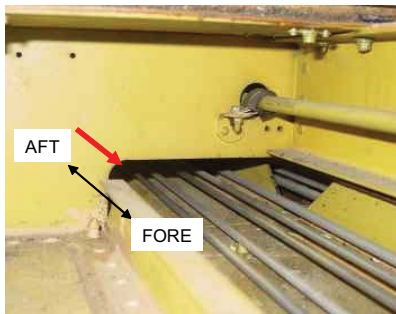


IMPROVING COMPONENT LIFE AND PERFORMANCE

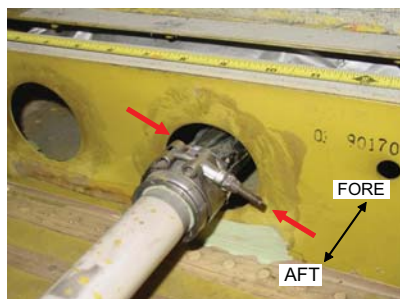
AIRCRAFT STRUCTURES



MITIGATING STRESS CONCENTRATIONS IN P-3 FLOOR BEAMS



The US Navy and its foreign military sales partners are extending the service life of the P-3 Orion. Fleet aircraft are currently averaging approximately 24,000 flight hours, 16,500 hours past the designed service life. Full-scale pressurization testing showed that several forged floor beams are prone to fatigue damage due to stress concentrations from machined cutouts. Replacement of the components is impossible, so a program was implemented by NAVAIR to evaluate performance improvement by LPB. LPB treatment of P-3 Orion floor beams increases fatigue life and eliminates stress-related fractures.



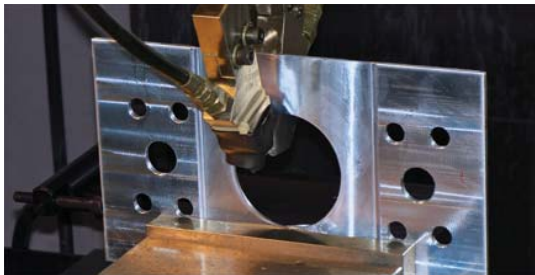
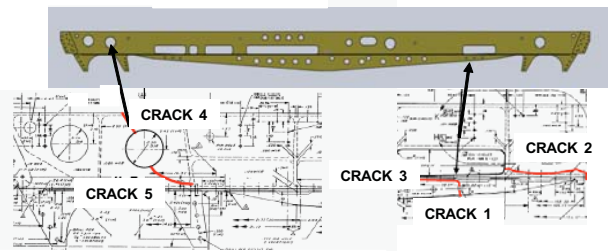
Crack-prone areas

- Improves Safety
- Eliminates the Need for Early Retirement
- Lowers Maintenance Costs
- Increases Time in Service





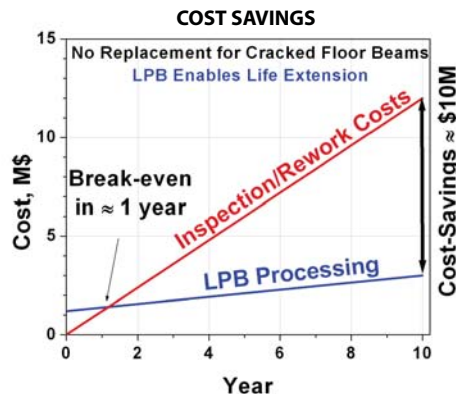
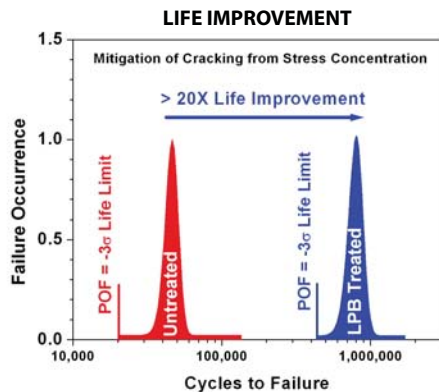
High stress concentrations in the P-3 floor beams can lead to premature cracking and decreased service life of the aircraft, adversely impacting crew safety and fleet readiness, as well as significantly increasing the total cost of ownership and operation. Applying designed compression from low plasticity burnishing solves these problems.



LPB Processing of a Simulated Part

To demonstrate the life improvement from LPB treatment, fatigue testing was performed on two types of feature specimens that simulated the crack-prone areas of the floor beam. Stress concentration factors, k_t , were calculated with finite element analysis. Residual compression required to overcome the stress concentration was determined with Lambda's fatigue design method. Verification tests were conducted to the event of component fracture or until a "run-out" life of 10 million cycles was attained.

LPB treatment improves fatigue life exceeding 20 times compared to the as-manufactured condition. This corresponds to a safe service life of roughly 2.25 million flight hours. Improved fatigue performance allows increased inspection intervals and providing an estimated cost savings of 10 million dollars.



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- P. Prev y, D. Hornbach, J. Scheel. "The Effect of Surface Enhancement on the Corrosion Properties, Fatigue Strength, and Degradation of Aircraft Aluminum," <http://web.nace.org/Departments/Store/Product.aspx?ID=ef1f6fac-515c-df11-a321-005056ac759b>. NACE Corrosion 2010.

<http://www.lambdatechs.com/publications/all-technical-papers.html>

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