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Paper Title: Laser Technology for Aerospace Maintenance and Sustainment Applications

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Abstract: Increased mission readiness. Enhanced worker safety. Decreased maintenance costs. Improved substrate conditions. All from one technology...now that's a great idea! The AF is leading a program replacing traditional chemical/mechanical coating removal with laser technology. Depainting is one of the most costly and harmful operations within DoD maintenance depots due to worker exposure issues, high amounts of hazardous waste, and large labor investment. Laser technology directly addresses and improves all of these factors.

Laser coating removal is an ablative process where laser energy is focused on a surface and absorbed into the coating resulting in decomposition and removal of the coating. Total waste disposal is approximately 99% less and eliminates hazardous air emissions. No more cadmium or chromium dust covering depot floors or traveling into break rooms. Extensive fatigue testing showed less damaging impact on substrates. Robotic lasers can selectively strip coatings, for the first time having the capability to only strip the top coat. This technology projected to save the AF over \$150M annually.

Incorporation of robotics provides additional capabilities, greater worker safety and health conditions, and improved throughput. Paint removal is the biggest bottleneck through the repair process; this technology rapidly returns aircraft to mission capable status by over 50% reduction in flow-days (F-16 reduction from 7 to 3 days). Lasers strip radomes in fourth the time than PMB (reduced from 4 hours to 45 minutes). The system can intelligently map an aircraft and set parameters of when, where, and how to strip coatings and virtually masks areas not needing to be stripped saving hundreds of man hours masking. Aircraft-by-tail-number mapping is critical to innovative maintenance methodologies such as Condition Based Maintenance (CBM). For the first time, robotic laser technology offers a means to create "medical records" for the fleet and properly treat each aircraft based on specific conditions. It gets even better...through semi-autonomous robots; the worker is now safely placed in an operations room versus being directly exposed to hazmats. Personal protective equipment is eliminated and transforms the dirty job of depainting into a clean, safe operation. The best part is the fact that it revolutionizes the entire aerospace industry; it's applicable to all services and commercial industry.

This program began with validation of portable, low-powered, handheld lasers to remove coatings from small, hard-to-reach areas and evolved into implementation of full aircraft depainting. The system is designed to maximize reliability using commercial off-the-shelf components that have proven reliability and proven industrial use. The system is mobile, utilizing smallest footprint possible, including state-of-the-art control package that allows selective stripping, thermal heat monitoring, and a particle collection system to reduce waste.

Systems are being implemented for F-16 and C-130 full aircraft repainting and currently being designed for F-15, B-1, KC-46, KC-135, Global Hawk....this is just the beginning! Material testing on-going for Low Observable (LO) platforms (B-2, F-22, F-35), projected to save millions and reduce flow days to labor intensive maintenance operations. The next step.....explore multi-functional purposes that include robotic non-destructive inspections, laser cleaning, painting, corrosion control, and CBM+.