STIC Note

Laser Corrosion Removal Machines

BACKGROUND/PROBLEM

The U.S. Coast Guard is required by statute to respond to missions that occur in or on the seas, navigable waterways, and their tributaries. The equipment needed for these missions has to be ready and functional. Equipment surfaces and internals are often required to be refurbished to remove corrosion and other materials because they are subjected to sea water. The present corrosion removal method is to blast with media (either walnut husks or sand).

Figure 1. P100 pump. (Source: USCG)

The current process creates a quantity of hazmat that needs to be addressed. All the used media must be disposed of since contaminates cannot be separated. In addition, media blasting cannot ensure that the surface of the substrate is not damaged from the aggressive removal of corrosion during this process.

Figure 2. PO Eiden, Array of samples for ablation. (Source: USCG)

Figure 3. Engine blocks – Left: Laser ablation, Right: Walnut media blast. (Source: USCG)

METHODS

A search for more efficient and controllable corrosion removal methods was initiated since removing surface corrosion and paint/primer is difficult to control with media blast.

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Market research found that there are many laser ablation machines allowing improved control of the depth during contaminant removal. One of these machines was procured for operational evaluation.

EVALUATION

Operators in the CG Naval Engineering Division (NED) at Base Alameda, CA evaluated the media blast pump cleaning process against the laser ablation process. The evaluation was designed to demonstrate the difference between media blast and laser processes. During evaluation, it was noted that operators needed additional time and experience using the laser machine to effectively and efficiently remove corrosion.

Several parts were ablated using both methods applied to several substrates and coatings.

A technique to enhance the laser is to spray water vapor onto the part for hard-to-reach areas. There are other lenses that can be used to change the beam shape, which may be better for some materials.

Figure 4. Aluminum plate, center surface corrosion – Left: Laser, Right: Sand blast. (Source: USCG)

Figure 5. Laser machine (Source: USCG)

CONCLUSIONS

The laser corrosion removal machine was able to effectively ablate by layers. In other words, depth was well-controlled and the laser was able to remove just corrosion. A second pass demonstrated that primer or paint is eliminated while barely removing substrate. Controlling the media blast was not precise. Media blast generally cleaned to the substrate and removed substrate material. Depth of the penetration of substrate material is not controllable with the media blast process. This condition may not be an issue depending on the application.

FUTURE WORK

CG Naval Engineering Division operators will become more proficient with the laser as they have more opportunities to use it. Mr. Thomas Drennan, USCG SFLC-IOD Compliance Branch, is working on a permanent Laser Safe Working Space to be installed at the NED, Base Alameda, CA. The transition of the device to NED is complete and any further experimentation and resulting procedure modification will be conducted by NED, Base Alameda, CA.

The Science and Technology Innovation Center (STIC) is a DHS S&T and USCG collaboration.

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