New Aerospace Technologies from EWI

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Acous Tek Machining Overview

Ultra Sonic Machining

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EWI Twist Drill System

- Drill head
- Knee mill
- Dukane 20kHz, 5kW power supply
- Laptop for control of drives, US, and data collection
Is it possible to integrate an US transmission line to portable equipment for field repairs
Results

- Capable of performing operation in 36-sec. Not desirable due to surface finish.
- Successfully met surface requirements at ~5-min operation time; was a 2 hr. operation
- Improved true position of hole
- Maintained ability to revert to Morse taper tooling
- Completely isolated vibrations from drill head
- Capable of performing several operations with same drill bit
Customer request for drilling of 60 Rc part
- Actual part hardness was 52 Rc
- Their tool of choice was a solid carbide drill
- W/O Ultra Sonics drill just dulled w/o cutting
- With US we were able to drill ½” dia. hole 1” deep

Additional demonstration
- Drilled through 3 ½” dia. through hardened part
- Intersecting hole was a question but posed no problem
Development of a machining center compatible US machining units (e.g. drilling tools and/or milling tools) will be the next step in making the technology available to industry.
Concept has been to incorporate 20-kHz transducer into live spindle case.

- Must allow for the following:
  - Electrical contacts
  - Various mounting provisions accepting different size tool holders (HSK/CAT 40, 60,…)
  - Repairable/serviceable
  - Use of shrink-fit tooling
  - Isolate vibrations from spindle
  - Tool changer adaptable

Four prototype systems fabricated & currently in testing
US drilling studies have been conducted on a wide range of materials

- Ti 6Al-4V, HY-80, 4140, 6061-Al, Inconel 600/700

- Key benefits
  - Improved productivity, increase in tool life, reduction in operating forces, elimination of cutting fluids, reduced formation of white layer
  - 2-10x improvement in tool life
  - 2-20x improvement in feed rates
  - Significant improvements in surface finish

- System available for conducting feasibility studies with drilling or milling

- System developed for machining platforms, continued testing required

- Benefits attainable with soft or hard materials
Questions?
Update on LPS Activities

Advances in Laser Paint Stripping & Laser Surface Preparation

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Another way to scan a beam - polygon scanner by EWI and CWA -

- Up to 50 m/s scan speed
- All reflective optics
- One moving part
- Constant scan velocity across scan width

EWI Scanner, Patent Pending
Polygon “Beta” Scanner
- “COTS” availability from WTT -

- More robust
- Contamination resistant

Protective “door”
Single body component
Water cooling
Servo Drive

Patent Pending
Why the polygon scanner works

- Scan speed reduces flame height
- Reduced flame height reduces beam interference
- Reduced flame height improves effluent removal
- Reduced flame height supports cleaner combustion
- Reduced flame height permits better vision

High speed video (approximately 300X) with diode laser illumination
Need for process control
- more important for shorter wavelength -

- Paint thickness is not constant
- Undocumented paint layers may exist
- Overlap between passes cannot be assured
System Considerations

- LPS of component parts can be relatively simple
- Many off-aircraft components are candidates
White, Commercial Aircraft?
- Fiber lasers not a productive option

- Repositionable robot platform for CO₂ laser
- Technically feasible but not an attractive solution
Mobile CO$_2$ LPS Platform?
- we’ll never know if we don’t ask -

- Large mobile platforms are commercially available
- Many questions about laser tolerance to motion
After decades of “investigation,” laser paint stripping technology has made strong progress in recent years.

EWI’s polygon scanner has demonstrated best ever reported:
- Paint stripping efficiency
- Paint stripping rates
- Small size and light scanner weight
- Effluent removal capability
- Hardware robustness

LPS implementation challenges are now shifted to:
- Process control
- Large area motion control and path management

Imagination will lead to solutions
Questions

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Since the early 1980s, EWI has helped manufacturers in the energy, defense, transportation, construction, and consumer goods industries improve their productivity, time to market, and profitability through innovative materials joining and allied technologies. Today, we also operate a variety of centers and consortia to advance U.S. manufacturing through public/private cooperation.