Optimization of Application Equipment and Processes

Background:

The Coatings Technology Integration Office conducted an assessment of commercially available technologies to improve the effectiveness of spray applied coatings in 1996 - 1997. This effort is a follow-on project and will explore techniques to refine coatings application, thus improving protection provided by the coating system against corrosion and inherently reducing the frequency of subsequent paint repairs.

Project Sponsor/Customer: Air Force wide
Period of Performance: Mar 99 – Nov 00

Objective:

To improve the quality of application of coating systems at both the depots and field units and ensuring optimum film properties and coating performance. This will be accomplished by utilizing techniques/processes familiar in the commercial arena. Better application will improve coverage, provide thickness control, increase transfer efficiency, and enhance the appearance of the applied coatings. Knowledge gained will be transferred throughout the US Air Force in a timely manner via web site linkage.

Status:

CTIO staff members reviewed the data and recommendations from the 96-97 project. Trips were made to several vendors and AF locations to fully understand the users existing problems and potential performance improvements from commercial vendors.

Some technologies identified by the FY97 assessment are not practical at this time. The Dielectric Analysis technique by Micromet Instruments cannot be utilized easily for monitoring paint cure on aircraft. The hand-held FTIR by Sensiv, Inc of Foster-Miller has not proven acceptable in the paint hangar. The paint environment of humidity, temperature, and airflow affects the dry/cure time; this instrumentation may prove to be very useful to determine when the primer has cured sufficiently for topcoat application. The Controlled Stress Rheometer may be used at CTIO to characterize paint, but this instrumentation will probably not be used in the field. Raman Spectroscopy has not developed to the point where it could be implemented without interpretation of data, resolving field-acquired spectra, and elimination of background “noise”.

Several avenues explored during the FY97 assessment do not appear to be mature enough for utilization by the USAF at this time. The Ice-Jet Nozzle, used to enhance cleaning, is still in the developmental stage. The End Effector spray gun is used by the US Navy as a short-term solution to contain paint particles/overspray and prevent water pollution, but has not been proven applicable to USAF utilization. Recommended spray guns such as the Can-Am Turbo Coatair HVLP, Devilbiss OMX™, and Graco Optimiser™ were evaluated under this project. The analysis of HVLP spray guns and more specifically the control of air supply was selected by CTIO as the area which would most benefit from spray application optimization.

Aerospace painting facilities must adhere to the Clean Air Act regulations as defined in the Aerospace National Emission Standards for Hazardous Air Pollutants (NESHAP) while painting with High Volume Low Pressure (HVLP) paint guns. HVLP guns are used because, when functioning properly, they operate at low pressures, which reduces the release of hazardous emissions. However, HVLP guns are occasionally used in conditions where an existing compressed air line cannot supply the minimum required flow rate and/or pressure. If a compressed air line is not sized properly, the HVLP spray gun cannot perform as intended due to insufficient flow rates. The operator may try to compensate for this by increasing the pressure into the HVLP gun which may result in an atomizing pressure exceeding the maximum specified by the Aerospace NESHAP. In order to minimize the risk of violating Clean Air Act regulations, CTIO has created a set of tools enabling an HVLP gun operator to determine whether a proposed compressed air line is capable of supplying the HVLP gun with its recommended flow parameters. By using the results of this study, shop personnel or facility supervisors can construct a compressed air line to operated HVLP gun in its optimum range while maintaining hazardous emissions within the guidelines set forth by the Aerospace NESHAP.

Project Plan: Dated Dec 99
Final Report: Titled: “Optimization of Application Equipment & Processes: Spray Optimization Guideline Assessment”
Dated: Nov 2000
Authors: Stephen L. Wiedmann; Mark Lesher, P.E.; Glynn Bartlett, P.E.

As of Date: Apr 01