings was achieved through reduced compliance costs, more efficient and user-friendly production lines, lower disposal costs and enhanced weapon systems.

The team developed outstanding risk management tools that are considered the benchmark throughout the AF and DoD. Over a dozen comprehensive PESHEs were created for major programs, including the C-5 Avionics Modernization Program, F-16 foreign buy program and JSF development. More than 30 Hazardous Material Management Plans were managed for ASC weapon systems. The P2 team managed the environmental sections of acquisition plans for over 100 programs with approximately 1,000 support documents reviewed without any infractions.



PROGRAM SUMMARY

The WPAFB, ASC P2 Team achieved their primary objective of protecting and preserving the environment while improving weapons systems' performance and operations through conscientious and cost-effective management, resourcefulness, innovation and dedication. The P2 processes

and business practices ensure a comprehensive P2 focus across all weapon systems acquisition processes. The P2 team approach:

- provides ESOH collocate experts to the SPOs providing expertise and focus in the acquisition process from cradle-to-grave;
- establishes and develops Integrated Production Teams to work with partners in industry, thereby alleviating environmental concerns at the production line;
- leverages contractor expertise;
- transitions existing opportunities into P2 results through the Technology Transition Program;
- permeates mission areas with a strong environmental and P2 ethic through education, training and awareness; and
- institutionalizes P2 and ESOH using the comprehensive systems engineering process and making ESOH an integral part of weapon system trade-offs.

A multitude of positive impacts and products are delivered including:

- management of the acquisition environmental program through aggressive P2 efforts;
- ESOH expertise in the System Program Offices/Integrated Production Teams;
- identification of P2 early in the life cycle of weapon systems;
- ESOH guidance to programs and contractors;
- leadership positions on environmental working groups for the weapon systems;
- identification of plan, program and budget ESOH requirements;
- ESOH education and training;

- project risk assessments and ESOH evaluations to ensure proper balance between funding and risk;
- ESOH input to PESHE, Hazardous Material Management Plan and acquisition management documents;
- National Environmental Policy Act review and documentation of all relevant weapon system actions; and
- outreach and cross feed within and outside the government to optimize benefits to the environment.

This integrated focus was the foundation for the WPAFB, ASC P2 Team receiving the Air Force General Thomas D. White, FY 2002-2003, Pollution Prevention Acquisition Team Award. The team was recognized for outstanding efforts that permeated throughout every major (ASC) weapon systems acquisition program, resulting in a multitude of environmental and production improvements.

ACCOMPLISHMENTS

Incorporating ESOH Analysis into the Acquisition Decision Making Process

Cradle-to-grave ESOH consideration throughout the acquisition process is a primary focus of the ASC P2 team. A pervasive management structure is integral in all acquisition offices. This includes the management of Environmental Working Groups in all the major SPOs and the 15 working groups organized and administered by the collocates. These 15 groups encompassed more than 100 acquisition and development programs.

The team continually seeks new methods to enrich the process. A risk-based PESHE tool that communicates ESOH impacts and risks into common weapon system program management language, information databases and engineering analysis was developed.

This tool uses a six-stage operational risk management process, ensuring all ESOH factors are considered and mitigated.

SIX-STAGE OPERATIONAL RISK

Management Process

1. Identify the risk
2. Assess the risk
3. Analyze risk control measures
4. Make control decisions
5. Implement risk controls
6. Review decisions for improvement

The team dramatically improved the decision making process by establishing an interdisciplinary team that developed a data automated PESHE template. SAF/AQRE lauded the template as the “model to follow” and is considering cross feeding it throughout the DOD. This template is an ideal management tool that assists users in making more effective programmatic decisions by flagging risk to avoid loss of life, injury, property damage and program failures. It replaces the existing PESHE’s, standardizing reviews while allowing the SPO’s flexibility to tailor reviews to specific needs. Serving as the strategic plan for incorporating ESOH requirements into standard weapons systems acquisition and systems engineering processes, it provides an in-depth evaluation end expedites ESOH reviews by more than 30%, saving countless man-hours. The new PESHE format assists with program planning, including operational safety, suitability and effectiveness.

The ASC P2 team led the way by developing the “first of its kind” acquisition P2 technology transition roadmap. This premier roadmap provides consistent structured ESOH requirements analysis that assists program managers in identifying the strength of their programs and making necessary improvements. By standardizing impact analysis, implementing the new PESHE tool and prioritizing requirements across ASC systems, the roadmap provides a “one stop

shop” for analysis of potential technologies, materials or process substitutions. Efficiency will be improved by 20-30% and 7,000-10,000 man-hours will be saved annually.

The team also created an Emerging Technologies Integrated Production Team that studied and identified double the number of P2 opportunities that were identified in previous years for acquisition program managers. The team identified 20 new opportunities, totaling more than \$10 million in requirements that will save the AF more than \$40 million over the next five years.

Always seeking ways to improve processes, the ASC P2 team conducted an in-depth ESOH requirements analysis at Government Owned, Contractor Operated production plants and SPOs. More than 300 needs were loaded into the Environmental Development Planning Database, enabling proper planning to avert hazards and develop corrective action plans.

ESOH INTEGRATION

ESOH integration is interwoven throughout the WPAFB ASC acquisition process.

A massive effort to baseline hazardous materials weapons systems usage for every SPO resulted in a significant tool to manage and track P2 opportunities. This comprehensive database is used to identify areas for substitution or elimination of hazardous materials and incorporates hazardous materials management programs. These programs now have a usable database of all hazardous materials currently used during manufacture and sustainment of the weapon system.

An Internet-based P2 solutions database that contains more than 600 weapon systems P2 technology transition projects and P2 opportunities in the field is an invaluable tool for managers.

Another preliminary database provides critical information about the characteristics, quantities and management requirements of systems containing hazardous materials associated with aircraft deactivation, demilitarization and disposal. Team members are currently working with the Aerospace Maintenance and Regeneration Center to determine the best way to dispose of hazardous materials consistent with management hierarchy and end of life costs of disposition.

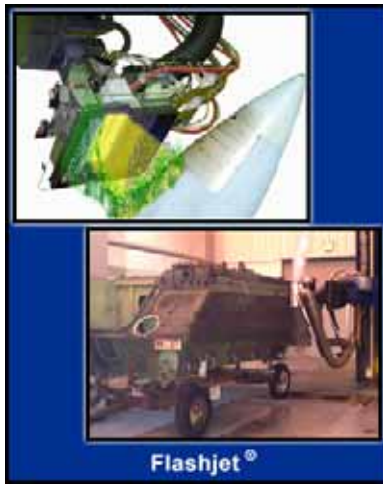
The team resourcefully applied a manufacturing recycling process for jet engine turbine blades to depot repair processes that saved more than \$36 million in life cycle costs for the JSF program. Recycled material from F-100 fan blades is used in F119/120 fan blades that also conserve critical strategic materials. This new process is being studied for application in other programs.



The P2 team collaborated with Air Force Research Lab, aircraft paint vendors and the AF Corrosion Program Office to improve and/or replace previous C-17 aircraft topcoat. This productive teamwork led to a new topcoat, the Advanced Performance Coating, being used in C-17's. The AF realized a \$115 million life cycle cost savings due to improved durability.

Creating new coatings is only half the battle. Safe, environmentally friendly and cost-

effective removal is equally important. The WPAFB, ASC P2 team developed a new coatings removal technology known as Flashjet. This system eliminates damage to aircraft and missile composites caused by chemical etching during the removal process. Approximately 500,000 gallons of methylene chloride and 50,000 gallons of methyl ethyl ketone per year were eliminated resulting in a \$3.5 million annual savings.



FLASHJET COATINGS REMOVAL

- Eliminated damage to composites
- Used on F-15, C-141, C-130 and B-1 aircraft
- Eliminated 500,000 gallons of methylene chloride
- Eliminated 50,000 gallons of MEK per year
- \$3.5 million annual savings

A monumental effort eliminated the need for an Industrial Wastewater Treatment plant and associated environmental compliance requirements on-site. The P2 team strategically implemented use of a coolant recycler at AF Government Owned, Contractor Operated Plant 44, missile production facility, metal fabrication and tool machine shops. This effort eliminated almost 400,000 gallons of waste machine coolant oil contaminated rinse water per year.

Seeking new opportunities to do things smarter, faster and cheaper, the team created

an oxygen line cleaner and wipe solvent to clean aircraft pilot breathing systems. This new process reduced cleaning solution flow time from one month to four hours for the B-1. This quicker, less invasive process eliminates the use of ozone depleting chemicals (CFC-113) and saves \$1million per B-1 aircraft. This technology is currently being transitioned to B-2, F-15, F-16 and C-5 aircraft.

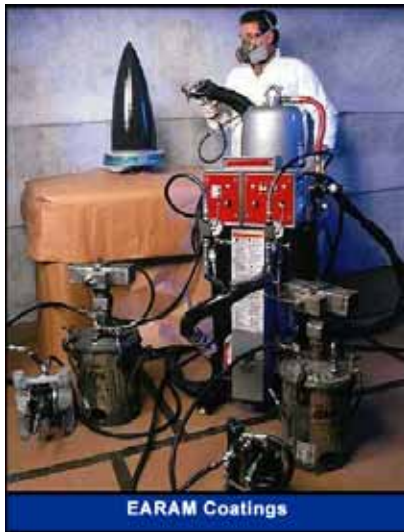
A matte topcoat cleaner for multiple weapon systems including the C-17, C-130 and F-15 was introduced. This cleaner increases time between repainting resulting in a significant reduction in hazardous material usage and waste.

Seeking to reduce the Environmental Protection Agencies (EPA) 17 chemicals, the team reduced these constituents by 43% per C-17 aircraft. In all, the use of EPA 17 chemicals per aircraft to date amounts to 1,092 pounds compared to the 1995 baseline of 18,582 pounds per aircraft.

Ozone depleting substances were also reduced 98% or 628,000 pounds annually. The team eliminated 4,189 call-outs for hazardous materials in 410 technical orders.

MATERIAL SUBSTITUTION

Supporting AF missions while protecting the environment by instituting innovative technologies resulted in the ASC P2 team leading the transition of new Environmentally Advantaged Radar Absorbing Material (EARAM) coatings. This superior initiative won Environmental Security Technology Certification Program funding, a corporate DOD program that promotes innovative, cost-effective environmental technologies through demonstration and validation at DOD sites.



This lower cost, easy application and low observable coating guarantees continued unobservable footprint for aircraft. EARAM saves the B-2 program \$3.9 million alone for each depot maintenance cycle and reduces air pollution from volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) by 70% from 750 mg/l down to 144 mg/l.

EARAM COATINGS AT A GLANCE

- Application time and labor reduced 75%
- VOC emissions reduced from 750 mg/l to 144 mg/l
- Saves 25,000 pounds of VOC emissions
- Saves 8,100 pounds of cleanup solvents/waste

Approximately 25,000 pounds of VOC emissions and 8,100 pounds of cleanup solvent and waste are avoided. There is an 80% reduction in B-2 maintainer application costs and the process is being considered for use on other platforms such as F-22 fighter and the Joint Strike Fighter.

High Velocity Oxygen Fuel thermal spray coatings, a dry process that produces a metallic coating equal to wet hard chrome plating, was also implemented. This technique is now qualified for engine repairs and is being evaluated for aircraft landing gear and hydraulic actuators.

The ASC P2 team spearheaded the effort to develop, demonstrate, validate and qualify sputter coat aluminum material for internal surface corrosion protection of landing gear using ion vapor technology. This system allows aluminum substitution for cadmium/chromium on landing gear, eliminating 150,000 gallons of cadmium/chromium and elimination of \$400,000 in disposal costs each year.

A thin film appliqué demonstration program including supersonic flight-tests on two F-16 aircraft to obtain critical flight data, led to the elimination of sprayed-on chromium based paint systems. Coordinating with the Joint Strike Fighter office for integration, the appliqué tape method is now the topcoat of choice for aircraft for all three services involved in its development and eliminates a tremendous waste burden for the Department of Defense.

The team orchestrated another AF-wide program using hydraulic fluid purification systems. This application potentially reduces hazardous waste by 1.5 million gallons per year. By purifying and reusing the fluid, hazardous waste is reduced by 5,300 tons per year and purchase of hazardous material is reduced by 90%. Purification cost is 15% of the cost to purchase equal quantities of the new material with an estimated savings to the AF of more than \$15 million annually. In addition, air deployable units reduce the need to airlift 55 gallon barrels to improve mobility and war readiness.



The ASC P2 team also initiated the substitution of supercritical carbon dioxide for VOC solvents in the “wet” painting processes for missile systems thereby eliminating 100%, or 4,400 pounds per year, of HAP/VOC solvents such as methyl ethyl ketone and toluene from air emissions.



Looking at the “big picture,” team members managed comprehensive runway deicing materials compatibility tests on a multitude of old and new deicers to determine any impact to aircraft coatings including low observables, infrared windows, landing gear, electrical components and connectors, brakes, lubricants, elastomers, sealants, composites and specific metals. The project was so successful that the Society of Automotive Engineers asked that ASC P2 members chair the Ground Deicing Fluids Subcommittee and also contribute papers and briefings at conferences and training symposiums.

<p>AIRCRAFT/RUNWAY DEICING</p> <ul style="list-style-type: none"> ▪ Integrates IR heat, forced air, IR detection ▪ Eliminates glycol based deicers in military and commercial sectors
--

A tremendous effort to identify hazardous material alternatives in AF technical orders resulted in replacements in 30,000 applications specified in nearly 1,700 technical orders. The rapid identification of

these alternatives was crucial in their inclusion in technical orders at no cost to the AF.

EDUCATION AND OUTREACH

Understanding that education is the key to success, the WPAFB ASC P2 is involved in worldwide outreach efforts through conferences, seminars and workshops presenting technical papers and briefings and education and training. The team shared their solutions and lessons learned through a display booth at 11 major environmental and engineering conferences where they distributed more than 10,000 items to environmental experts and manufacturers.

CONFERENCES
Defense Manufacturing Conference
DOD P2 and Hazardous Waste Management Conference
American Industrial Hygienists Conference and Exhibition
Environmental Engineering Worldwide Conference
Workshop on Solvent Substitution & Elimination of Toxic Substances and Emissions
National Space Systems Engineering and Risk Management Conference
American Society of Safety Engineers Conference
National Environmental and Energy Symposium
Air and Waste Management Association (AWMA) Conference
National Aeronautical Systems and Technology Conference
Society of Automotive Engineers Aerospace Congress

In addition to conference displays, ASC P2 team members presented technical expert briefings and papers.

Briefings and papers on P2 reduction and opportunities were provided for the:

- International Conference for Environmental Systems;

- Environment Security Technology Certification Program;
- Joint Services P2 Hazardous Waste Management Conference;
- American Electroplaters and Surface Finishers Society;
- DoD Hard Chrome Alternatives Team,
- DoD Joint Technology Exchange Group;
- Workshop on Solvent Substitution;
- Elimination of Toxic Substances and Emissions; and
- the DoD P2 Worldwide Conference.

The team developed and updated numerous courses including materials for:

- Air Force Environmental Engineers Basic Course;
- Environmental Safety and Health Course;
- training for new ASC environmental personnel; and
- a Back to the Basics Environmental Training course for new acquisition managers.

PRESENTATION/PAPER	EVENT
Risk Based Hazardous Material Management Program	Annual Conference of the Air and Waste Management Association
Chaired plenary session	AWMA conference on DoD environmental pollution control issues
Objective Evaluation of Fluid, Blower and Infrared Ground Deicing Technologies	American Institute of Aeronautics and Astronautics
Air Force Perspective on Deicing	FAA/SAE Aircraft Ground Deicing Conference
Environmentally Friendly, Non-Glycol Type I Aircraft Deicing Fluid	FAA/SAE Aircraft Ground Deicing Conference
Environmental Regulations, Standards and Specifications and the Military	Standards Engineering Society World Standards Day
Acquisition Pollution Prevention in the AF	AWMA
Pollution Prevention Technology used at AF Plants	AWMA



SUMMARY

The WPAFB ASC P2 Team is organized, managed, and focused on ensuring environmental awareness throughout the acquisition process. The team continually reaches out to manufacturers, engineers, scientists and environmental experts, providing P2 solutions that make a real difference. The ASC P2 Branch excelled and continues to excel in protecting the nation, DoD and ASC operators from environmental hazards.