



Hepburn and Sons LLC

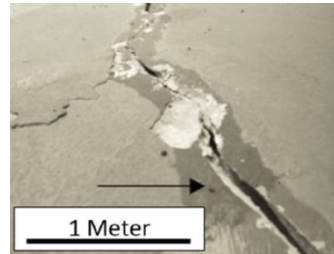
"Trusted advisors to the American Maritime Industry"



TECHNOLOGY FACT SHEET – Laser Shock Peening

TECHNICAL CHALLENGE

- Aluminum shipbuilding on the rise in the Navy, leading to materials problems like stress corrosion cracking (SCC) and sensitization
- Repair yards tasked with these substantial repairs
- Aluminum repair has significant rework, as it is difficult to work with
- Welding repairs impart large stresses on and deform the aluminum
- Flame straightening not permitted on marine grade aluminum
- Common aluminum forming methods are laborious, costly, and time-consuming



SCC on aluminum ship superstructure

10X

Compressive residual stress benefits over other peening methods and treatments

48X

Lifetime extension of sensitized aluminum when laser shock peened versus no treatment

1-5 mm

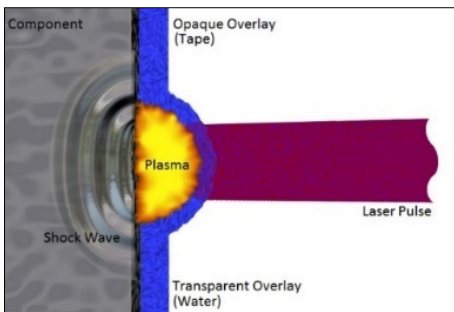
Range of compressive residual stress depth as a result of laser shock peening

20 years

Length of time that laser shock peening has been successfully used in the aerospace industry to improve the fatigue life of aircraft parts

9

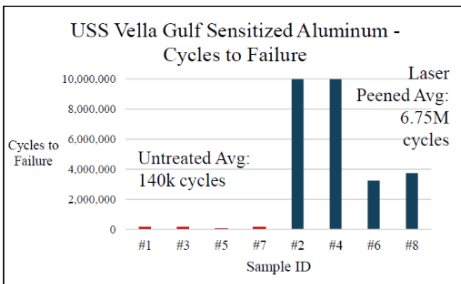
Technology Readiness Level (TRL) of laser shock peening in the aerospace industry



Laser peening a metal surface

TECHNOLOGY OVERVIEW

- High-energy pulsed laser directed at material surface to generate pressure pulses
- Shock wave plastically yields and cold works the material to generate deep compressive stresses
- Residual stress layers are orders of magnitude deeper than that achievable with shot peening
- Highly predictive and deterministic stress profiles
- Used successfully in the aerospace industry for nearly 20 years
- Significantly improves aluminum lifespan
- Arrests crack growth and mitigates stress corrosion cracking
- Mitigates aluminum sensitization and shapes complex geometries with minimum heat



48X lifespan improvement with laser peening

BENEFIT TO THE WARFIGHTER

- Reduces costs of labor, upfront construction, and repair
- Avoids introduction of heat (welding), which prevents weakening of the aluminum ships
- Significantly improves fatigue life of aluminum ships, which reduces the frequency of repair/replacement
- Long lasting repairs to Navy ships



U.S. Navy Cruiser