C-130 Flight Control Surfaces Depaint Process Optimization

Background:

The leading source of toxic pollutants in the waste stream generated by the Air Force continues to be related to aircraft paint and depaint operations. Optimization of Air Force approved depaint methods is a means of reducing the volume of this toxic waste stream through development of more efficient depaint methods and/or processes. Air Force efforts to meet pollution prevention goals include a reduction in the use of certain chemicals for depaint operations. The Air Force, after appropriate testing and evaluations, has approved several forms of PMB for coatings removal on airframe components to help in attaining this goal. These methods use various polymeric media as an abrasive agent. Testing and evaluations have been conducted with Type V (acrylic) media on various 0.032-inch thick aluminum alloys typically used for airframe construction. Plastic Media Blasting (PMB) on alloy substrate materials with Type V (acrylic) media has been given Air Force approval for use on materials of 0.032 inch thickness or greater. No quantitative data has been developed by the Air Force for this process on thinner substrate materials (0.016 inch),or structures comprised of these thinner materials. OO-ALC desired to use a PMB process for depainting the C-130 aircraft maintained by this AF depot.

OO-ALC is developing the means to use the Type V PMB process to depaint the C-130 aircraft maintenance at this depot. The PMB process used by OO-ALC has been approved by the C-130 System Program Director, WR-ALC, for use on most of the aircraft, but certain areas, i.e., those with thin substrate materials, have not been approved for stripping with this process. In order to avoid use of toxic chemicals to strip these areas, OO-ALC wishes to optimize their current PMB process to obtain C-130 SPD approval for use on the areas in question.

While it would be advantageous to OO-ALC to use their current Type V media PMB process for the entire aircraft, this matter must be validated through development of reliable data to characterize possible PMB induced effects on the control surfaces. In addition to any structural and/or materials data required for any SPD process approval,

other factors such as the integration of an optimized process from bench top testing into full scale production must also be considered.

Project Sponsor/Customer: OO-ALC
Period of Performance: Sep 96 - Dec 99

Objective:

Ogden Air Logistics Center (OO-ALC) requested CTIOs support to address the use of Plastic Media Blasting (PMB) on thin aluminum alloy structures typical to the C-130 flight controls. The CTIO developed an approach to test the feasibility of this request.

Status:

The CTIO conducted a test program for coatings removal on substrates consisting of spot welded, thin alloy materials. Specifically, the substrates under consideration for this assessment were the C-130 flight control surfaces, fabricated with 0.016 inch, 2024-T3, clad aluminum. The PMB process proposed for this purpose by OO-ALC was based on Type V (MIL-P-85891A) blast media.

PMB process/materials characterizations for this project were coordinated between OO-ALC and the C-130 SPD (WR-ALC/LB), and were designed to produce an evaluation of possible PMB imposed changes to material and structural (i.e., spot welded components) properties. The tests conducted addressed these and other possible PMB produced effects on thin (0.016 inch) spot welded structures and face sheet materials. These evaluations included low cycle fatigue of the face sheet materials, low cycle fatigue of spot-welded structures, spot weld shear strength, and spot weld tensile strength. In addition, other data were developed to help validated the process and to obtain C-130 SPD approval. These data consisted of qualitative residual stress measurements (aero Almen measurements), and surface roughness measurements.

Statistical and comparative analysis of the materials/structural test data indicated no degradation produced by the OO-ALC PMB process in regards to the majority of the assessments conducted in this project. This includes all aspects of testing of the spot welded materials/structures, and most of the assessments of the PMB process effects on substrate materials. The single exception to the preceding statements, regarding materials degradation, was that the analysis of the face sheet material low cycle fatigue data sets indicated a reduction of 25% between the control materials and the materials

conditioned by four, zero dwell blast cycles at the normal standoff distance. This difference was determined to be statistically significant.

On the basis of the data developed by this study, CTIO recommended OO-ALC pursue C-130 SPD approval regardless of the single low cycle fatigue data non-compliance data point. CTIO's assessment, regarding the overall aircraft integrity, determined the one variation of fatigue life was not significant enough to stop the utilization of this process

The test results for parameters more likely to be pertinent regarding aircraft integrity, such as spot weld reliability, residual stresses, and surface profile indicated an acceptable PMB process per the Test Plan and acceptance criteria associated with this study. The process evaluated by this project was subsequently approved for use by the C-130 SPD. The parameters and certain quality assurance measures resulting from this assessment have been incorporated into an OO-ALC process specification used for the depaint operations on the C-130 flight control surfaces.

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