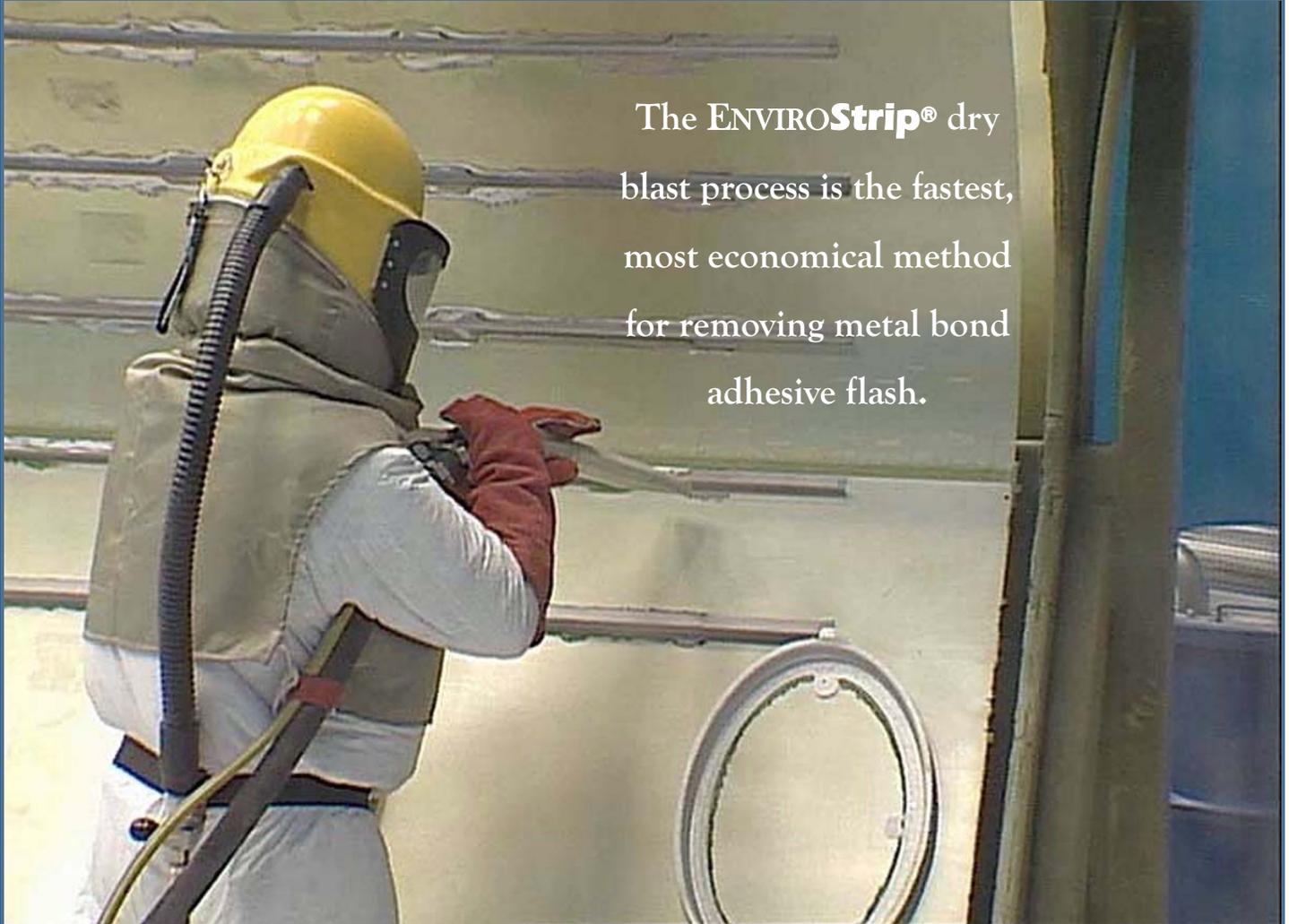


Adhesive Flash Removal From Bonded Parts

January 2002



The ENVIROStrip® dry blast process is the fastest, most economical method for removing metal bond adhesive flash.

- **PROVEN TECHNOLOGY**
- **UTILIZED BY MAJOR INDUSTRY OEM'S**
- **EASY IMPLEMENTATION**
- **MAJOR COST SAVINGS**

Adhesive Flash Removal

What do aircraft metal bonding and a worldwide agricultural processor have in common? More than one would think. Specially designed blast media made from

integrity, these new high-strength bonding adhesives continue to gain acceptance in aerospace manufacturing.

Adhesive bonding of metal and composite aerospace structures offers several benefits over riveted designs; including lower weight, better sealing, more aerodynamic qualities, and improved fatigue resistance. Adhesives also provide a strong bond for dissimilar materials and are well suited to metal-metal,

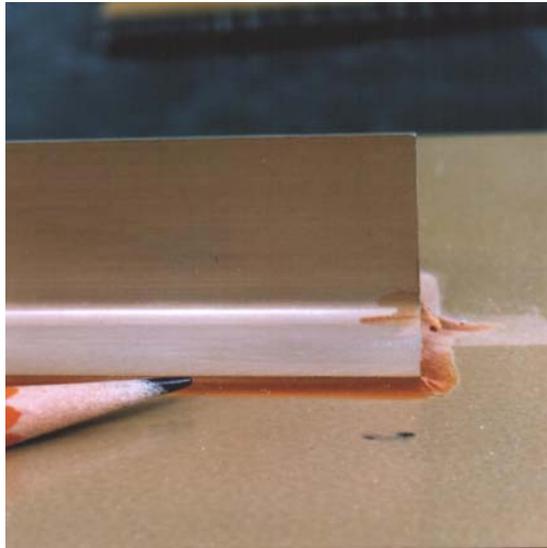
material to provide the necessary vacuum. During autoclaving, adhesive squeezes out from the bond areas and accumulates along bond lines. This unwanted adhesive is commonly referred to as “flash”.

Protective or masking tapes can be used to minimize the adhesive flash formed, but it is never eliminated. It is preferable to see some adhesive flash

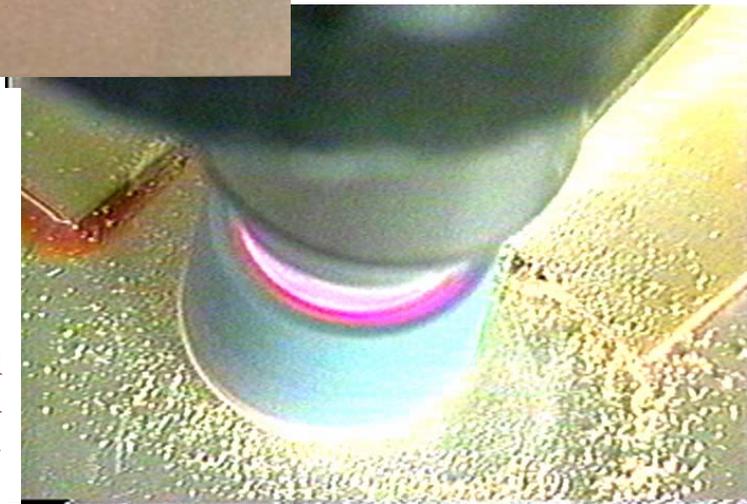
present at the bond line as the absence of adhesive flash may be an indication that insufficient adhesive was used and voids or open-ended gaps may have been created. Once the autoclaving

process is complete, bagging material and tape are removed and the part is processed for future finishing.

During the cleaning and inspection of the finished part, areas where adhesive flash must be removed are identified. This excess adhesive is usually removed for proper part assembly, aerodynamic profile, appearance, or weight reduction requirements.



ABOVE: Example of unwanted adhesive flash.



RIGHT: Typical mechanical grinding method.

engineered agricultural products offer the aircraft industry a new and widely approved alternative for removing metal bond adhesive flash.

Today's aircraft design relies increasingly on adhesive metal bonding technology to replace conventional riveting methods. As confidence grows in their environmental durability and structural

metal-composite, and all composite structures.

Adhesive films are used on various sub-assembly aircraft sections, exterior skins, wing areas, and engine nacelles. In the metal bond operation, film adhesive is cured in an autoclave at high temperature (250°F to 350°F). The part, which can be held in a form or tool, is sealed with a bagging

Methods for Removing Adhesive Flash

Traditional methods for removing adhesive flash are mechanical grinding, hand sanding, chemicals, hand scraping, or a combination of these. Not only are these methods labor intensive and time-consuming, they often damage parts that are in an ad-

vanced stage of fabrication.

When adhesive flash is removed with aggressive mechanical techniques or sharp hand tools, not only are the bond primer and conversion coatings removed, the clad layer can be penetrated as well, causing serious quality problems. This leads to either reapplication of primer and conversion coatings, extensive repairs, or rejection of parts.

The overriding concern with chemical techniques is to avoid contact with the bond line as chemicals can initiate bond delamination. This restricts the ability of chemicals to clean away adhesive flash at the bond line and usually

results in the use of hand tools. Once again damage to parts arises as the slightest cut or gouge into the metal can be cause for rejection

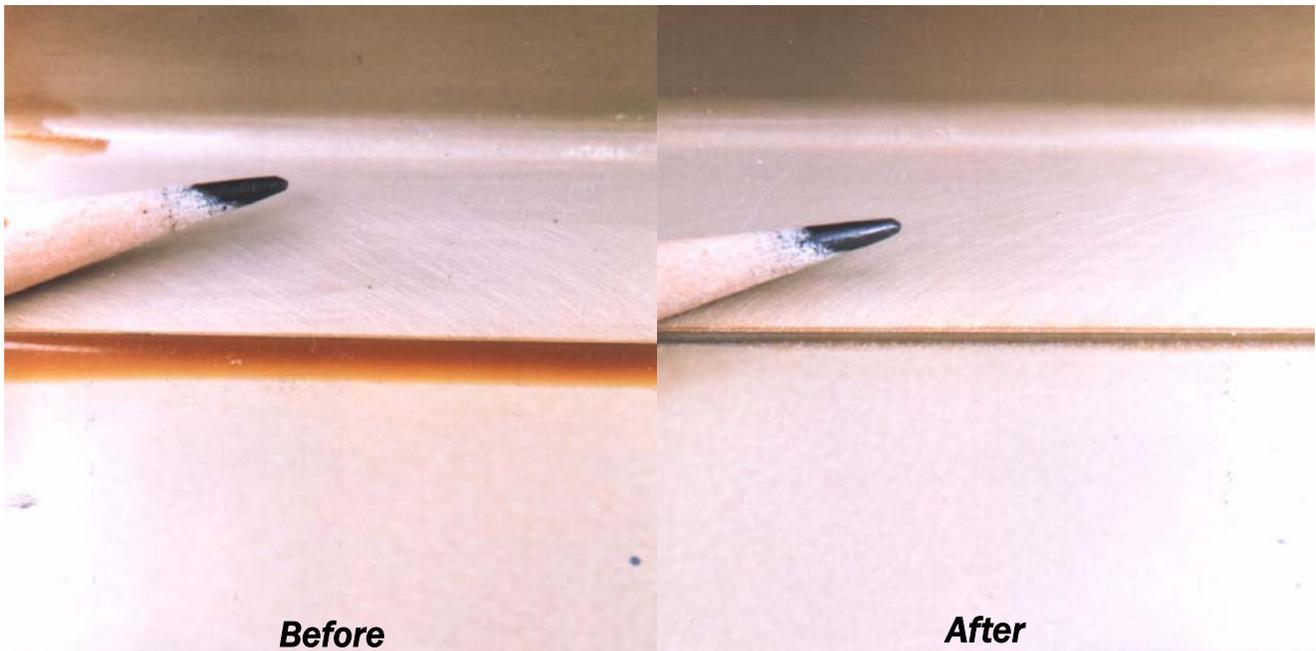


Damage caused by mechanical grinding.

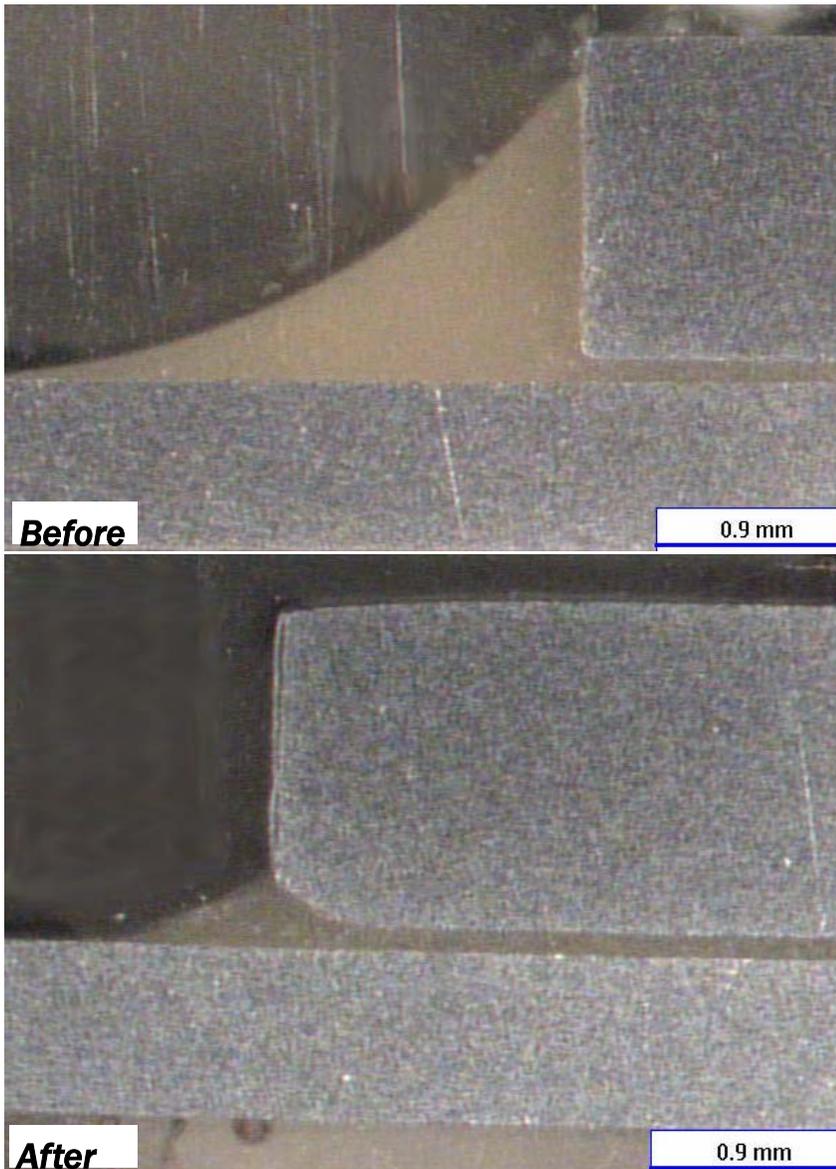
tion due to fatigue or corrosion concerns.

The Natural Solution

With the increased use of metal bonding in aircraft structures, manufacturers recognized the problem of adhesive flash removal and actively sought new technology. In 1990, Archer Daniels Midland (ADM), based in Decatur, Illinois, developed a blast media engineered from wheat starch and introduced it to the aircraft industry for coating removal applications. In 1993, Cessna Aircraft (Wichita, KS) began using ADM's EnviroStrip wheat starch media to remove the unwanted adhesive from metal bonded parts. Since then, most major aerospace manufacturers have adopted this low-pressure,



Example of metal bond adhesive before and after removal with the EnviroStrip process.



ABOVE: Cross sectional views of a metal bond area before and after application of Envirostrip.

coatings. Using established process parameters, both solvent and water-based bond primers can be left intact, which means the additional step of reapplying primer or conversion coatings can be eliminated. Because the bond primer and conversion coating are unaffected there is no risk of damaging the part substrate. A cross sectional view of a metal bond area shows how the EnviroStrip adhesive removal process removes the adhesive without affecting the substrate or bonded area.

The EnviroStrip deflash technology is now an integral part of the manufacturing process at many aircraft companies and subcontractors. Boeing Commercial Airplane Group has included wheat starch media as a preferred alternative in Boeing's Adhesive Flash Removal specification BAC 5514.

Simple and Fast – A Proven Process for Adhesive Removal

The EnviroStrip deflash process is applied in a contained environment such as a blast room or hand cabinet. In cases where mechanical methods are being dis-

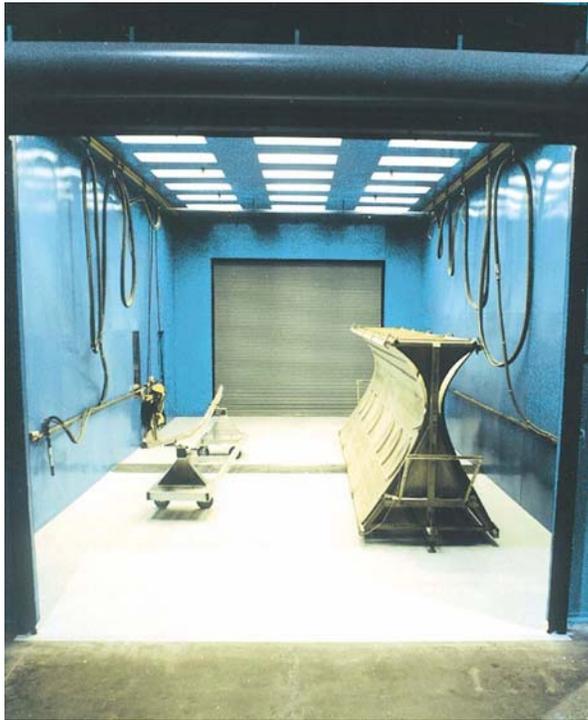
light abrasive blasting technique for a variety of coating and adhesive removal requirements. The Envirostrip starch media are uniquely developed agricultural-based products designed for removing tough aerospace coatings from sensitive substrates. The media is engineered to provide specific results, depending upon the coating removal requirement. The patented product is manufactured

to strict quality control standards in one of ADM's starch plants.

The EnviroStrip dry blast process is extremely fast in removing the metal bond adhesive, saving considerable time and labor; and it does so without removing or damaging the underlying bond primer and conversion



ABOVE: Operator applying the Envirostrip process to a large metal bonded structural part.
(Photo courtesy of Pauli)



A typical blast room for large parts. Hand cabinets may be used for smaller applications.

placed, the wheat starch media can be applied, with some facility modification, in the same room or enclosure previously used for sanding.

Typical process parameters are listed in Table 1. The ability to remove the adhesive flash without removing the bond primer is accomplished by controlling key parameters. Blast pressure and media particle size are two important, and controllable, parameters that ensure specific results. By limiting the blast pressure, in combination with removing the smaller more aggressive media particles from the blast stream, the adhesive is removed without affecting the bond primer. In general, the EnviroStrip process offers a 10:1 improvement in removal rates over conventional methods. The direct deflash labor savings alone can justify the capital investment required to adopt this

technology. However, current users of the process have pointed to improved part quality, elimination of labor-intensive manufacturing steps (pre-taping and post alodine/primer requirements) and reduction in scrap parts as being the primary benefits.

Boeing, Cessna and Raytheon - Major Aircraft OEM's Now Using the EnviroStrip Technology

The EnviroStrip deflash process offers a major leap forward in improving metal bond deflash production rates while maintaining part integrity.

Table 2 provides a labor and general cost comparison between standard hand sanding/scraping methods and the EnviroStrip deflash process. This comparison is based upon data gathered during recent OEM deflash demonstrations on actual aircraft metal bonded parts. It represents a typical, large metal bonded aircraft sub-assembly with over 90 lineal feet of bond line adhesive requiring removal.

Major aircraft manufacturers now have over 17 years of combined production experience utilizing ADM's deflash process.

Capital investment returns have proven to be more than acceptable to the users of the process. The capital equipment costs required to utilize the deflash process typically range from

Table 1. EnviroStrip Process Parameters for Adhesive Flash Removal

Parameters	3/8-inch dia. Blast Nozzle
Nozzle Pressure (psi)	15 - 30
Media Flow Rate (lb/min)	4 - 8
Stand-off Distance (inches)	2 - 4
Impingement Angle (degrees)	20 - 40
Adhesive Removal Rate (linear feet per minute)*	0.5 - 3.0

*Dependent on amount of adhesive, adhesive type, nozzle type and operator skill.

Table 2. Economics: Conventional Hand Sanding vs. the EnviroStrip Deflash Process

Conventional Hand Sanding		EnviroStrip Deflash Process	
Labor to Pre-Tape Part: Hours	2	Labor to Pre-Tape Part:	0
Labor to Remove Flash: Hours	8	Labor to Remove Flash:	1 ½ Hours (includes post water wash and clean-up)
Labor to re-alodine or re-prime:	1 Hour	Labor to re-alodine or re-prime:	0
TOTAL HOURS REQUIRED:	11	TOTAL HOURS REQUIRED:	1 ½
Material Costs (tape, sandpaper):	\$40.00	Material Costs (media):	\$160.00
Rejected Part Cost: ???		Rejected Part Cost:	0

Adhesive Deflash

\$20,000 for a small hand cabinet to over \$250,000 for a walk-in blast room capable of handling large aircraft metal bond sub-assemblies. Several companies in North America and Europe manufacture equipment for the deflash process.

Evaluation and Implementation Made Easy

ADM provides support to the aircraft industry through its test center located in Montreal, Canada. The test facility is available for customers to visit and use prior to implementing the technol-

"...the EnviroStrip process offers a 10:1 improvement in removal rates over conventional methods."

ogy. The center allows customers the opportunity to evaluate the EnviroStrip process, develop process parameters particular to their own parts, obtain production costs and determine equipment needs.



ADM Test Center provides customer support.



Flat Nozzle removing adhesive flash. (Photo courtesy of Pauli Systems)

The center has also been utilized by aircraft manufacturers developing approval specifications.

Removing excess adhesive without compromising part integrity can often be a difficult and costly endeavor. As metal bonding

becomes increasingly common in the manufacturing of aircraft, this natural solution for removal of adhesive flash offers new opportunities to the advanced materials industry.



Archer Daniels Midland Company
995 Mill Street
Montreal, Quebec, Canada, H3C 1Y5
www.EnviroStrip.com

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Cameron Drake - North America

Phone: 865-675-4333

Fax: 865-675-4403

E-mail: cdrake@mindspring.com

John Oestreich - International

Phone/Fax: 44-1295-788-125