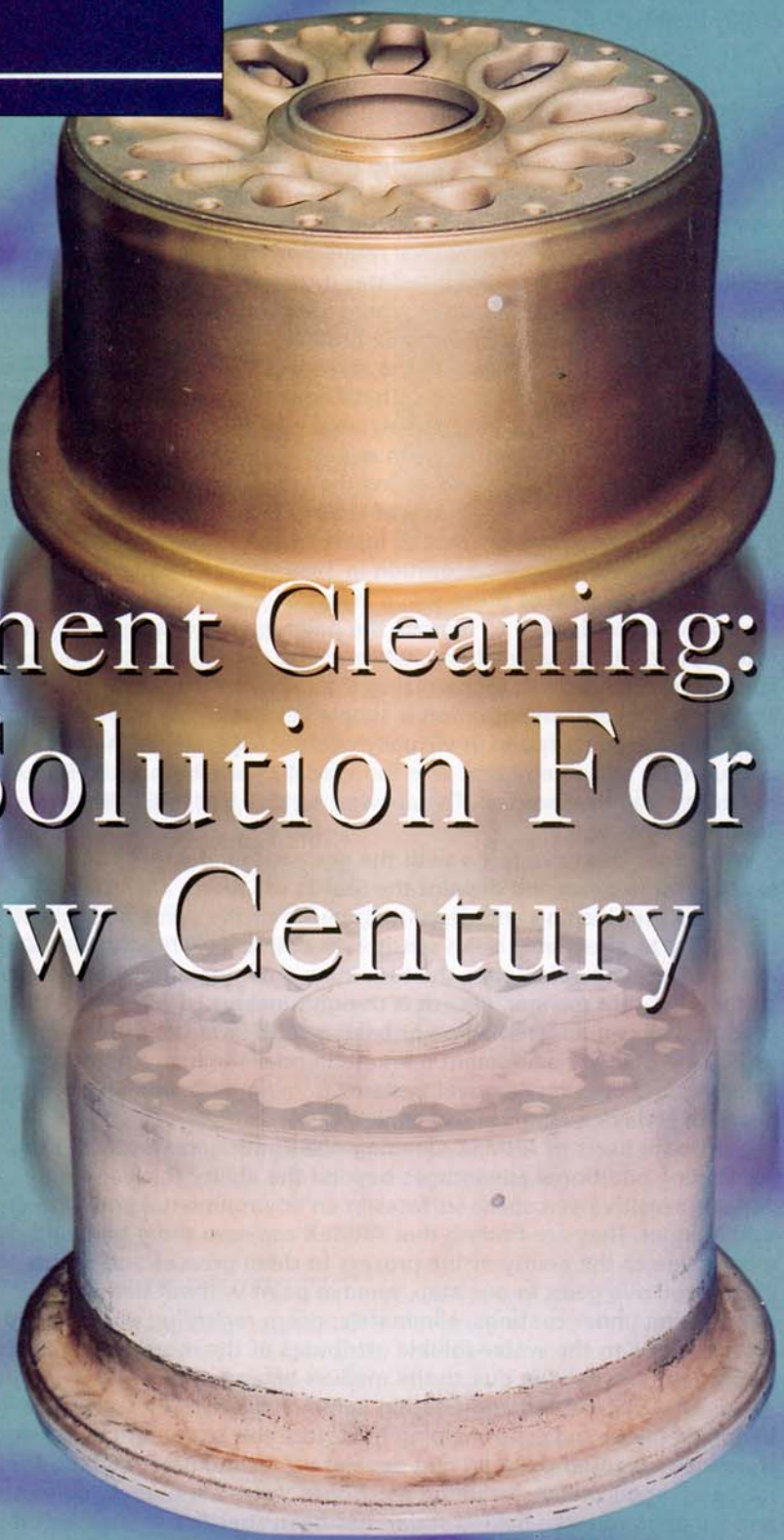
ARMEX™
Cleaning and Coating Removal Systems



Component Cleaning: The Solution For A New Century

ARM & HAMMER®
THE STANDARD OF PURITY

A Supplement To:

Aviation Maintenance

by Clif Stroud

Meeting The Needs Of The Marketplace

Clif Stroud

The fastest changing part of the aviation maintenance world right now is the regulatory environment. In an already heavily regulated industry, aviation maintenance managers at airlines, repair stations, corporate flight departments and in the military are bombarded daily with new costly and cumbersome regulations from a host of government agencies—the FAA, EPA and OSHA. Caustic chemicals and solvents used for cleaning parts and stripping paint off of aircraft—once a staple in the aviation maintenance process—are fast becoming history due to these stringent regulations. A variety of new media has been tested as a substitute for these chemicals, but none has proved completely satisfactory.

Enter ARMEX. ARMEX, whose parent company manufactures ARM & HAMMER, has developed an effective, non-abrasive, environmentally safe cleaning process that is based on a simple household product—baking soda. The extensive testing that has been conducted—both by ARMEX and by independent organizations—has proven that the ARMEX® Soluble Blast Media process is a viable alternative to chemicals such as methylene chloride.

ARMEX has seized on a perfect opportunity. It researched the marketplace, identified a need, developed a product to fulfill that need, and now has brought it to market. ARMEX Soluble Blast Media should be of interest to every maintenance manager and technician involved in the cleaning, degreasing and stripping of aircraft parts.

Clifton Stroud
Editor
Aviation Maintenance

Table of Contents

Cover: Every 20 cycles 20-inch diameter wheels of military aircraft have to be cleaned. Solvents and plastic media blast were used to clean the wheels, but the plastic media also removed the anodized coating. Using the ARMEX media, the wheels are now clean in less than 30 minutes. The solvent step is eliminated and the anodized coating is left intact.

Letter From The General Manager

by Ken Colbert

Ken Colbert

With every passing year the pressure mounts on organizations to meet ever tightening environmental and worker safety regulations. While meeting these regulations is, in and of itself, a significant task it becomes even more daunting when having to meet them without adversely impacting operational efficiency or cost structure. It seems with every new regulation the solutions are increasingly intricate, which usually translates into more time, expense and operational complexity. However, there are times when a simple solution does solve a seemingly complex problem.

The simple solution to many of the aerospace industry's complex cleaning problems may be baking soda. That's right—baking soda. This powerful yet simple product was most likely used by your grandparents to clean porcelain sinks and brush their teeth as well as to clean the world's most famous statue that was erected during the era of your grandparents.

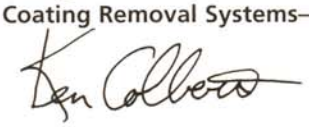
The year is 1886 and the Statue of Liberty is dedicated in New York Harbor. Over the next 97 years the inside of the statue is painted seven times. For the centennial celebration in 1986 the restoration effort includes the removal of these seven layers of paint. The dilemma facing the conservators is how to remove the paint without harming the delicate copper skin of Lady Liberty, while at the same time not creating any hazardous waste or jeopardizing the safety of the workers. The answer to this difficult situation is simple yet extremely effective, based on a product found in virtually every refrigerator in America and produced by a company that was founded 40 years before the Statue of Liberty was first erected. The answer: ARM & HAMMER® Baking Soda.

What does this have to do with the aerospace industry? The attributes required to clean and depaint the Statue of Liberty are strikingly similar to the cleaning and depainting needs of the aerospace industry: the ability to effectively clean sensitive substrates with no damage and at the same time accomplish the task in an environmentally responsible and worker-safe manner. Church & Dwight, makers of ARM & HAMMER products, has engineered a line of baking soda-based abrasives and associated delivery equipment marketed under the name ARMEX® Cleaning and Coating Removal Systems to meet the complex cleaning needs of today's aerospace companies.

Aerospace users of ARMEX Cleaning and Coating Removal Systems are finding additional advantages beyond the ability to clean and depaint sensitive aerospace surfaces in an environmental and worker-safe manner. They are finding that ARMEX can save them time and money due to the ability of the process to clean greases and oils as well as remove paint in one step, remove paint without damaging anodization under coatings, eliminate concern regarding passageway blockage due to the water-soluble attributes of the media, and reduce cradle-to-grave liability due to the media's benign nature.

The ARMEX Cleaning and Coating Removal Systems Business was begun from our success in helping to restore the Statue of Liberty and is now an accepted cleaning and depainting technology in a broad range of applications, including aerospace. A well known, widely used and trusted product—baking soda—has been specifically engineered for use in meeting the increasingly demanding requirements for aerospace cleaning and depainting.

ARMEX Cleaning and Coating Removal Systems—a simple solution for complex problems.



Component Cleaning: The Solution For A New Century

Kelly AFB cleans jet deswirlers with a sodium bicarbonate-based cleaning system. Before switching to this system, Kelly had a 95% scrap rate because technicians could not effectively clean the deswirlers.

Kelly Air Force Base, Air Logistics Command in San Antonio, TX, had an expensive problem to solve. The scrap rate for jet engine deswirlers had escalated to 95%. The current technology's inability to clean the engine parts properly for inspection prompted the undesirable use of caustic chemicals, which also failed to do an adequate job. The deswirlers, at a cost of about $10,000 each, were damaged beyond use while technicians tried unsuccessfully to clean them. Ineffective results, a very expensive scrap pile, and a hazardous waste material presented such a dilemma as to search for alternatives.

Thanks to a benign sodium bicarbonate-based cleaning and coating removal system, Kelly now removes baked-on carbon in a one-step process that takes about 15 minutes per part and reduces the scrap rate to just 5%. ARMEX® Blast Media, the water-soluble abrasive used in the process, is saving the Air Force thousands of dollars by increasing productivity and reducing costs for both parts procurement and waste disposal. The ARMEX abrasive is based on ARM & HAMMER® Baking Soda—yes, the same white baking soda that is in your refrigerator removing odors—and is an ingredient in your chocolate chip cookies.

Kaman Aerospace, a helicopter and aerospace component manufacturer in Bloomfield, CT, was looking for a process or product to remove paint from delicate fiberglass helicopter blades without damaging them during the rework process. Originally, the manufacturer was using a grinder and MEK to remove paint. Not only did this process include the use and disposal of a hazardous material, it also failed to create a clean enough surface to provide good adhesion for the subsequent layer of paint. Besides the sodium-bicarbonate-based product, Kaman evaluated several other products—including wheat starch and plastic media blasting. Although the plastic media took about the same amount of time to clean the components, ARMEX proved to be more cost effective and easier to use. "ARMEX creates a much better surface to bond on," said Ron Mador, senior manufacturing engineer for Kaman.

Because of its benign nature and water solubility, the waste generated was also minimized. Following filtration, only the insoluble coating residues needed to be disposed. "I like it and I've used several types of media. It can do so many things so well—degreasing, cleaning and paint removal," states Mador.

The versatile ARMEX System also came to the aid of Kaman's aircraft component depainting problems. The manufacturer primarily uses ARMEX to degrease small parts and gearboxes, and to strip paint off helicopter blades. According to Mador, it is gentler yet more efficient. "We've had really good consistency with it."

Other aerospace manufacturers and contractors are substantially reducing the cost of non-destructive testing procedures. Previously, solvent strippers such as MEK, abrasive scrubbing agents and elbow grease were used to clean aluminum fixturing and other sensitive substrates. Cleaning was required to expose the surface so technicians could inspect for structural damage. The old methods, however, would often cover cracks making them undetectable during nondestructive testing, thereby defeating the purpose of degreasing and depainting.

ARMEX not only does an excellent job of revealing cracks but has greatly reduced the cleaning time, in some cases from eight hours to 10 minutes. As a result, the advantage of using ARMEX extends well beyond improving testing process efficacy. It represents a big savings in labor costs, in addition to the financial and environmental benefits of using a baking soda-based product instead of hazardous chemicals.

Aerospace component cleaning can be done both wet and dry, depending on the application. Most manufacturers just removing paint use ARMEX dry, but when the aluminum is covered in grease, too, wet application is preferred.

ARMEX® Cleaning and Coating Removal Systems, a division of Church & Dwight Co., Inc., manufacturer of ARM & HAMMER products and provider of sodium bicarbonate and related technologies for more than 150 years, produces the easy one-step ARMEX Soluble Blast Media and ACCUSTRIP SYSTEM® Delivery Device.

Technical considerations

How does ARMEX work? Sodium bicarbonate (baking soda) is a soft white crystalline powder that is produced by bubbling carbon dioxide through sodium carbonate solutions. It is mildly alkaline and acts as a buffering agent in acids and bases.

Although it is a sodium-based product, third-party tests have proven that under the conditions

that ARMEX is used, even in aerospace operating conditions, it does not deteriorate into sodium carbonate, a corrosive to aluminum. Under very severe conditions of time and temperature, sodium bicarbonate can slowly decompose to non-corrosive sodium sesquicarbonate, which having a strong equilibrium, prevents it from further deteriorating to sodium carbonate.

In addition, ARMEX is an inorganic salt, and does not corrode metals as would sodium chloride—the compounds are very different. Despite some misconceptions in the industry, ARMEX does not cause corrosion—it actually inhibits oxidation on metal surfaces. As Chart 1 indicates, ARMEX is less corrosive to aircraft aluminum than tap water.

The cleaning agent is a nontoxic*, odorless blast media that is available in 16 formulations. Variations in particulate size, flow agents and other performance enhancement ingredients make up the differences. The choice of which media and what pressure to use depends on the sensitivity of the substrate and the surface preparation desired. "The size and complexity of the part to be cleaned will dictate these parameters as well as the choice of equipment and containment," said Mike Doty, technical service manager for ARMEX.

ARMEX is poured into the ACCUSTRIP SYSTEM pressure pot that can be used for open blasting or introduced to a cabinet for contained blasting. The operator simply adjusts the differential pressure, tank pressure and blast pressure—selects either the wet or dry method—and cleans away. "The technician can quickly judge which parameters to use based on the part," explained Doty. He suggests doing a test spot to evaluate whether to proceed wet or dry and at which pressure. The appropriate range to be established is somewhere between 40 to 100 psi.

When ARMEX strikes the component surface, the crystals quickly and gently remove virtually any coating from most surfaces. Generally, wet blasting is best used when grease and/or surface corrosion is present, and dry blasting is usually best for paint removal.

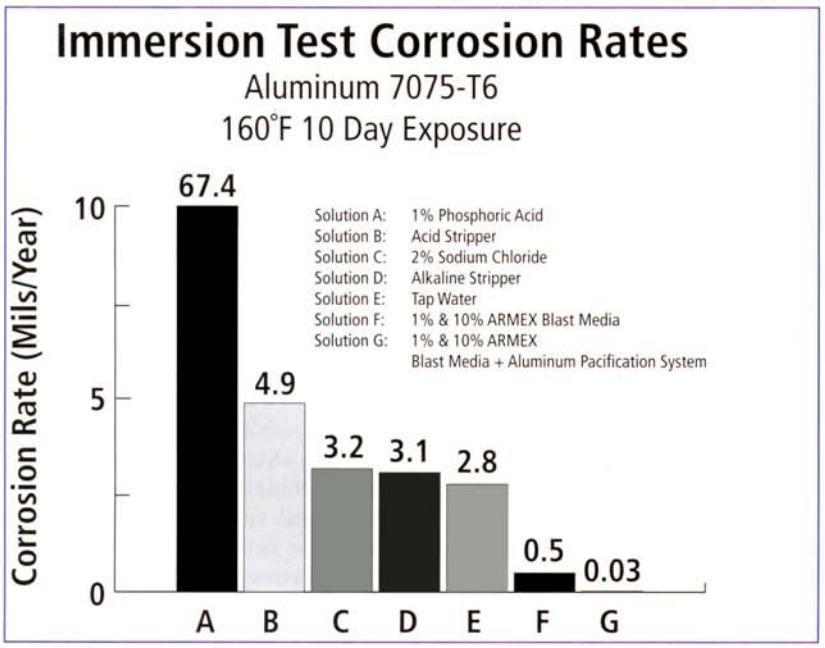
Aviation components, like cylinders, typically have passageways that can trap various media, causing restriction or blockage to critical areas. Some non-soluble media can get trapped in cracks or crevices—dislodging later when vibrated—possibly causing extensive damage and potentially life-threatening consequences, particularly if the dislodgement prompts an equipment failure. Fortunately, this cannot happen with ARMEX. Technicians can thoroughly rinse the components with water after the blasting is finished, flushing away the water soluable media.

■ Stripping Air Force Aircraft Wheels

One of the defense contractors working with the US Air Force presented a challenging cleaning problem. Every 20 cycles the 20-inch diameter wheels of the aircraft need to be cleaned. The current process was not satisfactory for a number of reasons and needed to be improved. Originally, solvents were used to degrease the wheels and remove tire marks. Following this step, a plastic media blast was used to remove the paint. However, the plastic blast was too aggressive because it removed the paint and the anodized coating. Subsequently, the anodized coating had to be reapplied, which added an unnecessary and very time-consuming step to the process.

On top of that, the spent plastic beads had to be cleaned and recycled, and the resulting hazardous waste disposed of. Reusing the media also presented the possible risk of contaminating a cleaned surface with soiled residues still present on the recycled media.

According to Ken Colbert, ARMEX general manager, the contractor sent the wheels to ARMEX for a test cleaning. With the ARMEX media, both paint and grime were blasted off in less than 30 minutes, and the anodized coating was left intact. This coating, which is applied as a thin gold-colored plate, was completely undamaged, which eliminated the unnecessary step of reapplication.



* Per EPA and OSHA regulations

In addition, when ARMEX strikes the surface is doesn't create thermal sparks; there is not a flashpoint at any temperature that could cause a reaction.* Since there are no solvents and no VOCs—there are no fumes or vapors emitted by the ARMEX process. If you were cleaning fuel and oil off a component with a traditional degreaser, you would be working with two fuels and different flashpoints. Since baking soda does not have a low-vapor pressure flashpoint, safety is enhanced.

Other medias that are organic, like some plastic media and wheat starch, have the potential to explode when they get to a fine particulate. Every so often you read about a grain elevator exploding. There can be lot of fine organic dust in a silo, and at certain concentrations, organic dusts may become explosive.

The same goes for some plastic media and wheat starch abrasives. "When plastic media or wheat starch fractures, you are creating this fine dust. In the presence of a spark, you could have an explosion," noted Ken Colbert, ARMEX general manager. ARMEX is inorganic, and inorganic dusts do not explode. "Not that you read about a lot of explosions when people are blasting in the aerospace industry," stated Colbert, "but it is always an advantage when risks can be minimized."

"ARMEX provides the customer versatility—one type of media for many different projects," added Doty. The one-step process blasts away paint, grease, and dirt from the component—without stripping hard anodized coating from the metal—or damaging the substrate. Because it can do so many different things, "I would recommend it to anyone who can't store lots of different types of media," added Mador, of Kaman.

The ACCUSTRIP SYSTEMS or blasting machines are available in a number of different models varying primarily in pot size and volume capacity. Any of the systems designed to precisely meter the amount of media dispensed can be used alone or with a variety of containment or cabinet systems. There is a system process for basically any component cleaning and depainting application.

■ Arnold AFB Saves $35,000 In Maintenance

Arnold Air Force Base in Tennessee is saving time and money cleaning engine-test-facility compressor rotor and stator baskets using ARMEX, a baking-soda-based cleaner and degreaser. The previous process, which took about two weeks to complete, was very labor intensive and cost $4,500 or more in labor costs alone, has been replaced by the one step, one shift ARMEX Cleaning and Coating Removal System. Since the AFB typically cleans eight compressors per year, the annual cost savings from using the baking soda media and blasting device will be $35,000.

The Arnold maintenance crew used to dip the compressors in a hazardous chemical bath, manually scrub the pieces and then reinstall the compressor. Now the crew just connects the cleaning device to a cold water source and a standard portable air compressor. When ARMEX is blasted on the corroded and dirty equipment at 100 psi, it removes the corrosion, oil and grease buildup. Then a water rinse removes any residue and drains onto a heavy plastic sheet below the equipment.

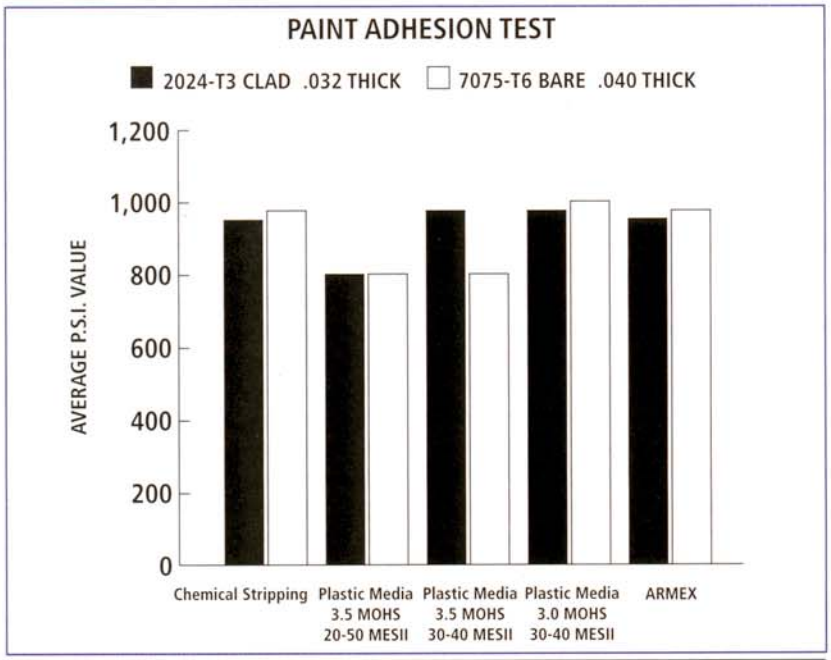
The residue, which contains oil and grease, dries through evaporation into a paste, and is acceptable for disposal in a sanitary landfill.

Adhesion

Paint adheres to surfaces better if the metal or composite is clean and residue-free. It is imperative that dirt, chemicals, corrosion and any leftover media are removed before painting. Similar to painting a wall of a house, the cleaner the surface, the better the paint will adhere.

A third-party test was performed to quantify how aircraft paint adhered to aluminum after the metal was prepared using chemical stripping, plastic media bead dry blasting and wet blasting with ARMEX. Two aluminum alloys were prepared, evaluated for surface roughness, and then painted with zinc chromate/polyurethane primer/topcoat. (See chart for results.)

Kaman Aerospace also performed its own paint adhesion test on panels. After putting the panels through extreme conditions followed by blasting, the panels were repainted to test for adhesion. "Adhesion is much better with sodium bicarbonate because it makes a better surface to bond on compared



*Thermal sparks apply only to Profile formulations of ARMEX Blast Media. Potential static charge buildup and discharge applies to all ARMEX Blast Media. Make sure equipment is bonded and grounded to prevent static spark discharges, especially when working in areas where flammable or combustible gases, vapors, mists or clouds of potentially explosive dusts are present.

to MEK. ARMEX is a very inexpensive way to prepare for paint," revealed Mador.

Choosing a Cleaner

When evaluating aviation component cleaning products—such as chemical stripping, plastic media, wheat starch, or sodium bicarbonate blasting—make sure to consider the process' full life-cycle cost. Besides the product's effectiveness and initial procurement cost, also evaluate expenditures associated with transportation, storage and treatment of hazardous waste, staff training needed to use the process, personal protection requirements, potential environmental liability, medical hazards, facility enhancements and maintenance, and support equipment.

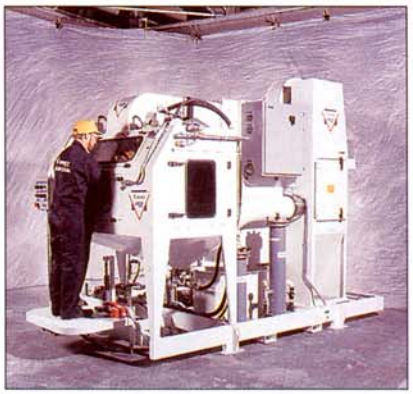
Heated chemistries not only generate fumes, but cost money to reach and maintain temperatures—particularly if you are putting the parts in a large vat.

Companies must look at total cost—accounting for each step from the beginning to the end of the process. The "cradle-to-grave" responsibility of dealing with hazardous materials is one that is much bigger than just initially treating the waste. Long-term liability exists for any party generating or handling such wastes. Minimizing both the volume and the toxicity of waste disposal is a enormous environmental and economic concern now and for future generations.

In addition, is the product flexible and versatile? Can it change with your altering requirements?

Battelle Research Institute conducted a study for the EPA at NASA's wheel shop that compared the costs associated with a chemical process versus ARMEX. The research organization examined procurement costs, labor expenses and disposal costs for both processes. The chemical process' total cost was $16,810 and ARMEX's was $2,640. (See chart for expense breakout.)

Also examine a product's Material Safety Data Sheet, in particular, the "Hazards Identification" section, which provides an emergency overview. It details any health or environmental concerns you should be aware of.



The most popular aviation industry blasting device is the ARMEX® Blast Cabinet System WS Series (wet series), which is mounted on skids so it can be easily moved. After adjusting the blast parameters and selecting either the wet or dry method, a technician adjusts the height of the operator lift so he/she is properly aligned with the blast cabinet window. Then the technician inserts his/her arms into thick rubber arm gloves, which are attached to the machine, grabs the media nozzle and depresses the foot pedal to begin operation. A window washer assures the viewing area is always clean, maintaining the system's superior visibility.

Ron Mador of Kaman said an example of a good MSDS is ARMEX's—"there's nothing to fear in the product." The emergency section of the MSDS states that ARMEX generates a "nuisance dust" and inherently there are "no other significant health or environmental effects associated with these products." (Check applicable regulations concerning proper waste disposal and worker safety measures.)

Safety Concerns

Environmental concerns often mirror worker safety and comfort concerns. Solvents such as 1,1,1, trichloroethane have an unpleasant odor that can be overwhelming. When technicians are working with dangerous chemicals such as this, dealing with the associated strong chemical smells makes handling the part more difficult, which reduces operational efficiency.

NASA Wheel Shop

	Armex	Chemical
Cost	$1,879	$1,600
Labor expenses	$261	$13,290
Disposal	$500	$1,920
Total cost	**$2,640**	**$16,810**

* Based on cleaning a batch of military wheels

With products like ARMEX, there is no odor as associated with solvents, and it can be used at room temperature, unlike many caustic chemicals. By eliminating the odor and/or heat factors, a safer, more pleasant and possibly more productive environment is provided.

In most ARMEX formulations* everything is fit for food contact or as a food additive—ingesting it (although not encouraged) in small doses would not be dangerous. As the MSDS states, "Practically non-toxic. Ingestion of small amounts (1-2 tablespoons) during normal handling operations are not likely to cause injury." Obviously this benign nature is nowhere noted on a MEK or plastic media MSDS.

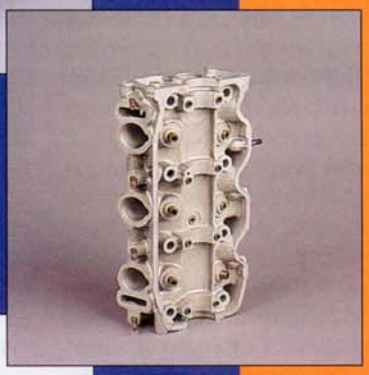
Although technicians should wear protective clothing and a dust mask when blasting, ARMEX has been shown to be non-irritating to the skin and eyes, so workers feel more comfortable using the process. According to Mador, "Everyone who uses it likes it," including Kaman Aerospace CEO Charlie Kaman, who was quite impressed with the system.

Solution For Complex Problem

Although aircraft component cleaning needs can be complex—especially with all of the varying materials used in aerospace—the answer is simply ARMEX Cleaning and Coating Removal Systems. Stripping costly aviation parts can be done with a baking-soda-based product. ARMEX and its manufacturer, Church & Dwight Co., Inc., firmly believe in continual research and development to anticipate customers' needs. "We want to be the first and the best and keep going—we're not a one-shot company. ARMEX will keep developing and improving our offerings," discloses Doty. ARMEX and ARM & HAMMER are names you can trust now and in the future—because they will be around in the next century, committed to evolving as industry demands. ARM & HAMMER Baking Soda can still be used in your chocolate chip cookies, but as formulated in ARMEX it can also be safely used in the aviation maintenance facility to clean aviation components. ■

* Except Profile formula products.

You can obtain these results in just one step without solvents or caustic chemicals by using ARMEX Cleaning and Coating Removal Systems.



The ARMEX® Blast Cabinet System DS Series offers dry blasting and dry waste disposal.

ARMEX™
Cleaning and Coating Removal Systems

Contact Information:
Delia Downes
ARMEX
5 Crescent Ave.
P.O. Box 349
Rocky Hill, NJ 08553

800/332-5424, fax 609/497-9308

ARM & HAMMER
THE STANDARD OF PURITY®