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FLASHJET® Qualification Test Programs Expand Customer Applications

The FLASHJET® Coatings Removal Process has gained wider acceptance and approval in recent years and is undergoing additional qualification testing to further broaden approved application. Since 1991, Navy, Air Force, Army and Industry qualification test programs have been conducted to test, evaluate, and demonstrate the FLASHJET Coatings Removal Process for various applications. Materials properties testing captures the necessary data to make engineering decisions on the applicability of the process.

Fixed Wing Aircraft Approvals

In October 1998, after successful testing and demonstration of the technology, the USAF added the FLASHJET Process to Tech Order 1-1-8 "Application and Removal of Organic Coatings, Aerospace and Non-Aerospace Equipment" as an effective method of finish system removal on both metallic and non-metallic surfaces.

The Naval Air Systems Team completed Navy-specific tests and, in July 1997, authorized the FLASHJET Process for removing organic coatings from *metallic* fixed wing aircraft structures, including aluminum of thickness .025" and greater, and steel and titanium substrates. In April 2000, the Naval Team expanded its approval to include monolithic carbon epoxy *composite* substrates (cured at 350°F or greater) of thickness .073" and greater. Both the USAF and Navy approved the process for depot level capable activities.

Qualifying FLASHJET for Rotorcraft

Boeing St. Louis recently completed efforts in a joint U.S. Army / Navy / Air Force project focusing on qualifying FLASHJET for paint removal from rotary wing aircraft fuselage metallic skins. Three series of high cycle fatigue testing programs were conducted to determine if the FLASHJET Process causes any degradation to thin aluminum (2024 and 7075 series) substrates commonly found on rotary wing aircraft.

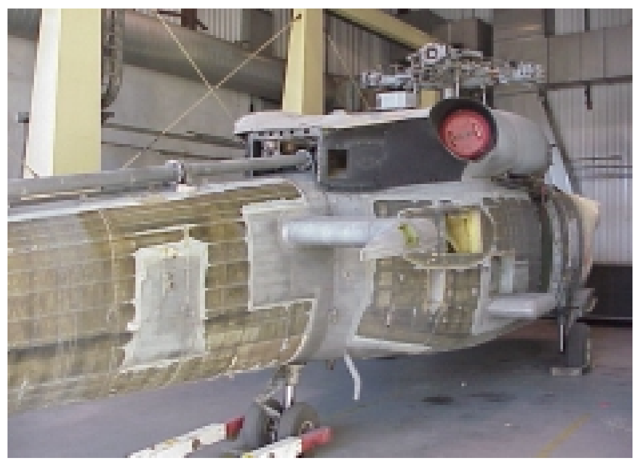

Figure 1. Portion of SH-60 Seahawk After Stripping

In the first phase of tests, a high cycle fatigue testing program was conducted by the Naval Air Systems Command at the Patuxent River Naval Air Station, MD to grant the approval for a one time strip of an operational SH-60 Seahawk, as shown in Figure 1. The fatigue tests were conducted on .025" thick specimens and found to be acceptable (i.e., statistically no difference between stripped and unstripped control specimen fatigue means at 95% confidence

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level). With these acceptable results, the SH-60 Program Manager granted a one-time strip of an operational SH-60 fleet rotorcraft using the FLASHJET Process. The SH-60 was stripped successfully in December 1999.

In the second phase of the joint project, high cycle fatigue testing was conducted to support the life-cycle use (multiple strips) of the FLASHJET Process on metallic rotary wing fuselage skins. Aluminum test panels were exposed to five cycles of painting, artificial aging, and FLASHJET stripping.

All panels were stripped to the substrate during each strip cycle. The Navy again conducted specimen machining and high cycle fatigue testing. This phase of testing was completed in October 2000 and statistical analysis of results indicate that the fatigue life of .025” thick 2024-T3 or 7075-T6 aluminum is not degraded by the FLASHJET Process through the 5 strip cycles. A final report has been drafted and Navy approval for life-cycle depainting of rotary wing fuselage skins is expected this year.

The third and final phase of the joint project addresses specific US Army requirements. Specifically, the aluminum panels were cut into individual coupons, and center holes or center cracks were machined before painting and stripping. This preparation method was selected to reflect how panels on aircraft are manufactured, painted, baked, stripped, repainted and used. A total of forty-eight pre-machined specimens were stripped to the substrate in each of five paint/strip cycles and another forty-eight pre-machined specimens were stripped to a saturation condition, consisting of stripping to the substrate plus additional FLASHJET passes to simulate overexposure. These specimens are currently in high cycle fatigue testing at the Army Research Laboratory, Aberdeen, MD. Results available to date indicate that FLASHJET-stripped specimens are performing equivalent to or better than the unpainted, unstripped control groups. This phase of tests is scheduled to be completed during the first quarter of 2001, and will provide the necessary data for the US Army to approve the FLASHJET Process for life-cycle use on rotorcraft.

Adhesively-Bonded Metallic Honeycomb Structure

In January 2001, a new test program was initiated with the US Navy to focus on testing of the FLASHJET Process on adhesively-bonded metallic honeycomb aircraft structural materials. Although some bonded structure testing has been completed, this program will be looking at skins of .016", different adhesive systems, and a more severe conditioning environment than looked at previously. Completion of this testing with acceptable results will result in expanding Navy approval of FLASHJET to metal thicknesses as low as .016", including thin-skin bonded metallic honeycomb structure.

Commercial Aircraft Application

The FLASHJET Process was approved by the Douglas Aircraft Company for use on their commercial aircraft in 1993. A test program was initiated in 2000 to provide additional information for approval of FLASHJET on 700 Series Boeing Commercial jets. The information includes fatigue data on thin gauge aluminum lap joints to address concerns with 737 Classic structures. Additional flexure and flatwise tension data is also necessary on specific nonmetallic composite honeycomb structure. Completion of these tests is expected in 2001.

The Process

The FLASHJET Process is designed to safely and economically remove aircraft coatings from both metals and composites without the use of hazardous chemicals or potentially damaging impingement media. It significantly reduces the amount of hazardous waste generated compared to chemical stripping or media blasting processes.

FLASHJET, as diagramed in Figure 2, combines a xenon flash lamp with a low-pressure carbon dioxide (dry ice) pellet stream. The xenon flash lamp ablates the coating from the substrate and the dry ice pellets cool and clean the substrate and sweep the coating ash into an effluent capture system. The effluent capture system vacuums the by-product dust through air pollution control equipment including High Efficiency Particulate Air (HEPA) filters, leaving the air clean enough for venting to the atmosphere.

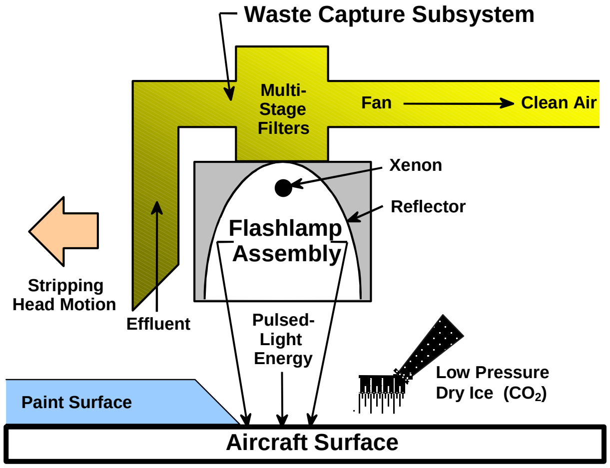

Figure 2. Synergism of Pulsed Light and Dry Ice = Removed Coating

Operational FLASHJET Systems

Seven operational FLASHJET systems have been demonstrated and/or implemented at:

1) Boeing St. Louis - Demonstration, development and production facility.
2) Boeing Mesa - 182 U.S. Army AH-64A Apaches stripped to date.
3) NAS-Kingsville- 29 T-45A Goshawks stripped to date.
4) Naval Aviation Depot-Jacksonville - Successful demonstration of a P-3C Aircraft Mobile Stripping System.
5) Singapore Technologies – Mobile system for stripping USMC and SAF C-130s.
6) Corpus Christi Army Depot – Gantry system for stripping helicopter systems.
7) Warner Robins Aircraft Logistics Center – Gantry system for stripping off-aircraft composite parts from the F-15, C-130, C-141 and C-5.

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MPK RECYCLING AT BOEING ST. LOUIS

Environmental Assurance is working with the Waste Minimization Group of Environment & Hazardous Materials Services (EHMS) on a project to recycle Methyl Propyl Ketone (MPK) that has been used to clean silk-screens in the Boeing St. Louis paint shops. The silk-screen cleaning operation consists of soaking used silk-screens in basins full of MPK and scrubbing them to remove paint. When a large amount of paint is contained in the MPK, it is emptied into waste drums for disposal. It is estimated that recycling the MPK will save approximately 3000 gallons of waste and $10K per year.

A local company that provides a mobile distillation service capable of recycling our spent MPK did a trial run. Their truck-mounted unit distilled three drums of spent MPK. Samples of the distillate were taken during the trial, one at the beginning, one in the middle, and one at the end. A sample of the spent MPK, and a sample of the new MPK currently used in the paint shop, were also taken. They were all analyzed in the lab to find the composition, non-volatile residue, vapor pressure, and water content. Solvent color was also noted. The samples of recycled MPK compared very closely to the new MPK. The only concern was slightly higher water content in the first sample.

Personnel in the paint shop indicated that they used to perform solvent recycling on-site but had problems with water in the solvent damaging the silk-screens. Some testing has been performed on silk-screens with the higher water content recycled MPK and so far the results are favorable for using it to clean the silk-screens. The recycled solvent will only be used for silk-screen cleaning and will not be approved for any other cleaning operations.

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PFOS. Going…Going…

This story is a little different from our norm. A family of chemicals is being removed from commerce by its sole manufacturer; EPA is monitoring the rest of industry to make sure no new manufacture of these chemicals begins without review. The problem for an end user is that there is no sure way to know which of the formulated products we use contain these chemicals because they often are present in quantities small enough that they need not be listed on the product's Material Safety Data Sheet (MSDS). When our material suppliers (or companies that supply *them*) reformulate to replace these materials, we may not know it. We may see performance changes and not understand the cause. *This is a heads-up.*

The family of chemicals is the Perfluorooctyl Sulfonates (PFOS), manufactured by 3M. These chemicals are persistent in the environment and have a tendency to accumulate in human and animal tissues. 3M elected to discontinue production, even though after 40 years of use, levels that have been measured do not pose a human health or environmental risk.

The most familiar commercial products using PFOS are probably the Scotchgard line. EPA has announced a Significant New Use Rule (SNUR) to monitor any attempts by other companies to start making any of 90 CAS numbers (see http://www.epa.gov/fedrgstr/EPA-TOX/2000/October/Day-18/t26751.htm). 3M is discontinuing manufacture of all PFOS by the end of 2002. Some materials are being phased out earlier. 3M's list of affected products is at: http://www.3m.com/about3M/worldwide/release.html.

EPA summarizes current PFOS uses in three main categories: surface treatments for fabrics, paper protectors, and performance chemicals (including fire fighting foams, acid mist suppressants for metal plating and electronic etching baths, alkaline cleaners, floor polishes, photographic film, chemical intermediates and coating additives....).

A search of our corporate MSDS database for these 90 CAS numbers or for the 3M product names turned up a number of 'hits'; all were products manufactured by 3M. More troubling were the few instances in which we knew that a PFOS was used in a product manufactured by another company, not 3M. These were not found in our searches because the PFOS was used in such a small quantity that it was not listed on the MSDS. However, even in small quantities, PFOS can be important to performance.

For example, Skydrol (the hydraulic fluid used in all commercial transports) contains a small amount of a PFOS, which is not listed on the MSDS. The manufacturers of Skydrol have taken steps to assure continued supply for a lengthy period while a substitute is being developed and qualified. Boeing is tied in with the replacement tasks to assure the new product will perform acceptably. This is how change of this type should be managed.

There is no way to know how many other products are being reformulated to replace PFOS without notifying the end user. In most cases, the reformulated products will perform well and the change will be 'transparent'. Some changes, though, may result in problems unforeseen by the formulator. End users trying to trouble shoot product or process abnormalities should know to ask whether recent reformulations have been forced by the unavailability of PFOS ingredients. That change may be part of the problem.

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