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## LOCALIZED COATING REMOVAL USING PLASTIC MEDIA BLASTING

Howard L. Novak

Michael G. Wyckoff

Lee M. Zook

### Introduction

USBI, a Division of United Technologies, is responsible for the assembly, checkout and refurbishment of the structural, guidance and recovery components of the Solid Rocket Booster (SRB) as part of the NASA Space Transportation system, Space Shuttle. The work is performed at Kennedy Space Center, Florida and the contract is administered by Marshall Space Flight Center (MSFC) in Huntsville, Alabama. Figure 1 shows the SRB and associated hardware that USBI is responsible for. Recently, a considerable effort was made to qualify the use of Plastic Media Blasting (PMB) for safely and effectively removing paint and other coatings from SRB aluminum structures. As a result of the effort an improvement was made in the design of surface finishing equipment for processing flight hardware, in addition to a potentially patentable idea on improved plastic media composition.

### Test and Objectives

Normal refinishing for the aluminum alloy SRB structures involves coating removal using walnut hull blasting, chemical paint stripping and hand sanding or scraping, followed by chromate conversion coating, epoxy priming and topcoating. Some of the drawbacks to the normal refinishing processes are: Walnut Hull Media is hygroscopic and difficult to store; Chemical Paint strippers contain Methylene Chloride and Toluene (Toluols) that require toxic waste disposal techniques and special protective clothing during use, while handsanding and scraping are extremely time consuming and difficult to control. Because of all of these difficulties, USBI proposed to NASA, MSFC the use of PMB and associated special equipment for coating removal on the Aft Skirt structure. The plastic media is composed of a urea-formaldehyde resin with a MOH hardness of 3.5 and a mesh size of 30-40. The specially designed nozzle accurately controlled media blast pattern and standoff distance. Blast pressure is preset and maintained throughout the blasting cycle. In order to gain acceptance for using the PMB process on flight hardware it was necessary to verify that:

- o Adhesion of reapplied coatings was adequate
- o Embedment or surface residue did not exist
- o Reusability of media was practical & economical

Test panels measuring 24" x 24" x 1/8" and made of 2219-T87 aluminum were prepared as shown in Figures 2 and 3. Various surface finishes were employed to verify adhesion of coatings to the substrate. A typical painted panel showing primer and topcoat is seen in Figure 4. Hundreds of flatwise tensile coupons were prepared from test panels, as shown in Figure 5. Testing was performed under controlled laboratory conditions. Statistical analysis of flatwise tensile testing verified the excellent adhesion of chromate conversion coating epoxy primer and topcoat to the PMB substrate. Wet tape testing of the adhesion characteristics of coating to substrate (performed after 34 hours of immersion in water) proved excellent with no failures. Visual examination of test coupons were made using a LECO M300 metallograph at 100 X magnification, and revealed no apparent embedment of the plastic media. A nicolelet fourier transform infra-red spectrometer revealed no surface residuals after standard cleaning procedures were employed. A fixed charge of plastic media was used to blast the various test and demonstration panels, requiring ten (10) recycles of the media charge. Examination of the media was made using a 10X and 30X magnifier, revealing no anomalies in appearance or performance. Additional work is underway to ascertain the limits of continued reuse of the plastic media. Plastic media blast equipment is readily available from local suppliers who also furnish the special guns and nozzles required for working on the Aft skirt hardware. Figures 6 and 7 show the general arrangement of blast equipment and nozzle configuration. The gun is easily manipulated by the operator and provides excellent visibility during the blasting operation. Cumbersome protective clothing is not required for the machine operator and productivity is extremely good. Figures 8 and 9 exhibit typical flight hardware on the Aft Skirt being processed at the USBI-Assembly and Refurbishment facility, Kennedy Space Center, Florida.

### Conclusion

As a result of successful testing and implementation of the PMB process at USBI-KSC, other United Technologies Divisions have expressed interest in utilizing the process for commercial applications. Pratt & Whitney, Military Engine Div., is presently working on a joint venture development with USBI on advanced processing using PMB. A patent has been applied for an improved media design that should help improve the state of the art of surface finishing. A potential new product line using advanced processing capabilities is being contemplated. The commercialization of space related technology is a goal of USBI and United Technologies Corporation. Hopefully, continued effort in this arena will strengthen our companies posture in the commercial market place and augment the goal of maintaining the United States' leadership in innovation and invention.

## SOLID ROCKET BOOSTER

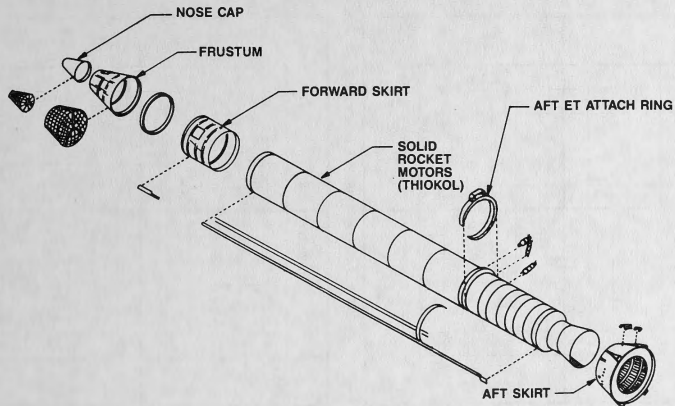
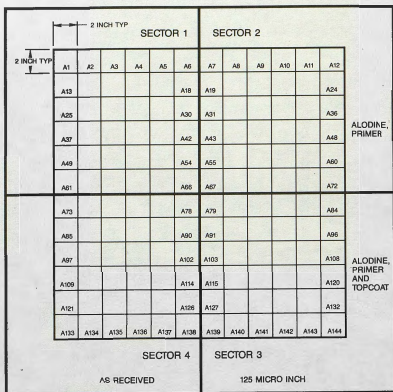
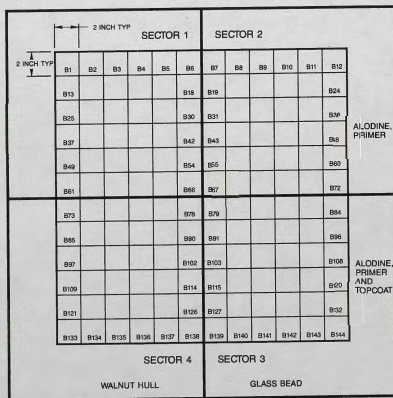


FIGURE 1 SOLID ROCKET BOOSTER



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FIGURE 2 PANEL A — SURFACE CONDITIONS



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FIGURE 3 PANEL B — SURFACE CONDITIONS

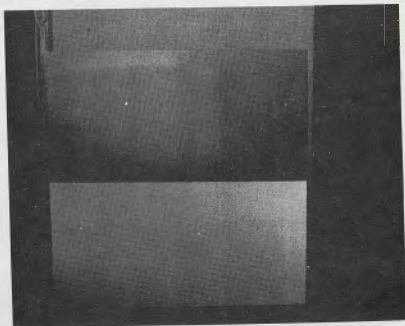


FIGURE 4 PANEL A — PRIMED AND PAINTED

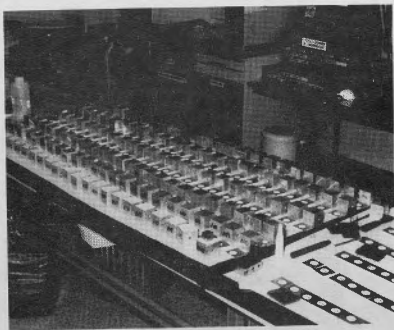
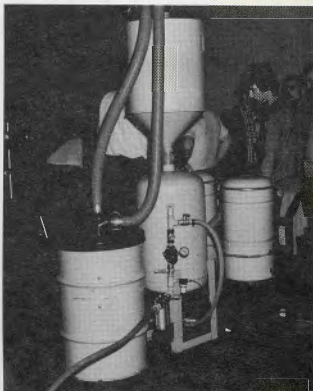


FIGURE 5 TENSILE SPECIMENS IN VARIOUS STAGES OF ASSEMBLY



**FIGURE 6 PLASTIC GRIT BLAST SYSTEM**



**FIGURE 7 VACUUMING PLASTIC GRIT WITH NOZZLE**

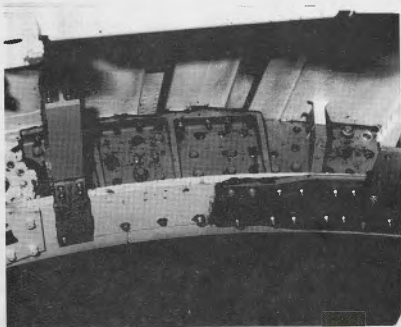


FIGURE 8 AFT SKIRT HARDWARE

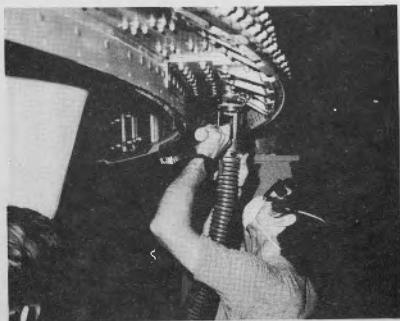


FIGURE 9 GRIT BLASTING AFT SKIRT — OVERHEAD POSITION



Howard Novak is Senior Materials Engineer at USBI, a division of United Technologies. Mr. Novak has been involved in Manufacturing, Quality and Materials Engineering Technology in Nuclear Power, U.S. Government Missile Systems and Space Craft Development for the last 25 years. His background includes experience with establishing manual and automatic media blasting facilities for large steam turbine components. Mr. Novak is a graduate of the Polytechnic University of New York with a Bachelor of Science degree in Mechanical Engineering and a Masters degree in Engineering Administration.

Michael Wyckoff is a Production Engineer with USBI a division of United Technologies located at the Kennedy Space Center, Florida. Mr. Wyckoff, a 1982 graduate of the University of Central Florida with a Bachelor of Science degree in Engineering has been involved for the past five years in the assembly and refurbishment of the non-motor segments of the Space Shuttle's Solid Rocket Boosters. Mr. Wyckoff's experience includes operations in stripping and recoating aluminum and steel components from small parts to major structures.

Lee Zook is a Materials Engineer with USBI, a division of United Technologies. Mr. Zook, a 1984 graduate of Auburn University with a Bachelor of Materials Engineer degree, has been involved with corrosion and the uses of coatings, sealants and adhesives on the non-motor components of the Solid Rocket Boosters. He has experience in metallurgy. He is currently studying toward a Masters degree in Physics.